Apache HTTP Server Version 1.3

Apache 1.3 User's Guide

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Overview of New Features in Apache 1.3

New features with this release, as extensions of the Apache functionality. Because the core code has changed so significantly, there are certain liberties that earlier versions of Apache (and the NCSA daemon) took that recent Apache versions are pickier about - please check the compatibility notes if you have any problems.

If you're upgrading from Apache 1.2, you may wish to read the upgrade notes.

Enhancements: Core | Performance | Configuration | Modules | API | Misc

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Core Enhancements:

Dynamic Shared Object (DSO) support

Apache modules may now be loaded at runtime; this means that modules can be loaded into the server process space only when necessary, thus overall memory usage by Apache will be significantly reduced. DSO currently is supported on FreeBSD, OpenBSD, NetBSD, Linux, Solaris, SunOS, Digital UNIX, IRIX, HP/UX, UnixWare, AIX, ReliantUnix and generic SVR4 platforms.

Support for Windows NT/95

Apache now experimentally supports the Windows NT and Windows 95 operating systems.

Re-organized Sources

The source files for Apache have been re-organized. The main difference for Apache users is that the "Module" lines in `Configuration` have been replaced with "AddModule" with a slightly different syntax. For module authors there are some changes designed to make it easier for users to add their module.

Reliable Piped Logs

On almost all Unix architectures Apache now implements "reliable" piped logs in mod_log_config. Where reliable means that if the logging child dies for whatever reason, Apache will recover and respawn it without having to restart the entire server. Furthermore if the logging child becomes "stuck" and isn't reading its pipe frequently enough Apache will also restart it. This opens up more opportunities for log rotation, hit filtering, real-time splitting of multiple vhosts into separate logs, and asynchronous DNS resolving on the fly.

Performance Improvements

- IP-based virtual hosts are looked up via hash table.
- <Directory> parsing speedups.
- The critical path for static requests has fewer system calls. This generally helps all requests. (45 syscalls for a static request in 1.2 versus 22 in 1.3 in a well tuned configuration).
- `ProxyReceiveBufferSize` directive gives `mod_proxy`'s outgoing connections larger network buffers, for increased throughput.
- The low level I/O routines use `writev` (where available) to issue multiple writes with a single system call. They also avoid copying memory into buffers as much as possible. The result is less CPU time spent on transferring large files.
- Static requests are served using `mmap`, which means bytes are only copied from the disk buffer to the network buffer directly by the kernel. The program never copies bytes around, which reduces CPU time. (Only where available/tested.)
- When presented with a load spike, the server quickly adapts by spawning children at faster rates.
- The code which dispatches modules was optimized to avoid repeatedly skipping over modules that don't implement certain phases of the API. (This skipping showed up as 5% of the cpu time on profiles of a server with the default module mix.)
- Revamp of the Unix scoreboard management code so that less time is spent counting children in various states. Previously a scan was performed for each hit, now it is performed only once per second. This should be noticeable on servers running with hundreds of children and high loads.
- New serialization choices improve performance on Linux, and IRIX.
- `mod_log_config` can be compile-time configured to buffer writes.
- Replaced `strncpy()` with `ap_cpystrn()`, a routine which doesn't have to zero-fill the entire result. This has dramatic effects on `mod_include` speed.
- Additions to the internal "table" API (used for keeping lists of key/value string pairs) provide for up to 20% performance improvement in many situations.

See the new performance documentation for more information.

Configuration Enhancements

Unified Server Configuration Files

(Apache 1.3.4) The contents of the three server configuration files (httpd.conf, srm.conf, and access.conf) have been merged into a single httpd.conf file. The srm.conf and access.conf files are now empty except for comments directing the Webmaster to look in httpd.conf. In addition, the merged httpd.conf file has been restructured to allow directives to appear in a hopefully more intuitive and meaningful order.

Continuation Lines in config files

Directive lines in the server configuration files may now be split onto multiple lines by using the canonical Unix continuation mechanism, namely a '\' as the last non-blank character on the line to indicate that the next line should be concatenated.

Apache Autoconf-style Interface (APACI)

Until Apache 1.3 there was no real out-of-the-box batch-capable build and installation procedure for the complete Apache package. This is now provided by a top-level `configure` script and a corresponding top-level `Makefile.tmpl` file. The goal is to provide a GNU Autoconf-style frontend which is capable to both drive the old `src/Configure` stuff in batch and additionally installs the package with a GNU-conforming directory layout. Any options from the old configuration scheme are available plus a lot of new options for flexibly customizing Apache. **Note:** The default installation layout has changed for Apache 1.3.4. See the files `README.configure` and `INSTALL` for more information.

APache eXtenSion (APXS) support tool

Now that Apache provides full support for loading modules under runtime from dynamic shared object (DSO) files, a new support tool `apxs` was created which provides off-source building, installing and activating of those DSO-based modules. It completely hides the platform-dependent DSO-build commands from the user and provides an easy way to build modules outside the Apache source tree. To achieve this APACI installs the Apache C header files together with the `apxs` tool.

Default Apache directory path changed to `/usr/local/apache/`

The default directory for the apache ServerRoot changed from the NCSA-compatible `/usr/local/etc/httpd/` to `/usr/local/apache/`. This change covers only the default setting (and the documentation); it is of course possible to override it using the -d *ServerRoot* and -f *httpd.conf* switches when starting apache.

Improved HTTP/1.1-style Virtual Hosts

The new `NameVirtualHost` directive is used to list IP address:port pairs on which HTTP/1.1-style virtual hosting occurs. This is vhosting based on the `Host:` header from the client. Previously this address was implicitly the same as the "main address" of the machine, and this caused no end of problems for users, and was not powerful enough. Please see the Apache Virtual Host documentation for further details on configuration.

`Include` directive

The `Include` directive includes other config files immediately at that point in parsing.

-S command line option for debugging vhost setup

If Apache is invoked with the `-S` command line option it will dump out information regarding how it parsed the `VirtualHost` sections. This is useful for folks trying to debug their virtual host configuration.

Control of HTTP methods

<LimitExcept> and </LimitExcept> are used to enclose a group of access control directives which will then apply to any HTTP access method not listed in the arguments; i.e., it is the opposite of a section and can be used to control both standard and nonstandard/unrecognized methods.

Module Enhancements

Improved mod_negotiation

The optional content negotiation (MultiViews) module has been completely overhauled for Apache 1.3.4, incorporating the latest HTTP/1.1 revisions and the experimental Transparent Content Negotion features of RFC 2295 and RFC 2296.

NEW - Spelling correction module

This optional module corrects frequently occurring spelling and capitalization errors in document names requested from the server.

NEW - Conditional setting of environment variables

The addition of `SetEnvIf` and `SetEnvIfNoCase`. These allow you to set environment variables for server and CGI use based upon attributes of the request.

NEW - "Magic" MIME-typing

The optional `mod_mime_magic` has been added. It uses "magic numbers" and other hints from a file's contents to figure out what the contents are. It then uses this information to set the file's media type, if it cannot be determined by the file's extension.

NEW - Unique Request Identifiers

mod_unique_id can be included to generate a unique identifier that distinguishes a hit from every other hit. ("Unique" has some restrictions on it.) The identifier is available in the environment variable `UNIQUE_ID`.

mod_proxy enhancements:

- Easier and safer authentification for ftp proxy logins: When no ftp user name and/or password is specified in the URL, but the destination ftp server requires one, apache now returns a "[401] Authorization Required" status. This status code usually makes the client browser pop up an "Enter user name and password" dialog, and the request is retried with the given user authentification. That is slightly more secure than specifying the authentication information as part of the request URL, where it could be logged in plaintext by older proxy servers.
- The new AllowCONNECT directive allows configuration of the port numbers to which the proxy CONNECT method may connect. That allows proxying to https://some.server:8443/ which resulted in an error message prior to Apache version 1.3.2.
- The proxy now supports the HTTP/1.1 "Via:" header as specified in RFC2068. The new `ProxyVia` directive allows switching "Via:" support off or on, or suppressing outgoing "Via:" header lines altogether for privacy reasons.
- The "Max-Forwards:" TRACE header specified in HTTP/1.1 is now supported. With it, you can trace the path of a request along a chain of proxies (if they, too, support it).
- `NoProxy` and `ProxyDomain` directives added to proxy, useful for intranets.
- New `ProxyPassReverse` directive. It lets Apache adjust the URL in the `Location` header on HTTP redirect responses.

- Easier navigation in ftp server directory trees.

Enhanced `mod_include` string comparisons

The string-based server-side include (SSI) flow-control directives now include comparison for less-than (<), less-than-or-equal (<=), greater-than (>), and greater-than-or-equal (>=). Previously comparisons could only be made for equality or inequality.

ServerRoot relative auth filenames

Auth filenames for the various authentication modules are now treated as relative to the ServerRoot if they are not full paths.

Enhancements to directory indexing:

- **Code split:**The `mod_dir` module has been split in two, with mod_dir handling directory index files, and mod_autoindex creating directory listings. Thus allowing folks to remove the indexing function from critical servers.
- **Sortable:** Clicking on a column title will now sort the listing in order by the values in that column. This feature can be disabled using the `SuppressColumnSorting` IndexOptions keyword.
- **`SuppressHTMLPreamble`** can be used if your README.html file includes its own HTML header.
- The **`IndexOptions`** directive now allows the use of incremental prefixes (+/- to add/remove the respective keyword feature, as was already possible for the Options directive) to its keyword arguments. Multiple IndexOptions directives applying to the same directory will now be merged.
- **`IconHeight`** and **`IconWidth`** let you set height and width attributes to the `<IMG>` tag in directory listings.
- The new **`NameWidth`** keyword to the IndexOptions directive lets you set the number of columns for "fancy" directory listings. If set to an '*' asterisk, the name width will be adjusted automatically.
- The FancyIndexing directive now correctly has the same impact as IndexOptions FancyIndexing without replacing the effect of any existing IndexOptions directive.

Less Buffering of CGI Script Output

In previous versions of Apache, the output from CGI scripts would be internally buffered by the server, and wouldn't be forwarded to the client until either the buffers were full or the CGI script completed. As of Apache 1.3, the buffer to the client is flushed any time it contains something and the server is waiting for more information from the script. This allows CGI script to provide partial status reports during long processing operations.

Regular Expression support for `Alias` and `Redirect`

New `AliasMatch`, `ScriptAliasMatch`, and `RedirectMatch` directives allow for the use of regular expression matching. Additionally, new `<DirectoryMatch>`, `<LocationMatch>`, and `<FilesMatch>` sections provide a new syntax for regular expression

sectioning.

`AddModuleInfo` directive added to mod_info

Allows additional information to be listed along with a specified module.

Absence of any `TransferLog` disables logging

If no `TransferLog` directive is given then no log is written. This supports co-existence with other logging modules.

Ability to name logging formats

The `LogFormat` directive has been enhanced to allow you to give nicknames to specific logging formats. You can then use these nicknames in other `LogFormat` and `CustomLog` directives, rather than having to spell out the complete log format string each time.

Conditional logging

mod_log_config now supports logging based upon environment variables. mod_log_referer and mod_log_agent are now deprecated.

mod_cern_meta configurable per-directory

mod_cern_meta is now configurable on a per-directory basis.

New map types for `RewriteMap` directive

The new map types `Randomized Plain Text' and `Internal Function' were added to the `RewriteMap` directive of mod_rewrite. They provide two new features: First, you now can randomly choose a sub-value from a value which was looked-up in a rewriting map (which is useful when choosing between backend servers in a Reverse Proxy situation). Second, you now can translate URL parts to fixed (upper or lower) case (which is useful when doing mass virtual hosting by the help of mod_rewrite).

CIDR and Netmask access control

mod_access directives now support CIDR (Classless Inter-Domain Routing) style prefixes, and netmasks for greater control over IP access lists.

API Additions and Changes

For all those module writers and code hackers:

`child_init`

A new phase for Apache's API is called once per "heavy-weight process," before any requests are handled. This allows the module to set up anything that need to be done once per processes. For example, connections to databases.

`child_exit`

A new phase called once per "heavy-weight process," when it is terminating. Note that it can't be called in some fatal cases (such as segfaults and kill -9). The `child_init` and `child_exit` functions are passed a pool whose lifetime is the same as the lifetime of the child (modulo completely fatal events in which apache has no hope of recovering). In contrast, the module `init` function is passed a pool whose lifetime ends when the parent exits or restarts.

`child_terminate`

Used in the child to indicate the child should exit after finishing the current request.

`register_other_child`

See `http_main.h`. This is used in the parent to register a child for monitoring. The parent will report status to a supplied callback function. This allows modules to create their own children which are monitored along with the httpd children.

`piped_log`

See `http_log.h`. This API provides the common code for implementing piped logs. In particular it implements a reliable piped log on architectures supporting it (*i.e.*, Unix at the moment).

scoreboard format changed

The scoreboard format is quite different. It is considered a "private" interface in general, so it's only mentioned here as an FYI.

`set_last_modified` split into three

The old function `set_last_modified` performed multiple jobs including the setting of the `Last-Modified` header, the `ETag` header, and processing conditional requests (such as IMS). These functions have been split into three functions: `set_last_modified`, `set_etag`, and `meets_conditions`. The field `mtime` has been added to `request_rec` to facilitate `meets_conditions`.

New error logging function: `ap_log_error`

All old logging functions are deprecated, we are in the process of replacing them with a single function called `ap_log_error`. This is still a work in progress.

`set_file_slot` for config parsing

The `set_file_slot` routine provides a standard routine that prepends ServerRoot to non-absolute paths.

`post_read_request` module API

This request phase occurs immediately after reading the request (headers), and immediately after creating an internal redirect. It is most useful for setting environment variables to affect future phases.

`psocket`, and `popendir`

The `psocket` and `pclosesocket` functions allow for race-condition free socket creation with resource tracking. Similarly `popendir` and `pclosedir` protect directory reading.

`is_initial_req`

Test if the request is the initial request (*i.e.*, the one coming from the client).

`kill_only_once`

An option to `ap_spawn_child` functions which prevents Apache from aggressively trying to kill off the child.

`alloc debugging code`

Defining `ALLOC_DEBUG` provides a rudimentary memory debugger which can be used on live servers with low impact -- it sets all allocated and freed memory bytes to 0xa5. Defining

`ALLOC_USE_MALLOC` will cause the alloc code to use `malloc()` and `free()` for each ob
This is far more expensive and should only be used for testing with tools such as Electric Fence
and Purify. See `main/alloc.c` for more details.

`ap_cpystrn`

The new `strncpy` "lookalike", with slightly different semantics is much faster than `strncpy` because it doesn't have to zero-fill the entire buffer.

`table_addn`, `table_setn`, `table_mergen`

These new functions do **not** call `pstrdup` on their arguments. This provides for big speedups. There is also some debugging support to ensure code uses them properly. See `src/CHANGES` for more information.

`construct_url`

The function prototype for this changed from taking a `server_rec *` to taking a `request_rec *`.

`get_server_name`, `get_server_port`

These are wrappers which deal with the UseCanonicalName directive when retrieving the server name and port for a request.

Change to prototype for `ap_bspawn_child` and `ap_call_exec`

Added a `child_info *` to `spawn` function (as passed to `ap_bspawn_child`) and to `ap_call_exec` to allow children to work correctly on Win32. We also cleaned up the nomenclature a bit, replacing `spawn_child_err` with simply `ap_spawn_child` and `spawn_child_err_buff` with simply `ap_bspawn_child`.

`ap_add_version_component()`

This API function allows for modules to add their own additional server tokens which are printed on the on the `Server:` header line. Previous 1.3beta versions had used a `SERVER_SUBVERSION` compile-time `#define` to perform this function. Whether the tokens are actually displayed is controlled by the new `ServerTokens` directive.

Miscellaneous Enhancements

Port to EBCDIC mainframe machine running BS2000/OSD

As a premiere, this version of Apache comes with a beta version of a port to a mainframe machine which uses the EBCDIC character set as its native codeset (It is the SIEMENS family of mainframes running the BS2000/OSD operating system on a IBM/390 compatible processor. This mainframe OS nowadays features a SVR4-like POSIX subsystem).

`AccessFileName` Enhancement

The `AccessFileName` directive can now take more than one filename. This lets sites serving pages from network file systems and more than one Apache web server, configure access based on the server through which shared pages are being served.

`HostNameLookups` now defaults to "Off"

The `HostNameLookups` directive now defaults to "Off". This means that, unless explicitly turned on, the server will not resolve IP addresses into names. This was done to spare the Internet from unnecessary DNS traffic.

Double-Reverse DNS enforced

The `HostnameLookups` directive now supports double-reverse DNS. (Known as *PARANOID* in the terminology of tcp_wrappers.) An IP address passes a double-reverse DNS test if the forward map of the reverse map includes the original IP. Regardless of the HostnameLookups setting, mod_access access lists using DNS names **require** all names to pass a double-reverse DNS test. (Prior versions of Apache required a compile-time switch to enable double-reverse DNS.)

LogLevel and syslog support

Apache now has configurable error logging levels and supports error logging via syslogd(8).

Detaching from stdin/out/err

On boot Apache will now detach from stdin, stdout, and stderr. It does not detach from stderr until it has successfully read the config files. So you will see errors in the config file. This should make it easier to start Apache via rsh or crontab.

Year-2000 Improvements

The default `timefmt` string used by `mod_include` has been modified to display the year using four digits rather than the two-digit format used previously. The `mod_autoindex` module has also been modified to display years using four digits in FancyIndexed directory listings.

Common routines Moving to a Separate Library

There are a number of functions and routines that have been developed for the Apache project that supplement or supersede library routines that differ from one operating system to another. While most of these are used only by the Apache server itself, some are referenced by supporting applications (such as `htdigest`), and these other applications would fail to build because the routines were built only into the server. These routines are now being migrated to a separate subdirectory and library so they can be used by other applications than just the server. See the `src/ap/` subdirectory.

New `ServerSignature` directive

This directive optionally adds a line containing the server version and virtual host name to server-generated pages (error documents, ftp directory listings, mod_info output *etc.*). This makes it easier for users to tell which server produced the error message, especially in a proxy chain (often found in intranet environments).

New `UseCanonicalName` directive

This directive gives control over how Apache creates self-referential URLs. Previously Apache would always use the ServerName and Port directives to construct a "canonical" name for the server. With `UseCanonicalName off` Apache will use the hostname and port supplied by the client, if available.

`SERVER_VERSION` definition abstracted, and server build date added

In earlier versions, the Apache server version was available to modules through the `#defined` value for `SERVER_VERSION`. In order to keep this value consistent when modules and the core

server are compiled at different times, this information is now available through the core API routine `ap_get_server_version()`. The use of the `SERVER_VERSION` symbol is deprecated. Also, `ap_get_server_built()` returns a string representing the time the core server was linked.

Including the operating system in the server identity

A new directive, `ServerTokens`, allows the Webmaster to change the value of the `Server` response header field which is sent back to clients. The `ServerTokens` directive controls whether the server will include a non-specific note in the server identity about the type of operating system on which the server is running as well as included module information. As of Apache 1.3, this additional information is included by default.

Support for Netscape style SHA1 encrypted passwords

To facilitate migration or integration of BasicAuth password schemes where the password is encrypted using SHA1 (as opposed to apache's build in MD5 and/or the OS specific crypt(3) function) passwords prefixed with with `{SHA1}` are taken as Base64 encoded SHA1 passwords. More information and some utilities to convert Netscape ldap/ldif entries can be found in support/SHA1.

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Compatibility Notes with NCSA's Server

While Apache is for the most part a drop-in replacement for NCSA's httpd, there are a couple gotcha's to watch out for. These are mostly due to the fact that the parser for config and access control files was rewritten from scratch, so certain liberties the earlier servers took may not be available here. These are all easily fixable. If you know of other non-fatal problems that belong here, let us know.

Please also check the known client problems page.

1. As of Apache 1.3.1, methods named in a <Limit> section *must* be listed in upper-case. Lower- or mixed-case method names will result in a configuration error.
2. The basic mod_auth `AuthGroupFile`-specified group file format allows commas between user names - Apache does not.
3. If you follow the NCSA guidelines for setting up access restrictions based on client domain, you may well have added entries for, `AuthType, AuthName, AuthUserFile` or `AuthGroupFile`. **None** of these are needed (or appropriate) for restricting access based on client domain. When Apache sees `AuthType` it (reasonably) assumes you are using some authorization type based on username and password. Please remove `AuthType`, it's unnecessary even for NCSA.
4. `OldScriptAlias` is no longer supported.
5. `exec cgi=""` produces reasonable **malformed header** responses when used to invoke non-CGI scripts.
   The NCSA code ignores the missing header. (bad idea)
   Solution: write CGI to the CGI spec and use `include virtual`, or use `exec cmd=""` instead.
6. Icons for FancyIndexing broken - well, no, they're not broken, we've just upgraded the icons from flat .xbm files to pretty and much smaller .gif files, courtesy of Kevin Hughes at EIT. If you are using the same srm.conf from an old distribution, make sure you add the new AddIcon, AddIconByType, and DefaultIcon directives.
7. Apache versions before 1.2b1 will ignore the last line of configuration files if the last line does not have a trailing newline. This affects configuration files (httpd.conf, access.conf and srm.conf), and htpasswd and htgroup files.
8. Apache does not permit commas delimiting the methods in <Limit>.
9. Apache's `<VirtualHost>` treats all addresses as "optional" (*i.e.*, the server should continue booting if it can't resolve the address). Whereas in NCSA the default is to fail booting unless an

added `optional` keyword is included.

10. Apache does not implement `OnDeny` use `ErrorDocument` instead.
11. Apache (as of 1.3) always performs the equivalent of `HostnameLookups minimal`. `minimal` is not an option to `HostnameLookups`.
12. To embed spaces in directive arguments NCSA used a backslash before the space. Apache treats backslashes as normal characters. To embed spaces surround the argument with double-quotes instead.
13. Apache does not implement the NCSA `referer` directive. See PR#968 for a few brief suggestions on alternative ways to implement the same thing under Apache.
14. Apache does not allow ServerRoot settings inside a VirtualHost container. There is only one global ServerRoot in Apache; any desired changes in paths for virtual hosts need to be made with the explicit directives, eg. DocumentRoot, TransferLog, *etc.*

More to come when we notice them....

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Known Problems in Clients

Over time the Apache Group has discovered or been notified of problems with various clients which we have had to work around, or explain. This document describes these problems and the workarounds available. It's not arranged in any particular order. Some familiarity with the standards is assumed, but not necessary.

For brevity, *Navigator* will refer to Netscape's Navigator product (which in later versions was renamed "Communicator" and various other names), and *MSIE* will refer to Microsoft's Internet Explorer product. All trademarks and copyrights belong to their respective companies. We welcome input from the various client authors to correct inconsistencies in this paper, or to provide us with exact version numbers where things are broken/fixed.

For reference, RFC1945 defines HTTP/1.0, and RFC2068 defines HTTP/1.1. Apache as of version 1.2 is an HTTP/1.1 server (with an optional HTTP/1.0 proxy).

Various of these workarounds are triggered by environment variables. The admin typically controls which are set, and for which clients, by using mod_browser. Unless otherwise noted all of these workarounds exist in versions 1.2 and later.

Trailing CRLF on POSTs

This is a legacy issue. The CERN webserver required `POST` data to have an extra `CRLF` following it. Thus many clients send an extra `CRLF` that is not included in the `Content-Length` of the request. Apache works around this problem by eating any empty lines which appear before a request.

Broken keepalive

Various clients have had broken implementations of *keepalive* (persistent connections). In particular the Windows versions of Navigator 2.0 get very confused when the server times out an idle connection. The workaround is present in the default config files:

```
BrowserMatch Mozilla/2 nokeepalive
```

Note that this matches some earlier versions of MSIE, which began the practice of calling themselves *Mozilla* in their user-agent strings just like Navigator.

MSIE 4.0b2, which claims to support HTTP/1.1, does not properly support keepalive when it is used on 301 or 302 (redirect) responses. Unfortunately Apache's `nokeepalive` code prior to 1.2.2 would not work with HTTP/1.1 clients. You must apply this patch to version 1.2.1. Then add this to your config:

```
BrowserMatch "MSIE 4\.0b2;" nokeepalive
```

Incorrect interpretation of `HTTP/1.1` in response

To quote from section 3.1 of RFC1945:

> HTTP uses a "<MAJOR>.<MINOR>" numbering scheme to indicate versions of the protocol. The protocol versioning policy is intended to allow the sender to indicate the format of a message and its capacity for understanding further HTTP communication, rather than the features obtained via that communication.

Since Apache is an HTTP/1.1 server, it indicates so as part of its response. Many client authors mistakenly treat this part of the response as an indication of the protocol that the response is in, and then refuse to accept the response.

The first major indication of this problem was with AOL's proxy servers. When Apache 1.2 went into beta it was the first wide-spread HTTP/1.1 server. After some discussion, AOL fixed their proxies. In anticipation of similar problems, the `force-response-1.0` environment variable was added to Apache. When present Apache will indicate "HTTP/1.0" in response to an HTTP/1.0 client, but will not in any other way change the response.

The pre-1.1 Java Development Kit (JDK) that is used in many clients (including Navigator 3.x and MSIE 3.x) exhibits this problem. As do some of the early pre-releases of the 1.1 JDK. We think it is fixed in the 1.1 JDK release. In any event the workaround:

```
BrowserMatch Java/1.0 force-response-1.0
BrowserMatch JDK/1.0 force-response-1.0
```

RealPlayer 4.0 from Progressive Networks also exhibits this problem. However they have fixed it in version 4.01 of the player, but version 4.01 uses the same `User-Agent` as version 4.0. The workaround is still:

```
BrowserMatch "RealPlayer 4.0" force-response-1.0
```

Requests use HTTP/1.1 but responses must be in HTTP/1.0

MSIE 4.0b2 has this problem. Its Java VM makes requests in HTTP/1.1 format but the responses must be in HTTP/1.0 format (in particular, it does not understand *chunked* responses). The workaround is to fool Apache into believing the request came in HTTP/1.0 format.

```
BrowserMatch "MSIE 4\.0b2;" downgrade-1.0 force-response-1.0
```

This workaround is available in 1.2.2, and in a patch against 1.2.1.

Boundary problems with header parsing

All versions of Navigator from 2.0 through 4.0b2 (and possibly later) have a problem if the trailing CRLF of the response header starts at offset 256, 257 or 258 of the response. A BrowserMatch for this would match on nearly every hit, so the workaround is enabled automatically on all responses. The workaround implemented detects when this condition would occur in a response and adds extra padding to the header to push the trailing CRLF past offset 258 of the response.

Multipart responses and Quoted Boundary Strings

On multipart responses some clients will not accept quotes (") around the boundary string. The MIME standard recommends that such quotes be used. But the clients were probably written based on one of the examples in RFC2068, which does not include quotes. Apache does not include quotes on its boundary strings to workaround this problem.

Byterange requests

A byterange request is used when the client wishes to retrieve a portion of an object, not necessarily the entire object. There was a very old draft which included these byteranges in the URL. Old clients such as Navigator 2.0b1 and MSIE 3.0 for the MAC exhibit this behaviour, and it will appear in the servers' access logs as (failed) attempts to retrieve a URL with a trailing ";xxx-yyy". Apache does not attempt to implement this at all.

A subsequent draft of this standard defines a header `Request-Range`, and a response type `multipart/x-byteranges`. The HTTP/1.1 standard includes this draft with a few fixes, and it defines the header `Range` and type `multipart/byteranges`.

Navigator (versions 2 and 3) sends both `Range` and `Request-Range` headers (with the same value), but does not accept a `multipart/byteranges` response. The response must be `multipart/x-byteranges`. As a workaround, if Apache receives a `Request-Range` header it considers it "higher priority" than a `Range` header and in response uses `multipart/x-byteranges`.

The Adobe Acrobat Reader plugin makes extensive use of byteranges and prior to version 3.01 supports only the `multipart/x-byterange` response. Unfortunately there is no clue that it is the plugin making the request. If the plugin is used with Navigator, the above workaround works fine. But if the plugin is used with MSIE 3 (on Windows) the workaround won't work because MSIE 3 doesn't give the `Range-Request` clue that Navigator does. To workaround this, Apache special cases "MSIE 3" in the `User-Agent` and serves `multipart/x-byteranges`. Note that the necessity for this with MSIE 3 is actually due to the Acrobat plugin, not due to the browser.

Netscape Communicator appears to not issue the non-standard `Request-Range` header. When an Acrobat plugin prior to version 3.01 is used with it, it will not properly understand byteranges. The user must upgrade their Acrobat reader to 3.01.

`Set-Cookie` header is unmergeable

The HTTP specifications say that it is legal to merge headers with duplicate names into one (separated by commas). Some browsers that support Cookies don't like merged headers and prefer that each `Set-Cookie` header is sent separately. When parsing the headers returned by a CGI, Apache will explicitly avoid merging any `Set-Cookie` headers.

`Expires` headers and GIF89A animations

Navigator versions 2 through 4 will erroneously re-request GIF89A animations on each loop of the animation if the first response included an `Expires` header. This happens regardless of how far in the future the expiry time is set. There is no workaround supplied with Apache, however there are hacks for 1.2 and for 1.3.

`POST` without `Content-Length`

In certain situations Navigator 3.01 through 3.03 appear to incorrectly issue a POST without the request body. There is no known workaround. It has been fixed in Navigator 3.04, Netscapes provides some information. There's also some information about the actual problem.

JDK 1.2 betas lose parts of responses.

The http client in the JDK1.2beta2 and beta3 will throw away the first part of the response body when both the headers and the first part of the body are sent in the same network packet AND keep-alive's are being used. If either condition is not met then it works fine.

See also Bug-ID's 4124329 and 4125538 at the java developer connection.

If you are seeing this bug yourself, you can add the following BrowserMatch directive to work around it:

```
BrowserMatch "Java1\.2beta[23]" nokeepalive
```

We don't advocate this though since bending over backwards for beta software is usually not a good idea; ideally it gets fixed, new betas or a final release comes out, and no one uses the broken old software anymore. In theory.

`Content-Type` change is not noticed after reload

Navigator (all versions?) will cache the `content-type` for an object "forever". Using reload or shift-reload will not cause Navigator to notice a `content-type` change. The only work-around is for the user to flush their caches (memory and disk). By way of an example, some folks may be using an old `mime.types` file which does not map `.htm` to `text/html`, in this case Apache will default to sending `text/plain`. If the user requests the page and it is served as `text/plain`. After the admin fixes the server, the user will have to flush their caches before the object will be shown with the correct `text/html` type.

MSIE Cookie problem with expiry date in the year 2000

MSIE versions 3.00 and 3.02 (without the Y2K patch) do not handle cookie expiry dates in the year 2000 properly. Years after 2000 and before 2000 work fine. This is fixed in IE4.01 service pack 1, and in the Y2K patch for IE3.02. Users should avoid using expiry dates in the year 2000.

Lynx incorrectly asking for transparent content negotiation

The Lynx browser versions 2.7 and 2.8 send a "negotiate: trans" header in their requests, which is an indication the browser supports transparent content negotiation (TCN). However the browser does not support TCN. As of version 1.3.4, Apache supports TCN, and this causes problems with these versions of Lynx. As a workaround future versions of Apache will ignore this header when sent by the Lynx client.

MSIE 4.0 mishandles Vary response header

MSIE 4.0 does not handle a Vary header properly. The Vary header is generated by mod_rewrite in apache 1.3. The result is an error from MSIE saying it cannot download the requested file. There are more details in PR#4118.

A workaround is to add the following to your server's configuration files:

```
BrowserMatch "MSIE 4\.0" force-no-vary
```

(This workaround is only available with releases **after** 1.3.6 of the Apache Web server.)

Apache HTTP Server Version 1.3

Module mod_browser

This module is contained in the `mod_browser.c` file, and is compiled in by default. It provides for setting environment variables based on the browser. This module is part of Apache 1.2.* only. From Apache 1.3 onwards `mod_setenvif` provides the functionality of this module.

Summary

This module allows you to set environment variables based on the name of the browser accessing your document, based on the `User-Agent` header field. This is especially useful when combined with a conditional HTML language such as XSSI or PHP, and can provide for simple browser-based negotiation of HTML features.

Directives

- BrowserMatch
- BrowserMatchNoCase

BrowserMatch

Syntax: BrowserMatch *regex attr1 attr2...*
Context: server config
Status: base
Module: mod_browser
Compatibility: Apache 1.2 and above

The BrowserMatch directive defines environment variables based on the User-Agent header. The first argument should be a POSIX.2 extended regular expression (similar to an egrep-style regex). The rest of the arguments give names of variables to set. These take the form of either "`varname`", "`!varname`" or "`varname=value`". In the first form, the value will be set to "1". The second will remove the given variable if already defined, and the third will set the variable to the value given by `value`. If a User-Agent string matches more than one entry, they will be merged. Entries are processed in the order they appear, and later entries can override earlier ones.

For example:

```
BrowserMatch ^Mozilla forms jpeg=yes browser=netscape
BrowserMatch "^Mozilla/[2-3]" tables agif frames javascript
BrowserMatch MSIE !javascript
```

BrowserMatchNoCase

Syntax: BrowserMatchNoCase *regex attr1 attr2...*
Context: server config
Status: base
Module: mod_browser
Compatibility: Apache 1.2 and above

The `BrowserMatchNoCase` directive is semantically identical to the `BrowserMatch` directive. However, it provides for case-insensitive matching. For example:

```
BrowserMatchNoCase mac platform=macintosh
BrowserMatchNoCase win platform=windows
```

TOC

Apache HTTP Server Version 1.3

Module mod_setenvif

This module is contained in the mod_setenvif.c file, and **is** compiled in by default. It provides for the ability to set environment variables based upon attributes of the request.

Summary

The mod_setenvif module allows you to set environment variables according to whether different aspects of the request match regular expressions you specify. These envariables can be used by other parts of the server to make decisions about actions to be taken.

The directives are considered in the order they appear in the configuration files. So more complex sequences can be used, such as this example, which sets `netscape` if the browser is mozilla but not MSIE.

```
BrowserMatch ^Mozilla netscape
BrowserMatch MSIE !netscape
```

Directives

The BrowserMatch Directive

Syntax: BrowserMatch *regex envar[=value] [...]*
Default: *none*
Context: server config
Override: *none*
Status: Base

Module: mod_setenvif
Compatibility: Apache 1.2 and above (in Apache 1.2 this directive was found in the now-obsolete mod_browser module)

The BrowserMatch directive defines environment variables based on the User-Agent HTTP request header field. The first argument should be a POSIX.2 extended regular expression (similar to an egrep-style regex). The rest of the arguments give the names of variables to set, and optionally values to which they should be set. These take the form of

1. *varname*, or
2. !*varname*, or
3. *varname=value*

In the first form, the value will be set to "1". The second will remove the given variable if already defined, and the third will set the variable to the value given by *value*. If a User-Agent string matches more than one entry, they will be merged. Entries are processed in the order in which they appear, and later entries can override earlier ones.

For example:

```
BrowserMatch ^Mozilla forms jpeg=yes browser=netscape
BrowserMatch "^Mozilla/[2-3]" tables agif frames javascript
BrowserMatch MSIE !javascript
```

Note that the regular expression string is **case-sensitive**. For cane-INsensitive matching, see the BrowserMatchNoCase directive.

The BrowserMatch and BrowserMatchNoCase directives are special cases of the SetEnvIf and SetEnvIfNoCase directives. The following two lines have the same effect:

```
BrowserMatchNoCase Robot is_a_robot
SetEnvIfNoCase User-Agent Robot is_a_robot
```

The BrowserMatchNoCase Directive

Syntax: BrowserMatchNoCase *regex envar[=value] [...]*
Default: *none*
Context: server config
Override: *none*
Status: Base
Module: mod_setenvif
Compatibility: Apache 1.2 and above (in Apache 1.2 this directive was found in the now-obsolete

mod_browser module)

The BrowserMatchNoCase directive is semantically identical to the BrowserMatch directive. However, it provides for case-insensitive matching. For example:

```
BrowserMatchNoCase mac platform=macintosh
BrowserMatchNoCase win platform=windows
```

The BrowserMatch and BrowserMatchNoCase directives are special cases of the SetEnvIf and SetEnvIfNoCase directives. The following two lines have the same effect:

```
BrowserMatchNoCase Robot is_a_robot
SetEnvIfNoCase User-Agent Robot is_a_robot
```

The SetEnvIf Directive

Syntax: SetEnvIf *attribute regex envar[=value] [...]*
Default: *none*
Context: server config
Override: *none*
Status: Base
Module: mod_setenvif
Compatibility: Apache 1.3 and above; the Request_Protocol keyword and environment-variable matching are only available with 1.3.7 and later

The SetEnvIf directive defines environment variables based on attributes of the request. These attributes can be the values of various HTTP request header fields (see http://ds.internic.net/rfc/rfc2068.txt for more information about these), or of other aspects of the request, including the following:

- Remote_Host - the hostname (if available) of the client making the request
- Remote_Addr - the IP address of the client making the request
- Remote_User - the authenticated username (if available)
- Request_Method - the name of the method being used (GET, POST, *et cetera*)
- Request_Protocol - the name and version of the protocol with which the request was made (*e.g.*, "HTTP/0.9", "HTTP/1.1", *etc.*)
- Request_URI - the portion of the URL following the scheme and host portion

Some of the more commonly used request header field names include Host, User-Agent, and Referer.

If the *attribute* name doesn't match any of the special keywords, nor any of the request's header field names, it is tested as the name of an environment variable in the list of those associated with the request. This allows `SetEnvIf` directives to test against the result of prior matches.

Only those environment variables defined by earlier `SetEnvIf[NoCase]` directives are available for testing in this manner. 'Earlier' means that they were defined at a broader scope (such as server-wide) or previously in the current directive's scope.

Example:

```
SetEnvIf Request_URI "\.gif$" object_is_image=gif
SetEnvIf Request_URI "\.jpg$" object_is_image=jpg
SetEnvIf Request_URI "\.xbm$" object_is_image=xbm
      :
SetEnvIf Referer www\.mydomain\.com intra_site_referral
      :
SetEnvIf object_is_image xbm XBIT_PROCESSING=1
```

The first three will set the envariable object_is_image if the request was for an image file, and the fourth sets intra_site_referral if the referring page was somewhere on the www.mydomain.com Web site.

The SetEnvIfNoCase Directive

Syntax: SetEnvIfNoCase *attribute regex envar[=value] [...]*
Default: *none*
Context: server config
Override: *none*
Status: Base
Module: mod_setenvif
Compatibility: Apache 1.3 and above

The SetEnvIfNoCase is semantically identical to the SetEnvIf directive, and differs only in that the regular expression matching is performed in a case-insensitive manner. For example:

```
SetEnvIfNoCase Host Apache\.Org site=apache
```

This will cause the site envariable to be set to "apache" if the HTTP request header field Host: was included and contained Apache.Org, apache.org, or any other combination.

Apache HTTP Server Version 1.3

Terms Used to Describe Apache Directives

Each Apache configuration directive is described using a common format that looks like this:

Syntax: *directive-name some args*
Default: *directive-name default-value*
Context: *context-list*
Override: *override*
Status: *status*
Module: *module-name*
Compatibility: *compatibility notes*

Each of the directive's attributes, complete with possible values where possible, are described in this document.

Directive Terms

Syntax

This indicates the format of the directive as it would appear in a configuration file. This syntax is extremely directive-specific, so refer to the text of the directive's description for details.

Default

If the directive has a default value (*i.e.*, if you omit it from your configuration entirely, the Apache Web server will behave as though you set it to a particular value), it is described here. If there is no default value, this section should say "*None*".

Context

This indicates where in the server's configuration files the directive is legal. It's a comma-separated list of one or more of the following values:

server config

This means that the directive may be used in the server configuration files (*e.g.*, httpd.conf, srm.conf, and access.conf), but **not** within any <VirtualHost> or <Directory> containers. It is not allowed in .htaccess files at all.

virtual host

This context means that the directive may appear inside <VirtualHost> containers in the server configuration files.

directory

A directive marked as being valid in this context may be used inside <Directory>, <Location>, and <Files> containers in the server configuration files, subject to the restrictions outlined in How Directory, Location and Files sections work.

.htaccess

If a directive is valid in this context, it means that it can appear inside *per*-directory .htaccess files. It may not be processed, though depending upon the overrides currently active.

The directive is *only* allowed within the designated context; if you try to use it elsewhere, you'll get a configuration error that will either prevent the server from handling requests in that context correctly, or will keep the server from operating at all -- *i.e.*, the server won't even start.

The valid locations for the directive are actually the result of a Boolean OR of all of the listed contexts. In other words, a directive that is marked as being valid in "server config, .htaccess" can be used in the httpd.conf file and in .htaccess files, but not within any <Directory> or <VirtualHost> containers.

Override

This directive attribute indicates which configuration override must be active in order for the directive to be processed when it appears in a .htaccess file. If the directive's context doesn't permit it to appear in .htaccess files, this attribute should say "*Not applicable*".

Overrides are activated by the AllowOverride directive, and apply to a particular scope (such as a

directory) and all descendants, unless further modified by other AllowOverride directives at lower le
The documentation for that directive also lists the possible override names available.

Status

This indicates how tightly bound into the Apache Web server the directive is; in other words, you may need to recompile the server with an enhanced set of modules in order to gain access to the directive and its functionality. Possible values for this attribute are:

Core

If a directive is listed as having "Core" status, that means it is part of the innermost portions of the Apache Web server, and is always available.

Base

A directive labeled as having "Base" status is supported by one of the standard Apache modules which is compiled into the server by default, and is therefore normally available unless you've taken steps to remove the module from your configuration.

Extension

A directive with "Extension" status is provided by one of the modules included with the Apache server kit, but the module isn't normally compiled into the server. To enable the directive and its functionality, you will need to change the server build configuration files and re-compile Apache.

Experimental

"Experimental" status indicates that the directive is available as part of the Apache kit, but you're on your own if you try to use it. The directive is being documented for completeness, and is not necessarily supported. The module which provides the directive may or may not be compiled in by default; check the top of the page which describes the directive and its module to see if it remarks on the availability.

Module

This quite simply lists the name of the source module which defines the directive.

Compatibility

If the directive wasn't part of the original Apache version 1 distribution, the version in which it was introduced should be listed here. If the directive has the same name as one from the NCSA HTTPd server, any inconsistencies in behaviour between the two should also be mentioned. Otherwise, this attribute should say "*No compatibility issues.*"

Apache HTTP Server Version 1.3

How Directory, Location and Files sections work

The sections <Directory>, <Location> and <Files> can contain directives which only apply to specified directories, URLs or files respectively. Also htaccess files can be used inside a directory to apply directives to that directory. This document explains how these different sections differ and how they relate to each other when Apache decides which directives apply for a particular directory or request URL.

Directives allowed in the sections

Everything that is syntactically allowed in <Directory> is also allowed in <Location> (except a sub-<Files> section). Semantically however some things, and the most notable are AllowOverride and the two options FollowSymLinks and SymLinksIfOwnerMatch, make no sense in <Location>, <LocationMatch> or <DirectoryMatch>. The same for <Files> -- syntactically everything is fine, but semantically some things are different.

How the sections are merged

The order of merging is:

1. <Directory> (except regular expressions) and .htaccess done simultaneously (with .htaccess overriding <Directory>)
2. <DirectoryMatch>, and <Directory> with regular expressions
3. <Files> and <FilesMatch> done simultaneously
4. <Location> and <LocationMatch> done simultaneously

Apart from <Directory>, each group is processed in the order that they appear in the configuration files. <Directory> (group 1 above) is processed in the order shortest directory component to longest. If multiple <Directory> sections apply to the same directory they they are processed in the configuration file order. The configuration files are read in the order httpd.conf, srm.conf and access.conf. Configurations included via the Include directive will be treated as if they where inside the including file at the location of the Include directive.

Sections inside <VirtualHost> sections are applied *after* the corresponding sections outside the virtual host definition. This allows virtual hosts to override the main server configuration. (Note: this

only works correctly from 1.2.2 and 1.3a2 onwards. Before those releases sections inside virtual hos were applied *before* the main server).

Notes about using sections

The general guidelines are:

- If you are attempting to match objects at the filesystem level then you must use `<Directory>` and/or `<Files>`.
- If you are attempting to match objects at the URL level then you must use `<Location>`

But a notable exception is:

- proxy control is done via `<Directory>`. This is a legacy mistake because the proxy existed prior to `<Location>`. A future version of the config language should probably switch this to `<Location>`.

Note about .htaccess parsing:

- Modifying .htaccess parsing during Location doesn't do anything because .htaccess parsing has already occurred.

`<Location>` and symbolic links:

- It is not possible to use "`Options FollowSymLinks`" or "`Options SymLinksIfOwnerMatch`" inside a `<Location>`, `<LocationMatch>` or `<DirectoryMatch>` section (the options are simply ignored). Using the options in question is only possible inside a `<Directory>` section (or a `.htaccess` file).

`<Files>` and `Options`:

- Apache won't check for it, but using an `Options` directive inside a `<Files>` section has no effect.

Another note:

- There is actually a `<Location>`/`<LocationMatch>` sequence performed just before the name translation phase (where `Aliases` and `DocumentRoots` are used to map URLs to filenames). The results of this sequence are completely thrown away after the translation has completed.

Apache HTTP Server Version 1.3

Apache Core Features

These configuration parameters control the core Apache features, and are always available.

Directives

AccessConfig directive

Syntax: AccessConfig *filename*
Default: `AccessConfig conf/access.conf`
Context: server config, virtual host
Status: core

The server will read this file for more directives after reading the ResourceConfig file. *Filename* is relative to the ServerRoot. This feature can be disabled using:

```
AccessConfig /dev/null
```

Historically, this file only contained <Directory> sections; in fact it can now contain any server directive allowed in the *server config* context.

AccessFileName directive

Syntax: AccessFileName *filename filename* ...
Default: `AccessFileName .htaccess`
Context: server config, virtual host

Status: core
Compatibility: AccessFileName can accept more than one filename only in Apache 1.3 and later

When returning a document to the client the server looks for the first existing access control file from this list of names in every directory of the path to the document, if access control files are enabled for that directory. For example:

```
AccessFileName .acl
```

before returning the document /usr/local/web/index.html, the server will read /.acl, /usr/.acl, /usr/local/.acl and /usr/local/web/.acl for directives, unless they have been disabled with

```
<Directory />
AllowOverride None
</Directory>
```

AddModule directive

Syntax: AddModule *module module* ...
Context: server config
Status: core
Compatibility: AddModule is only available in Apache 1.2 and later

The server can have modules compiled in which are not actively in use. This directive can be used to enable the use of those modules. The server comes with a pre-loaded list of active modules; this list can be cleared with the ClearModuleList directive.

AllowOverride directive

Syntax: AllowOverride *override override* ...
Default: `AllowOverride All`
Context: directory
Status: core

When the server finds an .htaccess file (as specified by AccessFileName) it needs to know which directives declared in that file can override earlier access information.

Override can be set to `None`, in which case the server will not read the file, `All` in which case the server will allow all the directives, or one or more of the following:

AuthConfig

Allow use of the authorization directives (AuthDBMGroupFile, AuthDBMUserFile, AuthGroupFile, AuthName, AuthType, AuthUserFile, require, *etc.*).

FileInfo

Allow use of the directives controlling document types (AddEncoding, AddLanguage, AddTy
DefaultType, ErrorDocument, LanguagePriority, *etc.*).

Indexes

Allow use of the directives controlling directory indexing (AddDescription, AddIcon, AddIconByEncoding, AddIconByType, DefaultIcon, DirectoryIndex, FancyIndexing, HeaderName, IndexIgnore, IndexOptions, ReadmeName, *etc.*).

Limit

Allow use of the directives controlling host access (allow, deny and order).

Options

Allow use of the directives controlling specific directory features (Options and XBitHack).

AuthName directive

Syntax: AuthName *auth-domain*
Context: directory, .htaccess
Override: AuthConfig
Status: core

This directive sets the name of the authorization realm for a directory. This realm is given to the client so that the user knows which username and password to send. AuthName takes a single argument; if the realm name contains spaces, it must be enclosed in quotation marks. It must be accompanied by AuthType and require directives, and directives such as AuthUserFile and AuthGroupFile to work.

AuthType directive

Syntax: AuthType *type*
Context: directory, .htaccess
Override: AuthConfig
Status: core

This directive selects the type of user authentication for a directory. Only `Basic` and `Digest` are currently implemented. It must be accompanied by AuthName and require directives, and directives such as AuthUserFile and AuthGroupFile to work.

BindAddress directive

Syntax: BindAddress *saddr*
Default: `BindAddress *`
Context: server config
Status: core

A Unix® http server can either listen for connections to every IP address of the server machine, or just one IP address of the server machine. *Saddr* can be

- *
- An IP address
- A fully-qualified Internet domain name

If the value is *, then the server will listen for connections on every IP address, otherwise it will only listen on the IP address specified.

Only one `BindAddress` directive can be used. For more control over which address and ports Apache listens to, use the `Listen` directive instead of `BindAddress`.

`BindAddress` can be used as an alternative method for supporting virtual hosts using multiple independent servers, instead of using `<VirtualHost>` sections.

See Also: DNS Issues
See Also: Setting which addresses and ports Apache uses

BS2000Account directive

Syntax: BS2000Account *account*
Default: *none*
Context: server config
Status: core
Compatibility: BS2000Account is only available for BS2000 machines, as of Apache 1.3 and later.

The `BS2000Account` directive is available for BS2000 hosts only. It must be used to define the account number for the non-privileged apache server user (which was configured using the User directive). This is required by the BS2000 POSIX subsystem (to change the underlying BS2000 task environment by performing a sub-LOGON) to prevent CGI scripts from accessing resources of the privileged account which started the server, usually SYSROOT.
Only one `BS2000Account` directive can be used.

See Also: Apache EBCDIC port

ClearModuleList directive

Syntax: ClearModuleList
Context: server config
Status: core
Compatibility: ClearModuleList is only available in Apache 1.2 and later

The server comes with a built-in list of active modules. This directive clears the list. It is assumed that the list will then be re-populated using the AddModule directive.

ContentDigest directive

Syntax: ContentDigest *on|off*
Default: `ContentDigest off`
Context: server config, virtual host, directory, .htaccess
Override: Options
Status: experimental
Compatibility: ContentDigest is only available in Apache 1.1 and later

This directive enables the generation of `Content-MD5` headers as defined in RFC1864 respectively RFC2068.

MD5 is an algorithm for computing a "message digest" (sometimes called "fingerprint") of arbitrary-length data, with a high degree of confidence that any alterations in the data will be reflected in alterations in the message digest.

The `Content-MD5` header provides an end-to-end message integrity check (MIC) of the entity-body. A proxy or client may check this header for detecting accidental modification of the entity-body in transit. Example header:

```
Content-MD5: AuLb7Dp1rqtRtxz2m9kRpA==
```

Note that this can cause performance problems on your server since the message digest is computed on every request (the values are not cached).

`Content-MD5` is only sent for documents served by the core, and not by any module. For example, SSI documents, output from CGI scripts, and byte range responses do not have this header.

CoreDumpDirectory directive

Syntax: CoreDumpDirectory *directory*
Default: the same location as ServerRoot
Context: server config

Status: core

This controls the directory to which Apache attempts to switch before dumping core. The default is in the ServerRoot directory, however since this should not be writable by the user the server runs as, core dumps won't normally get written. If you want a core dump for debugging, you can use this directive to place it in a different location.

DefaultType directive

Syntax: DefaultType *MIME-type*
Default: `DefaultType text/html`
Context: server config, virtual host, directory, .htaccess
Override: FileInfo
Status: core

There will be times when the server is asked to provide a document whose type cannot be determined by its MIME types mappings.

The server must inform the client of the content-type of the document, so in the event of an unknown type it uses the `DefaultType`. For example:

```
DefaultType image/gif
```

would be appropriate for a directory which contained many gif images with filenames missing the .gif extension.

<Directory> directive

Syntax: <Directory *directory*> ... </Directory>
Context: server config, virtual host
Status: Core.

<Directory> and </Directory> are used to enclose a group of directives which will apply only to the named directory and sub-directories of that directory. Any directive which is allowed in a directory context may be used. *Directory* is either the full path to a directory, or a wild-card string. In a wild-card string, `?' matches any single character, and `*' matches any sequences of characters. As of Apache 1.3, you may also use `[]' character ranges like in the shell. Also as of Apache 1.3 none of the wildcards match a `/' character, which more closely mimics the behaviour of Unix shells. Example:

```
<Directory /usr/local/httpd/htdocs>
Options Indexes FollowSymLinks
</Directory>
```

Apache 1.2 and above: Extended regular expressions can also be used, with the addition of the ~

character. For example:

```
<Directory ~ "^/www/.*/[0-9]{3}">
```

would match directories in /www/ that consisted of three numbers.

If multiple (non-regular expression) directory sections match the directory (or its parents) containing a document, then the directives are applied in the order of shortest match first, interspersed with the directives from the .htaccess files. For example, with

```
<Directory />
AllowOverride None
</Directory>

<Directory /home/*>
AllowOverride FileInfo
</Directory>
```

for access to the document `/home/web/dir/doc.html` the steps are:

- Apply directive `AllowOverride None` (disabling `.htaccess` files).
- Apply directive `AllowOverride FileInfo` (for directory `/home/web`).
- Apply any FileInfo directives in `/home/web/.htaccess`

Regular expression directory sections are handled slightly differently by Apache 1.2 and 1.3. In Apache 1.2 they are interspersed with the normal directory sections and applied in the order they appear in the configuration file. They are applied only once, and apply when the shortest match possible occurs. In Apache 1.3 regular expressions are not considered until after all of the normal sections have been applied. Then all of the regular expressions are tested in the order they appeared in the configuration file. For example, with

```
<Directory ~ abc$>
... directives here ...
</Directory>
```

Suppose that the filename being accessed is `/home/abc/public_html/abc/index.html`. The server considers each of `/`, `/home`, `/home/abc`, `/home/abc/public_html`, and `/home/abc/public_html/abc` in that order. In Apache 1.2, when `/home/abc` is considered, the regular expression will match and be applied. In Apache 1.3 the regular expression isn't considered at all at that point in the tree. It won't be considered until after all normal <Directory>s and `.htaccess` files have been applied. Then the regular expression will match on `/home/abc/public_html/abc` and be applied.

Note that the default Apache access for <Directory /> is Allow from All. This means that Apache will serve any file mapped from an URL. It is recommended that you change this with a block such as

```
<Directory />
    Order Deny,Allow
    Deny from All
```

```
</Directory>
```

and then override this for directories you *want* accessible. See the Security Tips page for more details.

The directory sections typically occur in the access.conf file, but they may appear in any configuration file. <Directory> directives cannot nest, and cannot appear in a <Limit> or <LimitExcept> section.

See also: How Directory, Location and Files sections work for an explanation of how these different sections are combined when a request is received

---

<DirectoryMatch>

Syntax: <DirectoryMatch *regex*> ... </DirectoryMatch>
Context: server config, virtual host
Status: Core.
Compatibility: Available in Apache 1.3 and later

<DirectoryMatch> and </DirectoryMatch> are used to enclose a group of directives which will apply only to the named directory and sub-directories of that directory, the same as <Directory>. However, it takes as an argument a regular expression. For example:

```
<DirectoryMatch "^/www/.*/[0-9]{3}">
```

would match directories in /www/ that consisted of three numbers.

See Also: <Directory> for a description of how regular expressions are mixed in with normal <Directory>s.
See also: How Directory, Location and Files sections work for an explanation of how these different sections are combined when a request is received

---

DocumentRoot directive

Syntax: DocumentRoot *directory-filename*
Default: `DocumentRoot /usr/local/apache/htdocs`
Context: server config, virtual host
Status: core

This directive sets the directory from which httpd will serve files. Unless matched by a directive like Alias, the server appends the path from the requested URL to the document root to make the path to the document. Example:

```
DocumentRoot /usr/web
```

then an access to `http://www.my.host.com/index.html` refers to `/usr/web/index.html`.

There appears to be a bug in mod_dir which causes problems when the DocumentRoot has a trailing slash (*i.e.*, "DocumentRoot /usr/web/") so please avoid that.

ErrorDocument directive

Syntax: ErrorDocument *error-code document*
Context: server config, virtual host, directory, .htaccess
Status: core
Override: FileInfo
Compatibility: The directory and .htaccess contexts are only available in Apache 1.1 and later.

In the event of a problem or error, Apache can be configured to do one of four things,

1. output a simple hardcoded error message
2. output a customized message
3. redirect to a local URL to handle the problem/error
4. redirect to an external URL to handle the problem/error

The first option is the default, while options 2-4 are configured using the `ErrorDocument` directive, which is followed by the HTTP response code and a message or URL.

Messages in this context begin with a single quote ("), which does not form part of the message itself. Apache will sometimes offer additional information regarding the problem/error.

URLs can begin with a slash (/) for local URLs, or be a full URL which the client can resolve. Examples:

```
ErrorDocument 500 http://foo.example.com/cgi-bin/tester
ErrorDocument 404 /cgi-bin/bad_urls.pl
ErrorDocument 401 /subscription_info.html
ErrorDocument 403 "Sorry can't allow you access today
```

Note that when you specify an `ErrorDocument` that points to a remote URL (ie. anything with a method such as "http" in front of it) Apache will send a redirect to the client to tell it where to find the document, even if the document ends up being on the same server.. This has several implications, the most important being that **if you use an "ErrorDocument 401" directive then it must refer to a local document.** This results from the nature of the HTTP basic authentication scheme.

See Also: documentation of customizable responses.

ErrorLog directive

Syntax: ErrorLog *filename*|`syslog[:facility]`
Default: `ErrorLog logs/error_log` (Unix)
Default: `ErrorLog logs/error.log` (Windows and OS/2)

Context: server config, virtual host
Status: core

The error log directive sets the name of the file to which the server will log any errors it encounters. If the filename does not begin with a slash (/) then it is assumed to be relative to the ServerRoot. If the filename begins with a pipe (|) then it is assumed to be a command to spawn to handle the error log.

Apache 1.3 and above: Using `syslog` instead of a filename enables logging via syslogd(8) if the system supports it. The default is to use syslog facility `local7`, but you can override this by using the `syslog:`*facility* syntax where *facility* can be one of the names usually documented in syslog(1).

SECURITY: See the security tips document for details on why your security could be compromised if the directory where logfiles are stored is writable by anyone other than the user that starts the server.

See also: LogLevel

<Files> directive

Syntax: <Files *filename*> ... </Files>
Context: server config, virtual host, .htaccess
Status: core
Compatibility: only available in Apache 1.2 and above.

The <Files> directive provides for access control by filename. It is comparable to the <Directory> directive and <Location> directives. It should be matched with a </Files> directive. The directives given within this section will be applied to any object with a basename (last component of filename) matching the specified filename. `<Files>` sections are processed in the order they appear in the configuration file, after the <Directory> sections and `.htaccess` files are read, but before <Location> sections. Note that <Files> can be nested inside <Directory> sections to restrict the portion of the filesystem they apply to.

The *filename* argument should include a filename, or a wild-card string, where `?' matches any single character, and `*' matches any sequences of characters. Extended regular expressions can also be used, with the addition of the `~` character. For example:

```
<Files ~ "\.(gif|jpe?g|png)$">
```

would match most common Internet graphics formats. In Apache 1.3 and later, <FilesMatch> is preferred, however.

Note that unlike `<Directory>` and `<Location>` sections, `<Files>` sections can be used inside .htaccess files. This allows users to control access to their own files, at a file-by-file level.

See also: How Directory, Location and Files sections work for an explanation of how these different sections are combined when a request is received

---

<FilesMatch>

Syntax: <FilesMatch *regex*> ... </FilesMatch>
Context: server config, virtual host, .htaccess
Status: core
Compatibility: only available in Apache 1.3 and above.

The <FilesMatch> directive provides for access control by filename, just as the <Files> directive does. However, it accepts a regular expression. For example:

```
<FilesMatch "\.(gif|jpe?g|png)$">
```

would match most common Internet graphics formats.

See also: How Directory, Location and Files sections work for an explanation of how these different sections are combined when a request is received

---

Group directive

Syntax: Group *unix-group*
Default: `Group #-1`
Context: server config, virtual host
Status: core

The Group directive sets the group under which the server will answer requests. In order to use this directive, the stand-alone server must be run initially as root. *Unix-group* is one of:

A group name

Refers to the given group by name.

followed by a group number.

Refers to a group by its number.

It is recommended that you set up a new group specifically for running the server. Some admins use user `nobody`, but this is not always possible or desirable.

Note: if you start the server as a non-root user, it will fail to change to the specified group, and will instead continue to run as the group of the original user.

Special note: Use of this directive in <VirtualHost> requires a properly configured suEXEC wrapper. When used inside a <VirtualHost> in this manner, only the group that CGIs are run as is affected. Non-CGI requests are still processed as the group specified in the main Group directive.

SECURITY: See User for a discussion of the security considerations.

HostNameLookups directive

Syntax: HostNameLookups *on* | *off* | *double*
Default: `HostNameLookups off`
Context: server config, virtual host, directory
Status: core
Compatibility: `double` available only in Apache 1.3 and above.
Compatibility: Default was `on` prior to Apache 1.3.

This directive enables DNS lookups so that host names can be logged (and passed to CGIs/SSIs in `REMOTE_HOST`). The value `double` refers to doing double-reverse DNS. That is, after a reverse lookup is performed, a forward lookup is then performed on that result. At least one of the ip addresses in the forward lookup must match the original address. (In "tcpwrappers" terminology this is called `PARANOID`.)

Regardless of the setting, when mod_access is used for controlling access by hostname, a double reverse lookup will be performed. This is necessary for security. Note that the result of this double-reverse isn't generally available unless you set `HostnameLookups double`. For example, if only `HostnameLookups on` and a request is made to an object that is protected by hostname restrictions, regardless of whether the double-reverse fails or not, CGIs will still be passed the single-reverse result in `REMOTE_HOST`.

The default for this directive was previously `on` in versions of Apache prior to 1.3. It was changed to `off` in order to save the network traffic for those sites that don't truly need the reverse lookups done. It is also better for the end users because they don't have to suffer the extra latency that a lookup entails. Heavily loaded sites should leave this directive `off`, since DNS lookups can take considerable amounts of time. The utility *logresolve*, provided in the */support* directory, can be used to look up host names from logged IP addresses offline.

IdentityCheck directive

Syntax: IdentityCheck *boolean*
Default: `IdentityCheck off`
Context: server config, virtual host, directory
Status: core

This directive enables RFC1413-compliant logging of the remote user name for each connection, where the client machine runs identd or something similar. This information is logged in the access log. *Boolean* is either `on` or `off`.

The information should not be trusted in any way except for rudimentary usage tracking.

Note that this can cause serious latency problems accessing your server since every request requires one of these lookups to be performed. When firewalls are involved each lookup might possibly fail and add

30 seconds of latency to each hit. So in general this is not very useful on public servers accessible fr
the Internet.

<IfDefine> directive

Syntax: <IfDefine [!]*parameter-name*> ... </IfDefine>
Default: None
Context: all
Status: Core
Compatibility: <IfDefine> is only available in 1.3.1 and later.

The <IfDefine *test*>...</IfDefine> section is used to mark directives that are conditional. The directives within an IfDefine section are only processed if the *test* is true. If *test* is false, everything between the start and end markers is ignored.

The *test* in the <IfDefine> section directive can be one of two forms:

- *parameter-name*
- !*parameter-name*

In the former case, the directives between the start and end markers are only processed if the parameter named *parameter-name* is defined. The second format reverses the test, and only processes the directives if *parameter-name* is **not** defined.

The *parameter-name* argument is a define as given on the `httpd` command line via `-D`*parameter-*, at the time the server was started.

<IfDefine> sections are nest-able, which can be used to implement simple multiple-parameter tests. Example:

```
$ httpd -DReverseProxy ...

# httpd.conf
<IfDefine ReverseProxy>
LoadModule rewrite_module libexec/mod_rewrite.so
LoadModule proxy_module   libexec/libproxy.so
</IfDefine>
```

<IfModule> directive

Syntax: <IfModule [!]*module-name*> ... </IfModule>
Default: None
Context: all

Status: Core
Compatibility: IfModule is only available in 1.2 and later.

The <IfModule *test*>...</IfModule> section is used to mark directives that are conditional. The directives within an IfModule section are only processed if the *test* is true. If *test* is false, everything between the start and end markers is ignored.

The *test* in the <IfModule> section directive can be one of two forms:

- *module name*
- !*module name*

In the former case, the directives between the start and end markers are only processed if the module named *module name* is compiled in to Apache. The second format reverses the test, and only processes the directives if *module name* is **not** compiled in.

The *module name* argument is a module name as given as the file name of the module, at the time it was compiled. For example, `mod_rewrite.c`.

<IfModule> sections are nest-able, which can be used to implement simple multiple-module tests.

Include directive

Syntax: Include *filename*
Context: server config
Status: Core
Compatibility: Include is only available in Apache 1.3 and later.

This directive allows inclusion of other configuration files from within the server configuration files.

KeepAlive directive

Syntax: (Apache 1.1) KeepAlive *max-requests*
Default: (Apache 1.1) `KeepAlive 5`
Syntax: (Apache 1.2) KeepAlive *on/off*
Default: (Apache 1.2) `KeepAlive On`
Context: server config
Status: Core
Compatibility: KeepAlive is only available in Apache 1.1 and later.

This directive enables Keep-Alive support.

Apache 1.1: Set *max-requests* to the maximum number of requests you want Apache to entertain per request. A limit is imposed to prevent a client from hogging your server resources. Set this to `0` to disable

support.

Apache 1.2 and later: Set to "On" to enable persistent connections, "Off" to disable. See also the MaxKeepAliveRequests directive.

KeepAliveTimeout directive

Syntax: KeepAliveTimeout *seconds*
Default: `KeepAliveTimeout 15`
Context: server config
Status: Core
Compatibility: KeepAliveTimeout is only available in Apache 1.1 and later.

The number of seconds Apache will wait for a subsequent request before closing the connection. Once a request has been received, the timeout value specified by the `Timeout` directive applies.

<Limit> directive

Syntax: <Limit *method method* ... > ... </Limit>
Context: any
Status: core

Access controls are normally effective for **all** access methods, and this is the usual desired behaviour. **In the general case, access control directives should not be placed within a `<limit>` section.**

The purpose of the <Limit> directive is to restrict the effect of the access controls to the nominated HTTP methods. For all other methods, the access restrictions that are enclosed in the <Limit> bracket **will have no effect**. The following example applies the access control only to the methods POST, PUT, and DELETE, leaving all other methods unprotected:

```
<Limit POST PUT DELETE>
require valid-user
</Limit>
```

The method names listed can be one or more of: GET, POST, PUT, DELETE, CONNECT, OPTIONS, TRACE, PATCH, PROPFIND, PROPPATCH, MKCOL, COPY, MOVE, LOCK, and UNLOCK. **The method name is case-sensitive.** If GET is used it will also restrict HEAD requests.

<LimitExcept> directive

Syntax: <LimitExcept *method method* ... > ... </LimitExcept>
Context: any

Status: core
Compatibility: Available in Apache 1.3.5 and later

<LimitExcept> and </LimitExcept> are used to enclose a group of access control directives which will then apply to any HTTP access method **not** listed in the arguments; i.e., it is the opposite of a <Limit> section and can be used to control both standard and nonstandard/unrecognized methods. See the documentation for <Limit> for more details.

LimitRequestBody directive

Syntax: LimitRequestBody *number*
Default: `LimitRequestBody 0`
Context: server config, virtual host, directory, .htaccess
Status: core
Compatibility: LimitRequestBody is only available in Apache 1.3.2 and later.

Number is a long integer from 0 (meaning unlimited) to 2147483647 (2GB). The default value is defined by the compile-time constant `DEFAULT_LIMIT_REQUEST_BODY` (0 as distributed).

The LimitRequestBody directive allows the user to set a limit on the allowed size of an HTTP request message body within the context in which the directive is given (server, per-directory, per-file or per-location). If the client request exceeds that limit, the server will return an error response instead of servicing the request. The size of a normal request message body will vary greatly depending on the nature of the resource and the methods allowed on that resource. CGI scripts typically use the message body for passing form information to the server. Implementations of the PUT method will require a value at least as large as any representation that the server wishes to accept for that resource.

This directive gives the server administrator greater control over abnormal client request behavior, which may be useful for avoiding some forms of denial-of-service attacks.

LimitRequestFields directive

Syntax: LimitRequestFields *number*
Default: `LimitRequestFields 100`
Context: server config
Status: core
Compatibility: LimitRequestFields is only available in Apache 1.3.2 and later.

Number is an integer from 0 (meaning unlimited) to 32767. The default value is defined by the compile-time constant `DEFAULT_LIMIT_REQUEST_FIELDS` (100 as distributed).

The LimitRequestFields directive allows the server administrator to modify the limit on the number of

request header fields allowed in an HTTP request. A server needs this value to be larger than the nu of fields that a normal client request might include. The number of request header fields used by a cl rarely exceeds 20, but this may vary among different client implementations, often depending upon the extent to which a user has configured their browser to support detailed content negotiation. Optional HTTP extensions are often expressed using request header fields.

This directive gives the server administrator greater control over abnormal client request behavior, which may be useful for avoiding some forms of denial-of-service attacks. The value should be increased if normal clients see an error response from the server that indicates too many fields were sent in the request.

LimitRequestFieldsize directive

Syntax: LimitRequestFieldsize *number*
Default: `LimitRequestFieldsize 8190`
Context: server config
Status: core
Compatibility: LimitRequestFieldsize is only available in Apache 1.3.2 and later.

Number is an integer size in bytes from 0 to the value of the compile-time constant `DEFAULT_LIMIT_REQUEST_FIELDSIZE` (8190 as distributed).

The LimitRequestFieldsize directive allows the server administrator to reduce the limit on the allowed size of an HTTP request header field below the normal input buffer size compiled with the server. A server needs this value to be large enough to hold any one header field from a normal client request. The size of a normal request header field will vary greatly among different client implementations, often depending upon the extent to which a user has configured their browser to support detailed content negotiation.

This directive gives the server administrator greater control over abnormal client request behavior, which may be useful for avoiding some forms of denial-of-service attacks. Under normal conditions, the value should not be changed from the default.

LimitRequestLine directive

Syntax: LimitRequestLine *number*
Default: `LimitRequestLine 8190`
Context: server config
Status: core
Compatibility: LimitRequestLine is only available in Apache 1.3.2 and later.

Number is an integer size in bytes from 0 to the value of the compile-time constant

`DEFAULT_LIMIT_REQUEST_LINE` (8190 as distributed).

The LimitRequestLine directive allows the server administrator to reduce the limit on the allowed size of a client's HTTP request-line below the normal input buffer size compiled with the server. Since the request-line consists of the HTTP method, URI, and protocol version, the LimitRequestLine directive places a restriction on the length of a request-URI allowed for a request on the server. A server needs this value to be large enough to hold any of its resource names, including any information that might be passed in the query part of a GET request.

This directive gives the server administrator greater control over abnormal client request behavior, which may be useful for avoiding some forms of denial-of-service attacks. Under normal conditions, the value should not be changed from the default.

Listen directive

Syntax: Listen [*IP address*:]*port number*
Context: server config
Status: core
Compatibility: Listen is only available in Apache 1.1 and later.

The Listen directive instructs Apache to listen to more than one IP address or port; by default it responds to requests on all IP interfaces, but only on the port given by the `Port` directive.

`Listen` can be used instead of `BindAddress` and `Port`. It tells the server to accept incoming requests on the specified port or address-and-port combination. If the first format is used, with a port number only, the server listens to the given port on all interfaces, instead of the port given by the `Port` directive. If an IP address is given as well as a port, the server will listen on the given port and interface.

Note that you may still require a `Port` directive so that URLs that Apache generates that point to your server still work.

Multiple Listen directives may be used to specify a number of addresses and ports to listen to. The server will respond to requests from any of the listed addresses and ports.

For example, to make the server accept connections on both port 80 and port 8000, use:

```
Listen 80
Listen 8000
```

To make the server accept connections on two specified interfaces and port numbers, use

```
Listen 192.170.2.1:80
Listen 192.170.2.5:8000
```

See Also: DNS Issues
See Also: Setting which addresses and ports Apache uses

ListenBacklog directive

Syntax: ListenBacklog *backlog*
Default: `ListenBacklog 511`
Context: server config
Status: Core
Compatibility: ListenBacklog is only available in Apache versions after 1.2.0.

The maximum length of the queue of pending connections. Generally no tuning is needed or desired, however on some systems it is desirable to increase this when under a TCP SYN flood attack. See the backlog parameter to the `listen(2)` system call.

This will often be limited to a smaller number by the operating system. This varies from OS to OS. Also note that many OSes do not use exactly what is specified as the backlog, but use a number based on (but normally larger than) what is set.

<Location> directive

Syntax: <Location *URL*> ... </Location>
Context: server config, virtual host
Status: core
Compatibility: Location is only available in Apache 1.1 and later.

The <Location> directive provides for access control by URL. It is similar to the <Directory> directive, and starts a subsection which is terminated with a </Location> directive. `<Location>` sections are processed in the order they appear in the configuration file, after the <Directory> sections and `.htaccess` files are read, and after the <Files> sections.

Note that URLs do not have to line up with the filesystem at all, it should be emphasized that <Location> operates completely outside the filesystem.

For all origin (non-proxy) requests, the URL to be matched is of the form `/path/`, and you should not include any `http://servername` prefix. For proxy requests, the URL to be matched is of the form `scheme://servername/path`, and you must include the prefix.

The URL may use wildcards In a wild-card string, `?' matches any single character, and `*' matches any sequences of characters.

Apache 1.2 and above: Extended regular expressions can also be used, with the addition of the ~ character. For example:

```
<Location ~ "/(extra|special)/data">
```

would match URLs that contained the substring "/extra/data" or "/special/data". In Apache 1.3 and above,

a new directive <LocationMatch> exists which behaves identical to the regex version of `<Locatio`

The `Location` functionality is especially useful when combined with the `SetHandler` directive. For example, to enable status requests, but allow them only from browsers at foo.com, you might use:

```
<Location /status>
SetHandler server-status
order deny,allow
deny from all
allow from .foo.com
</Location>
```

Apache 1.3 and above note about / (slash): The slash character has special meaning depending on where in a URL it appears. People may be used to its behaviour in the filesystem where multiple adjacent slashes are frequently collapsed to a single slash (*i.e.*, `/home///foo` is the same as `/home/foo`). In URL-space this is not necessarily true. The `<LocationMatch>` directive and the regex version of `<Location>` require you to explicitly specify multiple slashes if that is your intention. For example, `<LocationMatch ^/abc>` would match the request URL `/abc` but not the request URL `//abc`. The (non-regex) `<Location>` directive behaves similarly when used for proxy requests. But when (non-regex) `<Location>` is used for non-proxy requests it will implicitly match multiple slashes with a single slash. For example, if you specify `<Location /abc/def>` and the request is to `/abc//def` then it will match.

See also: How Directory, Location and Files sections work for an explanation of how these different sections are combined when a request is received

---

<LocationMatch>

Syntax: <LocationMatch *regex*> ... </LocationMatch>
Context: server config, virtual host
Status: core
Compatibility: LocationMatch is only available in Apache 1.3 and later.

The <LocationMatch> directive provides for access control by URL, in an identical manner to <Location>. However, it takes a regular expression as an argument instead of a simple string. For example:

```
<LocationMatch "/(extra|special)/data">
```

would match URLs that contained the substring "/extra/data" or "/special/data".

See also: How Directory, Location and Files sections work for an explanation of how these different sections are combined when a request is received

---

LockFile directive

Syntax: LockFile *filename*
Default: `LockFile logs/accept.lock`
Context: server config
Status: core

The LockFile directive sets the path to the lockfile used when Apache is compiled with either USE_FCNTL_SERIALIZED_ACCEPT or USE_FLOCK_SERIALIZED_ACCEPT. This directive should normally be left at its default value. The main reason for changing it is if the `logs` directory is NFS mounted, since **the lockfile must be stored on a local disk**. The PID of the main server process is automatically appended to the filename.

SECURITY: It is best to avoid putting this file in a world writable directory such as `/var/tmp` because someone could create a denial of service attack and prevent the server from starting by creating a lockfile with the same name as the one the server will try to create.

LogLevel directive

Syntax: LogLevel *level*
Default: `LogLevel error`
Context: server config, virtual host
Status: core
Compatibility: LogLevel is only available in 1.3 or later.

LogLevel adjusts the verbosity of the messages recorded in the error logs (see ErrorLog directive). The following *level*s are available, in order of decreasing significance:

Level	Description Example
`emerg`	Emergencies - system is unusable. "Child cannot open lock file. Exiting"
`alert`	Action must be taken immediately. "getpwuid: couldn't determine user name from uid"
`crit`	Critical Conditions. "socket: Failed to get a socket, exiting child"
`error`	Error conditions. "Premature end of script headers"
`warn`	Warning conditions. "child process 1234 did not exit, sending another SIGHUP"
`notice`	Normal but significant condition.

	"httpd: caught SIGBUS, attempting to dump core in ..."
`info`	Informational.
	"Server seems busy, (you may need to increase StartServers, or Min/MaxSpareServers)..."
`debug`	Debug-level messages
	"Opening config file ..."

When a particular level is specified, messages from all other levels of higher significance will be reported as well. *E.g.*, when `LogLevel info` is specified, then messages with log levels of `notice` and `warn` will also be posted.

Using a level of at least `crit` is recommended.

MaxClients directive

Syntax: MaxClients *number*
Default: `MaxClients 256`
Context: server config
Status: core

The MaxClients directive sets the limit on the number of simultaneous requests that can be supported; not more than this number of child server processes will be created. To configure more than 256 clients, you must edit the HARD_SERVER_LIMIT entry in httpd.h and recompile.

Any connection attempts over the MaxClients limit will normally be queued, up to a number based on the ListenBacklog directive. Once a child process is freed at the end of a different request, the connection will then be serviced.

MaxKeepAliveRequests directive

Syntax: MaxKeepAliveRequests *number*
Default: `MaxKeepAliveRequests 100`
Context: server config
Status: core
Compatibility: Only available in Apache 1.2 and later.

The MaxKeepAliveRequests directive limits the number of requests allowed per connection when KeepAlive is on. If it is set to "`0`", unlimited requests will be allowed. We recommend that this setting be kept to a high value for maximum server performance.

MaxRequestsPerChild directive

Syntax: MaxRequestsPerChild *number*
Default: `MaxRequestsPerChild 0`
Context: server config
Status: core

The MaxRequestsPerChild directive sets the limit on the number of requests that an individual child server process will handle. After MaxRequestsPerChild requests, the child process will die. If MaxRequestsPerChild is 0, then the process will never expire.

Setting MaxRequestsPerChild to a non-zero limit has two beneficial effects:

- it limits the amount of memory that process can consume by (accidental) memory leakage;
- by giving processes a finite lifetime, it helps reduce the number of processes when the server load reduces.

This directive has no effect on Win32.

NOTE: For *KeepAlive* requests, only the first request is counted towards this limit. In effect, it changes the behavior to limit the number of *connections* per child.

MaxSpareServers directive

Syntax: MaxSpareServers *number*
Default: `MaxSpareServers 10`
Context: server config
Status: core

The MaxSpareServers directive sets the desired maximum number of *idle* child server processes. An idle process is one which is not handling a request. If there are more than MaxSpareServers idle, then the parent process will kill off the excess processes.

Tuning of this parameter should only be necessary on very busy sites. Setting this parameter to a large number is almost always a bad idea.

This directive has no effect when used with the Apache Web server on a Microsoft Windows platform.

See also MinSpareServers and StartServers.

MinSpareServers directive

Syntax: MinSpareServers *number*
Default: `MinSpareServers 5`
Context: server config
Status: core

The MinSpareServers directive sets the desired minimum number of *idle* child server processes. An idle process is one which is not handling a request. If there are fewer than MinSpareServers idle, then the parent process creates new children at a maximum rate of 1 per second.

Tuning of this parameter should only be necessary on very busy sites. Setting this parameter to a large number is almost always a bad idea.

This directive has no effect on Microsoft Windows.

See also MaxSpareServers and StartServers.

NameVirtualHost directive

Syntax: NameVirtualHost *addr*[:*port*]
Context: server config
Status: core
Compatibility: NameVirtualHost is only available in Apache 1.3 and later

The NameVirtualHost directive is a required directive if you want to configure name-based virtual hosts.

Although *addr* can be hostname it is recommended that you always use an IP address, *e.g.*

```
NameVirtualHost 111.22.33.44
```

With the NameVirtualHost directive you specify the address to which your name-based virtual host names resolve. If you have multiple name-based hosts on multiple addresses, repeat the directive for each address.

Note: the "main server" and any _default_ servers will **never** be served for a request to a NameVirtualHost IP Address (unless for some reason you specify NameVirtualHost but then don't define any VirtualHosts for that address).

Optionally you can specify a port number on which the name-based virtual hosts should be used, *e.g.*

```
NameVirtualHost 111.22.33.44:8080
```

See also: Apache Virtual Host documentation

Options directive

Syntax: Options *[+|-]option [+|-]option ...*
Context: server config, virtual host, directory, .htaccess
Override: Options
Status: core

The Options directive controls which server features are available in a particular directory.

option can be set to `None`, in which case none of the extra features are enabled, or one or more of the following:

All

All options except for MultiViews. This is the default setting.

ExecCGI

Execution of CGI scripts is permitted.

FollowSymLinks

The server will follow symbolic links in this directory.
Note: even though the server follows the symlink it does *not* change the pathname used to match against `<Directory>` sections.
Note: this option gets ignored if set inside a <Location> section.

Includes

Server-side includes are permitted.

IncludesNOEXEC

Server-side includes are permitted, but the #exec command and #include of CGI scripts are disabled.

Indexes

If a URL which maps to a directory is requested, and the there is no DirectoryIndex (*e.g.*, index.html) in that directory, then the server will return a formatted listing of the directory.

MultiViews

Content negotiated MultiViews are allowed.

SymLinksIfOwnerMatch

The server will only follow symbolic links for which the target file or directory is owned by the same user id as the link.
Note: this option gets ignored if set inside a <Location> section.

Normally, if multiple `Options` could apply to a directory, then the most specific one is taken complete; the options are not merged. However if *all* the options on the `Options` directive are preceded by a + or - symbol, the options are merged. Any options preceded by a + are added to the options currently in force, and any options preceded by a - are removed from the options currently in force.

For example, without any + and - symbols:

```
<Directory /web/docs>
```


```
    Options Indexes FollowSymLinks
    </Directory>
    <Directory /web/docs/spec>
    Options Includes
    </Directory>
```

then only `Includes` will be set for the /web/docs/spec directory. However if the second `Options` directive uses the + and - symbols:

```
    <Directory /web/docs>
    Options Indexes FollowSymLinks
    </Directory>
    <Directory /web/docs/spec>
    Options +Includes -Indexes
    </Directory>
```

then the options `FollowSymLinks` and `Includes` are set for the /web/docs/spec directory.

Note: Using `-IncludesNOEXEC` or `-Includes` disables server-side includes completely regardless of the previous setting.

The default in the absence of any other settings is `All`.

PidFile directive

Syntax: PidFile *filename*
Default: `PidFile logs/httpd.pid`
Context: server config
Status: core

The PidFile directive sets the file to which the server records the process id of the daemon. If the filename does not begin with a slash (/) then it is assumed to be relative to the ServerRoot. The PidFile is only used in standalone mode.

It is often useful to be able to send the server a signal, so that it closes and then reopens its ErrorLog and TransferLog, and re-reads its configuration files. This is done by sending a SIGHUP (kill -1) signal to the process id listed in the PidFile.

The PidFile is subject to the same warnings about log file placement and security.

Port directive

Syntax: Port *number*
Default: `Port 80`

Context: server config
Status: core

Number is a number from 0 to 65535; some port numbers (especially below 1024) are reserved for particular protocols. See `/etc/services` for a list of some defined ports; the standard port for the http protocol is 80.

The Port directive has two behaviors, the first of which is necessary for NCSA backwards compatibility (and which is confusing in the context of Apache).

- In the absence of any Listen or BindAddress directives specifying a port number, a Port directive given in the "main server" (*i.e.*, outside any <VirtualHost> section) sets the network port on which the server listens. If there are any Listen or BindAddress directives specifying `:number` then Port has no effect on what address the server listens at.
- The Port directive sets the `SERVER_PORT` environment variable (for CGI and SSI), and is used when the server must generate a URL that refers to itself (for example when creating an external redirect to itself). This behaviour is modified by UseCanonicalName.

In no event does a Port setting affect what ports a VirtualHost responds on, the VirtualHost directive itself is used for that.

The primary behaviour of Port should be considered to be similar to that of the ServerName directive. The ServerName and Port together specify what you consider to be the *canonical* address of the server. (See also UseCanonicalName.)

Port 80 is one of Unix's special ports. All ports numbered below 1024 are reserved for system use, *i.e.*, regular (non-root) users cannot make use of them; instead they can only use higher port numbers. To use port 80, you must start the server from the root account. After binding to the port and before accepting requests, Apache will change to a low privileged user as set by the User directive.

If you cannot use port 80, choose any other unused port. Non-root users will have to choose a port number higher than 1023, such as 8000.

SECURITY: if you do start the server as root, be sure not to set User to root. If you run the server as root whilst handling connections, your site may be open to a major security attack.

---

require directive

Syntax: require *entity-name entity entity...*
Context: directory, .htaccess
Override: AuthConfig
Status: core

This directive selects which authenticated users can access a directory. The allowed syntaxes are:

- require user *userid userid* ...

Only the named users can access the directory.

- require group *group-name group-name ...*

  Only users in the named groups can access the directory.

- require valid-user

  All valid users can access the directory.

Require must be accompanied by AuthName and AuthType directives, and directives such as AuthUserFile and AuthGroupFile (to define users and groups) in order to work correctly. Example:

```
AuthType Basic
AuthName "Restricted Directory"
AuthUserFile /web/users
AuthGroupFile /web/groups
require group admin
```

Access controls which are applied in this way are effective for **all** methods. **This is what is normally desired.** If you wish to apply access controls only to specific methods, while leaving other methods unprotected, then place the `require` statement into a <Limit> section

---

ResourceConfig directive

Syntax: ResourceConfig *filename*
Default: `ResourceConfig conf/srm.conf`
Context: server config, virtual host
Status: core

The server will read this file for more directives after reading the httpd.conf file. *Filename* is relative to the ServerRoot. This feature can be disabled using:

```
ResourceConfig /dev/null
```

Historically, this file contained most directives except for server configuration directives and <Directory> sections; in fact it can now contain any server directive allowed in the *server config* context.

See also AccessConfig.

RLimitCPU directive

Syntax: RLimitCPU *# or 'max' [# or 'max']*
Default: *Unset; uses operating system defaults*
Context: server config, virtual host
Status: core

Compatibility: RLimitCPU is only available in Apache 1.2 and later

Takes 1 or 2 parameters. The first parameter sets the soft resource limit for all processes and the second parameter sets the maximum resource limit. Either parameter can be a number, or *max* to indicate to the server that the limit should be set to the maximum allowed by the operating system configuration. Raising the maximum resource limit requires that the server is running as root, or in the initial startup phase.

This applies to processes forked off from Apache children servicing requests, not the Apache children themselves. This includes CGI scripts and SSI exec commands, but not any processes forked off from the Apache parent such as piped logs.

CPU resource limits are expressed in seconds per process.

See also RLimitMEM or RLimitNPROC.

RLimitMEM directive

Syntax: RLimitMEM *# or 'max' [# or 'max']*
Default: *Unset; uses operating system defaults*
Context: server config, virtual host
Status: core
Compatibility: RLimitMEM is only available in Apache 1.2 and later

Takes 1 or 2 parameters. The first parameter sets the soft resource limit for all processes and the second parameter sets the maximum resource limit. Either parameter can be a number, or *max* to indicate to the server that the limit should be set to the maximum allowed by the operating system configuration. Raising the maximum resource limit requires that the server is running as root, or in the initial startup phase.

This applies to processes forked off from Apache children servicing requests, not the Apache children themselves. This includes CGI scripts and SSI exec commands, but not any processes forked off from the Apache parent such as piped logs.

Memory resource limits are expressed in bytes per process.

See also RLimitCPU or RLimitNPROC.

RLimitNPROC directive

Syntax: RLimitNPROC *# or 'max' [# or 'max']*
Default: *Unset; uses operating system defaults*
Context: server config, virtual host

Status: core
Compatibility: RLimitNPROC is only available in Apache 1.2 and later

Takes 1 or 2 parameters. The first parameter sets the soft resource limit for all processes and the second parameter sets the maximum resource limit. Either parameter can be a number, or *max* to indicate to the server that the limit should be set to the maximum allowed by the operating system configuration. Raising the maximum resource limit requires that the server is running as root, or in the initial startup phase.

This applies to processes forked off from Apache children servicing requests, not the Apache children themselves. This includes CGI scripts and SSI exec commands, but not any processes forked off from the Apache parent such as piped logs.

Process limits control the number of processes per user.

Note: If CGI processes are **not** running under userids other than the web server userid, this directive will limit the number of processes that the server itself can create. Evidence of this situation will be indicated by ***cannot fork*** messages in the error_log.

See also RLimitMEM or RLimitCPU.

Satisfy directive

Syntax: Satisfy *'any' or 'all'*
Default: Satisfy all
Context: directory, .htaccess
Status: core
Compatibility: Satisfy is only available in Apache 1.2 and later

Access policy if both allow and require used. The parameter can be either *'all'* or *'any'*. This directive is only useful if access to a particular area is being restricted by both username/password *and* client host address. In this case the default behavior ("all") is to require that the client passes the address access restriction *and* enters a valid username and password. With the "any" option the client will be granted access if they either pass the host restriction or enter a valid username and password. This can be used to password restrict an area, but to let clients from particular addresses in without prompting for a password.

ScoreBoardFile directive

Syntax: ScoreBoardFile *filename*
Default: `ScoreBoardFile logs/apache_status`
Context: server config

Status: core

The ScoreBoardFile directive is required on some architectures to place a file that the server will use to communicate between its children and the parent. The easiest way to find out if your architecture requires a scoreboard file is to run Apache and see if it creates the file named by the directive. If your architecture requires it then you must ensure that this file is not used at the same time by more than one invocation of Apache.

If you have to use a ScoreBoardFile then you may see improved speed by placing it on a RAM disk. But be careful that you heed the same warnings about log file placement and security.

Apache 1.2 and above:

Linux 1.x users might be able to add `-DHAVE_SHMGET -DUSE_SHMGET_SCOREBOARD` to the `EXTRA_CFLAGS` in your `Configuration`. This might work with some 1.x installations, but won't work with all of them. (Prior to 1.3b4, `HAVE_SHMGET` would have sufficed.)

SVR4 users should consider adding `-DHAVE_SHMGET -DUSE_SHMGET_SCOREBOARD` to the `EXTRA_CFLAGS` in your `Configuration`. This is believed to work, but we were unable to test it in time for 1.2 release. (Prior to 1.3b4, `HAVE_SHMGET` would have sufficed.)

See Also: Stopping and Restarting Apache

ScriptInterpreterSource directive

Syntax: ScriptInterpreterSource *'registry' or 'script'*
Default: `ScriptInterpreterSource script`
Context: directory, .htaccess
Status: core (Windows only)

This directive is used to control how Apache 1.3.5 and later finds the interpreter used to run CGI scripts. The default technique is to use the interpreter pointed to by the #! line in the script. Setting ScriptInterpreterSource registry will cause the Windows Registry to be searched using the script file extension (e.g., .pl) as a search key.

SendBufferSize directive

Syntax: SendBufferSize *bytes*
Context: server config
Status: core

The server will set the TCP buffer size to the number of bytes specified. Very useful to increase past standard OS defaults on high speed high latency (*i.e.*, 100ms or so, such as transcontinental fast pipes)

ServerAdmin directive

Syntax: ServerAdmin *email-address*
Context: server config, virtual host
Status: core

The ServerAdmin sets the e-mail address that the server includes in any error messages it returns to the client.

It may be worth setting up a dedicated address for this, *e.g.*

```
ServerAdmin www-admin@foo.bar.com
```

as users do not always mention that they are talking about the server!

ServerAlias directive

Syntax: ServerAlias *host1 host2 ...*
Context: virtual host
Status: core
Compatibility: ServerAlias is only available in Apache 1.1 and later.

The ServerAlias directive sets the alternate names for a host, for use with name-based virtual hosts.

See also: Apache Virtual Host documentation

ServerName directive

Syntax: ServerName *fully-qualified domain name*
Context: server config, virtual host
Status: core

The ServerName directive sets the hostname of the server; this is only used when creating redirection URLs. If it is not specified, then the server attempts to deduce it from its own IP address; however this may not work reliably, or may not return the preferred hostname. For example:

```
ServerName www.wibble.com
```

would be used if the canonical (main) name of the actual machine were `monster.wibble.com`.

See Also:
DNS Issues
UseCanonicalName

ServerPath directive

Syntax: ServerPath *pathname*
Context: virtual host
Status: core
Compatibility: ServerPath is only available in Apache 1.1 and later.

The ServerPath directive sets the legacy URL pathname for a host, for use with name-based virtual hosts.

See also: Apache Virtual Host documentation

ServerRoot directive

Syntax: ServerRoot *directory-filename*
Default: `ServerRoot /usr/local/apache`
Context: server config
Status: core

The ServerRoot directive sets the directory in which the server lives. Typically it will contain the subdirectories `conf/` and `logs/`. Relative paths for other configuration files are taken as relative to this directory.

See also the `-d` option to httpd.

See also the security tips for information on how to properly set permissions on the ServerRoot.

ServerSignature directive

Syntax: ServerSignature *Off* | *On* | *EMail*
Default: `ServerSignature Off`
Context: server config, virtual host, directory, .htaccess
Status: core
Compatibility: ServerSignature is only available in Apache 1.3 and later.

The ServerSignature directive allows the configuration of a trailing footer line under server-generated documents (error messages, mod_proxy ftp directory listings, mod_info output, ...). The reason why you would want to enable such a footer line is that in a chain of proxies, the user often has no possibility to tell which of the chained servers actually produced a returned error message.
The Off setting, which is the default, suppresses the error line (and is therefore compatible with the behavior of Apache-1.2 and below). The On setting simply adds a line with the server version number and ServerName of the serving virtual host, and the EMail setting additionally creates a "mailto:"

reference to the ServerAdmin of the referenced document.

ServerTokens directive

Syntax: ServerTokens *Minimal|OS|Full*
Default: `ServerTokens Full`
Context: server config
Status: core
Compatibility: ServerTokens is only available in Apache 1.3 and later

This directive controls whether Server response header field which is sent back to clients includes a description of the generic OS-type of the server as well as information about compiled-in modules.

`ServerTokens Min[imal]`

Server sends (*e.g.*): Server: Apache/1.3.0

`ServerTokens OS`

Server sends (*e.g.*): Server: Apache/1.3.0 (Unix)

`ServerTokens Full` (or not specified)

Server sends (*e.g.*): Server: Apache/1.3.0 (Unix) PHP/3.0 MyMod/1.2

This setting applies to the entire server, and cannot be enabled or disabled on a virtualhost-by-virtualhost basis.

ServerType directive

Syntax: ServerType *type*
Default: `ServerType standalone`
Context: server config
Status: core

The ServerType directive sets how the server is executed by the system. *Type* is one of

inetd

The server will be run from the system process inetd; the command to start the server is added to `/etc/inetd.conf`

standalone

The server will run as a daemon process; the command to start the server is added to the system startup scripts. (`/etc/rc.local` or `/etc/rc3.d/...`)

Inetd is the lesser used of the two options. For each http connection received, a new copy of the server is started from scratch; after the connection is complete, this program exits. There is a high price to pay per connection, but for security reasons, some admins prefer this option. Inetd mode is no longer recommended and does not always work properly. Avoid it if at all possible.

Standalone is the most common setting for ServerType since it is far more efficient. The server is sta once, and services all subsequent connections. If you intend running Apache to serve a busy site, standalone will probably be your only option.

StartServers directive

Syntax: StartServers *number*
Default: `StartServers 5`
Context: server config
Status: core

The StartServers directive sets the number of child server processes created on startup. As the number of processes is dynamically controlled depending on the load, there is usually little reason to adjust this parameter.

When running under Microsoft Windows, this directive has no effect. There is always one child which handles all requests. Within the child requests are handled by separate threads. The ThreadsPerChild directive controls the maximum number of child threads handling requests, which will have a similar effect to the setting of StartServers on Unix.

See also MinSpareServers and MaxSpareServers.

ThreadsPerChild

Syntax: ThreadsPerChild *number*
Default: `ThreadsPerChild 50`
Context: server config
Status: core (Windows)
Compatibility: Available only with Apache 1.3 and later with Windows

This directive tells the server how many threads it should use. This is the maximum number of connections the server can handle at once; be sure and set this number high enough for your site if you get a lot of hits.

This directive has no effect on Unix systems. Unix users should look at StartServers and MaxRequestsPerChild.

TimeOut directive

Syntax: TimeOut *number*
Default: `TimeOut 300`
Context: server config
Status: core

The TimeOut directive currently defines the amount of time Apache will wait for three things:

1. The total amount of time it takes to receive a GET request.
2. The amount of time between receipt of TCP packets on a POST or PUT request.
3. The amount of time between ACKs on transmissions of TCP packets in responses.

We plan on making these separately configurable at some point down the road. The timer used to default to 1200 before 1.2, but has been lowered to 300 which is still far more than necessary in most situations. It is not set any lower by default because there may still be odd places in the code where the timer is not reset when a packet is sent.

UseCanonicalName directive

Syntax: UseCanonicalName *on|off|dns*
Default: `UseCanonicalName on`
Context: server config, virtual host
Override: Options
Compatibility: UseCanonicalName is only available in Apache 1.3 and later

In many situations Apache has to construct a *self-referential* URL. That is, a URL which refers back to the same server. With `UseCanonicalName on` (and in all versions prior to 1.3) Apache will use the ServerName and Port directives to construct a canonical name for the server. This name is used in all self-referential URLs, and for the values of `SERVER_NAME` and `SERVER_PORT` in CGIs.

With `UseCanonicalName off` Apache will form self-referential URLs using the hostname and port supplied by the client if any are supplied (otherwise it will use the canonical name). These values are the same that are used to implement name based virtual hosts, and are available with the same clients. The CGI variables `SERVER_NAME` and `SERVER_PORT` will be constructed from the client supplied values as well.

An example where this may be useful is on an intranet server where you have users connecting to the machine using short names such as `www`. You'll notice that if the users type a shortname, and a URL which is a directory, such as `http://www/splat`, *without the trailing slash* then Apache will redirect them to `http://www.domain.com/splat/`. If you have authentication enabled, this will cause the user to have to reauthenticate twice (once for `www` and once again for `www.domain.com`). But if `UseCanonicalName` is set off, then Apache will redirect to `http://www/splat/`.

There is a third option, `UseCanonicalName DNS`, which is intended for use with mass IP-based virtual hosting to support ancient clients that do not provide a `Host:` header. With this option Apache does a reverse DNS lookup on the server IP address that the client connected to in order to work out self-referential URLs.

Warning: if CGIs make assumptions about the values of `SERVER_NAME` they may be broken by this option. The client is essentially free to give whatever value they want as a hostname. But if the CGI is only using `SERVER_NAME` to construct self-referential URLs then it should be just fine.

See also: ServerName, Port

User directive

Syntax: User *unix-userid*
Default: `User #-1`
Context: server config, virtual host
Status: core

The User directive sets the userid as which the server will answer requests. In order to use this directive, the standalone server must be run initially as root. *Unix-userid* is one of:

A username

Refers to the given user by name.

followed by a user number.

Refers to a user by their number.

The user should have no privileges which result in it being able to access files which are not intended to be visible to the outside world, and similarly, the user should not be able to execute code which is not meant for httpd requests. It is recommended that you set up a new user and group specifically for running the server. Some admins use user `nobody`, but this is not always possible or desirable. For example mod_proxy's cache, when enabled, must be accessible to this user (see the `CacheRoot` directive).

Notes: If you start the server as a non-root user, it will fail to change to the lesser privileged user, and will instead continue to run as that original user. If you do start the server as root, then it is normal for the parent process to remain running as root.

Special note: Use of this directive in <VirtualHost> requires a properly configured suEXEC wrapper. When used inside a <VirtualHost> in this manner, only the user that CGIs are run as is affected. Non-CGI requests are still processed with the user specified in the main User directive.

SECURITY: Don't set User (or Group) to `root` unless you know exactly what you are doing, and what the dangers are.

<VirtualHost> directive

Syntax: <VirtualHost *addr*[:*port*] ...> ... </VirtualHost>
Context: server config
Status: Core.
Compatibility: Non-IP address-based Virtual Hosting only available in Apache 1.1 and later.
Compatibility: Multiple address support only available in Apache 1.2 and later.

<VirtualHost> and </VirtualHost> are used to enclose a group of directives which will apply only to a particular virtual host. Any directive which is allowed in a virtual host context may be used. When the server receives a request for a document on a particular virtual host, it uses the configuration directives enclosed in the <VirtualHost> section. *Addr* can be

- The IP address of the virtual host
- A fully qualified domain name for the IP address of the virtual host.

Example:

```
<VirtualHost 10.1.2.3>
ServerAdmin webmaster@host.foo.com
DocumentRoot /www/docs/host.foo.com
ServerName host.foo.com
ErrorLog logs/host.foo.com-error_log
TransferLog logs/host.foo.com-access_log
</VirtualHost>
```

Each VirtualHost must correspond to a different IP address, different port number or a different host name for the server, in the latter case the server machine must be configured to accept IP packets for multiple addresses. (If the machine does not have multiple network interfaces, then this can be accomplished with the `ifconfig alias` command (if your OS supports it), or with kernel patches like VIF (for SunOS(TM) 4.1.x)).

The special name `_default_` can be specified in which case this virtual host will match any IP address that is not explicitly listed in another virtual host. In the absence of any _default_ virtual host the "main" server config, consisting of all those definitions outside any VirtualHost section, is used when no match occurs.

You can specify a `:port` to change the port that is matched. If unspecified then it defaults to the same port as the most recent `Port` statement of the main server. You may also specify `:*` to match all ports on that address. (This is recommended when used with `_default_`.)

SECURITY: See the security tips document for details on why your security could be compromised if the directory where logfiles are stored is writable by anyone other than the user that starts the server.

NOTE: The use of <VirtualHost> does **not** affect what addresses Apache listens on. You may need to ensure that Apache is listening on the correct addresses using either BindAddress or Listen.

See also: Apache Virtual Host documentation

See also: Warnings about DNS and Apache
See also: Setting which addresses and ports Apache uses
See also: How Directory, Location and Files sections work for an explanation of how these different sections are combined when a request is received

Apache HTTP Server Version 1.3

Module mod_auth_dbm

This module is contained in the `mod_auth_dbm.c` file, and is not compiled in by default. It provides for user authentication using DBM files.

AuthDBMGroupFile

Syntax: AuthDBMGroupFile *filename*
Context: directory, .htaccess
Override: AuthConfig
Status: Extension
Module: mod_auth_dbm

The AuthDBMGroupFile directive sets the name of a DBM file containing the list of user groups for user authentication. *Filename* is the absolute path to the group file.

The group file is keyed on the username. The value for a user is a comma-separated list of the groups to which the users belongs. There must be no whitespace within the value, and it must never contain any colons.

Security: make sure that the AuthDBMGroupFile is stored outside the document tree of the web-server; do *not* put it in the directory that it protects. Otherwise, clients will be able to download the AuthDBMGroupFile unless otherwise protected.

Combining Group and Password DBM files: In some cases it is easier to manage a single database which contains both the password and group details for each user. This simplifies any support programs that need to be written: they now only have to deal with writing to and locking a single DBM file. This can be accomplished by first setting the group and password files to point to the same DBM:

```
AuthDBMGroupFile /www/userbase
AuthDBMUserFile /www/userbase
```

The key for the single DBM is the username. The value consists of

```
Unix Crypt-ed Password : List of Groups [ : (ignored) ]
```

The password section contains the Unix crypt() password as before. This is followed by a colon and comma separated list of groups. Other data may optionally be left in the DBM file after another colon; it is ignored by the authentication module. This is what www.telescope.org uses for its combined password and group database.

See also AuthName, AuthType and AuthDBMUserFile.

AuthDBMUserFile

Syntax: AuthDBMUserFile *filename*
Context: directory, .htaccess
Override: AuthConfig
Status: Extension
Module: mod_auth_dbm

The AuthDBMUserFile directive sets the name of a DBM file containing the list of users and passwords for user authentication. *Filename* is the absolute path to the user file.

The user file is keyed on the username. The value for a user is the crypt() encrypted password, optionally followed by a colon and arbitrary data. The colon and the data following it will be ignored by the server.

Security: make sure that the AuthDBMUserFile is stored outside the document tree of the web-server; do *not* put it in the directory that it protects. Otherwise, clients will be able to download the AuthDBMUserFile.

Important compatibility note: The implementation of "dbmopen" in the apache modules reads the string length of the hashed values from the DBM data structures, rather than relying upon the string being NULL-appended. Some applications, such as the Netscape web server, rely upon the string being NULL-appended, so if you are having trouble using DBM files interchangeably between applications this may be a part of the problem.

See also AuthName, AuthType and AuthDBMGroupFile.

AuthDBMAuthoritative

Syntax: AuthDBMAuthoritative < **on**(default) | off >
Context: directory, .htaccess
Override: AuthConfig
Status: Base
Module: mod_auth

Setting the AuthDBMAuthoritative directive explicitly to **'off'** allows for both authentication and authorization to be passed on to lower level modules (as defined in the `Configuration` and

`modules.c` file if there is **no userID** or **rule** matching the supplied userID. If there is a userID and rule specified; the usual password and access checks will be applied and a failure will give an Authorization Required reply.

So if a userID appears in the database of more than one module; or if a valid require directive applies to more than one module; then the first module will verify the credentials; and no access is passed on; regardless of the AuthAuthoritative setting.

A common use for this is in conjunction with one of the basic auth modules; such as `mod_auth.c`. Whereas this DBM module supplies the bulk of the user credential checking; a few (administrator) related accesses fall through to a lower level with a well protected .htpasswd file.

Default: By default; control is not passed on; and an unknown userID or rule will result in an Authorization Required reply. Not setting it thus keeps the system secure; and forces an NCSA compliant behaviour.

Security: Do consider the implications of allowing a user to allow fall-through in his .htaccess file; and verify that this is really what you want; Generally it is easier to just secure a single .htpasswd file, than it is to secure a database which might have more access interfaces.

See also AuthName, AuthType and AuthDBMGroupFile.

Apache HTTP Server Version 1.3

Module mod_auth

This module is contained in the `mod_auth.c` file, and is compiled in by default. It provides for user authentication using textual files.

- AuthGroupFile
- AuthUserFile
- AuthAuthoritative

AuthGroupFile

Syntax: AuthGroupFile *filename*
Context: directory, .htaccess
Override: AuthConfig
Status: Base
Module: mod_auth

The AuthGroupFile directive sets the name of a textual file containing the list of user groups for user authentication. *Filename* is the path to the group file. If it is not absolute (*i.e.*, if it doesn't begin with a slash), it is treated as relative to the ServerRoot.

Each line of the group file contains a groupname followed by a colon, followed by the member usernames separated by spaces. Example:

```
mygroup: bob joe anne
```

Note that searching large text files is *very* inefficient; AuthDBMGroupFile should be used instead.

Security: make sure that the AuthGroupFile is stored outside the document tree of the web-server; do *not* put it in the directory that it protects. Otherwise, clients will be able to download the AuthGroupFile.

See also AuthName, AuthType and AuthUserFile.

AuthUserFile

Syntax: AuthUserFile *filename*
Context: directory, .htaccess
Override: AuthConfig
Status: Base
Module: mod_auth

The AuthUserFile directive sets the name of a textual file containing the list of users and passwords for user authentication. *Filename* is the path to the user file. If it is not absolute (*i.e.*, if it doesn't begin with a slash), it is treated as relative to the ServerRoot.

Each line of the user file file contains a username followed by a colon, followed by the crypt() encrypted password. The behavior of multiple occurrences of the same user is undefined.

The utility `htpasswd` which is installed as part of the binary distribution, or which can be found in `src/support`, is used to maintain this password file. See the `man` page for more details. In short

> `htpasswd -c Filename username`
> Create a password file 'Filename' with 'username' as the initial ID. It will prompt for the password. `htpasswd Filename username2`
> Adds or modifies in password file 'Filename' the 'username'.

Note that searching large text files is *very* inefficient; AuthDBMUserFile should be used instead.

Security: make sure that the AuthUserFile is stored outside the document tree of the web-server; do *not* put it in the directory that it protects. Otherwise, clients will be able to download the AuthUserFile.

See also AuthName, AuthType and AuthGroupFile.

AuthAuthoritative

Syntax: AuthAuthoritative < **on**(default) | off >
Context: directory, .htaccess
Override: AuthConfig
Status: Base
Module: mod_auth

Setting the AuthAuthoritative directive explicitly to **'off'** allows for both authentication and authorization to be passed on to lower level modules (as defined in the `Configuration` and `modules.c` files) if there is **no userID** or **rule** matching the supplied userID. If there is a userID and/or rule specified; the usual password and access checks will be applied and a failure will give an Authorization Required reply.

So if a userID appears in the database of more than one module; or if a valid require directive applies to

more than one module; then the first module will verify the credentials; and no access is passed on; regardless of the AuthAuthoritative setting.

A common use for this is in conjunction with one of the database modules; such as `mod_auth_db.c`, `mod_auth_dbm.c`, `mod_auth_msql.c`, and `mod_auth_anon.c`. These modules supply the bulk of the user credential checking; but a few (administrator) related accesses fall through to a lower level with a well protected AuthUserFile.

Default: By default; control is not passed on; and an unknown userID or rule will result in an Authorization Required reply. Not setting it thus keeps the system secure; and forces an NCSA compliant behaviour.

Security: Do consider the implications of allowing a user to allow fall-through in his .htaccess file; and verify that this is really what you want; Generally it is easier to just secure a single .htpasswd file, than it is to secure a database such as mSQL. Make sure that the AuthUserFile is stored outside the document tree of the web-server; do *not* put it in the directory that it protects. Otherwise, clients will be able to download the AuthUserFile.

See also AuthName, AuthType and AuthGroupFile.

TOC

Apache HTTP Server Version 1.3

Module mod_auth_db

This module is contained in the `mod_auth_db.c` file, and is not compiled in by default. It provides for user authentication using Berkeley DB files. It is an alternative to DBM files for those systems which support DB and not DBM. It is only available in Apache 1.1 and later.

On some BSD systems (*e.g.*, FreeBSD and NetBSD) dbm is automatically mapped to Berkeley DB. You can use either mod_auth_dbm or mod_auth_db. The latter makes it more obvious that it's Berkeley DB. On other platforms where you want to use the DB library you usually have to install it first. See http://www.sleepycat.com/ for the distribution. The interface this module uses is the one from DB version 1.85 and 1.86, but DB version 2.x can also be used when compatibility mode is enabled.

- AuthDBGroupFile
- AuthDBUserFile
- AuthDBAuthoritative

AuthDBGroupFile

Syntax: AuthDBGroupFile *filename*
Context: directory, .htaccess
Override: AuthConfig
Status: Extension
Module: mod_auth_db

The AuthDBGroupFile directive sets the name of a DB file containing the list of user groups for user authentication. *Filename* is the absolute path to the group file.

The group file is keyed on the username. The value for a user is a comma-separated list of the groups to which the users belongs. There must be no whitespace within the value, and it must never contain any colons.

Security: make sure that the AuthDBGroupFile is stored outside the document tree of the web-server; do *not* put it in the directory that it protects. Otherwise, clients will be able to download the AuthDBGroupFile unless otherwise protected.

Combining Group and Password DB files: In some cases it is easier to manage a single database which contains both the password and group details for each user. This simplifies any support programs that

need to be written: they now only have to deal with writing to and locking a single DBM file. This c
accomplished by first setting the group and password files to point to the same DB file:

```
AuthDBGroupFile /www/userbase
AuthDBUserFile /www/userbase
```

The key for the single DB record is the username. The value consists of

```
Unix Crypt-ed Password : List of Groups [ : (ignored) ]
```

The password section contains the Unix crypt() password as before. This is followed by a colon and the comma separated list of groups. Other data may optionally be left in the DB file after another colon; it is ignored by the authentication module.

See also AuthName, AuthType and AuthDBUserFile.

AuthDBUserFile

Syntax: AuthDBUserFile *filename*
Context: directory, .htaccess
Override: AuthConfig
Status: Extension
Module: mod_auth_db

The AuthDBUserFile directive sets the name of a DB file containing the list of users and passwords for user authentication. *Filename* is the absolute path to the user file.

The user file is keyed on the username. The value for a user is the crypt() encrypted password, optionally followed by a colon and arbitrary data. The colon and the data following it will be ignored by the server.

Security: make sure that the AuthDBUserFile is stored outside the document tree of the web-server; do *not* put it in the directory that it protects. Otherwise, clients will be able to download the AuthDBUserFile.

Important compatibility note: The implementation of "dbmopen" in the apache modules reads the string length of the hashed values from the DB data structures, rather than relying upon the string being NULL-appended. Some applications, such as the Netscape web server, rely upon the string being NULL-appended, so if you are having trouble using DB files interchangeably between applications this may be a part of the problem.

See also AuthName, AuthType and AuthDBGroupFile.

AuthDBAuthoritative

TOC

Syntax: AuthDBAuthoritative < **on**(default) | off >
Context: directory, .htaccess
Override: AuthConfig
Status: Base
Module: mod_auth

Setting the AuthDBAuthoritative directive explicitly to '**off**' allows for both authentication and authorization to be passed on to lower level modules (as defined in the `Configuration` and `modules.c` file if there is **no userID** or **rule** matching the supplied userID. If there is a userID and/or rule specified; the usual password and access checks will be applied and a failure will give an Authorization Required reply.

So if a userID appears in the database of more than one module; or if a valid require directive applies to more than one module; then the first module will verify the credentials; and no access is passed on; regardless of the AuthAuthoritative setting.

A common use for this is in conjunction with one of the basic auth modules; such as `mod_auth.c`. Whereas this DB module supplies the bulk of the user credential checking; a few (administrator) related accesses fall through to a lower level with a well protected .htpasswd file.

Default: By default; control is not passed on; and an unknown userID or rule will result in an Authorization Required reply. Not setting it thus keeps the system secure; and forces an NCSA compliant behaviour.

Security: Do consider the implications of allowing a user to allow fall-through in his .htaccess file; and verify that this is really what you want; Generally it is easier to just secure a single .htpasswd file, than it is to secure a database which might have more access interfaces.

See also AuthName, AuthType and AuthDBGroupFile.

Apache HTTP Server Version 1.3

Module mod_auth_anon

This module is contained in the `mod_auth_anon.c` file and is not compiled in by default. It is only available in Apache 1.1 and later. It allows "anonymous" user access to authenticated areas.

Summary

It does access control in a manner similar to anonymous-ftp sites; *i.e.* have a 'magic' user id 'anonymous' and the email address as a password. These email addresses can be logged.

Combined with other (database) access control methods, this allows for effective user tracking and customization according to a user profile while still keeping the site open for 'unregistered' users. One advantage of using Auth-based user tracking is that, unlike magic-cookies and funny URL pre/postfixes, it is completely browser independent and it allows users to share URLs.

Directives / Example / Compile time options /

Directives

Anonymous directive

Syntax: Anonymous *user user* ...
Default: none
Context: directory, .htaccess
Override: AuthConfig
Status: Extension

Module: mod_auth_anon

A list of one or more 'magic' userIDs which are allowed access without password verification. The userIDs are space separated. It is possible to use the ' and " quotes to allow a space in a userID as well as the \ escape character.

Please note that the comparison is **case-IN-sensitive**.
I strongly suggest that the magic username '`anonymous`' is always one of the allowed userIDs.

Example:
```
Anonymous anonymous "Not Registered" 'I don\'t know'
```

This would allow the user to enter without password verification by using the userId's 'anonymous', 'AnonyMous','Not Registered' and 'I Don't Know'.

Anonymous_Authoritative directive

Syntax: Anonymous_Authoritative *on* | *off*
Default: `Anonymous_Authoritative off`
Context: directory, .htaccess
Override: AuthConfig
Status: Extension
Module: mod_auth_anon

When set 'on', there is no fall-through to other authorization methods. So if a userID does not match the values specified in the `Anonymous` directive, access is denied.

Be sure you know what you are doing when you decide to switch it on. And remember that it is the linking order of the modules (in the Configuration / Make file) which details the order in which the Authorization modules are queried.

Anonymous_LogEmail directive

Syntax: Anonymous_LogEmail *on* | *off*
Default: `Anonymous_LogEmail on`
Context: directory, .htaccess
Override: AuthConfig
Status: Extension
Module: mod_auth_anon

When set 'on', the default, the 'password' entered (which hopefully contains a sensible email address) is logged in the error log.

Anonymous_MustGiveEmail directive

Syntax: Anonymous_MustGiveEmail *on* | *off*
Default: `Anonymous_MustGiveEmail on`
Context: directory, .htaccess
Override: AuthConfig
Status: Extension
Module: mod_auth_anon

Specifies whether the user must specify an email address as the password. This prohibits blank passwords.

Anonymous_NoUserID directive

Syntax: Anonymous_NoUserID *on* | *off*
Default: `Anonymous_NoUserID off`
Context: directory, .htaccess
Override: AuthConfig
Status: Extension
Module: mod_auth_anon

When set 'on', users can leave the userID (and perhaps the password field) empty. This can be very convenient for MS-Explorer users who can just hit return or click directly on the OK button; which seems a natural reaction.

Anonymous_VerifyEmail directive

Syntax: Anonymous_VerifyEmail *on* | *off*
Default: `Anonymous_VerifyEmail off`
Context: directory, .htaccess
Override: AuthConfig
Status: Extension
Module: mod_auth_anon

When set 'on' the 'password' entered is checked for at least one '@' and a '.' to encourage users to enter valid email addresses (see the above `Auth_LogEmail`).

Example

The example below (when combined with the Auth directives of a htpasswd-file based (or GDM, mSQL *etc.*) base access control system allows users in as 'guests' with the following properties:

- It insists that the user enters a userId. (`Anonymous_NoUserId`)
- It insists that the user enters a password. (`Anonymous_MustGiveEmail`)
- The password entered must be a valid email address, ie. contain at least one '@' and a '.'. (`Anonymous_VerifyEmail`)
- The userID must be one of `anonymous guest www test welcome` and comparison is **not** case sensitive.
- And the Email addresses entered in the passwd field are logged to the error log file (`Anonymous_LogEmail`)

Excerpt of access.conf:

```
Anonymous_NoUserId off
Anonymous_MustGiveEmail on
Anonymous_VerifyEmail on
Anonymous_LogEmail on
Anonymous anonymous guest www test welcome

AuthName "Use 'anonymous' & Email address for guest entry"
AuthType basic

# An AuthUserFile/AuthDBUserFile/AuthDBMUserFile
# directive must be specified, or use
# Anonymous_Authoritative for public access.
# In the .htaccess for the public directory, add:
<Files *>
order deny,allow
allow from all

require valid-user
</Files>
```

Compile Time Options

Currently there are no Compile options.

Apache HTTP Server Version 1.3

Module mod_mime

This module is contained in the `mod_mime.c` file, and is compiled in by default. It provides for determining the types of files from the filename.

Summary

This module is used to determine various bits of "meta information" about documents. This information relates to the content of the document and is returned to the browser or used in content-negotiation within the server. In addition, a "handler" can be set for a document, which determines how the document will be processed within the server.

The directives AddEncoding, AddHandler, AddLanguage and AddType are all used to map file extensions onto the meta-information for that file. Respectively they set the content-encoding, handler, content-language and MIME-type (content-type) of documents. The directive TypesConfig is used to specify a file which also maps extensions onto MIME types. The directives ForceType and SetHandler are used to associated all the files in a given location (*e.g.*, a particular directory) onto a particular MIME type or handler.

Note that changing the type or encoding of a file does not change the value of the `Last-Modified` header. Thus, previously cached copies may still be used by a client or proxy, with the previous headers.

Files with Multiple Extensions

Files can have more than one extension, and the order of the extensions is *normally* irrelevant. For example, if the file `welcome.html.fr` maps onto content type text/html and language French then the file `welcome.fr.html` will map onto exactly the same information. The only exception to this is if an extension is given which Apache does not know how to handle. In this case it will "forget" about any information it obtained from extensions to the left of the unknown extension. So, for example, if the extensions fr and html are mapped to the appropriate language and type but extension xxx is not assigned to anything, then the file `welcome.fr.xxx.html` will be associated with content-type text/html but *no* language.

If more than one extension is given which maps onto the same type of meta-information, then the one to the right will be used. For example, if ".gif" maps to the MIME-type image/gif and ".html" maps to the MIME-type text/html, then the file `welcome.gif.html` will be associated with the MIME-type "text/html".

Care should be taken when a file with multiple extensions gets associated with both a MIME-type and handler. This will usually result in the request being by the module associated with the handler. For example, if the `.imap` extension is mapped to the handler "imap-file" (from mod_imap) and the `.html` extension is mapped to the MIME-type "text/html", then the file `world.imap.html` will be associated with both the "imap-file" handler and "text/html" MIME-type. When it is processed, the "imap-file" handler will be used, and so it will be treated as a mod_imap imagemap file.

Directives

AddEncoding

Syntax: AddEncoding *MIME-enc extension extension...*
Context: server config, virtual host, directory, .htaccess
Override: FileInfo
Status: Base
Module: mod_mime

The AddEncoding directive maps the given filename extensions to the specified encoding type. *MIME-enc* is the MIME encoding to use for documents containing the *extension*. This mapping is added to any already in force, overriding any mappings that already exist for the same *extension*. Example:

```
AddEncoding x-gzip gz
AddEncoding x-compress Z
```

This will cause filenames containing the .gz extension to be marked as encoded using the x-gzip encoding, and filenames containing the .Z extension to be marked as encoded with x-compress.

Old clients expect `x-gzip` and `x-compress`, however the standard dictates that they're equivalent to `gzip` and `compress` respectively. Apache does content encoding comparisons by ignoring any leading `x-`. When responding with an encoding Apache will use whatever form (*i.e.*, `x-foo` or `foo`) the client requested. If the client didn't specifically request a particular form Apache will use the form given by the

`AddEncoding` directive. To make this long story short, you should always use `x-gzip` and `x-compress` for these two specific encodings. More recent encodings, such as `deflate` should be specified without the `x-`.

See also: Files with multiple extensions

AddHandler

Syntax: AddHandler *handler-name extension extension...*
Context: server config, virtual host, directory, .htaccess
Override: FileInfo
Status: Base
Module: mod_mime
Compatibility: AddHandler is only available in Apache 1.1 and later

AddHandler maps the filename extensions *extension* to the handler *handler-name*. This mapping is added to any already in force, overriding any mappings that already exist for the same *extension*. For example, to activate CGI scripts with the file extension "`.cgi`", you might use:

```
AddHandler cgi-script cgi
```

Once that has been put into your srm.conf or httpd.conf file, any file containing the "`.cgi`" extension will be treated as a CGI program.

See also: Files with multiple extensions

AddLanguage

Syntax: AddLanguage *MIME-lang extension extension...*
Context: server config, virtual host, directory, .htaccess
Override: FileInfo
Status: Base
Module: mod_mime

The AddLanguage directive maps the given filename extensions to the specified content language. *MIME-lang* is the MIME language of filenames containing *extension*. This mapping is added to any already in force, overriding any mappings that already exist for the same *extension*.

Example:

```
AddEncoding x-compress Z
AddLanguage en .en
AddLanguage fr .fr
```

Then the document `xxxx.en.Z` will be treated as being a compressed English document (as will the document `xxxx.Z.en`). Although the content language is reported to the client, the browser is unlikely to use this information. The AddLanguage directive is more useful for content negotiation, where the server returns one from several documents based on the client's language preference.

If multiple language assignments are made for the same extension, the last one encountered is the one that is used. That is, for the case of:

```
AddLanguage en .en
AddLanguage en-uk .en
AddLanguage en-us .en
```

documents with the extension "`.en`" would be treated as being "`en-us`".

See also: Files with multiple extensions
See also: mod_negotiation

AddType

Syntax: AddType *MIME-type extension extension...*
Context: server config, virtual host, directory, .htaccess
Override: FileInfo
Status: Base
Module: mod_mime

The AddType directive maps the given filename extensions onto the specified content type. *MIME-enc* is the MIME type to use for filenames containing *extension*. This mapping is added to any already in force, overriding any mappings that already exist for the same *extension*. This directive can be used to add mappings not listed in the MIME types file (see the `TypesConfig` directive). Example:

```
AddType image/gif GIF
```

It is recommended that new MIME types be added using the AddType directive rather than changing the TypesConfig file.

Note that, unlike the NCSA httpd, this directive cannot be used to set the type of particular files.

See also: Files with multiple extensions

DefaultLanguage

Syntax: DefaultLanguage *MIME-lang*
Context: server config, virtual host, directory, .htaccess
Override: FileInfo

Status: Base
Module: mod_mime

The DefaultLanguage directive tells Apache that all files in the directive's scope (*e.g.*, all files covered by the current `<Directory>` container) that don't have an explicit language extension (such as .fr or .de as configured by AddLanguage) should be considered to be in the specified *MIME-lang* language. This allows entire directories to be marked as containing Dutch content, for instance, without having to rename each file. Note that unlike using extensions to specify languages, DefaultLanguage can only specify a single language.

If no DefaultLanguage directive is in force, and a file does not have any language extensions as configured by AddLanguage, then that file will be considered to have no language attribute.

See also: mod_negotiation
See also: Files with multiple extensions

ForceType

Syntax: ForceType *media type*
Context: directory, .htaccess
Status: Base
Module: mod_mime
Compatibility: ForceType is only available in Apache 1.1 and later.

When placed into an `.htaccess` file or a `<Directory>` or `<Location>` section, this directive forces all matching files to be served as the content type given by *media type*. For example, if you had a directory full of GIF files, but did not want to label them all with ".gif", you might want to use:

```
ForceType image/gif
```

Note that this will override any filename extensions that might determine the media type.

RemoveHandler

Syntax: RemoveHandler *extension extension...*
Context: directory, .htaccess
Status: Base
Module: mod_mime
Compatibility: RemoveHandler is only available in Apache 1.3.4 and later.

The RemoveHandler directive removes any handler associations for files with the given extensions. This allows `.htaccess` files in subdirectories to undo any associations inherited from parent directories or the server config files. An example of its use might be:


```
/foo/.htaccess:
    AddHandler server-parsed .html
/foo/bar/.htaccess:
    RemoveHandler .html
```

This has the effect of returning .html files in the /foo/bar directory to being treated as normal files, rather than as candidates for parsing (see the mod_include module).

SetHandler

Syntax: SetHandler *handler-name*
Context: directory, .htaccess
Status: Base
Module: mod_mime
Compatibility: SetHandler is only available in Apache 1.1 and later.

When placed into an `.htaccess` file or a `<Directory>` or `<Location>` section, this directive forces all matching files to be parsed through the handler given by *handler-name*. For example, if you had a directory you wanted to be parsed entirely as imagemap rule files, regardless of extension, you might put the following into an `.htaccess` file in that directory:

```
    SetHandler imap-file
```

Another example: if you wanted to have the server display a status report whenever a URL of `http://servername/status` was called, you might put the following into access.conf:

```
    <Location /status>
    SetHandler server-status
    </Location>
```

TypesConfig

Syntax: TypesConfig *filename*
Default: `TypesConfig conf/MIME.types`
Context: server config
Status: Base
Module: mod_mime

The TypesConfig directive sets the location of the MIME types configuration file. *Filename* is relative to the ServerRoot. This file sets the default list of mappings from filename extensions to content types; changing this file is not recommended. Use the AddType directive instead. The file contains lines in the

format of the arguments to an AddType command:

MIME-type extension extension ...

The extensions are lower-cased. Blank lines, and lines beginning with a hash character (`#') are ignored.

Apache HTTP Server Version 1.3

Apache's Handler Use

What is a Handler

A "handler" is an internal Apache representation of the action to be performed when a file is called. Generally, files have implicit handlers, based on the file type. Normally, all files are simply served by the server, but certain file typed are "handled" separately. For example, you may use a type of "application/x-httpd-cgi" to invoke CGI scripts.

Apache 1.1 adds the additional ability to use handlers explicitly. Either based on filename extensions or on location, these handlers are unrelated to file type. This is advantageous both because it is a more elegant solution, but it also allows for both a type **and** a handler to be associated with a file (See also Files with Multiple Extensions)

Handlers can either be built into the server or to a module, or they can be added with the Action directive. The built-in handlers in the standard distribution are as follows:

- **default-handler**: Send the file using the `default_handler()`, which is the handler used by default to handle static content. (core)
- **send-as-is**: Send file with HTTP headers as is. (mod_asis)
- **cgi-script**: Treat the file as a CGI script. (mod_cgi)
- **imap-file**: Imagemap rule file. (mod_imap)
- **server-info**: Get the server's configuration information (mod_info)
- **server-parsed**: Parse for server-side includes (mod_include)
- **server-status**: Get the server's status report (mod_status)
- **type-map**: Parse as a type map file for content negotiation (mod_negotiation)

Directives

- AddHandler
- SetHandler

AddHandler

Syntax: AddHandler *handler-name extension extension...*
Context: server config, virtual host, directory, .htaccess
Override: FileInfo
Status: Base
Module: mod_mime
Compatibility: AddHandler is only available in Apache 1.1 and later

AddHandler maps the filename extensions *extension* to the handler *handler-name*. This mapping is added to any already in force, overriding any mappings that already exist for the same *extension*. For example, to activate CGI scripts with the file extension "`.cgi`", you might use:

```
AddHandler cgi-script cgi
```

Once that has been put into your srm.conf or httpd.conf file, any file containing the "`.cgi`" extension will be treated as a CGI program.

See also: Files with multiple extensions

SetHandler

Syntax: SetHandler *handler-name*
Context: directory, .htaccess
Status: Base
Module: mod_mime
Compatibility: SetHandler is only available in Apache 1.1 and later.

When placed into an `.htaccess` file or a `<Directory>` or `<Location>` section, this directive forces all matching files to be parsed through the handler given by *handler-name*. For example, if you had a directory you wanted to be parsed entirely as imagemap rule files, regardless of extension, you might put the following into an `.htaccess` file in that directory:

```
SetHandler imap-file
```

Another example: if you wanted to have the server display a status report whenever a URL of `http://servername/status` was called, you might put the following into access.conf:

```
<Location /status>
SetHandler server-status
</Location>
```

Programmer's Note

In order to implement the handler features, an addition has been made to the Apache API that you may wish to make use of. Specifically, a new record has been added to the `request_rec` structure:

```
char *handler
```

If you wish to have your module engage a handler, you need only to set `r->handler` to the name of the handler at any time prior to the `invoke_handler` stage of the request. Handlers are implemented as they were before, albeit using the handler name instead of a content type. While it is not necessary, the naming convention for handlers is to use a dash-separated word, with no slashes, so as to not invade the media type name-space.

Apache HTTP Server Version 1.3

Module mod_actions

This module is contained in the `mod_actions.c` file, and is compiled in by default. It provides for executing CGI scripts based on media type or request method. It is not present in versions prior to Apache 1.1.

Summary

This module lets you run CGI scripts whenever a file of a certain type is requested. This makes it much easier to execute scripts that process files.

Directives

- Action
- Script

Action directive

Syntax: Action *action-type cgi-script*
Context: server config, virtual host, directory, .htaccess
Override: FileInfo
Status: Base
Module: mod_actions
Compatibility: Action is only available in Apache 1.1 and later

This directive adds an action, which will activate *cgi-script* when *action-type* is triggered by the request. The *action-type* can be either a handler or a MIME content type. It sends the URL and file path of the requested document using the standard CGI PATH_INFO and PATH_TRANSLATED environment variables.

Script directive

TOC

Syntax: Script *method cgi-script*
Context: server config, virtual host, directory
Status: Base
Module: mod_actions
Compatibility: Script is only available in Apache 1.1 and later

This directive adds an action, which will activate *cgi-script* when a file is requested using the method of *method*, which can be one of `GET`, `POST`, `PUT` or `DELETE`. It sends the URL and file path of the requested document using the standard CGI PATH_INFO and PATH_TRANSLATED environment variables.

Note that the Script command defines default actions only. If a CGI script is called, or some other resource that is capable of handling the requested method internally, it will do so. Also note that Script with a method of `GET` will only be called if there are query arguments present (*e.g.*, foo.html?hi). Otherwise, the request will proceed normally.

Examples:

```
Script GET /cgi-bin/search     #e.g. for <ISINDEX>-style searching
Script PUT /~bob/put.cgi
```

Apache HTTP Server Version 1.3

Module mod_asis

This module is contained in the `mod_asis.c` file, and is compiled in by default. It provides for `.asis` files. Any document with mime type `httpd/send-as-is` will be processed by this module.

Purpose

To allow file types to be defined such that Apache sends them without adding HTTP headers.

This can be used to send any kind of data from the server, including redirects and other special HTTP responses, without requiring a cgi-script or an nph script.

Usage

In the server configuration file, define a new mime type called `httpd/send-as-is` *e.g.*

```
AddType httpd/send-as-is asis
```

this defines the `.asis` file extension as being of the new `httpd/send-as-is` mime type. The contents of any file with a `.asis` extension will then be sent by Apache to the client with almost no changes. Clients will need HTTP headers to be attached, so do not forget them. A Status: header is also required; the data should be the 3-digit HTTP response code, followed by a textual message.

Here's an example of a file whose contents are sent *as is* so as to tell the client that a file has redirected.

```
Status: 301 Now where did I leave that URL
Location: http://xyz.abc.com/foo/bar.html
Content-type: text/html

<HTML>
<HEAD>
<TITLE>Lame excuses'R'us</TITLE>
</HEAD>
<BODY>
<H1>Fred's exceptionally wonderful page has moved to
<A HREF="http://xyz.abc.com/foo/bar.html">Joe's</A> site.
</H1>
</BODY>
</HTML>
```

Notes: the server always adds a Date: and Server: header to the data returned to the client, so these should not be included in the file. The server does *not* add a Last-Modified header; it probably shoul

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Module mod_cgi

This module is contained in the `mod_cgi.c` file, and is compiled in by default. It provides for execution of CGI scripts. Any file with mime type `application/x-httpd-cgi` will be processed by this module.

Summary

Any file that has the mime type `application/x-httpd-cgi` or handler `cgi-script` (Apache 1.1 or later) will be treated as a CGI script, and run by the server, with its output being returned to the client. Files acquire this type either by having a name containing an extension defined by the AddType directive, or by being in a ScriptAlias directory.

When the server invokes a CGI script, it will add a variable called `DOCUMENT_ROOT` to the environment. This variable will contain the value of the DocumentRoot configuration variable.

CGI Environment variables

The server will set the CGI environment variables as described in the CGI specification, with the following provisions:

REMOTE_HOST
: This will only be set if `HostnameLookups` is set to `on` (it is off by default), and if a reverse DNS lookup of the accessing host's address indeed finds a host name.

REMOTE_IDENT
: This will only be set if IdentityCheck is set to `on` and the accessing host supports the ident protocol. Note that the contents of this variable cannot be relied upon because it can easily be faked, and if there is a proxy between the client and the server, it is usually totally useless.

REMOTE_USER
: This will only be set if the CGI script is subject to authentication.

CGI Debugging

Debugging CGI scripts has traditionally been difficult, mainly because it has not been possible to study the output (standard output and error) for scripts which are failing to run properly. These directives, included in Apache 1.2 and later, provide more detailed logging of errors when they occur.

CGI Logfile Format

When configured, the CGI error log logs any CGI which does not execute properly. Each CGI script which fails to operate causes several lines of information to be logged. The first two lines are always of the format:

```
%% [time] request-line
%% HTTP-status CGI-script-filename
```

If the error is that CGI script cannot be run, the log file will contain an extra two lines:

```
%%error
error-message
```

Alternatively, if the error is the result of the script returning incorrect header information (often due to a bug in the script), the following information is logged:

```
%request
All HTTP request headers received
POST or PUT entity (if any)
%response
All headers output by the CGI script
%stdout
CGI standard output
%stderr
CGI standard error
```

(The %stdout and %stderr parts may be missing if the script did not output anything on standard output or standard error).

Directives

ScriptLog

Syntax: ScriptLog *filename*
Default: none
Context: server config

Status: mod_cgi

The `ScriptLog` directive sets the CGI script error logfile. If no ScriptLog is given, no error log is created. If given, any CGI errors are logged into the filename given as argument. If this is a relative file or path it is taken relative to the server root.

This log will be opened as the user the child processes run as, ie. the user specified in the main User directive. This means that either the directory the script log is in needs to be writable by that user or the file needs to be manually created and set to be writable by that user. If you place the script log in your main logs directory, do **NOT** change the directory permissions to make it writable by the user the child processes run as.

Note that script logging is meant to be a debugging feature when writing CGI scripts, and is not meant to be activated continuously on running servers. It is not optimized for speed or efficiency, and may have security problems if used in a manner other than that for which it was designed.

ScriptLogLength

Syntax: ScriptLogLength *size*
Default: 10385760
Context: server config
Status: mod_cgi

`ScriptLogLength` can be used to limit the size of the CGI script logfile. Since the logfile logs a lot of information per CGI error (all request headers, all script output) it can grow to be a big file. To prevent problems due to unbounded growth, this directive can be used to set an maximum file-size for the CGI logfile. If the file exceeds this size, no more information will be written to it.

ScriptLogBuffer

Syntax: ScriptLogBuffer *size*
Default: 1024
Context: server config
Status: mod_cgi

The size of any PUT or POST entity body that is logged to the file is limited, to prevent the log file growing too big too quickly if large bodies are being received. By default, up to 1024 bytes are logged, but this can be changed with this directive.

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Module mod_alias

This module is contained in the `mod_alias.c` file, and is compiled in by default. It provides for mapping different parts of the host filesystem in the the document tree, and for URL redirection.

Directives

- Alias
- AliasMatch
- Redirect
- RedirectMatch
- RedirectTemp
- RedirectPermanent
- ScriptAlias
- ScriptAliasMatch

Alias directive

Syntax: Alias *url-path directory-filename*
Context: server config, virtual host
Status: Base
Module: mod_alias

The Alias directive allows documents to be stored in the local filesystem other than under the DocumentRoot. URLs with a (%-decoded) path beginning with *url-path* will be mapped to local files beginning with *directory-filename*.

Example:

```
Alias /image /ftp/pub/image
```

A request for http://myserver/image/foo.gif would cause the server to return the file /ftp/pub/image/foo.gif.

Note that if you include a trailing / on the *url-path* then the server will require a trailing / in order to expand the alias. That is, if you use `Alias /icons/ /usr/local/apache/icons/` then the `/icons` will not be aliased.

Note that you may need to specify additional `<Directory>` sections which cover the *destination* of aliases. Aliasing occurs before `<Directory>` sections are checked, so only the destination of aliases are affected. (Note however `<Location>` sections are run through once before aliases are performed, so they will apply.)

See also ScriptAlias.

AliasMatch

Syntax: AliasMatch *regex directory-filename*
Context: server config, virtual host
Status: Base
Module: mod_alias
Compatibility: Available in Apache 1.3 and later

This directive is equivalent to Alias, but makes use of standard regular expressions, instead of simple prefix matching. The supplied regular expression is matched against the URL, and if it matches, the server will substitute any parenthesized matches into the given string and use it as a filename. For example, to activate the `/icons` directory, one might use:

```
AliasMatch ^/icons(.*) /usr/local/apache/icons$1
```

Redirect directive

Syntax: Redirect [*status*] *url-path url*
Context: server config, virtual host, directory, .htaccess
Override: FileInfo
Status: Base
Module: mod_alias
Compatibility: The directory and .htaccess context's are only available in versions 1.1 and later. The *status* argument is only available in Apache 1.2 or later.

The Redirect directive maps an old URL into a new one. The new URL is returned to the client which attempts to fetch it again with the new address. *Url-path* a (%-decoded) path; any requests for documents beginning with this path will be returned a redirect error to a new (%-encoded) url beginning with *url*.

Example:

```
Redirect /service http://foo2.bar.com/service
```

If the client requests http://myserver/service/foo.txt, it will be told to access http://foo2.bar.com/service/foo.txt instead.

Note: Redirect directives take precedence over Alias and ScriptAlias directives, irrespective of their ordering in the configuration file. Also, *Url-path* must be an absolute path, not a relative path, even when used with .htaccess files or inside of <Directory> sections.

If no *status* argument is given, the redirect will be "temporary" (HTTP status 302). This indicates to the client that the resources is has moved temporarily. The *status* argument can be used to return other HTTP status codes:

permanent
: Returns a permanent redirect status (301) indicating that the resource has moved permanently.

temp
: Returns a temporary redirect status (302). This is the default.

seeother
: Returns a "See Other" status (303) indicating that the resource has been replaced.

gone
: Returns a "Gone" status (410) indicating that the resource has been permanently removed. When this status is used the *url* argument should be omitted.

Other status codes can be returned by giving the numeric status code as the value of *status*. If the status is between 300 and 399, the *url* argument must be present, otherwise it must be omitted. Note that the status must be known to the Apache code (see the function `send_error_response` in http_protocol.c).

RedirectMatch

Syntax: RedirectMatch [*status*] *regex url*
Context: server config, virtual host, directory, .htaccess
Override: FileInfo
Status: Base
Module: mod_alias
Compatibility: Available in Apache 1.3 and later

This directive is equivalent to Redirect, but makes use of standard regular expressions, instead of simple prefix matching. The supplied regular expression is matched against the URL, and if it matches, the server will substitute any parenthesized matches into the given string and use it as a filename. For example, to redirect all GIF files to like-named JPEG files on another server, one might use:

```
RedirectMatch (.*)\.gif$ http://www.anotherserver.com$1.jpg
```

RedirectTemp directive

Syntax: RedirectTemp *url-path url*
Context: server config, virtual host, directory, .htaccess
Override: FileInfo
Status: Base
Module: mod_alias
Compatibility: This directive is only available in 1.2

This directive makes the client know that the Redirect is only temporary (status 302). Exactly equivalent to `Redirect temp`.

RedirectPermanent directive

Syntax: RedirectPermanent *url-path url*
Context: server config, virtual host, directory, .htaccess
Override: FileInfo
Status: Base
Module: mod_alias
Compatibility: This directive is only available in 1.2

This directive makes the client know that the Redirect is permanent (status 301). Exactly equivalent to `Redirect permanent`.

ScriptAlias directive

Syntax: ScriptAlias *url-path directory-filename*
Context: server config, virtual host
Status: Base
Module: mod_alias

The ScriptAlias directive has the same behavior as the Alias directive, except that in addition it marks the target directory as containing CGI scripts. URLs with a (%-decoded) path beginning with *url-path* will be mapped to scripts beginning with *directory-filename*.

Example:

```
ScriptAlias /cgi-bin/ /web/cgi-bin/
```

A request for http://myserver/cgi-bin/foo would cause the server to run the script /web/cgi-bin/foo.

ScriptAliasMatch

Syntax: ScriptAliasMatch *regex directory-filename*
Context: server config, virtual host
Status: Base
Module: mod_alias
Compatibility: Available in Apache 1.3 and later

This directive is equivalent to ScriptAlias, but makes use of standard regular expressions, instead of simple prefix matching. The supplied regular expression is matched against the URL, and if it matches, the server will substitute any parenthesized matches into the given string and use it as a filename. For example, to activate the standard `/cgi-bin`, one might use:

```
ScriptAliasMatch ^/cgi-bin(.*) /usr/local/apache/cgi-bin$1
```

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Module mod_imap

This module is contained in the `mod_imap.c` file, and is compiled in by default. It provides for `.map` files, replacing the functionality of the `imagemap` CGI program. Any directory or document type configured to use the handler `imap-file` (using either `AddHandler` or `SetHandler`) will be processed by this module.

Summary

This module is in the default Apache distribution. The following directive will activate files ending with `.map` as imagemap files:

```
AddHandler imap-file map
```

Note that the following is still supported:

```
AddType application/x-httpd-imap map
```

However, we are trying to phase out "magic MIME types" so we are deprecating this method.

New Features

The imagemap module adds some new features that were not possible with previously distributed imagemap programs.

- URL references relative to the Referer: information.
- Default <BASE> assignment through a new map directive `base`.
- No need for `imagemap.conf` file.
- Point references.
- Configurable generation of imagemap menus.

Configuration Directives

- ImapMenu
- ImapDefault
- ImapBase

ImapMenu

Syntax: ImapMenu `{none, formatted, semiformatted, unformatted}`
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Module: mod_imap.c
Compatibility: ImapMenu is only available in Apache 1.1 and later.

The ImapMenu directive determines the action taken if an imagemap file is called without valid coordinates.

`none`

If ImapMenu is `none`, no menu is generated, and the `default` action is performed.

`formatted`

A `formatted` menu is the simplest menu. Comments in the imagemap file are ignored. A level one header is printed, then an hrule, then the links each on a separate line. The menu has a consistent, plain look close to that of a directory listing.

`semiformatted`

In the `semiformatted` menu, comments are printed where they occur in the imagemap file. Blank lines are turned into HTML breaks. No header or hrule is printed, but otherwise the menu is the same as a `formatted` menu.

`unformatted`

Comments are printed, blank lines are ignored. Nothing is printed that does not appear in the imagemap file. All breaks and headers must be included as comments in the imagemap file. This gives you the most flexibility over the appearance of your menus, but requires you to treat your map files as HTML instead of plaintext.

ImapDefault

Syntax: ImapDefault `{error, nocontent, map, referer, URL}`
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Module: mod_imap.c
Compatibility: ImapDefault is only available in Apache 1.1 and later.

The ImapDefault directive sets the default `default` used in the imagemap files. It's value is overridden by a `default` directive within the imagemap file. If not present, the `default` action is `nocontent`, which means that a `204 No Content` is sent to the client. In this case, the client should continue to display the original page.

ImapBase

Syntax: ImapBase `{map, referer, URL}`
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Module: mod_imap.c
Compatibility: ImapBase is only available in Apache 1.1 and later.

The ImapBase directive sets the default `base` used in the imagemap files. It's value is overridden by a `base` directive within the imagemap file. If not present, the `base` defaults to `http://servername/`.

Imagemap File

The lines in the imagemap files can have one of several formats:

```
directive value [x,y ...]
directive value "Menu text" [x,y ...]
directive value x,y ... "Menu text"
```

The directive is one of `base`, `default`, `poly`, `circle`, `rect`, or `point`. The value is an absolute or relative URL, or one of the special values listed below. The coordinates are `x,y` pairs separated by whitespace. The quoted text is used as the text of the link if a imagemap menu is generated. Lines beginning with '#' are comments.

Imagemap File Directives

There are six directives allowed in the imagemap file. The directives can come in any order, but are processed in the order they are found in the imagemap file.

`base` Directive

> Has the effect of `<BASE HREF="value">`. The non-absolute URLs of the map-file are taken relative to this value. The `base` directive overrides ImapBase as set in a .htaccess file or in the server configuration files. In the absence of an ImapBase configuration directive, `base` defaults to `http://server_name/`.
> `base_uri` is synonymous with `base`. Note that a trailing slash on the URL is significant.

`default` Directive

> The action taken if the coordinates given do not fit any of the `poly`, `circle` or `rect` directives, and there are no `point` directives. Defaults to `nocontent` in the absence of an ImapDefault configuration setting, causing a status code of `204 No Content` to be returned. The client should keep the same page displayed.

`poly` Directive

> Takes three to one-hundred points, and is obeyed if the user selected coordinates fall within the polygon defined by these points.

`circle`

Takes the center coordinates of a circle and a point on the circle. Is obeyed if the user selected point is with the circle.

`rect` Directive

Takes the coordinates of two opposing corners of a rectangle. Obeyed if the point selected is within this rectangle.

`point` Directive

Takes a single point. The point directive closest to the user selected point is obeyed if no other directives are satisfied. Note that `default` will not be followed if a `point` directive is present and valid coordinates are given.

Values

The values for each of the directives can any of the following:

a URL

The URL can be relative or absolute URL. Relative URLs can contain '..' syntax and will be resolved relative to the `base` value.
`base` itself will not resolved according to the current value. A statement `base mailto:` will work properly, though.

`map`

Equivalent to the URL of the imagemap file itself. No coordinates are sent with this, so a menu will be generated unless ImapMenu is set to 'none'.

`menu`

Synonymous with `map`.

`referer`

Equivalent to the URL of the referring document. Defaults to `http://servername/` if no Referer: header was present.

`nocontent`

Sends a status code of `204 No Content`, telling the client to keep the same page displayed. Valid for all but `base`.

`error`

Fails with a `500 Server Error`. Valid for all but `base`, but sort of silly for anything but `default`.

Coordinates

`0,0 200,200`

A coordinate consists of an `x` and a `y` value separated by a comma. The coordinates are separated from each other by whitespace. To accommodate the way Lynx handles imagemaps, should a user select the coordinate `0,0`, it is as if no coordinate had been selected.

Quoted Text

`"Menu Text"`

After the value or after the coordinates, the line optionally may contain text within double quotes. This string is used as the text for the link if a menu is generated:

```
<a HREF="http://foo.com/">Menu text</a>
```

If no quoted text is present, the name of the link will be used as the text:

```
<a HREF="http://foo.com/">http://foo.com</a>
```

It is impossible to escape double quotes within this text.

Example Mapfile

```
#Comments are printed in a 'formatted' or 'semiformatted'
menu.
#And can contain html tags. <hr>
base referer
poly map "Could I have a menu, please?" 0,0 0,10 10,10 10,0
rect .. 0,0 77,27 "the directory of the referer"
circle http://www.inetnebr.com/lincoln/feedback/ 195,0 305,27
rect another_file "in same directory as referer" 306,0 419,27
point http://www.zyzzyva.com/ 100,100
point http://www.tripod.com/ 200,200
rect mailto:nate@tripod.com 100,150 200,0 "Bugs?"
```

Referencing your mapfile

```
<A HREF="/maps/imagemap1.map">
<IMG ISMAP SRC="/images/imagemap1.gif">
</A>
```

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Module mod_info

This module is contained in the `mod_info.c` file. It provides a comprehensive overview of the server configuration including all installed modules and directives in the configuration files. This module is not compiled into the server by default. It is only available in Apache 1.1 and later. To enable it, add the following line to the server build Configuration file, and rebuild the server:

```
AddModule modules/standard/mod_info.o
```

Directives

- AddModuleInfo

To configure it, add the following to your `access.conf` file.

```
<Location /server-info>
SetHandler server-info
</Location>
```

You may wish to add a <Limit> clause inside the location directive to limit access to your server configuration information.

Once configured, the server information is obtained by accessing `http://your.host.dom/server-info`

> **Note that the configuration files are read by the module at run-time, and therefore the display may *not* reflect the running server's active configuration if the files have been changed since the server was last reloaded. Also, the configuration files must be readable by the user as which the server is running (see the User directive), or else the directive settings will not be listed.**
>
> **It should also be noted that if mod_info is compiled into the server, its handler capability is available in *all* configuration files, including *per*-directory files (*e.g.*, .htaccess). This may have security-related ramifications for your site.**

AddModuleInfo

Syntax: AddModuleInfo *module-name string*
Context: server config, virtual host
Status: base

Module: mod_browser
Compatibility: Apache 1.3 and above

This allows the content of *string* to be shown as HTML interpreted, **Additional Information** for the module *module-name*. Example:

```
AddModuleInfo mod_auth.c 'See <A
HREF="http://www.apache.org/docs/mod/mod_auth.html">http://www.apache.org/docs/mod/mod_auth.html</A>'
```

TOC

Apache HTTP Server Version 1.3

Module mod_include

This module is contained in the `mod_include.c` file, and is compiled in by default. It provides for server-parsed html documents. Several directives beyond the original NCSA definition were introduced in Apache 1.2 - these are flagged below with the phrase "Apache 1.2 and above". Of particular significance are the new flow control directives documented at the bottom.

Enabling Server-Side Includes

Any document with handler of "server-parsed" will be parsed by this module, if the `Includes` option is set. If documents containing server-side include directives are given the extension .shtml, the following directives will make Apache parse them and assign the resulting document the mime type of `text/html`:

```
AddType text/html .shtml
AddHandler server-parsed .shtml
```

The following directive must be given for the directories containing the shtml files (typically in a `<Directory>` section, but this directive is also valid .htaccess files if `AllowOverride Options` is set):

```
Options +Includes
```

Alternatively the `XBitHack` directive can be used to parse normal (`text/html`) files, based on file permissions.

For backwards compatibility, documents with mime type `text/x-server-parsed-html` or `text/x-server-parsed-html3` will also be parsed (and the resulting output given the mime type `text/html`).

Basic Elements

The document is parsed as an HTML document, with special commands embedded as SGML comments. A command has the syntax:

<!--#*element attribute=value attribute=value ...* -->

The value will often be enclosed in double quotes; many commands only allow a single attribute-value pair. Note that the comment terminator (-->) should be preceded by whitespace to ensure that it isn't

considered part of an SSI token.

The allowed elements are:

config

This command controls various aspects of the parsing. The valid attributes are:

errmsg

The value is a message that is sent back to the client if an error occurs whilst parsing the document.

sizefmt

The value sets the format to be used which displaying the size of a file. Valid values are `bytes` for a count in bytes, or `abbrev` for a count in Kb or Mb as appropriate.

timefmt

The value is a string to be used by the `strftime(3)` library routine when printing dates.

echo

This command prints one of the include variables, defined below. If the variable is unset, it is printed as `(none)`. Any dates printed are subject to the currently configured `timefmt`. Attributes:

var

The value is the name of the variable to print.

exec

The exec command executes a given shell command or CGI script. The IncludesNOEXEC Option disables this command completely. The valid attributes are:

cgi

The value specifies a (%-encoded) URL relative path to the CGI script. If the path does not begin with a (/), then it is taken to be relative to the current document. The document referenced by this path is invoked as a CGI script, even if the server would not normally recognize it as such. However, the directory containing the script must be enabled for CGI scripts (with ScriptAlias or the ExecCGI Option).

The CGI script is given the PATH_INFO and query string (QUERY_STRING) of the original request from the client; these cannot be specified in the URL path. The include variables will be available to the script in addition to the standard CGI environment.

If the script returns a Location: header instead of output, then this will be translated into an HTML anchor.

The `include virtual` element should be used in preference to `exec cgi`.

cmd

The server will execute the given string using `/bin/sh`. The include variables are available to the command.

fsize

This command prints the size of the specified file, subject to the `sizefmt` format specification.

Attributes:

file

The value is a path relative to the directory containing the current document being parsed.

virtual

The value is a (%-encoded) URL-path relative to the current document being parsed. If it does not begin with a slash (/) then it is taken to be relative to the current document.

flastmod

This command prints the last modification date of the specified file, subject to the `timefmt` format specification. The attributes are the same as for the `fsize` command.

include

This command inserts the text of another document or file into the parsed file. Any included file is subject to the usual access control. If the directory containing the parsed file has the Option IncludesNOEXEC set, and the including the document would cause a program to be executed, then it will not be included; this prevents the execution of CGI scripts. Otherwise CGI scripts are invoked as normal using the complete URL given in the command, including any query string.

An attribute defines the location of the document; the inclusion is done for each attribute given to the include command. The valid attributes are:

file

The value is a path relative to the directory containing the current document being parsed. It cannot contain `../`, nor can it be an absolute path. The `virtual` attribute should always be used in preference to this one.

virtual

The value is a (%-encoded) URL relative to the current document being parsed. The URL cannot contain a scheme or hostname, only a path and an optional query string. If it does not begin with a slash (/) then it is taken to be relative to the current document.

A URL is constructed from the attribute, and the output the server would return if the URL were accessed by the client is included in the parsed output. Thus included files can be nested.

printenv

This prints out a listing of all existing variables and their values. No attributes.

For example: `<!--#printenv -->`

Apache 1.2 and above.

set

This sets the value of a variable. Attributes:

var

The name of the variable to set.

value

The value to give a variable.

For example: `<!--#set var="category" value="help" -->`

Apache 1.2 and above.

Include Variables

In addition to the variables in the standard CGI environment, these are available for the `echo` command, for `if` and `elif`, and to any program invoked by the document.

DATE_GMT

The current date in Greenwich Mean Time.

DATE_LOCAL

The current date in the local time zone.

DOCUMENT_NAME

The filename (excluding directories) of the document requested by the user.

DOCUMENT_URI

The (%-decoded) URL path of the document requested by the user. Note that in the case of nested include files, this is *not* then URL for the current document.

LAST_MODIFIED

The last modification date of the document requested by the user.

Variable Substitution

Variable substitution is done within quoted strings in most cases where they may reasonably occur as an argument to an SSI directive. This includes the config, exec, flastmod, fsize, include, and set directives, as well as the arguments to conditional operators. You can insert a literal dollar sign into the string using backslash quoting:

```
<!--#if expr="$a = \$test" -->
```

If a variable reference needs to be substituted in the middle of a character sequence that might otherwise be considered a valid identifier in its own right, it can be disambiguated by enclosing the reference in braces, *à la* shell substitution:

```
<!--#set var="Zed" value="${REMOTE_HOST}_${REQUEST_METHOD}" -->
```

This will result in the Zed variable being set to "X_Y" if REMOTE_HOST is "X" and REQUEST_METHOD is "Y".

EXAMPLE: the below example will print "in foo" if the DOCUMENT_URI is /foo/file.html, "in bar" if it is /bar/file.html and "in neither" otherwise:

```
<!--#if expr="\"$DOCUMENT_URI\" = \"/foo/file.html\"" -->
in foo
<!--#elif expr="\"$DOCUMENT_URI\" = \"/bar/file.html\"" -->
```

```
in bar
<!--#else -->
in neither
<!--#endif -->
```

Flow Control Elements

These are available in Apache 1.2 and above. The basic flow control elements are:

```
<!--#if expr="test_condition" -->
<!--#elif expr="test_condition" -->
<!--#else -->
<!--#endif -->
```

The **`if`** element works like an if statement in a programming language. The test condition is evaluated and if the result is true, then the text until the next **`elif`**, **`else`**. or **`endif`** element is included in the output stream.

The **`elif`** or **`else`** statements are be used the put text into the output stream if the original test_condition was false. These elements are optional.

The **`endif`** element ends the **`if`** element and is required.

test_condition is one of the following:

string

true if *string* is not empty

string1 = *string2*
string1 != *string2*
string1 < *string2*
string1 <= *string2*
string1 > *string2*
string1 >= *string2*

Compare string1 with string 2. If string2 has the form */string/* then it is compared as a regular expression. Regular expressions have the same syntax as those found in the Unix egrep command.

(*test_condition*)

true if *test_condition* is true

! *test_condition*

true if *test_condition* is false

test_condition1 && *test_condition2*

true if both *test_condition1* and *test_condition2* are true

test_condition1 || *test_condition2*

true if either *test_condition1* or *test_condition2* is true

"=" and "*!*=" bind more tightly than "&&" and "||". "*!*" binds most tightly. Thus, the following are equivalent:


```
<!--#if expr="$a = test1 && $b = test2" -->
<!--#if expr="($a = test1) && ($b = test2)" -->
```

Anything that's not recognized as a variable or an operator is treated as a string. Strings can also be quoted: *'string'*. Unquoted strings can't contain whitespace (blanks and tabs) because it is used to separate tokens such as variables. If multiple strings are found in a row, they are concatenated using blanks. So,

```
 string1    string2  results in string1 string2
'string1    string2' results in string1    string2
```

Directives

- XBitHack

XBitHack

Syntax: XBitHack *status*
Default: `XBitHack off`
Context: server config, virtual host, directory, .htaccess
Override: Options
Status: Base
Module: mod_include

The XBitHack directives controls the parsing of ordinary html documents. This directive only affects files associated with the MIME type `text/html`. *Status* can have the following values:

off
: No special treatment of executable files.

on
: Any file that has the user-execute bit set will be treated as a server-parsed html document.

full
: As for `on` but also test the group-execute bit. If it is set, then set the Last-modified date of the returned file to be the last modified time of the file. If it is not set, then no last-modified date is sent. Setting this bit allows clients and proxies to cache the result of the request.

  Note: you would not want to use this, for example, when you `#include` a CGI that produces different output on each hit (or potentially depends on the hit).

Using Server Side Includes for ErrorDocuments

There is a document which describes how to use the features of mod_include to offer internationalized customized server error documents.

Apache HTTP Server Version 1.3

Using XSSI and ErrorDocument to configure customized international server error responses

Index

Introduction

This document describes an easy way to provide your apache WWW server with a set of customized error messages which take advantage of Content Negotiation and eXtended Server Side Includes (XSSI) to return error messages generated by the server in the client's native language.

By using XSSI, all customized messages can share a homogenous and consistent style and layout, and maintenance work (changing images, changing links) is kept to a minimum because all layout information can be kept in a single file. Error documents can be shared across different servers, or even hosts, because all varying information is inserted at the time the error document is returned on behalf of a failed request.

Content Negotiation then selects the appropriate language version of a particular error message text, honoring the language preferences passed in the client's request. (Users usually select their favorite languages in the preferences options menu of today's browsers). When an error document in the client's primary language version is unavailable, the secondary languages are tried or a default (fallback) version is used.

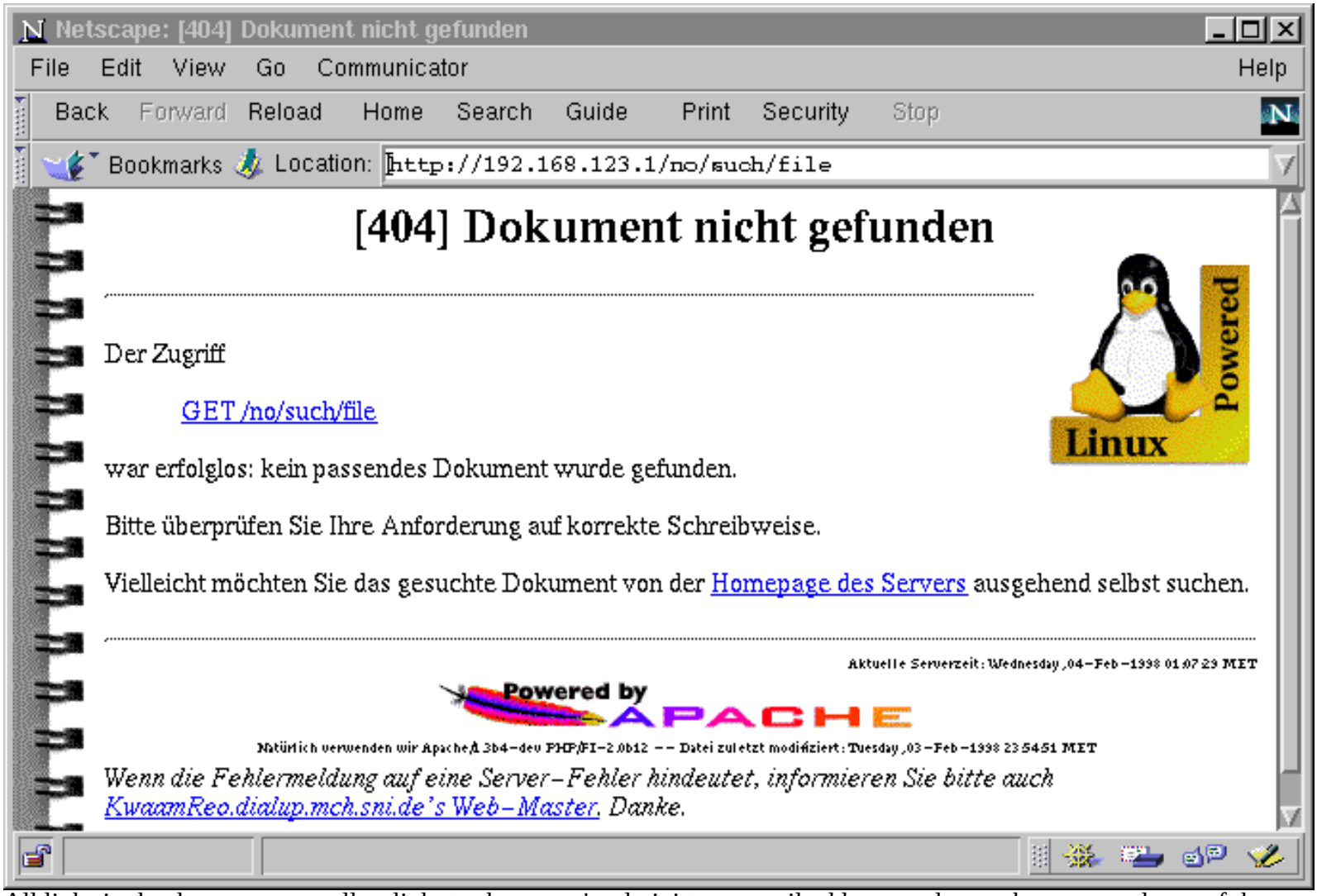
You have full flexibility in designing your error documents to your personal taste (or your company's conventions). For demonstration purposes, we present a simple generic error document scheme. For this hypothetic server, we assume that all error messages...

- possibly are served by different virtual hosts (different host name, different IP address, or different port) on the server machine,
- show a predefined company logo in the right top of the message (selectable by virtual host),
- print the error title first, followed by an explanatory text and (depending on the error context) help on how to

resolve the error,

- have some kind of standardized background image,
- display an apache logo and a feedback email address at the bottom of the error message.

An example of a "document not found" message for a german client might look like this:



All links in the document as well as links to the server's administrator mail address, and even the name and port of the serving virtual host are inserted in the error document at "run-time", *i.e.*, when the error actually occurs.

Creating an ErrorDocument directory

For this concept to work as easily as possible, we must take advantage of as much server support as we can get:

1. By defining the MultiViews option, we enable the language selection of the most appropriate language alternative (content negotiation).
2. By setting the LanguagePriority directive we define a set of default fallback languages in the situation where the client's browser did not express any preference at all.
3. By enabling Server Side Includes (and disallowing execution of cgi scripts for security reasons), we allow the server to include building blocks of the error message, and to substitute the value of certain environment variables into the generated document (dynamic HTML) or even to conditionally include or omit parts of the text.
4. The AddHandler and AddType directives are useful for automatically XSSI-expanding all files with a .shtml suffix to *text/html*.
5. By using the Alias directive, we keep the error document directory outside of the document tree because it can be

regarded more as a server part than part of the document tree.

6. The <Directory>-Block restricts these "special" settings to the error document directory and avoids an impact any of the settings for the regular document tree.
7. For each of the error codes to be handled (see RFC2068 for an exact description of each error code, or look at `src/main/http_protocol.c` if you wish to see apache's standard messages), an ErrorDocument in the aliased /errordocs directory is defined. Note that we only define the basename of the document here because the MultiViews option will select the best candidate based on the language suffixes and the client's preferences. Any error situation with an error code *not* handled by a custom document will be dealt with by the server in the standard way (*i.e.*, a plain error message in english).
8. Finally, the AllowOverride directive tells apache that it is not necessary to look for a .htaccess file in the /errordocs directory: a minor speed optimization.

The resulting httpd.conf configuration would then look similar to this: (Note that you can define your own error messages using this method for only part of the document tree, e.g., a /~user/ subtree. In this case, the configuration could as well be put into the .htaccess file at the root of the subtree, and the <Directory> and </Directory> directives -but not the contained directives- must be omitted.)

```
LanguagePriority en fr de
Alias  /errordocs  /usr/local/apache/errordocs
<Directory /usr/local/apache/errordocs>
 AllowOverride none
 Options MultiViews IncludesNoExec FollowSymLinks
 AddType text/html .shtml
 AddHandler server-parsed .shtml
</Directory>
#    "400 Bad Request",
ErrorDocument  400  /errordocs/400
#    "401 Authorization Required",
ErrorDocument  401  /errordocs/401
#    "403 Forbidden",
ErrorDocument  403  /errordocs/403
#    "404 Not Found",
ErrorDocument  404  /errordocs/404
#    "500 Internal Server Error",
ErrorDocument  500  /errordocs/500
```

The directory for the error messages (here: /usr/local/apache/errordocs/) must then be created with the appropriate permissions (readable and executable by the server uid or gid, only writable for the administrator).

Naming the individual error document files

By defining the MultiViews option, the server was told to automatically scan the directory for matching variants (looking at language and content type suffixes) when a requested document was not found. In the configuration, we defined the names for the error documents to be just their error number (without any suffix).

The names of the individual error documents are now determined like this (I'm using 403 as an example, think of it as a placeholder for any of the configured error documents):

- No file errordocs/403 should exist. Otherwise, it would be found and served (with the DefaultType, usually text/plain), all negotiation would be bypassed.
- For each language for which we have an internationalized version (note that this need not be the same set of languages for each error code - you can get by with a single language version until you actually *have* translated versions), a document errordocs/403.shtml.*lang* is created and filled with the error text in that language (see below).
- One fallback document called errordocs/403.shtml is created, usually by creating a symlink to the default language

variant (see below).

The common header and footer files

By putting as much layout information in two special "include files", the error documents can be reduced to a bare minimum.

One of these layout files defines the HTML document header and a configurable list of paths to the icons to be shown in the resulting error document. These paths are exported as a set of XSSI environment variables and are later evaluated by the "footer" special file. The title of the current error (which is put into the TITLE tag and an H1 header) is simply passed in from the main error document in a variable called `title`.
By changing this file, the layout of all generated error messages can be changed in a second. (By exploiting the features of XSSI, you can easily define different layouts based on the current virtual host, or even based on the client's domain name).

The second layout file describes the footer to be displayed at the bottom of every error message. In this example, it shows an apache logo, the current server time, the server version string and adds a mail reference to the site's webmaster.

For simplicity, the header file is simply called `head.shtml` because it contains server-parsed content but no language specific information. The footer file exists once for each language translation, plus a symlink for the default language.

Example: for English, French and German versions (default english)
`foot.shtml.en`,
`foot.shtml.fr`,
`foot.shtml.de`,
`foot.shtml` symlink to `foot.shtml.en`

Both files are included into the error document by using the directives `<!--#include virtual="head" -->` and `<!--#include virtual="foot" -->` respectively: the rest of the magic occurs in mod_negotiation and in mod_include.

See the listings below to see an actual HTML implementation of the discussed example.

Creating ErrorDocuments in different languages

After all this preparation work, little remains to be said about the actual documents. They all share a simple common structure:

```
<!--#set var="title" value="error description title" -->
<!--#include virtual="head" -->
   explanatory error text
<!--#include virtual="foot" -->
```

In the listings section, you can see an example of a [400 Bad Request] error document. Documents as simple as that certainly cause no problems to translate or expand.

The fallback language

Do we need a special handling for languages other than those we have translations for? We did set the LanguagePriority, didn't we?!

Well, the LanguagePriority directive is for the case where the client does not express any language priority at all. But what happens in the situation where the client wants one of the languages we do not have, and none of those we do have?

Without doing anything, the Apache server will usually return a [406 no acceptable variant] error, listing the choices from which the client may select. But we're in an error message already, and important error information might get lost when

the client had to choose a language representation first.

So, in this situation it appears to be easier to define a fallback language (by copying or linking, *e.g.*, the english version to a language-less version). Because the negotiation algorithm prefers "more specialized" variants over "more generic" variants, these generic alternatives will only be chosen when the normal negotiation did not succeed.

A simple shell script to do it (execute within the errordocs/ dir):

```
for f in *.shtml.en
do
   ln -s $f `basename $f .en`
done
```

Customizing Proxy Error Messages

As of Apache-1.3, it is possible to use the `ErrorDocument` mechanism for proxy error messages as well (previous versions always returned fixed predefined error messages).

Most proxy errors return an error code of [500 Internal Server Error]. To find out whether a particular error document was invoked on behalf of a proxy error or because of some other server error, and what the reason for the failure was, you can check the contents of the new `ERROR_NOTES` CGI environment variable: if invoked for a proxy error, this variable will contain the actual proxy error message text in HTML form.

The following excerpt demonstrates how to exploit the `ERROR_NOTES` variable within an error document:

```
 <!--#if expr="\"$REDIRECT_ERROR_NOTES\" = \"\"" -->
  <p>
   The server encountered an unexpected condition
   which prevented it from fulfilling the request.
  </p>
  <p>
   <A HREF="mailto:<!--#echo var="SERVER_ADMIN" -->"
    SUBJECT="Error message [<!--#echo var="REDIRECT_STATUS" -->] <!--#echo
var="title" --> for <!--#echo var="REQUEST_URI" -->">
   Please forward this error screen to <!--#echo var="SERVER_NAME" -->'s
   WebMaster</A>; it includes useful debugging information about
   the Request which caused the error.
   <pre><!--#printenv --></pre>
  </p>
 <!--#else -->
  <!--#echo var="REDIRECT_ERROR_NOTES" -->
 <!--#endif -->
```

HTML listing of the discussed example

So, to summarize our example, here's the complete listing of the 400.shtml.en document. You will notice that it contains almost nothing but the error text (with conditional additions). Starting with this example, you will find it easy to add more error documents, or to translate the error documents to different languages.

```
<!--#set var="title" value="Bad Request"
--><!--#include virtual="head" --><P>
   Your browser sent a request that this server could not understand:
```


```
   <BLOCKQUOTE>
     <STRONG><!--#echo var="REQUEST_URI" --></STRONG>
   </BLOCKQUOTE>
   The request could not be understood by the server due to malformed
   syntax. The client should not repeat the request without
   modifications.
   </P>
   <P>
   <!--#if expr="\"$HTTP_REFERER\" != \"\"" -->
    Please inform the owner of
    <A HREF="<!--#echo var="HTTP_REFERER" -->">the referring page</A> about
    the malformed link.
   <!--#else -->
    Please check your request for typing errors and retry.
   <!--#endif -->
   </P>
<!--#include virtual="foot" -->
```

Here is the complete head.shtml file (the funny line breaks avoid empty lines in the document after XSSI processing). Note the configuration section at top. That's where you configure the images and logos as well as the apache documentation directory. Look how this file displays two different logos depending on the content of the virtual host name ($SERVER_NAME), and that an animated apache logo is shown if the browser appears to support it (the latter requires server configuration lines of the form

`BrowserMatch "^Mozilla/[2-4]" anigif`

for browser types which support animated GIFs).

```
<!--#if expr="\"$SERVER_NAME\" = /.*\.mycompany\.com/"
--><!--#set var="IMG_CorpLogo"
            value="http://$SERVER_NAME:$SERVER_PORT/errordocs/CorpLogo.gif"
--><!--#set var="ALT_CorpLogo" value="Powered by Linux!"
--><!--#else
--><!--#set var="IMG_CorpLogo"
            value="http://$SERVER_NAME:$SERVER_PORT/errordocs/PrivLogo.gif"
--><!--#set var="ALT_CorpLogo" value="Powered by Linux!"
--><!--#endif
--><!--#set var="IMG_BgImage"
value="http://$SERVER_NAME:$SERVER_PORT/errordocs/BgImage.gif"
--><!--#set var="DOC_Apache" value="http://$SERVER_NAME:$SERVER_PORT/Apache/"
--><!--#if expr="$anigif"
--><!--#set var="IMG_Apache"
value="http://$SERVER_NAME:$SERVER_PORT/icons/apache_anim.gif"
--><!--#else
--><!--#set var="IMG_Apache"
value="http://$SERVER_NAME:$SERVER_PORT/icons/apache_pb.gif"
--><!--#endif
--><!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML//EN">
<HTML>
 <HEAD>
  <TITLE>
   [<!--#echo var="REDIRECT_STATUS" -->] <!--#echo var="title" -->
  </TITLE>
 </HEAD>
```


```
 <BODY BGCOLOR="white" BACKGROUND="<!--#echo var="IMG_BgImage" -->"><UL>
  <H1 ALIGN="center">
   [<!--#echo var="REDIRECT_STATUS" -->] <!--#echo var="title" -->
   <IMG SRC="<!--#echo var="IMG_CorpLogo" -->"
        ALT="<!--#echo var="ALT_CorpLogo" -->" ALIGN=right>
  </H1>
  <HR><!-- ========================================================= -->
  <DIV>
```

---

and this is the foot.shtml.en file:

```
  </DIV>
  <HR>
  <DIV ALIGN="right"><SMALL><SUP>Local Server time:
      <!--#echo var="DATE_LOCAL" -->
  </SUP></SMALL></DIV>
  <DIV ALIGN="center">
    <A HREF="<!--#echo var="DOC_Apache" -->">
    <IMG SRC="<!--#echo var="IMG_Apache" -->" BORDER=0 ALIGN="bottom"
         ALT="Powered by <!--#echo var="SERVER_SOFTWARE" -->"></A><BR>
    <SMALL><SUP><!--#set var="var"
     value="Powered by $SERVER_SOFTWARE -- File last modified on $LAST_MODIFIED"
    --><!--#echo var="var" --></SUP></SMALL>
  </DIV>
  <ADDRESS>If the indicated error looks like a misconfiguration, please inform
   <A HREF="mailto:<!--#echo var="SERVER_ADMIN" -->"
      SUBJECT="Feedback about Error message [<!--#echo var="REDIRECT_STATUS"
        -->] <!--#echo var="title" -->, req=<!--#echo var="REQUEST_URI" -->">
   <!--#echo var="SERVER_NAME" -->'s WebMaster</A>.
  </ADDRESS>
 </UL></BODY>
</HTML>
```

More welcome!

If you have tips to contribute, send mail to martin@apache.org

Apache HTTP Server Version 1.3

Content Negotiation

Apache's support for content negotiation has been updated to meet the HTTP/1.1 specification. It can choose the best representation of a resource based on the browser-supplied preferences for media type, languages, character set and encoding. It is also implements a couple of features to give more intelligent handling of requests from browsers which send incomplete negotiation information.

Content negotiation is provided by the mod_negotiation module, which is compiled in by default.

About Content Negotiation

A resource may be available in several different representations. For example, it might be available in different languages or different media types, or a combination. One way of selecting the most appropriate choice is to give the user an index page, and let them select. However it is often possible for the server to choose automatically. This works because browsers can send as part of each request information about what representations they prefer. For example, a browser could indicate that it would like to see information in French, if possible, else English will do. Browsers indicate their preferences by headers in the request. To request only French representations, the browser would send

```
Accept-Language: fr
```

Note that this preference will only be applied when there is a choice of representations and they vary by language.

As an example of a more complex request, this browser has been configured to accept French and English, but prefer French, and to accept various media types, preferring HTML over plain text or other text types, and preferring GIF or JPEG over other media types, but also allowing any other media type as a last resort:

```
Accept-Language: fr; q=1.0, en; q=0.5
Accept: text/html; q=1.0, text/*; q=0.8, image/gif; q=0.6,
      image/jpeg; q=0.6, image/*; q=0.5, */*; q=0.1
```

Apache 1.2 supports 'server driven' content negotiation, as defined in the HTTP/1.1 specification. It fully supports the Accept, Accept-Language, Accept-Charset and Accept-Encoding request headers. Apache 1.3.4 also supports 'transparent' content negotiation, which is an experimental negotiation protocol defined in RFC 2295 and RFC 2296. It does not offer support for 'feature negotiation' as defined in these RFCs.

A **resource** is a conceptual entity identified by a URI (RFC 2396). An HTTP server like Apache prov access to **representations** of the resource(s) within its namespace, with each representation in the for a sequence of bytes with a defined media type, character set, encoding, etc. Each resource may be associated with zero, one, or more than one representation at any given time. If multiple representations are available, the resource is referred to as **negotiable** and each of its representations is termed a **variant**. The ways in which the variants for a negotiable resource vary are called the **dimensions** of negotiation.

Negotiation in Apache

In order to negotiate a resource, the server needs to be given information about each of the variants. This is done in one of two ways:

- Using a type map (*i.e.*, a `*.var` file) which names the files containing the variants explicitly, or
- Using a 'MultiViews' search, where the server does an implicit filename pattern match and chooses from among the results.

Using a type-map file

A type map is a document which is associated with the handler named `type-map` (or, for backwards-compatibility with older Apache configurations, the mime type `application/x-type-map`). Note that to use this feature, you must have a handler set in the configuration that defines a file suffix as `type-map`; this is best done with a

```
AddHandler type-map var
```

in the server configuration file. See the comments in the sample config file for more details.

Type map files have an entry for each available variant; these entries consist of contiguous HTTP-format header lines. Entries for different variants are separated by blank lines. Blank lines are illegal within an entry. It is conventional to begin a map file with an entry for the combined entity as a whole (although this is not required, and if present will be ignored). An example map file is:

```
URI: foo

URI: foo.en.html
Content-type: text/html
Content-language: en

URI: foo.fr.de.html
Content-type: text/html;charset=iso-8859-2
Content-language: fr, de
```

If the variants have different source qualities, that may be indicated by the "qs" parameter to the media type, as in this picture (available as jpeg, gif, or ASCII-art):

```
URI: foo
```


```
URI: foo.jpeg
Content-type: image/jpeg; qs=0.8

URI: foo.gif
Content-type: image/gif; qs=0.5

URI: foo.txt
Content-type: text/plain; qs=0.01
```

qs values can vary in the range 0.000 to 1.000. Note that any variant with a qs value of 0.000 will never be chosen. Variants with no 'qs' parameter value are given a qs factor of 1.0. The qs parameter indicates the relative 'quality' of this variant compared to the other available variants, independent of the client's capabilities. For example, a jpeg file is usually of higher source quality than an ascii file if it is attempting to represent a photograph. However, if the resource being represented is an original ascii art, then an ascii representation would have a higher source quality than a jpeg representation. A qs value is therefore specific to a given variant depending on the nature of the resource it represents.

The full list of headers recognized is:

`URI:`

uri of the file containing the variant (of the given media type, encoded with the given content encoding). These are interpreted as URLs relative to the map file; they must be on the same server (!), and they must refer to files to which the client would be granted access if they were to be requested directly.

`Content-Type:`

media type --- charset, level and "qs" parameters may be given. These are often referred to as MIME types; typical media types are `image/gif`, `text/plain`, or `text/html; level=3`.

`Content-Language:`

The languages of the variant, specified as an Internet standard language tag from RFC 1766 (*e.g.*, `en` for English, `kr` for Korean, *etc.*).

`Content-Encoding:`

If the file is compressed, or otherwise encoded, rather than containing the actual raw data, this says how that was done. Apache only recognizes encodings that are defined by an AddEncoding directive. This normally includes the encodings `x-compress` for compress'd files, and `x-gzip` for gzip'd files. The `x-` prefix is ignored for encoding comparisons.

`Content-Length:`

The size of the file. Specifying content lengths in the type-map allows the server to compare file sizes without checking the actual files.

`Description:`

A human-readable textual description of the variant. If Apache cannot find any appropriate variant to return, it will return an error response which lists all available variants instead. Such a variant list will include the human-readable variant descriptions.

Multiviews

`MultiViews` is a per-directory option, meaning it can be set with an `Options` directive within a `<Directory>`, `<Location>` or `<Files>` section in `access.conf`, or (if `AllowOverride` is properly set) in `.htaccess` files. Note that `Options All` does not set `MultiViews`; you have to ask for it by name.

The effect of `MultiViews` is as follows: if the server receives a request for `/some/dir/foo`, if `/some/dir` has `MultiViews` enabled, and `/some/dir/foo` does *not* exist, then the server reads the directory looking for files named foo.*, and effectively fakes up a type map which names all those files, assigning them the same media types and content-encodings it would have if the client had asked for one of them by name. It then chooses the best match to the client's requirements.

`MultiViews` may also apply to searches for the file named by the `DirectoryIndex` directive, if the server is trying to index a directory. If the configuration files specify

```
DirectoryIndex index
```

then the server will arbitrate between `index.html` and `index.html3` if both are present. If neither are present, and `index.cgi` is there, the server will run it.

If one of the files found when reading the directive is a CGI script, it's not obvious what should happen. The code gives that case special treatment --- if the request was a POST, or a GET with QUERY_ARGS or PATH_INFO, the script is given an extremely high quality rating, and generally invoked; otherwise it is given an extremely low quality rating, which generally causes one of the other views (if any) to be retrieved.

The Negotiation Methods

After Apache has obtained a list of the variants for a given resource, either from a type-map file or from the filenames in the directory, it invokes one of two methods to decide on the 'best' variant to return, if any. It is not necessary to know any of the details of how negotiation actually takes place in order to use Apache's content negotiation features. However the rest of this document explains the methods used for those interested.

There are two negotiation methods:

1. **Server driven negotiation with the Apache algorithm** is used in the normal case. The Apache algorithm is explained in more detail below. When this algorithm is used, Apache can sometimes 'fiddle' the quality factor of a particular dimension to achieve a better result. The ways Apache can fiddle quality factors is explained in more detail below.
2. **Transparent content negotiation** is used when the browser specifically requests this through the mechanism defined in RFC 2295. This negotiation method gives the browser full control over deciding on the 'best' variant, the result is therefore dependent on the specific algorithms used by the browser. As part of the transparent negotiation process, the browser can ask Apache to run the 'remote variant selection algorithm' defined in RFC 2296.

Dimensions of Negotiation

Dimension	Notes
Media Type	Browser indicates preferences with the Accept header field. Each item can have an associated quality factor. Variant description can also have a quality factor (the "qs" parameter).
Language	Browser indicates preferences with the Accept-Language header field. Each item can have a quality factor. Variants can be associated with none, one or more than one language.
Encoding	Browser indicates preference with the Accept-Encoding header field. Each item can have a quality factor.
Charset	Browser indicates preference with the Accept-Charset header field. Each item can have a quality factor. Variants can indicate a charset as a parameter of the media type.

Apache Negotiation Algorithm

Apache can use the following algorithm to select the 'best' variant (if any) to return to the browser. This algorithm is not further configurable. It operates as follows:

1. First, for each dimension of the negotiation, check the appropriate *Accept** header field and assign a quality to each variant. If the *Accept** header for any dimension implies that this variant is not acceptable, eliminate it. If no variants remain, go to step 4.
2. Select the 'best' variant by a process of elimination. Each of the following tests is applied in order. Any variants not selected at each test are eliminated. After each test, if only one variant remains, select it as the best match and proceed to step 3. If more than one variant remains, move on to the next test.
    1. Multiply the quality factor from the Accept header with the quality-of-source factor for this variant's media type, and select the variants with the highest value.
    2. Select the variants with the highest language quality factor.
    3. Select the variants with the best language match, using either the order of languages in the Accept-Language header (if present), or else else the order of languages in the `LanguagePriority` directive (if present).
    4. Select the variants with the highest 'level' media parameter (used to give the version of text/html media types).
    5. Select variants with the best charset media parameters, as given on the Accept-Charset header line. Charset ISO-8859-1 is acceptable unless explicitly excluded. Variants with a `text/*` media type but not explicitly associated with a particular charset are assumed to be in ISO-8859-1.
    6. Select those variants which have associated charset media parameters that are *not* ISO-8859-1. If there are no such variants, select all variants instead.
    7. Select the variants with the best encoding. If there are variants with an encoding that is acceptable to the user-agent, select only these variants. Otherwise if there is a mix of encoded and non-encoded variants, select only the unencoded variants. If either all variants are encoded or all variants are not encoded, select all variants.

8. Select the variants with the smallest content length.
9. Select the first variant of those remaining. This will be either the first listed in the type-map file, or when variants are read from the directory, the one whose file name comes first when sorted using ASCII code order.

3. The algorithm has now selected one 'best' variant, so return it as the response. The HTTP response header Vary is set to indicate the dimensions of negotiation (browsers and caches can use this information when caching the resource). End.
4. To get here means no variant was selected (because none are acceptable to the browser). Return a 406 status (meaning "No acceptable representation") with a response body consisting of an HTML document listing the available variants. Also set the HTTP Vary header to indicate the dimensions of variance.

Fiddling with Quality Values

Apache sometimes changes the quality values from what would be expected by a strict interpretation of the Apache negotiation algorithm above. This is to get a better result from the algorithm for browsers which do not send full or accurate information. Some of the most popular browsers send Accept header information which would otherwise result in the selection of the wrong variant in many cases. If a browser sends full and correct information these fiddles will not be applied.

Media Types and Wildcards

The Accept: request header indicates preferences for media types. It can also include 'wildcard' media types, such as "image/*" or "*/*" where the * matches any string. So a request including:

```
Accept: image/*, */*
```

would indicate that any type starting "image/" is acceptable, as is any other type (so the first "image/*" is redundant). Some browsers routinely send wildcards in addition to explicit types they can handle. For example:

```
Accept: text/html, text/plain, image/gif, image/jpeg, */*
```

The intention of this is to indicate that the explicitly listed types are preferred, but if a different representation is available, that is ok too. However under the basic algorithm, as given above, the */* wildcard has exactly equal preference to all the other types, so they are not being preferred. The browser should really have sent a request with a lower quality (preference) value for *.*, such as:

```
Accept: text/html, text/plain, image/gif, image/jpeg, */*; q=0.01
```

The explicit types have no quality factor, so they default to a preference of 1.0 (the highest). The wildcard */* is given a low preference of 0.01, so other types will only be returned if no variant matches an explicitly listed type.

If the Accept: header contains *no* q factors at all, Apache sets the q value of "*/*", if present, to 0.01

to emulate the desired behavior. It also sets the q value of wildcards of the format "type/*" to 0.
(so these are preferred over matches against "*/*". If any media type on the Accept: header con
a q factor, these special values are *not* applied, so requests from browsers which send the correct
information to start with work as expected.

Variants with no Language

If some of the variants for a particular resource have a language attribute, and some do not, those variants with no language are given a very low language quality factor of 0.001.

The reason for setting this language quality factor for variant with no language to a very low value is to allow for a default variant which can be supplied if none of the other variants match the browser's language preferences. For example, consider the situation with three variants:

- foo.en.html, language en
- foo.fr.html, language en
- foo.html, no language

The meaning of a variant with no language is that it is always acceptable to the browser. If the request Accept-Language header includes either en or fr (or both) one of foo.en.html or foo.fr.html will be returned. If the browser does not list either en or fr as acceptable, foo.html will be returned instead.

Extensions to Transparent Content Negotiation

Apache extends the transparent content negotiation protocol (RFC 2295) as follows. A new `{encoding ..}` element is used in variant lists to label variants which are available with a specific content-encoding only. The implementation of the RVSA/1.0 algorithm (RFC 2296) is extended to recognize encoded variants in the list, and to use them as candidate variants whenever their encodings are acceptable according to the Accept-Encoding request header. The RVSA/1.0 implementation does not round computed quality factors to 5 decimal places before choosing the best variant.

Note on hyperlinks and naming conventions

If you are using language negotiation you can choose between different naming conventions, because files can have more than one extension, and the order of the extensions is normally irrelevant (see mod_mime documentation for details).

A typical file has a MIME-type extension (*e.g.*, html), maybe an encoding extension (*e.g.*, gz), and of course a language extension (*e.g.*, en) when we have different language variants of this file.

Examples:

- foo.en.html
- foo.html.en
- foo.en.html.gz

Here some more examples of filenames together with valid and invalid hyperlinks:

Filename	Valid hyperlink	Invalid hyperlink
foo.html.en	foo foo.html	-
foo.en.html	foo	foo.html
foo.html.en.gz	foo foo.html	foo.gz foo.html.gz
foo.en.html.gz	foo	foo.html foo.html.gz foo.gz
foo.gz.html.en	foo foo.gz foo.gz.html	foo.html
foo.html.gz.en	foo foo.html foo.html.gz	foo.gz

Looking at the table above you will notice that it is always possible to use the name without any extensions in an hyperlink (*e.g.*, foo). The advantage is that you can hide the actual type of a document rsp. file and can change it later, *e.g.*, from html to shtml or cgi without changing any hyperlink references.

If you want to continue to use a MIME-type in your hyperlinks (*e.g.* foo.html) the language extension (including an encoding extension if there is one) must be on the right hand side of the MIME-type extension (*e.g.*, foo.html.en).

Note on Caching

When a cache stores a representation, it associates it with the request URL. The next time that URL is requested, the cache can use the stored representation. But, if the resource is negotiable at the server, this might result in only the first requested variant being cached and subsequent cache hits might return the wrong response. To prevent this, Apache normally marks all responses that are returned after content negotiation as non-cacheable by HTTP/1.0 clients. Apache also supports the HTTP/1.1 protocol features to allow caching of negotiated responses.

For requests which come from a HTTP/1.0 compliant client (either a browser or a cache), the directive `CacheNegotiatedDocs` can be used to allow caching of responses which were subject to negotiation. This directive can be given in the server config or virtual host, and takes no

arguments. It has no effect on requests from HTTP/1.1 clients.

Apache HTTP Server Version 1.3

Module mod_negotiation

This module is contained in the `mod_negotiation.c` file, and is compiled in by default. It provides for content negotiation.

Summary

Content negotiation, or more accurately content selection, is the selection of the document that best matches the clients capabilities, from one of several available documents. There are two implementations of this.

- A type map (a file with the handler `type-map`) which explicitly lists the files containing the variants.
- A MultiViews search (enabled by the MultiViews Option, where the server does an implicit filename pattern match, and choose from amongst the results.

Type maps

A type map has the same format as RFC822 mail headers. It contains document descriptions separated by blank lines, with lines beginning with a hash character ('#') treated as comments. A document description consists of several header records; records may be continued on multiple lines if the continuation lines start with spaces. The leading space will be deleted and the lines concatenated. A header record consists of a keyword name, which always ends in a colon, followed by a value. Whitespace is allowed between the header name and value, and between the tokens of value. The headers allowed are:

Content-Encoding:

: The encoding of the file. Apache only recognizes encodings that are defined by an AddEncoding directive. This normally includes the encodings `x-compress` for compress'd files, and `x-gzip` for gzip'd files. The `x-` prefix is ignored for encoding comparisons.

Content-Language:

: The language of the variant, as an Internet standard language tag (RFC 1766). An example is `en`, meaning English.

Content-Length:

: The length of the file, in bytes. If this header is not present, then the actual length of the file is used.

Content-Type:

The MIME media type of the document, with optional parameters. Parameters are separated fr
the media type and from one another by a semi-colon, with a syntax of `name=value`. Comm
parameters include:

level

an integer specifying the version of the media type. For `text/html` this defaults to 2, otherwise 0.

qs

a floating-point number with a value in the range 0.0 to 1.0, indicating the relative 'quality' of this variant compared to the other available variants, independent of the client's capabilities. For example, a jpeg file is usually of higher source quality than an ascii file if it is attempting to represent a photograph. However, if the resource being represented is ascii art, then an ascii file would have a higher source quality than a jpeg file. All qs values are therefore specific to a given resource.

Example:

```
Content-Type: image/jpeg; qs=0.8
```

URI:

The path to the file containing this variant, relative to the map file.

MultiViews

A MultiViews search is enabled by the MultiViews Option. If the server receives a request for `/some/dir/foo` and `/some/dir/foo` does *not* exist, then the server reads the directory looking for all files named `foo.*`, and effectively fakes up a type map which names all those files, assigning them the same media types and content-encodings it would have if the client had asked for one of them by name. It then chooses the best match to the client's requirements, and returns that document.

Directives

- CacheNegotiatedDocs
- LanguagePriority

See also: DefaultLanguage, AddEncoding, AddLanguage, AddType, and Option.

CacheNegotiatedDocs

Syntax: CacheNegotiatedDocs
Context: server config
Status: Base
Module: mod_negotiation
Compatibility: CacheNegotiatedDocs is only available in Apache 1.1 and later.

If set, this directive allows content-negotiated documents to be cached by proxy servers. This could mean that clients behind those proxys could retrieve versions of the documents that are not the best match for their abilities, but it will make caching more efficient.

This directive only applies to requests which come from HTTP/1.0 browsers. HTTP/1.1 provides much better control over the caching of negotiated documents, and this directive has no effect in responses to HTTP/1.1 requests.

LanguagePriority

Syntax: LanguagePriority *MIME-lang MIME-lang...*
Context: server config, virtual host, directory, .htaccess
Override: FileInfo
Status: Base
Module: mod_negotiation

The LanguagePriority sets the precedence of language variants for the case where the client does not express a preference, when handling a MultiViews request. The list of *MIME-lang* are in order of decreasing preference. Example:

```
LanguagePriority en fr de
```

For a request for `foo.html`, where `foo.html.fr` and `foo.html.de` both existed, but the browser did not express a language preference, then `foo.html.fr` would be returned.

Note that this directive only has an effect if a 'best' language cannot be determined by any other means. Correctly implemented HTTP/1.1 requests will mean this directive has no effect.

See also: DefaultLanguage and AddLanguage

Apache HTTP Server Version 1.3

Module mod_status

The Status Module is only available in Apache 1.1 and later.

Function

The Status module allows a server administrator to find out how well their server is performing. A HTML page is presented that gives the current server statistics in an easily readable form. If required this page can be made to automatically refresh (given a compatible browser). Another page gives a simple machine-readable list of the current server state.

The details given are:

- The number of children serving requests
- The number of idle children
- The status of each child, the number of requests that child has performed and the total number of bytes served by the child (*)
- A total number of accesses and byte count served (*)
- The time the server was started/restarted and the time it has been running for
- Averages giving the number of requests per second, the number of bytes served per second and the average number of bytes per request (*)
- The current percentage CPU used by each child and in total by Apache (*)
- The current hosts and requests being processed (*)

A compile-time option must be used to display the details marked "(*)" as the instrumentation required for obtaining these statistics does not exist within standard Apache.

ExtendedStatus directive

Syntax: ExtendedStatus *On*|*Off*
Default: `ExtendedStatus Off`
Context: server config
Status: Base
Module: mod_status
Compatibility: ExtendedStatus is only available in Apache 1.3.2 and later.

This directive controls whether the server keeps track of extended status information for each reques
This is only useful if the status module is enabled on the server.

This setting applies to the entire server, and cannot be enabled or disabled on a virtualhost-by-virtualhost basis.

Enabling Status Support

To enable status reports only for browsers from the foo.com domain add this code to your `access.conf` configuration file

```
<Location /server-status>
SetHandler server-status

order deny,allow
deny from all
allow from .foo.com
</Location>
```

You can now access server statistics by using a Web browser to access the page `http://your.server.name/server-status`

Note that mod_status will only work when you are running Apache in standalone mode and not inetd mode.

Automatic Updates

You can get the status page to update itself automatically if you have a browser that supports "refresh". Access the page `http://your.server.name/server-status?refresh=N` to refresh the page every N seconds.

Machine Readable Status File

A machine-readable version of the status file is available by accessing the page `http://your.server.name/server-status?auto`. This is useful when automatically run, see the Perl program in the `/support` directory of Apache, `log_server_status`.

> **It should be noted that if mod_status is compiled into the server, its handler capability is available in *all* configuration files, including *per*-directory files (*e.g.*, .htaccess). This may have security-related ramifications for your site.**

Apache HTTP Server Version 1.3

Apache API notes

These are some notes on the Apache API and the data structures you have to deal with, *etc.* They are not yet nearly complete, but hopefully, they will help you get your bearings. Keep in mind that the API is still subject to change as we gain experience with it. (See the TODO file for what *might* be coming). However, it will be easy to adapt modules to any changes that are made. (We have more modules to adapt than you do).

A few notes on general pedagogical style here. In the interest of conciseness, all structure declarations here are incomplete --- the real ones have more slots that I'm not telling you about. For the most part, these are reserved to one component of the server core or another, and should be altered by modules with caution. However, in some cases, they really are things I just haven't gotten around to yet. Welcome to the bleeding edge.

Finally, here's an outline, to give you some bare idea of what's coming up, and in what order:

Basic concepts.

We begin with an overview of the basic concepts behind the API, and how they are manifested in the code.

Handlers, Modules, and Requests

Apache breaks down request handling into a series of steps, more or less the same way the Netscape server API does (although this API has a few more stages than NetSite does, as hooks for stuff I thought might be useful in the future). These are:

- URI -> Filename translation
- Auth ID checking [is the user who they say they are?]
- Auth access checking [is the user authorized *here*?]
- Access checking other than auth
- Determining MIME type of the object requested
- `Fixups' --- there aren't any of these yet, but the phase is intended as a hook for possible extensions like `SetEnv`, which don't really fit well elsewhere.
- Actually sending a response back to the client.
- Logging the request

These phases are handled by looking at each of a succession of *modules*, looking to see if each of them has a handler for the phase, and attempting invoking it if so. The handler can typically do one of three things:

- *Handle* the request, and indicate that it has done so by returning the magic constant `OK`.
- *Decline* to handle the request, by returning the magic integer constant `DECLINED`. In this case, the server behaves in all respects as if the handler simply hadn't been there.
- Signal an error, by returning one of the HTTP error codes. This terminates normal handling of the request, although an ErrorDocument may be invoked to try to mop up, and it will be logged in any case.

Most phases are terminated by the first module that handles them; however, for logging, `fixups', and non-access authentication checking, all handlers always run (barring an error). Also, the response phase is unique in that modules may declare multiple handlers for it, via a dispatch table keyed on the MIME type of the requested object. Modules may declare a response-phase handler which can handle *any* request, by giving it the key `*/*` (*i.e.*, a wildcard MIME type specification). However, wildcard handlers are only invoked if the server has already tried and failed to find a more specific response handler for the MIME type of the requested object (either none existed, or they all declined).

The handlers themselves are functions of one argument (a `request_rec` structure. vide infra), which returns an integer, as above.

A brief tour of a module

At this point, we need to explain the structure of a module. Our candidate will be one of the messier ones, the CGI module --- this handles both CGI scripts and the `ScriptAlias` config file command. It's actually a great deal more complicated than most modules, but if we're going to have only one example, it might as well be the one with its fingers in every place.

Let's begin with handlers. In order to handle the CGI scripts, the module declares a response handler for them. Because of `ScriptAlias`, it also has handlers for the name translation phase (to recognize `ScriptAlias`ed URIs), the type-checking phase (any `ScriptAlias`ed request is typed as a CGI script).

The module needs to maintain some per (virtual) server information, namely, the `ScriptAlias`es in effect; the module structure therefore contains pointers to a functions which builds these structures, and to another which combines two of them (in case the main server and a virtual server both have `ScriptAlias`es declared).

Finally, this module contains code to handle the `ScriptAlias` command itself. This particular module only declares one command, but there could be more, so modules have *command tables* which declare their commands, and describe where they are permitted, and how they are to be invoked.

A final note on the declared types of the arguments of some of these commands: a `pool` is a pointer to a *resource pool* structure; these are used by the server to keep track of the memory which has been allocated, files opened, *etc.*, either to service a particular request, or to handle the process of configuring itself. That way, when the request is over (or, for the configuration pool, when the server is restarting), the memory can be freed, and the files closed, *en masse*, without anyone having to write explicit code to track them all down and dispose of them. Also, a `cmd_parms` structure contains various information about the config file being read, and other status information, which is sometimes of use to the function which processes a config-file command (such as `ScriptAlias`). With no further ado, the module itself:

```
/* Declarations of handlers. */

int translate_scriptalias (request_rec *);
int type_scriptalias (request_rec *);
int cgi_handler (request_rec *);

/* Subsidiary dispatch table for response-phase handlers, by MIME type */

handler_rec cgi_handlers[] = {
{ "application/x-httpd-cgi", cgi_handler },
{ NULL }
};

/* Declarations of routines to manipulate the module's configuration
 * info.  Note that these are returned, and passed in, as void *'s;
 * the server core keeps track of them, but it doesn't, and can't,
 * know their internal structure.
 */

void *make_cgi_server_config (pool *);
void *merge_cgi_server_config (pool *, void *, void *);

/* Declarations of routines to handle config-file commands */

extern char *script_alias(cmd_parms *, void *per_dir_config, char *fake,
                          char *real);
```


```
command_rec cgi_cmds[] = {
{ "ScriptAlias", script_alias, NULL, RSRC_CONF, TAKE2,
    "a fakename and a realname"},
{ NULL }
};

module cgi_module = {
   STANDARD_MODULE_STUFF,
   NULL,                        /* initializer */
   NULL,                        /* dir config creator */
   NULL,                        /* dir merger --- default is to override */
   make_cgi_server_config,      /* server config */
   merge_cgi_server_config,     /* merge server config */
   cgi_cmds,                    /* command table */
   cgi_handlers,                /* handlers */
   translate_scriptalias,       /* filename translation */
   NULL,                        /* check_user_id */
   NULL,                        /* check auth */
   NULL,                        /* check access */
   type_scriptalias,            /* type_checker */
   NULL,                        /* fixups */
   NULL,                        /* logger */
   NULL                         /* header parser */
};
```

How handlers work

The sole argument to handlers is a `request_rec` structure. This structure describes a particular request which has been made to the server, on behalf of a client. In most cases, each connection to the client generates only one `request_rec` structure.

A brief tour of the `request_rec`

The `request_rec` contains pointers to a resource pool which will be cleared when the server is finished handling the request; to structures containing per-server and per-connection information, and most importantly, information on the request itself.

The most important such information is a small set of character strings describing attributes of the object being requested, including its URI, filename, content-type and content-encoding (these being filled in by the translation and type-check handlers which handle the request, respectively).

Other commonly used data items are tables giving the MIME headers on the client's original request, MIME headers to be sent back with the response (which modules can add to at will), and environment variables for any subprocesses which are spawned off in the course of servicing the request. These tables are manipulated using the `ap_table_get` and `ap_table_set` routines.

Note that the Content-type header value *cannot* be set by module content-handlers using the

ap_table_*() routines. Rather, it is set by pointing the content_type field in the request_rec structure to an appropriate string. *E.g.*,

```
r->content_type = "text/html";
```

Finally, there are pointers to two data structures which, in turn, point to per-module configuration structures. Specifically, these hold pointers to the data structures which the module has built to describe the way it has been configured to operate in a given directory (via `.htaccess` files or `<Directory>` sections), for private data it has built in the course of servicing the request (so modules' handlers for one phase can pass `notes' to their handlers for other phases). There is another such configuration vector in the `server_rec` data structure pointed to by the `request_rec`, which contains per (virtual) server configuration data.

Here is an abridged declaration, giving the fields most commonly used:

```
struct request_rec {

  pool *pool;
  conn_rec *connection;
  server_rec *server;

  /* What object is being requested */

  char *uri;
  char *filename;
  char *path_info;
  char *args;            /* QUERY_ARGS, if any */
  struct stat finfo;     /* Set by server core;
                          * st_mode set to zero if no such file */

  char *content_type;
  char *content_encoding;

  /* MIME header environments, in and out.  Also, an array containing
   * environment variables to be passed to subprocesses, so people can
   * write modules to add to that environment.
   *
   * The difference between headers_out and err_headers_out is that
   * the latter are printed even on error, and persist across internal
   * redirects (so the headers printed for ErrorDocument handlers will
   * have them).
   */

  table *headers_in;
  table *headers_out;
  table *err_headers_out;
  table *subprocess_env;

  /* Info about the request itself... */
```


```
  int header_only;     /* HEAD request, as opposed to GET */
  char *protocol;      /* Protocol, as given to us, or HTTP/0.9 */
  char *method;        /* GET, HEAD, POST, etc. */
  int method_number;   /* M_GET, M_POST, etc. */

  /* Info for logging */

  char *the_request;
  int bytes_sent;

  /* A flag which modules can set, to indicate that the data being
   * returned is volatile, and clients should be told not to cache it.
   */

  int no_cache;

  /* Various other config info which may change with .htaccess files
   * These are config vectors, with one void* pointer for each module
   * (the thing pointed to being the module's business).
   */

  void *per_dir_config;   /* Options set in config files, etc. */
  void *request_config;   /* Notes on *this* request */

};
```

Where request_rec structures come from

Most `request_rec` structures are built by reading an HTTP request from a client, and filling in the fields. However, there are a few exceptions:

- If the request is to an imagemap, a type map (*i.e.*, a `*.var` file), or a CGI script which returned a local `Location:', then the resource which the user requested is going to be ultimately located by some URI other than what the client originally supplied. In this case, the server does an *internal redirect*, constructing a new `request_rec` for the new URI, and processing it almost exactly as if the client had requested the new URI directly.
- If some handler signaled an error, and an `ErrorDocument` is in scope, the same internal redirect machinery comes into play.
- Finally, a handler occasionally needs to investigate `what would happen if' some other request were run. For instance, the directory indexing module needs to know what MIME type would be assigned to a request for each directory entry, in order to figure out what icon to use.

  Such handlers can construct a *sub-request*, using the functions `ap_sub_req_lookup_file`, `ap_sub_req_lookup_uri`, and `ap_sub_req_method_uri`; these construct a new `request_rec` structure and processes it as you would expect, up to but not including the point of actually sending a response. (These functions skip over the access checks if the sub-request is for a file

in the same directory as the original request).

(Server-side includes work by building sub-requests and then actually invoking the response handler for them, via the function `ap_run_sub_req`).

Handling requests, declining, and returning error codes

As discussed above, each handler, when invoked to handle a particular `request_rec`, has to return an `int` to indicate what happened. That can either be

- OK --- the request was handled successfully. This may or may not terminate the phase.
- DECLINED --- no erroneous condition exists, but the module declines to handle the phase; the server tries to find another.
- an HTTP error code, which aborts handling of the request.

Note that if the error code returned is `REDIRECT`, then the module should put a `Location` in the request's `headers_out`, to indicate where the client should be redirected *to*.

Special considerations for response handlers

Handlers for most phases do their work by simply setting a few fields in the `request_rec` structure (or, in the case of access checkers, simply by returning the correct error code). However, response handlers have to actually send a request back to the client.

They should begin by sending an HTTP response header, using the function `ap_send_http_header`. (You don't have to do anything special to skip sending the header for HTTP/0.9 requests; the function figures out on its own that it shouldn't do anything). If the request is marked `header_only`, that's all they should do; they should return after that, without attempting any further output.

Otherwise, they should produce a request body which responds to the client as appropriate. The primitives for this are `ap_rputc` and `ap_rprintf`, for internally generated output, and `ap_send_fd`, to copy the contents of some `FILE *` straight to the client.

At this point, you should more or less understand the following piece of code, which is the handler which handles `GET` requests which have no more specific handler; it also shows how conditional `GET`s can be handled, if it's desirable to do so in a particular response handler --- `ap_set_last_modified` checks against the `If-modified-since` value supplied by the client, if any, and returns an appropriate code (which will, if nonzero, be USE_LOCAL_COPY). No similar considerations apply for `ap_set_content_length`, but it returns an error code for symmetry.

```
int default_handler (request_rec *r)
{
    int errstatus;
    FILE *f;

    if (r->method_number != M_GET) return DECLINED;
    if (r->finfo.st_mode == 0) return NOT_FOUND;

    if ((errstatus = ap_set_content_length (r, r->finfo.st_size))
```


```
        || (errstatus = ap_set_last_modified (r, r->finfo.st_mtime)))
        return errstatus;

    f = fopen (r->filename, "r");

    if (f == NULL) {
        log_reason("file permissions deny server access",
                   r->filename, r);
        return FORBIDDEN;
    }

    register_timeout ("send", r);
    ap_send_http_header (r);

    if (!r->header_only) send_fd (f, r);
    ap_pfclose (r->pool, f);
    return OK;
}
```

Finally, if all of this is too much of a challenge, there are a few ways out of it. First off, as shown above, a response handler which has not yet produced any output can simply return an error code, in which case the server will automatically produce an error response. Secondly, it can punt to some other handler by invoking `ap_internal_redirect`, which is how the internal redirection machinery discussed above is invoked. A response handler which has internally redirected should always return `OK`.

(Invoking `ap_internal_redirect` from handlers which are *not* response handlers will lead to serious confusion).

Special considerations for authentication handlers

Stuff that should be discussed here in detail:

- Authentication-phase handlers not invoked unless auth is configured for the directory.
- Common auth configuration stored in the core per-dir configuration; it has accessors `ap_auth_type`, `ap_auth_name`, and `ap_requires`.
- Common routines, to handle the protocol end of things, at least for HTTP basic authentication (`ap_get_basic_auth_pw`, which sets the `connection->user` structure field automatically, and `ap_note_basic_auth_failure`, which arranges for the proper `WWW-Authenticate:` header to be sent back).

Special considerations for logging handlers

When a request has internally redirected, there is the question of what to log. Apache handles this by bundling the entire chain of redirects into a list of `request_rec` structures which are threaded through the `r->prev` and `r->next` pointers. The `request_rec` which is passed to the logging handlers in such cases is the one which was originally built for the initial request from the client; note that the bytes_sent field will only be correct in the last request in the chain (the one for which a response was actually sent).

Resource allocation and resource pools

One of the problems of writing and designing a server-pool server is that of preventing leakage, that is, allocating resources (memory, open files, *etc.*), without subsequently releasing them. The resource pool machinery is designed to make it easy to prevent this from happening, by allowing resource to be allocated in such a way that they are *automatically* released when the server is done with them.

The way this works is as follows: the memory which is allocated, file opened, *etc.*, to deal with a particular request are tied to a *resource pool* which is allocated for the request. The pool is a data structure which itself tracks the resources in question.

When the request has been processed, the pool is *cleared*. At that point, all the memory associated with it is released for reuse, all files associated with it are closed, and any other clean-up functions which are associated with the pool are run. When this is over, we can be confident that all the resource tied to the pool have been released, and that none of them have leaked.

Server restarts, and allocation of memory and resources for per-server configuration, are handled in a similar way. There is a *configuration pool*, which keeps track of resources which were allocated while reading the server configuration files, and handling the commands therein (for instance, the memory that was allocated for per-server module configuration, log files and other files that were opened, and so forth). When the server restarts, and has to reread the configuration files, the configuration pool is cleared, and so the memory and file descriptors which were taken up by reading them the last time are made available for reuse.

It should be noted that use of the pool machinery isn't generally obligatory, except for situations like logging handlers, where you really need to register cleanups to make sure that the log file gets closed when the server restarts (this is most easily done by using the function `ap_pfopen`, which also arranges for the underlying file descriptor to be closed before any child processes, such as for CGI scripts, are `exec`ed), or in case you are using the timeout machinery (which isn't yet even documented here). However, there are two benefits to using it: resources allocated to a pool never leak (even if you allocate a scratch string, and just forget about it); also, for memory allocation, `ap_palloc` is generally faster than `malloc`.

We begin here by describing how memory is allocated to pools, and then discuss how other resources are tracked by the resource pool machinery.

Allocation of memory in pools

Memory is allocated to pools by calling the function `ap_palloc`, which takes two arguments, one being a pointer to a resource pool structure, and the other being the amount of memory to allocate (in `char`s). Within handlers for handling requests, the most common way of getting a resource pool structure is by looking at the `pool` slot of the relevant `request_rec`; hence the repeated appearance of the following idiom in module code:

```
int my_handler(request_rec *r)
{
    struct my_structure *foo;
    ...

    foo = (foo *)ap_palloc (r->pool, sizeof(my_structure));
```

```
}
```

Note that *there is no* `ap_pfree` --- `ap_palloc`ed memory is freed only when the associated resource pool is cleared. This means that `ap_palloc` does not have to do as much accounting as `malloc()`; all it does in the typical case is to round up the size, bump a pointer, and do a range check.

(It also raises the possibility that heavy use of `ap_palloc` could cause a server process to grow excessively large. There are two ways to deal with this, which are dealt with below; briefly, you can use `malloc`, and try to be sure that all of the memory gets explicitly `free`d, or you can allocate a sub-pool of the main pool, allocate your memory in the sub-pool, and clear it out periodically. The latter technique is discussed in the section on sub-pools below, and is used in the directory-indexing code, in order to avoid excessive storage allocation when listing directories with thousands of files).

Allocating initialized memory

There are functions which allocate initialized memory, and are frequently useful. The function `ap_pcalloc` has the same interface as `ap_palloc`, but clears out the memory it allocates before it returns it. The function `ap_pstrdup` takes a resource pool and a `char *` as arguments, and allocates memory for a copy of the string the pointer points to, returning a pointer to the copy. Finally `ap_pstrcat` is a varargs-style function, which takes a pointer to a resource pool, and at least two `char *` arguments, the last of which must be `NULL`. It allocates enough memory to fit copies of each of the strings, as a unit; for instance:

```
ap_pstrcat (r->pool, "foo", "/", "bar", NULL);
```

returns a pointer to 8 bytes worth of memory, initialized to `"foo/bar"`.

Commonly-used pools in the Apache Web server

A pool is really defined by its lifetime more than anything else. There are some static pools in http_main which are passed to various non-http_main functions as arguments at opportune times. Here they are:

permanent_pool

- never passed to anything else, this is the ancestor of all pools

pconf

- subpool of permanent_pool
- created at the beginning of a config "cycle"; exists until the server is terminated or restarts; passed to all config-time routines, either via cmd->pool, or as the "pool *p" argument on those which don't take pools
- passed to the module init() functions

ptemp

- sorry I lie, this pool isn't called this currently in 1.3, I renamed it this in my pthreads development. I'm referring to the use of ptrans in the parent... contrast this with the later definition of ptrans in the child.
- subpool of permanent_pool
- created at the beginning of a config "cycle"; exists until the end of config parsing; passed to config-time routines *via* cmd->temp_pool. Somewhat of a "bastard child" because it isn't

available everywhere. Used for temporary scratch space which may be needed by some cor routines but which is deleted at the end of config.

pchild

- subpool of permanent_pool
- created when a child is spawned (or a thread is created); lives until that child (thread) is destroyed
- passed to the module child_init functions
- destruction happens right after the child_exit functions are called... (which may explain why I think child_exit is redundant and unneeded)

ptrans

- should be a subpool of pchild, but currently is a subpool of permanent_pool, see above
- cleared by the child before going into the accept() loop to receive a connection
- used as connection->pool

r->pool

- for the main request this is a subpool of connection->pool; for subrequests it is a subpool of the parent request's pool.
- exists until the end of the request (*i.e.*, ap_destroy_sub_req, or in child_main after process_request has finished)
- note that r itself is allocated from r->pool; *i.e.*, r->pool is first created and then r is the first thing palloc()d from it

For almost everything folks do, r->pool is the pool to use. But you can see how other lifetimes, such as pchild, are useful to some modules... such as modules that need to open a database connection once per child, and wish to clean it up when the child dies.

You can also see how some bugs have manifested themself, such as setting connection->user to a value from r->pool -- in this case connection exists for the lifetime of ptrans, which is longer than r->pool (especially if r->pool is a subrequest!). So the correct thing to do is to allocate from connection->pool.

And there was another interesting bug in mod_include/mod_cgi. You'll see in those that they do this test to decide if they should use r->pool or r->main->pool. In this case the resource that they are registering for cleanup is a child process. If it were registered in r->pool, then the code would wait() for the child when the subrequest finishes. With mod_include this could be any old #include, and the delay can be up to 3 seconds... and happened quite frequently. Instead the subprocess is registered in r->main->pool which causes it to be cleaned up when the entire request is done -- *i.e.*, after the output has been sent to the client and logging has happened.

Tracking open files, etc.

As indicated above, resource pools are also used to track other sorts of resources besides memory. The most common are open files. The routine which is typically used for this is `ap_pfopen`, which takes a resource pool and two strings as arguments; the strings are the same as the typical arguments to `fopen`, *e.g.*,

```
...
FILE *f = ap_pfopen (r->pool, r->filename, "r");
```


```
if (f == NULL) { ... } else { ... }
```

There is also a `ap_popenf` routine, which parallels the lower-level `open` system call. Both of these routines arrange for the file to be closed when the resource pool in question is cleared.

Unlike the case for memory, there *are* functions to close files allocated with `ap_pfopen`, and `ap_popenf`, namely `ap_pfclose` and `ap_pclosef`. (This is because, on many systems, the number of files which a single process can have open is quite limited). It is important to use these functions to close files allocated with `ap_pfopen` and `ap_popenf`, since to do otherwise could cause fatal errors on systems such as Linux, which react badly if the same `FILE*` is closed more than once.

(Using the `close` functions is not mandatory, since the file will eventually be closed regardless, but you should consider it in cases where your module is opening, or could open, a lot of files).

Other sorts of resources --- cleanup functions

> More text goes here. Describe the the cleanup primitives in terms of which the file stuff is implemented; also, `spawn_process`.

Pool cleanups live until clear_pool() is called: clear_pool(a) recursively calls destroy_pool() on all subpools of a; then calls all the cleanups for a; then releases all the memory for a. destroy_pool(a) calls clear_pool(a) and then releases the pool structure itself. *i.e.*, clear_pool(a) doesn't delete a, it just frees up all the resources and you can start using it again immediately.

Fine control --- creating and dealing with sub-pools, with a note on sub-requests

On rare occasions, too-free use of `ap_palloc()` and the associated primitives may result in undesirably profligate resource allocation. You can deal with such a case by creating a *sub-pool*, allocating within the sub-pool rather than the main pool, and clearing or destroying the sub-pool, which releases the resources which were associated with it. (This really *is* a rare situation; the only case in which it comes up in the standard module set is in case of listing directories, and then only with *very* large directories. Unnecessary use of the primitives discussed here can hair up your code quite a bit, with very little gain).

The primitive for creating a sub-pool is `ap_make_sub_pool`, which takes another pool (the parent pool) as an argument. When the main pool is cleared, the sub-pool will be destroyed. The sub-pool may also be cleared or destroyed at any time, by calling the functions `ap_clear_pool` and `ap_destroy_pool`, respectively. (The difference is that `ap_clear_pool` frees resources associated with the pool, while `ap_destroy_pool` also deallocates the pool itself. In the former case, you can allocate new resources within the pool, and clear it again, and so forth; in the latter case, it is simply gone).

One final note --- sub-requests have their own resource pools, which are sub-pools of the resource pool for the main request. The polite way to reclaim the resources associated with a sub request which you have allocated (using the `ap_sub_req_...` functions) is `ap_destroy_sub_req`, which frees the resource pool. Before calling this function, be sure to copy anything that you care about which might be allocated in the sub-request's resource pool into someplace a little less volatile (for instance, the filename in its `request_rec` structure).

(Again, under most circumstances, you shouldn't feel obliged to call this function; only 2K of memory or so

are allocated for a typical sub request, and it will be freed anyway when the main request pool is cleared only when you are allocating many, many sub-requests for a single main request that you should seriously consider the `ap_destroy_...` functions).

Configuration, commands and the like

One of the design goals for this server was to maintain external compatibility with the NCSA 1.3 server --- that is, to read the same configuration files, to process all the directives therein correctly, and in general to be a drop-in replacement for NCSA. On the other hand, another design goal was to move as much of the server's functionality into modules which have as little as possible to do with the monolithic server core. The only way to reconcile these goals is to move the handling of most commands from the central server into the modules.

However, just giving the modules command tables is not enough to divorce them completely from the server core. The server has to remember the commands in order to act on them later. That involves maintaining data which is private to the modules, and which can be either per-server, or per-directory. Most things are per-directory, including in particular access control and authorization information, but also information on how to determine file types from suffixes, which can be modified by `AddType` and `DefaultType` directives, and so forth. In general, the governing philosophy is that anything which *can* be made configurable by directory should be; per-server information is generally used in the standard set of modules for information like `Alias`es and `Redirect`s which come into play before the request is tied to a particular place in the underlying file system.

Another requirement for emulating the NCSA server is being able to handle the per-directory configuration files, generally called `.htaccess` files, though even in the NCSA server they can contain directives which have nothing at all to do with access control. Accordingly, after URI -> filename translation, but before performing any other phase, the server walks down the directory hierarchy of the underlying filesystem, following the translated pathname, to read any `.htaccess` files which might be present. The information which is read in then has to be *merged* with the applicable information from the server's own config files (either from the `<Directory>` sections in `access.conf`, or from defaults in `srm.conf`, which actually behaves for most purposes almost exactly like `<Directory />`).

Finally, after having served a request which involved reading `.htaccess` files, we need to discard the storage allocated for handling them. That is solved the same way it is solved wherever else similar problems come up, by tying those structures to the per-transaction resource pool.

Per-directory configuration structures

Let's look out how all of this plays out in `mod_mime.c`, which defines the file typing handler which emulates the NCSA server's behavior of determining file types from suffixes. What we'll be looking at, here, is the code which implements the `AddType` and `AddEncoding` commands. These commands can appear in `.htaccess` files, so they must be handled in the module's private per-directory data, which in fact, consists of two separate `table`s for MIME types and encoding information, and is declared as follows:

```
typedef struct {
    table *forced_types;      /* Additional AddTyped stuff */
    table *encoding_types;    /* Added with AddEncoding... */
```


```
} mime_dir_config;
```

When the server is reading a configuration file, or `<Directory>` section, which includes one of the MIME module's commands, it needs to create a `mime_dir_config` structure, so those commands have something to act on. It does this by invoking the function it finds in the module's `create per-dir config slot', with two arguments: the name of the directory to which this configuration information applies (or `NULL` for `srm.conf`), and a pointer to a resource pool in which the allocation should happen.

(If we are reading a `.htaccess` file, that resource pool is the per-request resource pool for the request; otherwise it is a resource pool which is used for configuration data, and cleared on restarts. Either way, it is important for the structure being created to vanish when the pool is cleared, by registering a cleanup on the pool if necessary).

For the MIME module, the per-dir config creation function just `ap_pallocs` the structure above, and a creates a couple of `tables` to fill it. That looks like this:

```
void *create_mime_dir_config (pool *p, char *dummy)
{
    mime_dir_config *new =
      (mime_dir_config *) ap_palloc (p, sizeof(mime_dir_config));

    new->forced_types = ap_make_table (p, 4);
    new->encoding_types = ap_make_table (p, 4);

    return new;
}
```

Now, suppose we've just read in a `.htaccess` file. We already have the per-directory configuration structure for the next directory up in the hierarchy. If the `.htaccess` file we just read in didn't have any `AddType` or `AddEncoding` commands, its per-directory config structure for the MIME module is still valid, and we can just use it. Otherwise, we need to merge the two structures somehow.

To do that, the server invokes the module's per-directory config merge function, if one is present. That function takes three arguments: the two structures being merged, and a resource pool in which to allocate the result. For the MIME module, all that needs to be done is overlay the tables from the new per-directory config structure with those from the parent:

```
void *merge_mime_dir_configs (pool *p, void *parent_dirv, void *subdirv)
{
    mime_dir_config *parent_dir = (mime_dir_config *)parent_dirv;
    mime_dir_config *subdir = (mime_dir_config *)subdirv;
    mime_dir_config *new =
      (mime_dir_config *)ap_palloc (p, sizeof(mime_dir_config));

    new->forced_types = ap_overlay_tables (p, subdir->forced_types,
                                           parent_dir->forced_types);
    new->encoding_types = ap_overlay_tables (p, subdir->encoding_types,
                                             parent_dir->encoding_types);
```

```
    return new;
}
```

As a note --- if there is no per-directory merge function present, the server will just use the subdirectory's configuration info, and ignore the parent's. For some modules, that works just fine (*e.g.*, for the includes module, whose per-directory configuration information consists solely of the state of the `XBITHACK`), and for those modules, you can just not declare one, and leave the corresponding structure slot in the module itself `NULL`.

Command handling

Now that we have these structures, we need to be able to figure out how to fill them. That involves processing the actual `AddType` and `AddEncoding` commands. To find commands, the server looks in the module's `command table`. That table contains information on how many arguments the commands take, and in what formats, where it is permitted, and so forth. That information is sufficient to allow the server to invoke most command-handling functions with pre-parsed arguments. Without further ado, let's look at the `AddType` command handler, which looks like this (the `AddEncoding` command looks basically the same, and won't be shown here):

```
char *add_type(cmd_parms *cmd, mime_dir_config *m, char *ct, char *ext)
{
    if (*ext == '.') ++ext;
    ap_table_set (m->forced_types, ext, ct);
    return NULL;
}
```

This command handler is unusually simple. As you can see, it takes four arguments, two of which are pre-parsed arguments, the third being the per-directory configuration structure for the module in question, and the fourth being a pointer to a `cmd_parms` structure. That structure contains a bunch of arguments which are frequently of use to some, but not all, commands, including a resource pool (from which memory can be allocated, and to which cleanups should be tied), and the (virtual) server being configured, from which the module's per-server configuration data can be obtained if required.

Another way in which this particular command handler is unusually simple is that there are no error conditions which it can encounter. If there were, it could return an error message instead of `NULL`; this causes an error to be printed out on the server's `stderr`, followed by a quick exit, if it is in the main config files; for a `.htaccess` file, the syntax error is logged in the server error log (along with an indication of where it came from), and the request is bounced with a server error response (HTTP error status, code 500).

The MIME module's command table has entries for these commands, which look like this:

```
command_rec mime_cmds[] = {
{ "AddType", add_type, NULL, OR_FILEINFO, TAKE2,
    "a mime type followed by a file extension" },
{ "AddEncoding", add_encoding, NULL, OR_FILEINFO, TAKE2,
    "an encoding (e.g., gzip), followed by a file extension" },
{ NULL }
};
```

The entries in these tables are:

- The name of the command
- The function which handles it
- a `(void *)` pointer, which is passed in the `cmd_parms` structure to the command handler --- this is useful in case many similar commands are handled by the same function.
- A bit mask indicating where the command may appear. There are mask bits corresponding to each `AllowOverride` option, and an additional mask bit, `RSRC_CONF`, indicating that the command may appear in the server's own config files, but *not* in any `.htaccess` file.
- A flag indicating how many arguments the command handler wants pre-parsed, and how they should be passed in. `TAKE2` indicates two pre-parsed arguments. Other options are `TAKE1`, which indicates one pre-parsed argument, `FLAG`, which indicates that the argument should be `On` or `Off`, and is passed in as a boolean flag, `RAW_ARGS`, which causes the server to give the command the raw, unparsed arguments (everything but the command name itself). There is also `ITERATE`, which means that the handler looks the same as `TAKE1`, but that if multiple arguments are present, it should be called multiple times, and finally `ITERATE2`, which indicates that the command handler looks like a `TAKE2`, but if more arguments are present, then it should be called multiple times, holding the first argument constant.
- Finally, we have a string which describes the arguments that should be present. If the arguments in the actual config file are not as required, this string will be used to help give a more specific error message. (You can safely leave this `NULL`).

Finally, having set this all up, we have to use it. This is ultimately done in the module's handlers, specifically for its file-typing handler, which looks more or less like this; note that the per-directory configuration structure is extracted from the `request_rec`'s per-directory configuration vector by using the `ap_get_module_config` function.

```
int find_ct(request_rec *r)
{
    int i;
    char *fn = ap_pstrdup (r->pool, r->filename);
    mime_dir_config *conf = (mime_dir_config *)
            ap_get_module_config(r->per_dir_config, &mime_module);
    char *type;

    if (S_ISDIR(r->finfo.st_mode)) {
        r->content_type = DIR_MAGIC_TYPE;
        return OK;
    }

    if((i=ap_rind(fn,'.')) < 0) return DECLINED;
    ++i;

    if ((type = ap_table_get (conf->encoding_types, &fn[i])))
    {
        r->content_encoding = type;

        /* go back to previous extension to try to use it as a type */
```


```
        fn[i-1] = '\0';
        if((i=ap_rind(fn,'.')) < 0) return OK;
        ++i;
    }

    if ((type = ap_table_get (conf->forced_types, &fn[i])))
    {
        r->content_type = type;
    }

    return OK;
}
```

Side notes --- per-server configuration, virtual servers, *etc*.

The basic ideas behind per-server module configuration are basically the same as those for per-directory configuration; there is a creation function and a merge function, the latter being invoked where a virtual server has partially overridden the base server configuration, and a combined structure must be computed. (As with per-directory configuration, the default if no merge function is specified, and a module is configured in some virtual server, is that the base configuration is simply ignored).

The only substantial difference is that when a command needs to configure the per-server private module data, it needs to go to the `cmd_parms` data to get at it. Here's an example, from the alias module, which also indicates how a syntax error can be returned (note that the per-directory configuration argument to the command handler is declared as a dummy, since the module doesn't actually have per-directory config data):

```
char *add_redirect(cmd_parms *cmd, void *dummy, char *f, char *url)
{
    server_rec *s = cmd->server;
    alias_server_conf *conf = (alias_server_conf *)
            ap_get_module_config(s->module_config,&alias_module);
    alias_entry *new = ap_push_array (conf->redirects);

    if (!ap_is_url (url)) return "Redirect to non-URL";

    new->fake = f; new->real = url;
    return NULL;
}
```

Apache HTTP Server Version 1.3

Module mod_autoindex

This module is contained in the `mod_autoindex.c` file, and is compiled in by default. It provides for automatic directory indexing.

Summary

The index of a directory can come from one of two sources:

- A file written by the user, typically called `index.html`. The DirectoryIndex directive sets the name of this file. This is controlled by `mod_dir`.
- Otherwise, a listing generated by the server. The other directives control the format of this listing. The AddIcon, AddIconByEncoding and AddIconByType are used to set a list of icons to display for various file types; for each file listed, the first icon listed that matches the file is displayed. These are controlled by `mod_autoindex`.

The two functions are separated so that you can completely remove (or replace) automatic index generation should you want to.

If FancyIndexing is enabled, or the FancyIndexing keyword is present on the IndexOptions directive, the column headers are links that control the order of the display. If you select a header link, the listing will be regenerated, sorted by the values in that column. Selecting the same header repeatedly toggles between ascending and descending order.

Note that when the display is sorted by "Size", it's the *actual* size of the files that's used, not the displayed value - so a 1010-byte file will always be displayed before a 1011-byte file (if in ascending order) even though they both are shown as "1K".

Directives

- AddIconByType
- DefaultIcon
- FancyIndexing
- HeaderName
- IndexIgnore
- IndexOptions
- IndexOrderDefault
- ReadmeName

AddAlt

Syntax: AddAlt *string file file*...
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Base
Module: mod_autoindex

This sets the alternate text to display for a file, instead of an icon, for FancyIndexing. *File* is a file extension, partial filename, wild-card expression or full filename for files to describe. *String* is enclosed in double quotes ("). This alternate text is displayed if the client is image-incapable or has image loading disabled.

AddAltByEncoding

Syntax: AddAltByEncoding *string MIME-encoding MIME-encoding*...
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Base
Module: mod_autoindex

This sets the alternate text to display for a file, instead of an icon, for FancyIndexing. *MIME-encoding* is a valid content-encoding, such as x-compress. *String* is enclosed in double quotes ("). This alternate text is displayed if the client is image-incapable or has image loading disabled.

AddAltByType

Syntax: AddAltByType *string MIME-type MIME-type* ...
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Base
Module: mod_autoindex

This sets the alternate text to display for a file, instead of an icon, for FancyIndexing. *MIME-type* is a valid content-type, such as text/html. *String* is enclosed in double quotes ("). This alternate text is displayed if the client is image-incapable or has image loading disabled.

AddDescription

Syntax: AddDescription *string file file*...
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Base
Module: mod_autoindex

This sets the description to display for a file, for FancyIndexing. *File* is a file extension, partial filename, wild-card expression or full filename for files to describe. *String* is enclosed in double quotes ("). Example:

```
AddDescription "The planet Mars" /web/pics/mars.gif
```

The description field is 23 bytes wide. 7 more bytes may be added if the directory is covered by an `IndexOptions SuppressSize`, and 19 bytes may be added if `IndexOptions SuppressLastModified` is in effect. The widest this column can be is therefore 49 bytes.

AddIcon

Syntax: AddIcon *icon name name* ...
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Base
Module: mod_autoindex

This sets the icon to display next to a file ending in *name* for FancyIndexing. *Icon* is either a (%-escaped) relative URL to the icon, or of the format (*alttext*,*url*) where *alttext* is the text tag given for an icon for non-graphical browsers.

Name is either ^^DIRECTORY^^ for directories, ^^BLANKICON^^ for blank lines (to format the list correctly), a file extension, a wildcard expression, a partial filename or a complete filename. Examples:

```
AddIcon (IMG,/icons/image.xbm) .gif .jpg .xbm
AddIcon /icons/dir.xbm ^^DIRECTORY^^
AddIcon /icons/backup.xbm *~
```

AddIconByType should be used in preference to AddIcon, when possible.

AddIconByEncoding

Syntax: AddIconByEncoding *icon MIME-encoding MIME-encoding ...*
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Base
Module: mod_autoindex

This sets the icon to display next to files with *MIME-encoding* for FancyIndexing. *Icon* is either a (%-escaped) relative URL to the icon, or of the format (*alttext*,*url*) where *alttext* is the text tag given for an icon for non-graphical browsers.

Mime-encoding is a wildcard expression matching required the content-encoding. Examples:

```
AddIconByEncoding /icons/compress.xbm x-compress
```

AddIconByType

Syntax: AddIconByType *icon MIME-type MIME-type ...*
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Base
Module: mod_autoindex

This sets the icon to display next to files of type *MIME-type* for FancyIndexing. *Icon* is either a (%-escaped) relative URL to the icon, or of the format (*alttext*,*url*) where *alttext* is the text tag given for an icon for non-graphical browsers.

Mime-type is a wildcard expression matching required the mime types. Examples:

```
AddIconByType (IMG,/icons/image.xbm) image/*
```

DefaultIcon

Syntax: DefaultIcon *url*
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Base
Module: mod_autoindex

The DefaultIcon directive sets the icon to display for files when no specific icon is known, for FancyIndexing. *Url* is a (%-escaped) relative URL to the icon. Examples:

```
DefaultIcon /icon/unknown.xbm
```

FancyIndexing

Syntax: FancyIndexing *boolean*
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Base
Module: mod_autoindex

The FancyIndexing directive sets the FancyIndexing option for a directory. *Boolean* can be `on` or `off`. The IndexOptions directive should be used in preference.

> **Note that in versions of Apache prior to 1.3.2, the FancyIndexing and IndexOptions directives will override each other. You should use IndexOptions FancyIndexing in preference to the standalone FancyIndexing directive. As of Apache 1.3.2, a standalone FancyIndexing directive is combined with any IndexOptions directive already specified for the current scope.**

HeaderName

Syntax: HeaderName *filename*
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Base
Module: mod_autoindex
Compatibility: some features only available after 1.3.6; see text

The HeaderName directive sets the name of the file that will be inserted at the top of the index listing. *Filename* is the name of the file to include.

> **Apache 1.3.6 and earlier:** The module first attempts to include *filename*`.html` as an

HTML document, otherwise it will try to include *filename* as plain text. *Filename* is treated as a filesystem path relative to the directory being indexed. In no case is SSI processing done. Example:

```
HeaderName HEADER
```

when indexing the directory `/web`, the server will first look for the HTML file `/web/HEADER.html` and include it if found, otherwise it will include the plain text file `/web/HEADER`, if it exists.

Apache versions after 1.3.6: *Filename* is treated as a URI path relative to the one used to access the directory being indexed, and must resolve to a document with a major content type of "text" (*e.g.*, text/html, text/plain, *etc.*). This means that *filename* may refer to a CGI script if the script's actual file type (as opposed to its output) is marked as text/html such as with a directive like:

```
AddType text/html .cgi
```

Content negotiation will be performed if the MultiViews option is enabled. If *filename* resolves to a static text/html document (not a CGI script) and the Includes option is enabled, the file will be processed for server-side includes (see the mod_include documentation).

See also ReadmeName.

IndexIgnore

Syntax: IndexIgnore *file file* ...
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Base
Module: mod_autoindex

The IndexIgnore directive adds to the list of files to hide when listing a directory. *File* is a file extension, partial filename, wildcard expression or full filename for files to ignore. Multiple IndexIgnore directives add to the list, rather than the replacing the list of ignored files. By default, the list contains `.'. Example:

```
IndexIgnore README .htaccess *~
```

IndexOptions

Syntax: IndexOptions *option option* ... (Apache 1.3.2 and earlier)
Syntax: IndexOptions *[+|-]option [+|-]option* ... (Apache 1.3.3 and later)
Context: server config, virtual host, directory, .htaccess
Override: Indexes

Status: Base
Module: mod_autoindex
Compatibility: '+/-' syntax and merging of multiple IndexOptions directives is only available with Apache 1.3.3 and later

The IndexOptions directive specifies the behavior of the directory indexing. *Option* can be one of

FancyIndexing

This turns on fancy indexing of directories.

Note that in versions of Apache prior to 1.3.2, the FancyIndexing and IndexOptions directives will override each other. You should use IndexOptions FancyIndexing in preference to the standalone FancyIndexing directive. As of Apache 1.3.2, a standalone FancyIndexing directive is combined with any IndexOptions directive already specified for the current scope.

IconHeight[=pixels] (*Apache 1.3 and later*)

Presence of this option, when used with IconWidth, will cause the server to include HEIGHT and WIDTH attributes in the IMG tag for the file icon. This allows browser to precalculate the page layout without having to wait until all the images have been loaded. If no value is given for the option, it defaults to the standard height of the icons supplied with the Apache software.

IconsAreLinks

This makes the icons part of the anchor for the filename, for fancy indexing.

IconWidth[=pixels] (*Apache 1.3 and later*)

Presence of this option, when used with IconHeight, will cause the server to include HEIGHT and WIDTH attributes in the IMG tag for the file icon. This allows browser to precalculate the page layout without having to wait until all the images have been loaded. If no value is given for the option, it defaults to the standard width of the icons supplied with the Apache software.

NameWidth=[*n* | *] (*Apache 1.3.2 and later*)

The NameWidth keyword allows you to specify the width of the filename column in bytes. If the keyword value is '*', then the column is automatically sized to the length of the longest filename in the display.

ScanHTMLTitles

This enables the extraction of the title from HTML documents for fancy indexing. If the file does not have a description given by AddDescription then httpd will read the document for the value of the TITLE tag. This is CPU and disk intensive.

SuppressColumnSorting

If specified, Apache will not make the column headings in a FancyIndexed directory listing into links for sorting. The default behaviour is for them to be links; selecting the column heading will sort the directory listing by the values in that column. **Only available in Apache 1.3 and later.**

SuppressDescription

This will suppress the file description in fancy indexing listings.

SuppressHTMLPreamble (*Apache 1.3 and later*)

If the directory actually contains a file specified by the HeaderName directive, the module usually

includes the contents of the file after a standard HTML preamble (<HTML>, <HEAD>, *et cet*
The SuppressHTMLPreamble option disables this behaviour, causing the module to start the display with the header file contents. The header file must contain appropriate HTML instructions in this case. If there is no header file, the preamble is generated as usual.

SuppressLastModified

This will suppress the display of the last modification date, in fancy indexing listings.

SuppressSize

This will suppress the file size in fancy indexing listings.

There are some noticeable differences in the behaviour of this directive in recent (post-1.3.0) versions of Apache.

Apache 1.3.2 and earlier:

The default is that no options are enabled. If multiple IndexOptions could apply to a directory, then the most specific one is taken complete; the options are not merged. For example:

```
<Directory /web/docs>
IndexOptions FancyIndexing
</Directory>
<Directory /web/docs/spec>
IndexOptions ScanHTMLTitles
</Directory>
```

then only `ScanHTMLTitles` will be set for the /web/docs/spec directory.

Apache 1.3.3 and later:

Apache 1.3.3 introduced some significant changes in the handling of IndexOptions directives. In particular,

- Multiple IndexOptions directives for a single directory are now merged together. The result of the example above will now be the equivalent of `IndexOptions FancyIndexing ScanHTMLTitles`.
- The addition of the incremental syntax (*i.e.*, prefixing keywords with '+' or '-').

Whenever a '+' or '-' prefixed keyword is encountered, it is applied to the current IndexOptions settings (which may have been inherited from an upper-level directory). However, whenever an unprefixed keyword is processed, it clears all inherited options and any incremental settings encountered so far. Consider the following example:

```
IndexOptions +ScanHTMLTitles -IconsAreLinks FancyIndexing
IndexOptions +SuppressSize
```

The net effect is equivalent to `IndexOptions FancyIndexing +SuppressSize`, because the unprefixed `FancyIndexing` discarded the incremental keywords before it, but allowed them to start accumulating again afterward.

To unconditionally set the `IndexOptions` for a particular directory, clearing the inherited settings, specify keywords without either '+' or '-' prefixes.

IndexOrderDefault

Syntax: IndexOrderDefault *Ascending|Descending Name|Date|Size|Description*
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Base
Module: mod_autoindex
Compatibility: IndexOrderDefault is only available in Apache 1.3.4 and later.

The IndexOrderDefault directive is used in combination with the FancyIndexing index option. By default, fancyindexed directory listings are displayed in ascending order by filename; the IndexOrderDefault allows you to change this initial display order.

IndexOrderDefault takes two arguments. The first must be either Ascending or Descending, indicating the direction of the sort. The second argument must be one of the keywords Name, Date, Size, or Description, and identifies the primary key. The secondary key is *always* the ascending filename.

You can force a directory listing to only be displayed in a particular order by combining this directive with the SuppressColumnSorting index option; this will prevent the client from requesting the directory listing in a different order.

ReadmeName

Syntax: ReadmeName *filename*
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Base
Module: mod_autoindex
Compatibility: some features only available after 1.3.6; see text

The ReadmeName directive sets the name of the file that will be appended to the end of the index listing. *Filename* is the name of the file to include, and is taken to be relative to the location being indexed.

> **The *filename* argument is treated as a stub filename in Apache 1.3.6 and earlier, and as a relative URI in later versions. Details of how it is handled may be found under the description of the HeaderName directive, which uses the same mechanism and changed at the same time as ReadmeName.**

See also HeaderName.

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Module mod_dir

This module is contained in the `mod_dir.c` file, and is compiled in by default. It provides for "trailing slash" redirects and serving directory index files.

Summary

The index of a directory can come from one of two sources:

- A file written by the user, typically called `index.html`. The DirectoryIndex directive sets the name of this file. This is controlled by `mod_dir`.
- Otherwise, a listing generated by the server. This is provided by `mod_autoindex`.

The two functions are separated so that you can completely remove (or replace) automatic index generation should you want to.

A "trailing slash" redirect is issued when the server receives a request for a URL http://servername/foo/dirname where dirname is a directory. Directories require a trailing slash, so `mod_dir` issues a redirect to http://servername/foo/dirname/.

Directives

- DirectoryIndex

DirectoryIndex

Syntax: DirectoryIndex *local-url local-url* ...
Default: `DirectoryIndex index.html`
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Base
Module: mod_dir

The DirectoryIndex directive sets the list of resources to look for, when the client requests an index of the directory by specifying a / at the end of the a directory name. *Local-url* is the (%-encoded) URL of a

document on the server relative to the requested directory; it is usually the name of a file in the direc
Several URLs may be given, in which case the server will return the first one that it finds. If none o
resources exist and the `Indexes` option is set, the server will generate its own listing of the directory.

Example:

```
DirectoryIndex index.html
```

then a request for `http://myserver/docs/` would return
`http://myserver/docs/index.html` if it exists, or would list the directory if it did not.

Note that the documents do not need to be relative to the directory;

```
DirectoryIndex index.html index.txt /cgi-bin/index.pl
```

would cause the CGI script `/cgi-bin/index.pl` to be executed if neither `index.html` or
`index.txt` existed in a directory.

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Apache Virtual Host documentation

The term Virtual Host refers to the practice of maintaining more than one server on one machine, as differentiated by their apparent hostname. For example, it is often desirable for companies sharing a web server to have their own domains, with web servers accessible as www.company1.com and www.company2.com, without requiring the user to know any extra path information.

Apache was one of the first servers to support IP-based virtual hosts right out of the box. Versions 1.1 and later of Apache support both, IP-based and name-based virtual hosts (vhosts). The latter variant of virtual hosts is sometimes also called host-based or non-IP virtual hosts.

Below is a list of documentation pages which explain all details of virtual host support in Apache version 1.3 and later.

Virtual Host Support

- IP-based Virtual Hosts
- Name-based Virtual Hosts
- Virtual Host examples for common setups
- In-Depth Discussion of Virtual Host Matching
- File Descriptor Limits
- Dynamically Configured Mass Virtual Hosting

Configuration directives

- <VirtualHost>
- NameVirtualHost
- ServerName
- ServerAlias
- ServerPath

Folks trying to debug their virtual host configuration may find the Apache `-S` command line switch useful. It will dump out a description of how Apache parsed the configuration file. Careful examination

of the IP addresses and server names may help uncover configuration mistakes.

TOC

Apache HTTP Server Version 1.3

Apache IP-based Virtual Host Support

See also: Name-based Virtual Hosts Support

System requirements

As the term IP-based indicates, the server **must have a different IP address for each IP-based virtual host**. This can be achieved by the machine having several physical network connections, or by use of virtual interfaces which are supported by most modern operating systems (see system documentation for details, these are frequently called "ip aliases", and the "ifconfig" command is most commonly used to set them up).

How to set up Apache

There are two ways of configuring apache to support multiple hosts. Either by running a separate httpd daemon for each hostname, or by running a single daemon which supports all the virtual hosts.

Use multiple daemons when:

- There are security partitioning issues, such as company1 does not want anyone at company2 to be able to read their data except via the web. In this case you would need two daemons, each running with different User, Group, Listen, and ServerRoot settings.
- You can afford the memory and file descriptor requirements of listening to every IP alias on the machine. It's only possible to Listen to the "wildcard" address, or to specific addresses. So if you have a need to listen to a specific address for whatever reason, then you will need to listen to all specific addresses. (Although one httpd could listen to N-1 of the addresses, and another could listen to the remaining address.)

Use a single daemon when:

- Sharing of the httpd configuration between virtual hosts is acceptable.
- The machine services a large number of requests, and so the performance loss in running separate daemons may be significant.

Setting up multiple daemons

Create a separate httpd installation for each virtual host. For each installation, use the Listen directive in the configuration file to select which IP address (or virtual host) that daemon services. e.g.

```
Listen www.smallco.com:80
```

It is recommended that you use an IP address instead of a hostname (see DNS caveats).

Setting up a single daemon with virtual hosts

For this case, a single httpd will service requests for the main server and all the virtual hosts. The VirtualHost directive in the configuration file is used to set the values of ServerAdmin, ServerName, DocumentRoot, ErrorLog and TransferLog or CustomLog configuration directives to different values for each virtual host. e.g.

```
<VirtualHost www.smallco.com>
ServerAdmin webmaster@mail.smallco.com
DocumentRoot /groups/smallco/www
ServerName www.smallco.com
ErrorLog /groups/smallco/logs/error_log
TransferLog /groups/smallco/logs/access_log
</VirtualHost>

<VirtualHost www.baygroup.org>
ServerAdmin webmaster@mail.baygroup.org
DocumentRoot /groups/baygroup/www
ServerName www.baygroup.org
ErrorLog /groups/baygroup/logs/error_log
TransferLog /groups/baygroup/logs/access_log
</VirtualHost>
```

It is recommended that you use an IP address instead of a hostname (see DNS caveats).

Almost **any** configuration directive can be put in the VirtualHost directive, with the exception of ServerType, StartServers, MaxSpareServers, MinSpareServers, MaxRequestsPerChild, BindAddress, Listen, PidFile, TypesConfig, ServerRoot and NameVirtualHost.

User and Group may be used inside a VirtualHost directive if the suEXEC wrapper is used.

SECURITY: When specifying where to write log files, be aware of some security risks which are present if anyone other than the user that starts Apache has write access to the directory where they are written. See the security tips document for details.

Apache HTTP Server Version 1.3

Apache name-based Virtual Host Support

See Also: IP-based Virtual Host Support

Name-based vs. IP-based virtual hosts

While the approach with IP-based virtual hosts works very well, it is not the most elegant solution, because a dedicated IP address is needed for every virtual host and it is hard to implement on some machines. The `HTTP/1.1` protocol contains a method for the server to identify what name it is being addressed as. Apache 1.1 and later support this approach as well as the traditional IP-address-per-hostname method.

The benefits of using the new name-based virtual host support is a practically unlimited number of servers, ease of configuration and use, and requires no additional hardware or software. The main disadvantage is that the client must support this part of the protocol. The latest versions of most browsers do, but there are still old browsers in use who do not. This can cause problems, although a possible solution is addressed below.

Using non-IP Virtual Hosts

Using the new virtual hosts is quite easy, and superficially looks like the old method. The notable difference between IP-based and name-based virtual host configuration is the `NameVirtualHost` directive which specifies an IP address that should be used as a target for name-based virtual hosts.

For example, suppose that both www.domain.tld and www.otherdomain.tld point at the IP address 111.22.33.44. Then you simply add to one of the Apache configuration files (most likely `httpd.conf` or `srm.conf`) code similar to the following:

```
NameVirtualHost 111.22.33.44

<VirtualHost 111.22.33.44>
ServerName www.domain.tld
DocumentRoot /www/domain
</VirtualHost>

<VirtualHost 111.22.33.44>
```

```
ServerName www.otherdomain.tld
DocumentRoot /www/otherdomain
</VirtualHost>
```

Of course, any additional directives can (and should) be placed into the `<VirtualHost>` section. To make this work, all that is needed is to make sure that the names www.domain.tld and www.otherdomain.tld are pointing to the IP address 111.22.33.44

Note: When you specify an IP address in a `NameVirtualHost` directive then requests to that IP address will only ever be served by matching <VirtualHost>s. The "main server" will **never** be served from the specified IP address. If you start to use virtual hosts you should stop to use the "main server" as an independent server and rather use it as a place for configuration directives that are common for all your virtual hosts. In other words, you should add a <VirtualHost> section for *every* server (hostname) you want to maintain on your server.

Additionally, many servers may wish to be accessible by more than one name. For example, the example server might want to be accessible as `domain.tld`, or `www2.domain.tld`, assuming the IP addresses pointed to the same server. In fact, one might want it so that all addresses at `domain.tld` were picked up by the server. This is possible with the `ServerAlias` directive, placed inside the <VirtualHost> section. For example:

```
ServerAlias domain.tld *.domain.tld
```

Note that you can use `*` and `?` as wild-card characters.

You also might need `ServerAlias` if you are serving local users who do not always include the domain name. For example, if local users are familiar with typing "www" or "www.foobar" then you will need to add `ServerAlias www www.foobar`. It isn't possible for the server to know what domain the client uses for their name resolution because the client doesn't provide that information in the request. The `ServerAlias` directive is generally a way to have different hostnames pointing to the same virtual host.

Compatibility with Older Browsers

As mentioned earlier, there are still some clients in use who do not send the required data for the name-based virtual hosts to work properly. These clients will always be sent the pages from the first virtual host listed for that IP address (the primary name-based virtual host).

There is a possible workaround with the `ServerPath` directive, albeit a slightly cumbersome one:

Example configuration:

```
NameVirtualHost 111.22.33.44

<VirtualHost 111.22.33.44>
ServerName www.domain.tld
ServerPath /domain
```

```
    DocumentRoot /web/domain
    </VirtualHost>
```

What does this mean? It means that a request for any URI beginning with "/domain" will be served from the virtual host www.domain.tld This means that the pages can be accessed as `http://www.domain.tld/domain/` for all clients, although clients sending a Host: header can also access it as `http://www.domain.tld/`.

In order to make this work, put a link on your primary virtual host's page to http://www.domain.tld/domain/ Then, in the virtual host's pages, be sure to use either purely relative links (*e.g.*, "file.html" or "../icons/image.gif" or links containing the prefacing /domain/ (*e.g.*, "http://www.domain.tld/domain/misc/file.html" or "/domain/misc/file.html").

This requires a bit of discipline, but adherence to these guidelines will, for the most part, ensure that your pages will work with all browsers, new and old.

See also: ServerPath configuration example

Apache HTTP Server Version 1.3

Virtual Host examples for common setups

Base configuration

Additional features

IP-based vhosts only

- **Setup 1:** The server machine has two IP addresses (111.22.33.44 and 111.22.33.55) which resolve to the names server.domain.tld and www.otherdomain.tld respectively. The hostname www.domain.tld is an alias (CNAME) for server.domain.tld and will represent the main server.

  Server configuration:

```
...
Port 80
DocumentRoot /www/domain
ServerName www.domain.tld

<VirtualHost 111.22.33.55>
DocumentRoot /www/otherdomain
ServerName www.otherdomain.tld
```


```
...
</VirtualHost>
```

www.otherdomain.tld can only be reached through the address 111.22.33.55, while www.domain.tld can only be reached through 111.22.33.44 (which represents our main server).

- **Setup 2:** Same as setup 1, but we don't want to have a dedicated main server.

  Server configuration:

```
...
Port 80
ServerName server.domain.tld

<VirtualHost 111.22.33.44>
DocumentRoot /www/domain
ServerName www.domain.tld
...
</VirtualHost>

<VirtualHost 111.22.33.55>
DocumentRoot /www/otherdomain
ServerName www.otherdomain.tld
...
</VirtualHost>
```

  The main server can never catch a request, because all IP addresses of our machine are in use for IP-based virtual hosts (only localhost requests can hit the main server).

- **Setup 3:** The server machine has two IP addresses (111.22.33.44 and 111.22.33.55) which resolve to the names server.domain.tld and www-cache.domain.tld respectively. The hostname www.domain.tld is an alias (CNAME) for server.domain.tld and will represent the main server. www-cache.domain.tld will become our proxy-cache listening on port 8080, while the web server itself uses the default port 80.

  Server configuration:

```
...
Port 80
Listen 111.22.33.44:80
Listen 111.22.33.55:8080
ServerName server.domain.tld

<VirtualHost 111.22.33.44:80>
DocumentRoot /www/domain
ServerName www.domain.tld
```


```
...
</VirtualHost>

<VirtualHost 111.22.33.55:8080>
ServerName www-cache.domain.tld
...
  <Directory proxy:>
  order deny,allow
  deny from all
  allow from 111.22.33
  </Directory>
</VirtualHost>
```

The main server can never catch a request, because all IP addresses (apart from localhost) of our machine are in use for IP-based virtual hosts. The web server can only be reached on the first address through port 80 and the proxy only on the second address through port 8080.

Name-based vhosts only

- **Setup 1:** The server machine has one IP address (111.22.33.44) which resolves to the name server.domain.tld. There are two aliases (CNAMEs) www.domain.tld and www.sub.domain.tld for the address 111.22.33.44.

  Server configuration:

```
...
Port 80
ServerName server.domain.tld

NameVirtualHost 111.22.33.44

<VirtualHost 111.22.33.44>
DocumentRoot /www/domain
ServerName www.domain.tld
...
</VirtualHost>

<VirtualHost 111.22.33.44>
DocumentRoot /www/subdomain
ServerName www.sub.domain.tld
...
</VirtualHost>
```

Apart from localhost there are no unspecified addresses/ports, therefore the main server only serves localhost requests. Due to the fact that www.domain.tld has the highest priority it can be seen as the default or primary server.

- **Setup 2:** The server machine has two IP addresses (111.22.33.44 and 111.22.33.55) which resolve to the names server1.domain.tld and server2.domain.tld respectively. The alias www.domain.tld should be used for the main server which should also catch any unspecified addresses. We want to use a virtual host for the alias www.otherdomain.tld and one virtual host should catch any request to hostnames of the form *.sub.domain.tld with www.sub.domain.tld as its server name. The address 111.22.33.55 should be used for the virtual hosts.

  Server configuration:

```
...
Port 80
ServerName www.domain.tld
DocumentRoot /www/domain

NameVirtualHost 111.22.33.55

<VirtualHost 111.22.33.55>
DocumentRoot /www/otherdomain
ServerName www.otherdomain.tld
...
</VirtualHost>

<VirtualHost 111.22.33.55>
DocumentRoot /www/subdomain
ServerName www.sub.domain.tld
ServerAlias *.sub.domain.tld
...
</VirtualHost>
```

  Any request to an address other than 111.22.33.55 will be served from the main server. A request to 111.22.33.55 with an unknown or no `Host:` header will be served from www.otherdomain.tld.

Mixed name-/IP-based vhosts

- **Setup:** The server machine has three IP addresses (111.22.33.44, 111.22.33.55 and 111.22.33.66) which resolve to the names server.domain.tld, www.otherdomain1.tld and www.otherdomain2.tld respectively. The address 111.22.33.44 should we used for a couple of name-based vhosts and the other addresses for IP-based vhosts.

  Server configuration:


```
...
Port 80
ServerName server.domain.tld

NameVirtualHost 111.22.33.44

<VirtualHost 111.22.33.44>
DocumentRoot /www/domain
ServerName www.domain.tld
...
</VirtualHost>

<VirtualHost 111.22.33.44>
DocumentRoot /www/subdomain1
ServerName www.sub1.domain.tld
...
</VirtualHost>

<VirtualHost 111.22.33.44>
DocumentRoot /www/subdomain2
ServerName www.sub2.domain.tld
...
</VirtualHost>

<VirtualHost 111.22.33.55>
DocumentRoot /www/otherdomain1
ServerName www.otherdomain1.tld
...
</VirtualHost>

<VirtualHost 111.22.33.66>
DocumentRoot /www/otherdomain2
ServerName www.otherdomain2.tld
...
</VirtualHost>
```

Port-based vhosts

- **Setup:** The server machine has one IP address (111.22.33.44) which resolves to the name www.domain.tld. If we don't have the option to get another address or alias for our server we can use port-based vhosts if we need a virtual host with a different configuration.

  Server configuration:


```
...
Listen 80
Listen 8080
ServerName www.domain.tld
DocumentRoot /www/domain

<VirtualHost 111.22.33.44:8080>
DocumentRoot /www/domain2
...
</VirtualHost>
```

A request to www.domain.tld on port 80 is served from the main server and a request to port 8080 is served from the virtual host.

Using `_default_` vhosts

- **Setup 1:** Catching *every* request to any unspecified IP address and port, *i.e.*, an address/port combination that is not used for any other virtual host.

  Server configuration:

  ```
  ...
  <VirtualHost _default_:*>
  DocumentRoot /www/default
  ...
  </VirtualHost>
  ```

  Using such a default vhost with a wildcard port effectively prevents any request going to the main server.
  A default vhost never serves a request that was sent to an address/port that is used for name-based vhosts. If the request contained an unknown or no `Host:` header it is always served from the primary name-based vhost (the vhost for that address/port appearing first in the configuration file).
  You can use `AliasMatch` or `RewriteRule` to rewrite any request to a single information page (or script).
- **Setup 2:** Same as setup 1, but the server listens on several ports and we want to use a second `_default_` vhost for port 80.

  Server configuration:

  ```
  ...
  <VirtualHost _default_:80>
  DocumentRoot /www/default80
  ```


```
...
</VirtualHost>

<VirtualHost _default_:*>
DocumentRoot /www/default
...
</VirtualHost>
```

The default vhost for port 80 (which *must* appear before any default vhost with a wildcard port) catches all requests that were sent to an unspecified IP address. The main server is never used to serve a request.

- **Setup 3:** We want to have a default vhost for port 80, but no other default vhosts.

  Server configuration:

```
...
<VirtualHost _default_:80>
DocumentRoot /www/default
...
</VirtualHost>
```

A request to an unspecified address on port 80 is served from the default vhost any other request to an unspecified address and port is served from the main server.

Migrating a name-based vhost to an IP-based vhost

- **Setup:** The name-based vhost with the hostname www.otherdomain.tld (from our name-based example, setup 2) should get its own IP address. To avoid problems with name servers or proxies who cached the old IP address for the name-based vhost we want to provide both variants during a migration phase.
  The solution is easy, because we can simply add the new IP address (111.22.33.66) to the `VirtualHost` directive.

  Server configuration:

```
...
Port 80
ServerName www.domain.tld
DocumentRoot /www/domain

NameVirtualHost 111.22.33.55

<VirtualHost 111.22.33.55 111.22.33.66>
DocumentRoot /www/otherdomain
```


```
ServerName www.otherdomain.tld
...
</VirtualHost>

<VirtualHost 111.22.33.55>
DocumentRoot /www/subdomain
ServerName www.sub.domain.tld
ServerAlias *.sub.domain.tld
...
</VirtualHost>
```

The vhost can now be accessed through the new address (as an IP-based vhost) and through the old address (as a name-based vhost).

Using the `ServerPath` directive

- **Setup:** We have a server with two name-based vhosts. In order to match the correct virtual host a client must send the correct `Host:` header. Old HTTP/1.0 clients do not send such a header and Apache has no clue what vhost the client tried to reach (and serves the request from the primary vhost). To provide as much backward compatibility as possible we create a primary vhost which returns a single page containing links with an URL prefix to the name-based virtual hosts.

  Server configuration:

```
...
NameVirtualHost 111.22.33.44

<VirtualHost 111.22.33.44>
# primary vhost
DocumentRoot /www/subdomain
RewriteEngine On
RewriteRule ^/.* /www/subdomain/index.html
...
</VirtualHost>

<VirtualHost 111.22.33.44>
DocumentRoot /www/subdomain/sub1
ServerName www.sub1.domain.tld
ServerPath /sub1/
RewriteEngine On
RewriteRule ^(/sub1/.*) /www/subdomain$1
...
</VirtualHost>
```


```
<VirtualHost 111.22.33.44>
DocumentRoot /www/subdomain/sub2
ServerName www.sub2.domain.tld
ServerPath /sub2/
RewriteEngine On
RewriteRule ^(/sub2/.*) /www/subdomain$1
...
</VirtualHost>
```

Due to the `ServerPath` directive a request to the URL http://www.sub1.domain.tld/sub1/ is *always* served from the sub1-vhost.
A request to the URL http://www.sub1.domain.tld/ is only served from the sub1-vhost if the client sent a correct `Host:` header. If no `Host:` header is sent the client gets the information page from the primary host.
Please note that there is one oddity: A request to http://www.sub2.domain.tld/sub1/ is also served from the sub1-vhost if the client sent no `Host:` header.
The `RewriteRule` directives are used to make sure that a client which sent a correct `Host:` header can use both URL variants, *i.e.*, with or without URL prefix.

Apache HTTP Server Version 1.3

Module mod_rewrite
URL Rewriting Engine

This module is contained in the `mod_rewrite.c` file, with Apache 1.2 and later. It provides a rule-based rewriting engine to rewrite requested URLs on the fly. It is not compiled into the server by default. To use `mod_rewrite` you have to enable the following line in the server build `Configuration` file:

```
AddModule  modules/standard/mod_rewrite.o
```

Summary

> ``*The great thing about mod_rewrite is it gives you all the configurability and flexibility of Sendmail. The downside to mod_rewrite is that it gives you all the configurability and flexibility of Sendmail."*
>
> -- Brian Behlendorf
> Apache Group
>
> `` *Despite the tons of examples and docs, mod_rewrite is voodoo. Damned cool voodoo, but still voodoo. "*
>
> -- Brian Moore
> bem@news.cmc.net

Welcome to mod_rewrite, the Swiss Army Knife of URL manipulation!

This module uses a rule-based rewriting engine (based on a regular-expression parser) to rewrite requested URLs on the fly. It supports an unlimited number of rules and an unlimited number of attached rule conditions for each rule to provide a really flexible and powerful URL manipulation mechanism. The URL manipulations can depend on various tests, for instance server variables, environment variables, HTTP headers, time stamps and even external database lookups in various formats can be used to achieve a really granular URL matching.

This module operates on the full URLs (including the path-info part) both in per-server context (`httpd.conf`) and per-directory context (`.htaccess`) and even can generate query-string parts on result. The rewritten result can lead to internal sub-processing, external request redirection or even to an internal proxy throughput.

But all this functionality and flexibility has its drawback: complexity. So don't expect to understand this module in it's whole in just one day.

This module was invented and originally written in April 1996
and gifted exclusively to the The Apache Group in July 1997 by

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Table Of Contents

Internal Processing

The internal processing of this module is very complex but needs to be explained once even to the average user to avoid common mistakes and to let you exploit its full functionality.

API Phases

First you have to understand that when Apache processes a HTTP request it does this in phases. A hook for each of these phases is provided by the Apache API. Mod_rewrite uses two of these hooks: the URL-to-filename translation hook which is used after the HTTP request was read and before any authorization starts and the Fixup hook which is triggered after the authorization phases and after the per-directory config files (`.htaccess`) where read, but before the content handler is activated.

So, after a request comes in and Apache has determined the corresponding server (or virtual server) the rewriting engine start processing of all mod_rewrite directives from the per-server configuration in the URL-to-filename phase. A few steps later when the final data directories are found, the per-directory configuration directives of mod_rewrite are triggered in the Fixup phase. In both situations mod_rewrite either rewrites URLs to new URLs or to filenames, although there is no obvious distinction between them. This is a usage of the API which was not intended this way when the API was designed, but as of Apache 1.x this is the only way mod_rewrite can operate. To make this point more clear remember the following two points:

1. The API currently provides only a URL-to-filename hook. Although mod_rewrite rewrites URLs to URLs, URLs to filenames and even filenames to filenames. In Apache 2.0 the two missing hooks will be added to make the processing more clear. But this point has no drawbacks for the user, it is just a fact which should be remembered: Apache does more in the URL-to-filename hook then the API intends for it.
2. Unbelievably mod_rewrite provides URL manipulations in per-directory context, *i.e.*, within `.htaccess` files, although these are reached a very long time after the URLs were translated to filenames (this has to be this way, because `.htaccess` files stay in the filesystem, so processing has already been reached this stage of

processing). In other words: According to the API phases at this time it is too late for any URL manipulations. To overcome this chicken and egg problem mod_rewrite uses a trick: When you manipulate a URL/filename in per-directory context mod_rewrite first rewrites the filename back to its corresponding URL (which it usually impossible, but see the `RewriteBase` directive below for the trick to achieve this) and then initiates a new internal sub-request with the new URL. This leads to a new processing of the API phases from the beginning.

Again mod_rewrite tries hard to make this complicated step totally transparent to the user, but you should remember here: While URL manipulations in per-server context are really fast and efficient, per-directory rewrites are slow and inefficient due to this chicken and egg problem. But on the other hand this is the only way mod_rewrite can provide (locally restricted) URL manipulations to the average user.

Don't forget these two points!

Ruleset Processing

Now when mod_rewrite is triggered in these two API phases, it reads the configured rulesets from its configuration structure (which itself was either created on startup for per-server context or while the directory walk of the Apache kernel for per-directory context). Then the URL rewriting engine is started with the contained ruleset (one or more rules together with their conditions). The operation of the URL rewriting engine itself is exactly the same for both configuration contexts. Just the final result processing is different.

The order of rules in the ruleset is important because the rewriting engine processes them in a special order. And this order is not very obvious. The rule is this: The rewriting engine loops through the ruleset rule by rule (`RewriteRule` directives!) and when a particular rule matched it optionally loops through existing corresponding conditions (`RewriteCond` directives). Because of historical reasons the conditions are given first, the control flow is a little bit winded. See Figure 1 for more details.

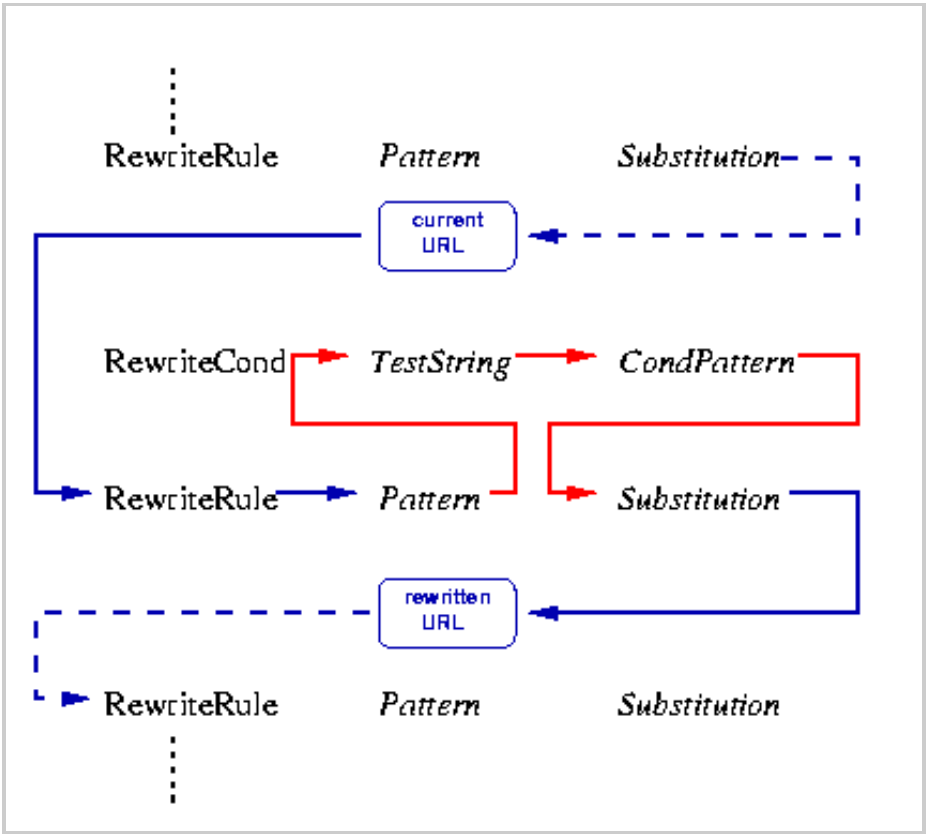

Figure 1: The control flow through the rewriting ruleset

As you can see, first the URL is matched against the *Pattern* of each rule. When it fails mod_rewrite immediately stops processing this rule and continues with the next rule. If the *Pattern* matched, mod_rewrite looks for corresponding rule conditions. If none are present, it just substitutes the URL with a new value which is constructed from the string *Substitution* and goes on with its rule-looping. But if conditions exists, it starts an inner loop for processing them in order they are listed. For conditions the logic is different: We don't match a pattern against the current URL. Instead we first create a string *TestString* by expanding variables, back-references, map lookups, *etc.* and then we try to match

CondPattern against it. If the pattern doesn't match, the complete set of conditions and the corresponding rule fails. If the pattern matches, then the next condition is processed until no more condition is available. If all conditions matched processing is continued with the substitution of the URL with *Substitution*.

Regex Back-Reference Availability

One important thing here has to be remembered: Whenever you use parenthesis in *Pattern* or in one of the *CondPattern* back-reference are internally created which can be used with the strings `$N` and `%N` (see below). And these are available for creating the strings *Substitution* and *TestCond*. Figure 2 shows at which locations the back-references are transfered to for expansion.

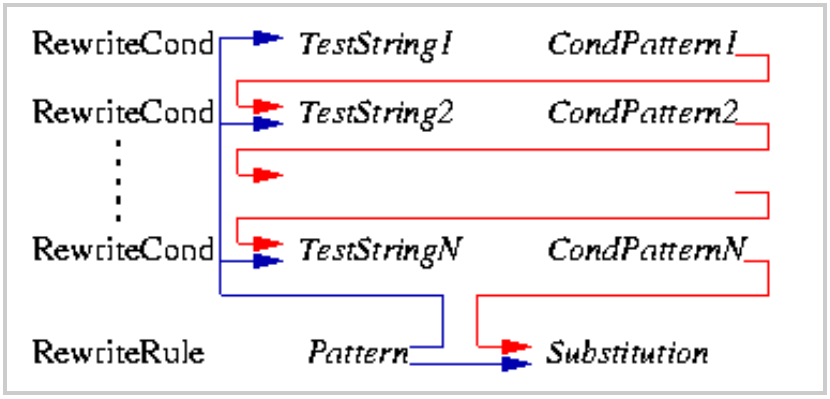

Figure 2: The back-reference flow through a rule

We know, this was a crash course of mod_rewrite's internal processing. But you will benefit from this knowledge when reading the following documentation of the available directives.

Configuration Directives

RewriteEngine

Syntax: `RewriteEngine {on,off}`
Default: **`RewriteEngine off`**
Context: server config, virtual host, directory, .htaccess
Override: FileInfo
Status: Extension
Module: mod_rewrite.c
Compatibility: Apache 1.2

The `RewriteEngine` directive enables or disables the runtime rewriting engine. If it is set to `off` this module does no runtime processing at all. It does not even update the `SCRIPT_URx` environment variables.

Use this directive to disable the module instead of commenting out all `RewriteRule` directives!

Note that, by default, rewrite configurations are not inherited. This means that you need to have a `RewriteEngine on` directive for each virtual host you wish to use it in.

RewriteOptions

Syntax: `RewriteOptions` *Option*
Default: *None*
Context: server config, virtual host, directory, .htaccess

Override: FileInfo
Status: Extension
Module: mod_rewrite.c
Compatibility: Apache 1.2

The `RewriteOptions` directive sets some special options for the current per-server or per-directory configuration. The *Option* strings can be one of the following:

- '**`inherit`**'
  This forces the current configuration to inherit the configuration of the parent. In per-virtual-server context this means that the maps, conditions and rules of the main server gets inherited. In per-directory context this means that conditions and rules of the parent directory's `.htaccess` configuration gets inherited.

RewriteLog

Syntax: `RewriteLog` *Filename*
Default: *None*
Context: server config, virtual host
Override: *Not applicable*
Status: Extension
Module: mod_rewrite.c
Compatibility: Apache 1.2

The `RewriteLog` directive sets the name of the file to which the server logs any rewriting actions it performs. If the name does not begin with a slash ('`/`') then it is assumed to be relative to the *Server Root*. The directive should occur only once per server config.

Notice: To disable the logging of rewriting actions it is not recommended to set *Filename* to `/dev/null`, because although the rewriting engine does not create output to a logfile it still creates the logfile output internally. **This will slow down the server with no advantage to the administrator!** To disable logging either remove or comment out the `RewriteLog` directive or use `RewriteLogLevel 0`!

Security: See the Apache Security Tips document for details on why your security could be compromised if the directory where logfiles are stored is writable by anyone other than the user that starts the server.

Example:

```
RewriteLog "/usr/local/var/apache/logs/rewrite.log"
```

RewriteLogLevel

Syntax: `RewriteLogLevel` *Level*
Default: **`RewriteLogLevel 0`**
Context: server config, virtual host
Override: *Not applicable*
Status: Extension
Module: mod_rewrite.c
Compatibility: Apache 1.2

The `RewriteLogLevel` directive set the verbosity level of the rewriting logfile. The default level 0 means no logging, while 9 or more means that practically all actions are logged.

To disable the logging of rewriting actions simply set *Level* to 0. This disables all rewrite action logs.

> **Notice:** Using a high value for *Level* will slow down your Apache server dramatically! Use the rewriting logfile only for debugging or at least at *Level* not greater than 2!

Example:

```
RewriteLogLevel 3
```

RewriteLock

Syntax: `RewriteLock` *Filename*
Default: *None*
Context: server config
Override: *Not applicable*
Status: Extension
Module: mod_rewrite.c
Compatibility: Apache 1.3

This directive sets the filename for a synchronization lockfile which mod_rewrite needs to communicate with RewriteMap *programs*. Set this lockfile to a local path (not on a NFS-mounted device) when you want to use a rewriting map-program. It is not required for all other types of rewriting maps.

RewriteMap

Syntax: `RewriteMap` *MapName MapType*`:`*MapSource*
Default: not used per default
Context: server config, virtual host
Override: *Not applicable*
Status: Extension
Module: mod_rewrite.c
Compatibility: Apache 1.2 (partially), Apache 1.3

The `RewriteMap` directive defines a *Rewriting Map* which can be used inside rule substitution strings by the mapping-functions to insert/substitute fields through a key lookup. The source of this lookup can be of various types.

The *MapName* is the name of the map and will be used to specify a mapping-function for the substitution strings of a rewriting rule via one of the following constructs:

`${` *MapName* `:` *LookupKey* `}`
`${` *MapName* `:` *LookupKey* `|` *DefaultValue* `}`

When such a construct occurs the map *MapName* is consulted and the key *LookupKey* is looked-up. If the key is found, the map-function construct is substituted by *SubstValue*. If the key is not found then it is substituted by *DefaultValue* or the empty string if no *DefaultValue* was specified.

The following combinations for *MapType* and *MapSource* can be used:

- **Standard Plain Text**
  MapType: `txt`, MapSource: Unix filesystem path to valid regular file

  This is the standard rewriting map feature where the *MapSource* is a plain ASCII file containing either blank lines, comment lines (starting with a '#' character) or pairs like the following - one per line.

MatchingKey SubstValue

Example:

```
##
##  map.txt -- rewriting map
##

Ralf.S.Engelschall    rse   # Bastard Operator From Hell
Mr.Joe.Average        joe   # Mr. Average
```

```
RewriteMap real-to-user txt:/path/to/file/map.txt
```

- **Randomized Plain Text**
  MapType: `rnd`, MapSource: Unix filesystem path to valid regular file

  This is identical to the Standard Plain Text variant above but with a special post-processing feature: After looking up a value it is parsed according to contained ``|'' characters which have the meaning of ``or''. Or in other words: they indicate a set of alternatives from which the actual returned value is chosen randomly. Although this sounds crazy and useless, it was actually designed for load balancing in a reverse proxy situation where the looked up values are server names. Example:

```
##
##  map.txt -- rewriting map
##

static   www1|www2|www3|www4
dynamic  www5|www6
```

```
RewriteMap servers rnd:/path/to/file/map.txt
```

- **Hash File**
  MapType: `dbm`, MapSource: Unix filesystem path to valid regular file

  Here the source is a binary NDBM format file containing the same contents as a *Plain Text* format file, but in a special representation which is optimized for really fast lookups. You can create such a file with any NDBM tool or with the following Perl script:

```
#!/path/to/bin/perl
##
##  txt2dbm -- convert txt map to dbm format
##

($txtmap, $dbmmap) = @ARGV;
open(TXT, "<$txtmap");
dbmopen(%DB, $dbmmap, 0644);
while (<TXT>) {
    next if (m|^s*#.*| or m|^s*$|);
    $DB{$1} = $2 if (m|^\s*(\S+)\s+(\S+)$|);
}
dbmclose(%DB);
close(TXT)
```

```
$ txt2dbm map.txt map.db
```

- **Internal Function**
  MapType: `int`, MapSource: Internal Apache function

  Here the source is an internal Apache function. Currently you cannot create your own, but the following functions already exists:

  - **toupper**:
    Converts the looked up key to all upper case.
  - **tolower**:
    Converts the looked up key to all lower case.
  - **escape**:
    Translates special characters in the looked up key to hex-encodings.
  - **unescape**:
    Translates hex-encodings in the looked up key back to special characters.

- **External Rewriting Program**
  MapType: `prg`, MapSource: Unix filesystem path to valid regular file

  Here the source is a Unix program, not a map file. To create it you can use the language of your choice, but the result has to be a run-able Unix executable (*i.e.*, either object-code or a script with the magic cookie trick '`#!/path/to/interpreter`' as the first line).

  This program gets started once at startup of the Apache servers and then communicates with the rewriting engine over its `stdin` and `stdout` file-handles. For each map-function lookup it will receive the key to lookup as a newline-terminated string on `stdin`. It then has to give back the looked-up value as a newline-terminated string on `stdout` or the four-character string ``NULL'' if it fails (*i.e.*, there is no corresponding value for the given key). A trivial program which will implement a 1:1 map (*i.e.*, key == value) could be:

  ```
  #!/usr/bin/perl
  $| = 1;
  while (<STDIN>) {
      # ...here any transformations
      # or lookups should occur...
      print $_;
  }
  ```

  But be very careful:

  1. ``*Keep the program simple, stupid*'' (KISS), because if this program hangs it will lead to a hang of the Apache server when the rule occurs.
  2. Avoid one common mistake: never do buffered I/O on `stdout`! This will cause a deadloop! Hence the ``$|=1'' in the above example...
  3. Use the RewriteLock directive to define a lockfile mod_rewrite can use to synchronize the communication to the program. Per default no such synchronization takes place.

The `RewriteMap` directive can occur more than once. For each mapping-function use one `RewriteMap` directive to declare its rewriting mapfile. While you cannot **declare** a map in per-directory context it is of course possible to **use** this map in per-directory context.

Notice: For plain text and DBM format files the looked-up keys are cached in-core until the `mtime` of the mapfile changes or the server does a restart. This way you can have map-functions in rules which are used for **every** request. This is no problem, because the external lookup only happens once!

RewriteBase

Syntax: `RewriteBase` *BaseURL*
Default: *default is the physical directory path*
Context: directory, .htaccess
Override: *FileInfo*
Status: Extension
Module: mod_rewrite.c
Compatibility: Apache 1.2

The `RewriteBase` directive explicitly sets the base URL for per-directory rewrites. As you will see below, `RewriteRule` can be used in per-directory config files (`.htaccess`). There it will act locally, *i.e.*, the local directory prefix is stripped at this stage of processing and your rewriting rules act only on the remainder. At the end it is automatically added.

When a substitution occurs for a new URL, this module has to re-inject the URL into the server processing. To be able to do this it needs to know what the corresponding URL-prefix or URL-base is. By default this prefix is the corresponding filepath itself. **But at most websites URLs are NOT directly related to physical filename paths, so this assumption will be usually be wrong!** There you have to use the `RewriteBase` directive to specify the correct URL-prefix.

> **Notice:** If your webserver's URLs are **not** directly related to physical file paths, you have to use `RewriteBase` in every `.htaccess` files where you want to use `RewriteRule` directives.

Example:

Assume the following per-directory config file:

```
#
#  /abc/def/.htaccess -- per-dir config file for directory /abc/def
#  Remember: /abc/def is the physical path of /xyz, i.e., the server
#            has a 'Alias /xyz /abc/def' directive e.g.
#

RewriteEngine On

#  let the server know that we are reached via /xyz and not
#  via the physical path prefix /abc/def
RewriteBase   /xyz

#  now the rewriting rules
RewriteRule   ^oldstuff\.html$  newstuff.html
```

In the above example, a request to `/xyz/oldstuff.html` gets correctly rewritten to the physical file `/abc/def/newstuff.html`.

Notice - For the Apache hackers:
The following list gives detailed information about the internal processing steps:

```
Request:
  /xyz/oldstuff.html

Internal Processing:
  /xyz/oldstuff.html     -> /abc/def/oldstuff.html  (per-server Alias)
  /abc/def/oldstuff.html -> /abc/def/newstuff.html  (per-dir    RewriteRule)
  /abc/def/newstuff.html -> /xyz/newstuff.html      (per-dir    RewriteBase)
  /xyz/newstuff.html     -> /abc/def/newstuff.html  (per-server Alias)

Result:
  /abc/def/newstuff.html
```

This seems very complicated but is the correct Apache internal processing, because the per-directory rewriting comes too late in the process. So, when it occurs the (rewritten) request has to be re-injected into the Apache kernel! BUT: While this seems like a serious overhead, it really isn't, because this re-injection happens fully internal to the Apache server and the same procedure is used by many other operations inside Apache. So, you can be sure the design and implementation is correct.

RewriteCond

Syntax: `RewriteCond` *TestString CondPattern*
Default: *None*
Context: server config, virtual host, directory, .htaccess
Override: *FileInfo*
Status: Extension
Module: mod_rewrite.c
Compatibility: Apache 1.2 (partially), Apache 1.3

The `RewriteCond` directive defines a rule condition. Precede a `RewriteRule` directive with one or more `RewriteCond` directives. The following rewriting rule is only used if its pattern matches the current state of the URI **and** if these additional conditions apply too.

TestString is a string which can contains the following expanded constructs in addition to plain text:

- **RewriteRule backreferences**: These are backreferences of the form

  `$N`

  (1 <= N <= 9) which provide access to the grouped parts (parenthesis!) of the pattern from the corresponding `RewriteRule` directive (the one following the current bunch of `RewriteCond` directives).

- **RewriteCond backreferences**: These are backreferences of the form

  `%N`

  (1 <= N <= 9) which provide access to the grouped parts (parenthesis!) of the pattern from the last matched `RewriteCond` directive in the current bunch of conditions.

- **Server-Variables**: These are variables of the form

  `%{` *NAME_OF_VARIABLE* `}`

  where *NAME_OF_VARIABLE* can be a string of the following list:

HTTP headers:	**connection & request:**
HTTP_USER_AGENT	REMOTE_ADDR
HTTP_REFERER	REMOTE_HOST
HTTP_COOKIE	REMOTE_USER
HTTP_FORWARDED	REMOTE_IDENT
HTTP_HOST	REQUEST_METHOD
HTTP_PROXY_CONNECTION	SCRIPT_FILENAME
HTTP_ACCEPT	PATH_INFO
	QUERY_STRING
	AUTH_TYPE

server internals:	system stuff:	specials:
DOCUMENT_ROOT	TIME_YEAR	API_VERSION
SERVER_ADMIN	TIME_MON	THE_REQUEST
SERVER_NAME	TIME_DAY	REQUEST_URI
SERVER_ADDR	TIME_HOUR	REQUEST_FILENAME
SERVER_PORT	TIME_MIN	IS_SUBREQ
SERVER_PROTOCOL	TIME_SEC	
SERVER_SOFTWARE	TIME_WDAY	
	TIME	

Notice: These variables all correspond to the similar named HTTP MIME-headers, C variables of the Apache server or `struct tm` fields of the Unix system.

Special Notes:

1. The variables SCRIPT_FILENAME and REQUEST_FILENAME contain the same value, *i.e.*, the value of the `filename` field of the internal `request_rec` structure of the Apache server. The first name is just the commonly known CGI variable name while the second is the consistent counterpart to REQUEST_URI (which contains the value of the `uri` field of `request_rec`).
2. There is the special format: `%{ENV:variable}` where *variable* can be any environment variable. This is looked-up via internal Apache structures and (if not found there) via `getenv()` from the Apache server process.
3. There is the special format: `%{HTTP:header}` where *header* can be any HTTP MIME-header name. This is looked-up from the HTTP request. Example: `%{HTTP:Proxy-Connection}` is the value of the HTTP header "`Proxy-Connection:`".
4. There is the special format `%{LA-U:variable}` for look-aheads which perform an internal (URL-based) sub-request to determine the final value of *variable*. Use this when you want to use a variable for rewriting which actually is set later in an API phase and thus is not available at the current stage. For instance when you want to rewrite according to the `REMOTE_USER` variable from within the per-server context (`httpd.conf` file) you have to use `%{LA-U:REMOTE_USER}` because this variable is set by the authorization phases which come *after* the URL translation phase where mod_rewrite operates. On the other hand, because mod_rewrite implements its per-directory context (`.htaccess` file) via the Fixup phase of the API and because the authorization phases come *before* this phase, you just can use `%{REMOTE_USER}` there.
5. There is the special format: `%{LA-F:variable}` which perform an internal (filename-based) sub-request to determine the final value of *variable*. This is the most of the time the same as LA-U above.

CondPattern is the condition pattern, *i.e.*, a regular expression which gets applied to the current instance of the *TestString*, *i.e.*, *TestString* gets evaluated and then matched against *CondPattern*.

Remember: *CondPattern* is a standard *Extended Regular Expression* with some additions:

1. You can precede the pattern string with a '`!`' character (exclamation mark) to specify a **non**-matching pattern.
2. There are some special variants of *CondPatterns*. Instead of real regular expression strings you can also use one of the following:
   - '**<CondPattern**' (is lexicographically lower)
     Treats the *CondPattern* as a plain string and compares it lexicographically to *TestString* and results in a true expression if *TestString* is lexicographically lower than *CondPattern*.
   - '**>CondPattern**' (is lexicographically greater)
     Treats the *CondPattern* as a plain string and compares it lexicographically to *TestString* and results in a true expression if *TestString* is lexicographically greater than *CondPattern*.
   - '**=CondPattern**' (is lexicographically equal)
     Treats the *CondPattern* as a plain string and compares it lexicographically to *TestString* and results in a true expression if *TestString* is lexicographically equal to *CondPattern*, i.e the two strings are exactly equal (character by character). If *CondPattern* is just "" (two quotation marks) this compares *TestString* against the empty string.
   - '**-d**' (is **d**irectory)
     Treats the *TestString* as a pathname and tests if it exists and is a directory.

- '**-f**' (is regular **f**ile)
  Treats the *TestString* as a pathname and tests if it exists and is a regular file.
- '**-s**' (is regular file with **s**ize)
  Treats the *TestString* as a pathname and tests if it exists and is a regular file with size greater than zero.
- '**-l**' (is symbolic **l**ink)
  Treats the *TestString* as a pathname and tests if it exists and is a symbolic link.
- '**-F**' (is existing file via subrequest)
  Checks if *TestString* is a valid file and accessible via all the server's currently-configured access controls for that path. This uses an internal subrequest to determine the check, so use it with care because it decreases your servers performance!
- '**-U**' (is existing URL via subrequest)
  Checks if *TestString* is a valid URL and accessible via all the server's currently-configured access controls for that path. This uses an internal subrequest to determine the check, so use it with care because it decreases your server's performance!

> **Notice:** All of these tests can also be prefixed by a not ('!') character to negate their meaning.

Additionally you can set special flags for *CondPattern* by appending

[*flags*]

as the third argument to the `RewriteCond` directive. *Flags* is a comma-separated list of the following flags:

- '**`nocase|NC`**' (**n**o **c**ase)
  This makes the condition test case-insensitive, *i.e.*, there is no difference between 'A-Z' and 'a-z' both in the expanded *TestString* and the *CondPattern*.
- '**`ornext|OR`**' (**or** next condition)
  Use this to combine rule conditions with a local OR instead of the implicit AND. Typical example:

```
RewriteCond %{REMOTE_HOST}  ^host1.*  [OR]
RewriteCond %{REMOTE_HOST}  ^host2.*  [OR]
RewriteCond %{REMOTE_HOST}  ^host3.*
RewriteRule ...some special stuff for any of these hosts...
```

  Without this flag you had to write down the cond/rule three times.

Example:

To rewrite the Homepage of a site according to the ``User-Agent:'' header of the request, you can use the following:

```
RewriteCond  %{HTTP_USER_AGENT}  ^Mozilla.*
RewriteRule  ^/$                 /homepage.max.html  [L]

RewriteCond  %{HTTP_USER_AGENT}  ^Lynx.*
RewriteRule  ^/$                 /homepage.min.html  [L]

RewriteRule  ^/$                 /homepage.std.html  [L]
```

Interpretation: If you use Netscape Navigator as your browser (which identifies itself as 'Mozilla'), then you get the max homepage, which includes Frames, *etc.* If you use the Lynx browser (which is Terminal-based), then you get the min homepage, which contains no images, no tables, *etc.* If you use any other browser you get the standard homepage.

RewriteRule

Syntax: `RewriteRule` *Pattern Substitution*
Default: *None*
Context: server config, virtual host, directory, .htaccess
Override: *FileInfo*
Status: Extension
Module: mod_rewrite.c
Compatibility: Apache 1.2 (partially), Apache 1.3

The `RewriteRule` directive is the real rewriting workhorse. The directive can occur more than once. Each directive then defines one single rewriting rule. The **definition order** of these rules is **important**, because this order is used when applying the rules at run-time.

Pattern can be (for Apache 1.1.x a System V8 and for Apache 1.2.x a POSIX) regular expression which gets applied to the current URL. Here ``current'' means the value of the URL when this rule gets applied. This may not be the original requested URL, because there could be any number of rules before which already matched and made alterations to it.

Some hints about the syntax of regular expressions:

```
Text:
  .           Any single character
  [chars]     Character class: One  of chars
  [^chars]    Character class: None of chars
  text1|text2 Alternative: text1 or text2

Quantifiers:
  ?           0 or 1 of the preceding text
  *           0 or N of the preceding text (N > 1)
  +           1 or N of the preceding text (N > 1)

Grouping:
  (text)      Grouping of text
              (either to set the borders of an alternative or
              for making backreferences where the Nth group can
              be used on the RHS of a RewriteRule with $N)

Anchors:
  ^           Start of line anchor
  $           End   of line anchor

Escaping:
  \char       escape that particular char
              (for instance to specify the chars ".[]()" etc.)
```

For more information about regular expressions either have a look at your local regex(3) manpage or its `src/regex/regex.3` copy in the Apache 1.3 distribution. When you are interested in more detailed and deeper information about regular expressions and its variants (POSIX regex, Perl regex, *etc.*) have a look at the following dedicated book on this topic:

> *Mastering Regular Expressions*
> Jeffrey E.F. Friedl
> Nutshell Handbook Series
> O'Reilly & Associates, Inc. 1997
> ISBN 1-56592-257-3

Additionally in mod_rewrite the NOT character ('`!`') is a possible pattern prefix. This gives you the ability to negate a pattern; to say, for instance: ``*if the current URL does **NOT** match to this pattern*''. This can be used for special cases

where it is better to match the negative pattern or as a last default rule.

Notice: When using the NOT character to negate a pattern you cannot have grouped wildcard parts in the pattern. This is impossible because when the pattern does NOT match, there are no contents for the groups. In consequence, if negated patterns are used, you cannot use `$N` in the substitution string!

Substitution of a rewriting rule is the string which is substituted for (or replaces) the original URL for which *Pattern* matched. Beside plain text you can use

1. back-references `$N` to the RewriteRule pattern
2. back-references `%N` to the last matched RewriteCond pattern
3. server-variables as in rule condition test-strings (`%{VARNAME}`)
4. mapping-function calls (`${mapname:key|default}`)

Back-references are **$N** (**N**=1..9) identifiers which will be replaced by the contents of the **N**th group of the matched *Pattern*. The server-variables are the same as for the *TestString* of a `RewriteCond` directive. The mapping-functions come from the `RewriteMap` directive and are explained there. These three types of variables are expanded in the order of the above list.

As already mentioned above, all the rewriting rules are applied to the *Substitution* (in the order of definition in the config file). The URL is **completely replaced** by the *Substitution* and the rewriting process goes on until there are no more rules (unless explicitly terminated by a **L** flag - see below).

There is a special substitution string named '`-`' which means: **NO substitution**! Sounds silly? No, it is useful to provide rewriting rules which **only** match some URLs but do no substitution, *e.g.*, in conjunction with the **C** (chain) flag to be able to have more than one pattern to be applied before a substitution occurs.

One more note: You can even create URLs in the substitution string containing a query string part. Just use a question mark inside the substitution string to indicate that the following stuff should be re-injected into the QUERY_STRING. When you want to erase an existing query string, end the substitution string with just the question mark.

Notice: There is a special feature. When you prefix a substitution field with `http://`*thishost*[`:`*thisport*] then **mod_rewrite** automatically strips it out. This auto-reduction on implicit external redirect URLs is a useful and important feature when used in combination with a mapping-function which generates the hostname part. Have a look at the first example in the example section below to understand this.

Remember: An unconditional external redirect to your own server will not work with the prefix `http://thishost` because of this feature. To achieve such a self-redirect, you have to use the **R**-flag (see below).

Additionally you can set special flags for *Substitution* by appending

[*flags*]

as the third argument to the `RewriteRule` directive. *Flags* is a comma-separated list of the following flags:

- '**`redirect|R`** **[**=***code***]**' (force **r**edirect)
  Prefix *Substitution* with `http://thishost[:thisport]/` (which makes the new URL a URI) to force a external redirection. If no *code* is given a HTTP response of 302 (MOVED TEMPORARILY) is used. If you want to use other response codes in the range 300-400 just specify them as a number or use one of the following symbolic names: `temp` (default), `permanent`, `seeother`. Use it for rules which should canonicalize the URL and gives it back to the client, *e.g.*, translate "`/~`" into "`/u/`" or always append a slash to `/u/`*user*, etc.

  Notice: When you use this flag, make sure that the substitution field is a valid URL! If not, you are redirecting to an invalid location! And remember that this flag itself only prefixes the URL with

`http://thishost[:thisport]/`, but rewriting goes on. Usually you also want to stop and do the redirection immediately. To stop the rewriting you also have to provide the 'L' flag.

- '**`forbidden|F`**' (force URL to be **f**orbidden)
  This forces the current URL to be forbidden, *i.e.*, it immediately sends back a HTTP response of 403 (FORBIDDEN). Use this flag in conjunction with appropriate RewriteConds to conditionally block some URLs.
- '**`gone|G`**' (force URL to be **g**one)
  This forces the current URL to be gone, *i.e.*, it immediately sends back a HTTP response of 410 (GONE). Use this flag to mark no longer existing pages as gone.
- '**`proxy|P`**' (force **p**roxy)
  This flag forces the substitution part to be internally forced as a proxy request and immediately (*i.e.*, rewriting rule processing stops here) put through the proxy module. You have to make sure that the substitution string is a valid URI (*e.g.*, typically starting with `http://`*hostname*) which can be handled by the Apache proxy module. If not you get an error from the proxy module. Use this flag to achieve a more powerful implementation of the ProxyPass directive, to map some remote stuff into the namespace of the local server.

  Notice: To use this functionality make sure you have the proxy module compiled into your Apache server program. If you don't know please check whether `mod_proxy.c` is part of the "`httpd -l`" output. If yes, this functionality is available to mod_rewrite. If not, then you first have to rebuild the "`httpd`" program with mod_proxy enabled.
- '**`last|L`**' (**l**ast rule)
  Stop the rewriting process here and don't apply any more rewriting rules. This corresponds to the Perl `last` command or the `break` command from the C language. Use this flag to prevent the currently rewritten URL from being rewritten further by following rules which may be wrong. For example, use it to rewrite the root-path URL ('`/`') to a real one, *e.g.*, '`/e/www/`'.
- '**`next|N`**' (**n**ext round)
  Re-run the rewriting process (starting again with the first rewriting rule). Here the URL to match is again not the original URL but the URL from the last rewriting rule. This corresponds to the Perl `next` command or the `continue` command from the C language. Use this flag to restart the rewriting process, *i.e.*, to immediately go to the top of the loop.
  But be careful not to create a deadloop!
- '**`chain|C`**' (**c**hained with next rule)
  This flag chains the current rule with the next rule (which itself can also be chained with its following rule, *etc.*). This has the following effect: if a rule matches, then processing continues as usual, *i.e.*, the flag has no effect. If the rule does **not** match, then all following chained rules are skipped. For instance, use it to remove the "`.www`" part inside a per-directory rule set when you let an external redirect happen (where the "`.www`" part should not to occur!).
- '**`type|T`**=*MIME-type*' (force MIME **t**ype)
  Force the MIME-type of the target file to be *MIME-type*. For instance, this can be used to simulate the `mod_alias` directive `ScriptAlias` which internally forces all files inside the mapped directory to have a MIME type of "`application/x-httpd-cgi`".
- '**`nosubreq|NS`**' (used only if **n**o internal **s**ub-request)
  This flag forces the rewriting engine to skip a rewriting rule if the current request is an internal sub-request. For instance, sub-requests occur internally in Apache when `mod_include` tries to find out information about possible directory default files (`index.xxx`). On sub-requests it is not always useful and even sometimes causes a failure to if the complete set of rules are applied. Use this flag to exclude some rules.

  Use the following rule for your decision: whenever you prefix some URLs with CGI-scripts to force them to be processed by the CGI-script, the chance is high that you will run into problems (or even overhead) on sub-requests. In these cases, use this flag.
- '**`nocase|NC`**' (**n**o **c**ase)
  This makes the *Pattern* case-insensitive, *i.e.*, there is no difference between 'A-Z' and 'a-z' when *Pattern* is matched against the current URL.
- '**`qsappend|QSA`**' (**q**uery **s**tring **a**ppend)
  This flag forces the rewriting engine to append a query string part in the substitution string to the existing one instead of replacing it. Use this when you want to add more data to the query string via a rewrite rule.

- '**passthrough|PT**' (**p**ass **t**hrough to next handler)
  This flag forces the rewriting engine to set the `uri` field of the internal `request_rec` structure to the value of the `filename` field. This flag is just a hack to be able to post-process the output of `RewriteRule` directives by `Alias`, `ScriptAlias`, `Redirect`, *etc.* directives from other URI-to-filename translators. A trivial example to show the semantics: If you want to rewrite `/abc` to `/def` via the rewriting engine of `mod_rewrite` and then `/def` to `/ghi` with `mod_alias`:

  ```
  RewriteRule ^/abc(.*)  /def$1 [PT]
  Alias       /def       /ghi
  ```

  If you omit the `PT` flag then `mod_rewrite` will do its job fine, *i.e.*, it rewrites `uri=/abc/...` to `filename=/def/...` as a full API-compliant URI-to-filename translator should do. Then `mod_alias` comes and tries to do a URI-to-filename transition which will not work.

  Notice: **You have to use this flag if you want to intermix directives of different modules which contain URL-to-filename translators**. The typical example is the use of `mod_alias` and `mod_rewrite`..

  Notice - For the Apache hackers:
  If the current Apache API had a filename-to-filename hook additionally to the URI-to-filename hook then we wouldn't need this flag! But without such a hook this flag is the only solution. The Apache Group has discussed this problem and will add such hooks into Apache version 2.0.

- '**skip|S**=*num*' (**s**kip next rule(s))
  This flag forces the rewriting engine to skip the next *num* rules in sequence when the current rule matches. Use this to make pseudo if-then-else constructs: The last rule of the then-clause becomes a `skip=N` where N is the number of rules in the else-clause. (This is **not** the same as the 'chain|C' flag!)

- '**env|E=***VAR*:*VAL*' (set **e**nvironment variable)
  This forces an environment variable named *VAR* to be set to the value *VAL*, where *VAL* can contain regexp backreferences `$N` and `%N` which will be expanded. You can use this flag more than once to set more than one variable. The variables can be later dereferenced at a lot of situations, but the usual location will be from within XSSI (via `<!--#echo var="VAR"-->`) or CGI (*e.g.* `$ENV{'VAR'}`). But additionally you can also dereference it in a following RewriteCond pattern via `%{ENV:VAR}`. Use this to strip but remember information from URLs.

Notice: Never forget that *Pattern* gets applied to a complete URL in per-server configuration files. **But in per-directory configuration files, the per-directory prefix (which always is the same for a specific directory!) gets automatically *removed* for the pattern matching and automatically *added* after the substitution has been done.** This feature is essential for many sorts of rewriting, because without this prefix stripping you have to match the parent directory which is not always possible.

There is one exception: If a substitution string starts with "`http://`" then the directory prefix will be **not** added and a external redirect or proxy throughput (if flag **P** is used!) is forced!

Notice: To enable the rewriting engine for per-directory configuration files you need to set "`RewriteEngine On`" in these files **and** "`Option FollowSymLinks`" enabled. If your administrator has disabled override of `FollowSymLinks` for a user's directory, then you cannot use the rewriting engine. This restriction is needed for security reasons.

Here are all possible substitution combinations and their meanings:

Inside per-server configuration (`httpd.conf`)

for request ``GET /somepath/pathinfo'':

Given Rule	Resulting Substitution
^/somepath(.*) otherpath$1	not supported, because invalid!
^/somepath(.*) otherpath$1 [R]	not supported, because invalid!
^/somepath(.*) otherpath$1 [P]	not supported, because invalid!
^/somepath(.*) /otherpath$1	/otherpath/pathinfo
^/somepath(.*) /otherpath$1 [R]	http://thishost/otherpath/pathinfo via external redirection
^/somepath(.*) /otherpath$1 [P]	not supported, because silly!
^/somepath(.*) http://thishost/otherpath$1	/otherpath/pathinfo
^/somepath(.*) http://thishost/otherpath$1 [R]	http://thishost/otherpath/pathinfo via external redirection
^/somepath(.*) http://thishost/otherpath$1 [P]	not supported, because silly!
^/somepath(.*) http://otherhost/otherpath$1	http://otherhost/otherpath/pathinfo via external redirection
^/somepath(.*) http://otherhost/otherpath$1 [R]	http://otherhost/otherpath/pathinfo via external redirection (the [R] flag is redundant)
^/somepath(.*) http://otherhost/otherpath$1 [P]	http://otherhost/otherpath/pathinfo via internal proxy

Inside per-directory configuration for `/somepath`
(*i.e.*, file `.htaccess` in dir `/physical/path/to/somepath` containing `RewriteBase /somepath`)
for request ``GET /somepath/localpath/pathinfo'':

Given Rule	Resulting Substitution
^localpath(.*) otherpath$1	/somepath/otherpath/pathinfo
^localpath(.*) otherpath$1 [R] http://thishost/somepath/otherpath/pathinfo	via external redirection
^localpath(.*) otherpath$1 [P]	not supported, because silly!
^localpath(.*) /otherpath$1	/otherpath/pathinfo
^localpath(.*) /otherpath$1 [R]	http://thishost/otherpath/pathinfo via external redirection
^localpath(.*) /otherpath$1 [P]	not supported, because silly!
^localpath(.*) http://thishost/otherpath$1	/otherpath/pathinfo


```
^localpath(.*) http://thishost/otherpath$1 [R]  http://thishost/otherpath/path
                                                via external redirection

^localpath(.*) http://thishost/otherpath$1 [P]  not supported, because silly!
-----------------------------------------------  ----------------------------------
^localpath(.*) http://otherhost/otherpath$1     http://otherhost/otherpath/pathinfo
                                                via external redirection

^localpath(.*) http://otherhost/otherpath$1 [R] http://otherhost/otherpath/pathinfo
                                                via external redirection
                                                (the [R] flag is redundant)

^localpath(.*) http://otherhost/otherpath$1 [P] http://otherhost/otherpath/pathinfo
                                                via internal proxy
```

Example:

We want to rewrite URLs of the form

`/` *Language* `/~` *Realname* `/.../` *File*

into

`/u/` *Username* `/.../` *File* `.` *Language*

We take the rewrite mapfile from above and save it under `/path/to/file/map.txt`. Then we only have to add the following lines to the Apache server configuration file:

```
RewriteLog    /path/to/file/rewrite.log
RewriteMap    real-to-user                txt:/path/to/file/map.txt
RewriteRule   ^/([^/]+)/~([^/]+)/(.*)$    /u/${real-to-user:$2|nobody}/$3.$1
```

Miscellaneous

Environment Variables

This module keeps track of two additional (non-standard) CGI/SSI environment variables named `SCRIPT_URL` and `SCRIPT_URI`. These contain the *logical* Web-view to the current resource, while the standard CGI/SSI variables `SCRIPT_NAME` and `SCRIPT_FILENAME` contain the *physical* System-view.

Notice: These variables hold the URI/URL *as they were initially requested*, *i.e.*, in a state *before* any rewriting. This is important because the rewriting process is primarily used to rewrite logical URLs to physical pathnames.

Example:

```
SCRIPT_NAME=/sw/lib/w3s/tree/global/u/rse/.www/index.html
SCRIPT_FILENAME=/u/rse/.www/index.html
SCRIPT_URL=/u/rse/
SCRIPT_URI=http://en1.engelschall.com/u/rse/
```

Practical Solutions

There is a comprehensive collection of practical solutions for URL-based problems available by the author of mod_rewrite. Here you will find real-life rulesets and additional information.

TOC

Apache HTTP Server Version 1.3

Security Tips for Server Configuration

Some hints and tips on security issues in setting up a web server. Some of the suggestions will be general, others specific to Apache.

Permissions on ServerRoot Directories

In typical operation, Apache is started by the root user, and it switches to the user defined by the **User** directive to serve hits. As is the case with any command that root executes, you must take care that it is protected from modification by non-root users. Not only must the files themselves be writeable only by root, but so must the directories, and parents of all directories. For example, if you choose to place ServerRoot in `/usr/local/apache` then it is suggested that you create that directory as root, with commands like these:

```
mkdir /usr/local/apache
cd /usr/local/apache
mkdir bin conf logs
chown 0 . bin conf logs
chgrp 0 . bin conf logs
chmod 755 . bin conf logs
```

It is assumed that /, /usr, and /usr/local are only modifiable by root. When you install the httpd executable, you should ensure that it is similarly protected:

```
cp httpd /usr/local/apache/bin
chown 0 /usr/local/apache/bin/httpd
chgrp 0 /usr/local/apache/bin/httpd
chmod 511 /usr/local/apache/bin/httpd
```

You can create an htdocs subdirectory which is modifiable by other users -- since root never executes any files out of there, and shouldn't be creating files in there.

If you allow non-root users to modify any files that root either executes or writes on then you open your system to root compromises. For example, someone could replace the httpd binary so that the next time you start it, it will execute some arbitrary code. If the logs directory is writeable (by a non-root user), someone could replace a log file with a symlink to some other system file, and then root might overwrite

that file with arbitrary data. If the log files themselves are writeable (by a non-root user), then someone may be able to overwrite the log itself with bogus data.

Server Side Includes

Server side includes (SSI) can be configured so that users can execute arbitrary programs on the server. That thought alone should send a shiver down the spine of any sys-admin.

One solution is to disable that part of SSI. To do that you use the IncludesNOEXEC option to the Options directive.

Non Script Aliased CGI

Allowing users to execute **CGI** scripts in any directory should only be considered if;

1. You trust your users not to write scripts which will deliberately or accidentally expose your system to an attack.
2. You consider security at your site to be so feeble in other areas, as to make one more potential hole irrelevant.
3. You have no users, and nobody ever visits your server.

Script Alias'ed CGI

Limiting **CGI** to special directories gives the admin control over what goes into those directories. This is inevitably more secure than non script aliased CGI, but **only if users with write access to the directories are trusted** or the admin is willing to test each new CGI script/program for potential security holes.

Most sites choose this option over the non script aliased CGI approach.

CGI in general

Always remember that you must trust the writers of the CGI script/programs or your ability to spot potential security holes in CGI, whether they were deliberate or accidental.

All the CGI scripts will run as the same user, so they have potential to conflict (accidentally or deliberately) with other scripts *e.g.* User A hates User B, so he writes a script to trash User B's CGI database. One program which can be used to allow scripts to run as different users is suEXEC which is included with Apache as of 1.2 and is called from special hooks in the Apache server code. Another

popular way of doing this is with CGIWrap.

Stopping users overriding system wide settings...

To run a really tight ship, you'll want to stop users from setting up `.htaccess` files which can override security features you've configured. Here's one way to do it...

In the server configuration file, put

```
<Directory />
AllowOverride None
Options None
allow from all
</Directory>
```

Then setup for specific directories

This stops all overrides, Includes and accesses in all directories apart from those named.

Protect server files by default

One aspect of Apache which is occasionally misunderstood is the feature of default access. That is, unless you take steps to change it, if the server can find its way to a file through normal URL mapping rules, it can serve it to clients.

For instance, consider the following example:

1. # cd /; ln -s / public_html
2. Accessing http://localhost/~root/

This would allow clients to walk through the entire filesystem. To work around this, add the following block to your server's configuration:

```
<Directory />
    Order deny,allow
    Deny from all
</Directory>
```

This will forbid default access to filesystem locations. Add appropriate <Directory> blocks to allow access only in those areas you wish. For example,

```
<Directory /usr/users/*/public_html>
    Order deny,allow
    Allow from all
</Directory>
```

```
<Directory /usr/local/httpd>
    Order deny,allow
    Allow from all
</Directory>
```

Pay particular attention to the interactions of <Location> and <Directory> directives; for instance, even if <Directory /> denies access, a <Location /> directive might overturn it.

Also be wary of playing games with the UserDir directive; setting it to something like "./" would have the same effect, for root, as the first example above. If you are using Apache 1.3 or above, we strongly recommend that you include the following line in your server configuration files:

UserDir disabled root

Please send any other useful security tips to The Apache Group by filling out a problem report. If you are confident you have found a security bug in the Apache source code itself, please let us know.

Apache HTTP Server Version 1.3

Apache suEXEC Support

1. **CONTENTS**

What is suEXEC?

The **suEXEC** feature -- introduced in Apache 1.2 -- provides Apache users the ability to run **CGI** and **SSI** programs under user IDs different from the user ID of the calling web-server. Normally, when a CGI or SSI program executes, it runs as the same user who is running the web server.

Used properly, this feature can reduce considerably the security risks involved with allowing users to develop and run private CGI or SSI programs. However, if suEXEC is improperly configured, it can cause any number of problems and possibly create new holes in your computer's security. If you aren't familiar with managing setuid root programs and the security issues they present, we highly recommend that you not consider using suEXEC.

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Before we begin.

Before jumping head-first into this document, you should be aware of the assumptions made on the part of the Apache Group and this document.

First, it is assumed that you are using a UNIX derivate operating system that is capable of **setuid** and **setgid** operations. All command examples are given in this regard. Other platforms, if they are capable of supporting suEXEC, may differ in their configuration.

Second, it is assumed you are familiar with some basic concepts of your computer's security and its

administration. This involves an understanding of **setuid/setgid** operations and the various effects th may have on your system and its level of security.

Third, it is assumed that you are using an **unmodified** version of suEXEC code. All code for suEXEC has been carefully scrutinized and tested by the developers as well as numerous beta testers. Every precaution has been taken to ensure a simple yet solidly safe base of code. Altering this code can cause unexpected problems and new security risks. It is **highly** recommended you not alter the suEXEC code unless you are well versed in the particulars of security programming and are willing to share your work with the Apache Group for consideration.

Fourth, and last, it has been the decision of the Apache Group to **NOT** make suEXEC part of the default installation of Apache. To this end, suEXEC configuration requires of the administrator careful attention to details. After due consideration has been given to the various settings for suEXEC, the administrator may install suEXEC through normal installation methods. The values for these settings need to be carefully determined and specified by the administrator to properly maintain system security during the use of suEXEC functionality. It is through this detailed process that the Apache Group hopes to limit suEXEC installation only to those who are careful and determined enough to use it.

Still with us? Yes? Good. Let's move on!

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suEXEC Security Model

Before we begin configuring and installing suEXEC, we will first discuss the security model you are about to implement. By doing so, you may better understand what exactly is going on inside suEXEC and what precautions are taken to ensure your system's security.

suEXEC is based on a setuid "wrapper" program that is called by the main Apache web server. This wrapper is called when an HTTP request is made for a CGI or SSI program that the administrator has designated to run as a userid other than that of the main server. When such a request is made, Apache provides the suEXEC wrapper with the program's name and the user and group IDs under which the program is to execute.

The wrapper then employs the following process to determine success or failure -- if any one of these conditions fail, the program logs the failure and exits with an error, otherwise it will continue:

1. **Was the wrapper called with the proper number of arguments?**

   The wrapper will only execute if it is given the proper number of arguments. The proper argument format is known to the Apache web server. If the wrapper is not receiving the proper number of arguments, it is either being hacked, or there is something wrong with the suEXEC portion of your Apache binary.

2. **Is the user executing this wrapper a valid user of this system?**

   This is to ensure that the user executing the wrapper is truly a user of the system.

3. **Is this valid user allowed to run the wrapper?**

   Is this user the user allowed to run this wrapper? Only one user (the Apache user) is allowed to execute this program.

4. **Does the target program have an unsafe hierarchical reference?**

   Does the target program contain a leading '/' or have a '..' backreference? These are not allowed; the target program must reside within the Apache webspace.

5. **Is the target user name valid?**

   Does the target user exist?

6. **Is the target group name valid?**

   Does the target group exist?

7. **Is the target user *NOT* superuser?**

   Presently, suEXEC does not allow 'root' to execute CGI/SSI programs.

8. **Is the target userid *ABOVE* the minimum ID number?**

   The minimum user ID number is specified during configuration. This allows you to set the lowest possible userid that will be allowed to execute CGI/SSI programs. This is useful to block out "system" accounts.

9. **Is the target group *NOT* the superuser group?**

   Presently, suEXEC does not allow the 'root' group to execute CGI/SSI programs.

10. **Is the target groupid *ABOVE* the minimum ID number?**

    The minimum group ID number is specified during configuration. This allows you to set the lowest possible groupid that will be allowed to execute CGI/SSI programs. This is useful to block out "system" groups.

11. **Can the wrapper successfully become the target user and group?**

    Here is where the program becomes the target user and group via setuid and setgid calls. The group access list is also initialized with all of the groups of which the user is a member.

12. **Does the directory in which the program resides exist?**

    If it doesn't exist, it can't very well contain files.

13. **Is the directory within the Apache webspace?**

    If the request is for a regular portion of the server, is the requested directory within the server's document root? If the request is for a UserDir, is the requested directory within the user's document root?

14. **Is the directory *NOT* writable by anyone else?**

    We don't want to open up the directory to others; only the owner user may be able to alter this directories contents.

15. **Does the target program exist?**

    If it doesn't exists, it can't very well be executed.

16. **Is the target program *NOT* writable by anyone else?**

    We don't want to give anyone other than the owner the ability to change the program.

17. **Is the target program *NOT* setuid or setgid?**

    We do not want to execute programs that will then change our UID/GID again.

18. **Is the target user/group the same as the program's user/group?**

Is the user the owner of the file?

19. **Can we successfully clean the process environment to ensure safe operations?**

    suEXEC cleans the process' environment by establishing a safe execution PATH (defined during configuration), as well as only passing through those variables whose names are listed in the safe environment list (also created during configuration).

20. **Can we successfully become the target program and execute?**

    Here is where suEXEC ends and the target program begins.

This is the standard operation of the the suEXEC wrapper's security model. It is somewhat stringent and can impose new limitations and guidelines for CGI/SSI design, but it was developed carefully step-by-step with security in mind.

For more information as to how this security model can limit your possibilities in regards to server configuration, as well as what security risks can be avoided with a proper suEXEC setup, see the "Beware the Jabberwock" section of this document.

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Configuring & Installing suEXEC

Here's where we begin the fun. If you use Apache 1.2 or prefer to configure Apache 1.3 with the "`src/Configure`" script you have to edit the suEXEC header file and install the binary in its proper location manually. This procedure is described in an extra document. The following sections describe the configuration and installation for Apache 1.3 with the AutoConf-style interface (APACI).

APACI's suEXEC configuration options

`--enable-suexec`

This option enables the suEXEC feature which is never installed or activated by default. At least one --suexec-xxxxx option has to be provided together with the --enable-suexec option to let APACI accept your request for using the suEXEC feature.

`--suexec-caller=`*`UID`*

The username under which Apache normally runs. This is the only user allowed to execute this program.

`--suexec-docroot=`*`DIR`*

Define as the DocumentRoot set for Apache. This will be the only hierarchy (aside from UserDirs) that can be used for suEXEC behavior. The default directory is the --datadir value with the suffix "/htdocs", *e.g.* if you configure with "`--datadir=/home/apache`" the directory "/home/apache/htdocs" is used as document root for the suEXEC wrapper.

`--suexec-logfile=`*`FILE`*

This defines the filename to which all suEXEC transactions and errors are logged (useful for auditing and debugging purposes). By default the logfile is named "suexec_log" and located in your standard logfile directory (--logfiledir).

`--suexec-userdir=`*`DIR`*

Define to be the subdirectory under users' home directories where suEXEC access should be allowed. All executables under this directory will be executable by suEXEC as the user so they should be "safe" programs. If you are using a "simple" UserDir directive (ie. one without a "*" in it) this should be set to the same value. suEXEC will not work properly in cases where the UserDir directive points to a location that is not the same as the user's home directory as referenced in the passwd file. Default value is "public_html".
If you have virtual hosts with a different UserDir for each, you will need to define them to all reside in one parent directory; then name that parent directory here. **If this is not defined properly, "~userdir" cgi requests will not work!**

`--suexec-uidmin=`*`UID`*

Define this as the lowest UID allowed to be a target user for suEXEC. For most systems, 500 or 100 is common. Default value is 100.

`--suexec-gidmin=`*`GID`*

Define this as the lowest GID allowed to be a target group for suEXEC. For most systems, 100 is common and therefore used as default value.

`--suexec-safepath=`*`PATH`*

Define a safe PATH environment to pass to CGI executables. Default value is "/usr/local/bin:/usr/bin:/bin".

Checking your suEXEC setup

Before you compile and install the suEXEC wrapper you can check the configuration with the --layout option.
Example output:

```
    suEXEC setup:
            suexec binary: /usr/local/apache/sbin/suexec
            document root: /usr/local/apache/share/htdocs
           userdir suffix: public_html
                  logfile: /usr/local/apache/var/log/suexec_log
              safe path: /usr/local/bin:/usr/bin:/bin
              caller ID: www
         minimum user ID: 100
        minimum group ID: 100
```

Compiling and installing the suEXEC wrapper

If you have enabled the suEXEC feature with the --enable-suexec option the suexec binary (together with Apache itself) is automatically built if you execute the command "make".
After all components have been built you can execute the command "make install" to install them. The binary image "suexec" is installed in the directory defined by the --sbindir option. Default location is "/usr/local/apache/sbin/suexec".
Please note that you need ***root privileges*** for the installation step. In order for the wrapper to set the user ID, it must be installed as owner *`root`* and must have the setuserid execution bit set for file modes.

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Enabling & Disabling suEXEC

Upon startup of Apache, it looks for the file "suexec" in the "sbin" directory (default is "/usr/local/apache/sbin/suexec"). If Apache finds a properly configured suEXEC wrapper, it will print the following message to the error log:

```
[notice] suEXEC mechanism enabled (wrapper: /path/to/suexec)
```

If you don't see this message at server startup, the server is most likely not finding the wrapper program where it expects it, or the executable is not installed *setuid root*.
If you want to enable the suEXEC mechanism for the first time and an Apache server is already running you must kill and restart Apache. Restarting it with a simple HUP or USR1 signal will not be enough.
If you want to disable suEXEC you should kill and restart Apache after you have removed the "suexec" file.

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Using suEXEC

Virtual Hosts:
One way to use the suEXEC wrapper is through the User and Group directives in VirtualHost definitions. By setting these directives to values different from the main server user ID, all requests for CGI resources will be executed as the *User* and *Group* defined for that `<VirtualHost>`. If only one or neither of these directives are specified for a `<VirtualHost>` then the main server userid is assumed.

User directories:
The suEXEC wrapper can also be used to execute CGI programs as the user to which the request is being directed. This is accomplished by using the "`~`" character prefixing the user ID for whom execution is desired. The only requirement needed for this feature to work is for CGI execution to be enabled for the user and that the script must meet the scrutiny of the security checks above.

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Debugging suEXEC

The suEXEC wrapper will write log information to the file defined with the --suexec-logfile option as indicated above. If you feel you have configured and installed the wrapper properly, have a look at this log and the error_log for the server to see where you may have gone astray.

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Beware the Jabberwock: Warnings & Examples

There are a few points of interest regarding the wrapper that can cause limitations on server setup. Please review these before submitting any "bugs" regarding suEXEC.

- **suEXEC Points Of Interest**

- Hierarchy limitations

  For security and efficiency reasons, all suexec requests must remain within either a top-level document root for virtual host requests, or one top-level personal document root for userdir requests. For example, if you have four VirtualHosts configured, you would need to structure all of your VHosts' document roots off of one main Apache document hierarchy to take advantage of suEXEC for VirtualHosts. (Example forthcoming.)

- suEXEC's PATH environment variable

  This can be a dangerous thing to change. Make certain every path you include in this define is a **trusted** directory. You don't want to open people up to having someone from across the world running a trojan horse on them.

- Altering the suEXEC code

  Again, this can cause **Big Trouble** if you try this without knowing what you are doing. Stay away from it if at all possible.

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Apache HTTP Server Version 1.3

Configuring & Installing suEXEC

This section describes the configuration and installation of the suEXEC feature with the "`src/Configure`" script. (If you use Apache 1.3 you may want to use the Apache AutoConf-style interface (APACI) which is described in the main suEXEC document).

EDITING THE SUEXEC HEADER FILE
- From the top-level of the Apache source tree, type: **`cd support [ENTER]`**

Edit the `suexec.h` file and change the following macros to match your local Apache installation.

From support/suexec.h

```
/*
 * HTTPD_USER -- Define as the username under which Apache normally
 *               runs.  This is the only user allowed to execute
 *               this program.
 */
#define HTTPD_USER "www"

/*
 * UID_MIN -- Define this as the lowest UID allowed to be a target user
 *            for suEXEC.  For most systems, 500 or 100 is common.
 */
#define UID_MIN 100

/*
 * GID_MIN -- Define this as the lowest GID allowed to be a target group
 *            for suEXEC.  For most systems, 100 is common.
 */
#define GID_MIN 100

/*
 * USERDIR_SUFFIX -- Define to be the subdirectory under users'
 *                   home directories where suEXEC access should
 *                   be allowed.  All executables under this directory
 *                   will be executable by suEXEC as the user so
 *                   they should be "safe" programs.  If you are
 *                   using a "simple" UserDir directive (ie. one
 *                   without a "*" in it) this should be set to
 *                   the same value.  suEXEC will not work properly
 *                   in cases where the UserDir directive points to
 *                   a location that is not the same as the user's
 *                   home directory as referenced in the passwd file.
 *
```


```
 *                  If you have VirtualHosts with a different
 *                  UserDir for each, you will need to define them to
 *                  all reside in one parent directory; then name that
 *                  parent directory here.  IF THIS IS NOT DEFINED
 *                  PROPERLY, ~USERDIR CGI REQUESTS WILL NOT WORK!
 *                  See the suEXEC documentation for more detailed
 *                  information.
 */
#define USERDIR_SUFFIX "public_html"

/*
 * LOG_EXEC -- Define this as a filename if you want all suEXEC
 *             transactions and errors logged for auditing and
 *             debugging purposes.
 */
#define LOG_EXEC "/usr/local/apache/logs/cgi.log" /* Need me? */

/*
 * DOC_ROOT -- Define as the DocumentRoot set for Apache.  This
 *             will be the only hierarchy (aside from UserDirs)
 *             that can be used for suEXEC behavior.
 */
#define DOC_ROOT "/usr/local/apache/htdocs"

/*
 * SAFE_PATH -- Define a safe PATH environment to pass to CGI executables.
 *
 */
#define SAFE_PATH "/usr/local/bin:/usr/bin:/bin"
```

COMPILING THE SUEXEC WRAPPER

You now need to compile the suEXEC wrapper. At the shell command prompt, after compiling Apache, type: **`make suexec[ENTER]`**. This should create the ***suexec*** wrapper executable.

COMPILING APACHE FOR USE WITH SUEXEC

By default, Apache is compiled to look for the suEXEC wrapper in the following location.

From src/include/httpd.h

```
/* The path to the suExec wrapper, can be overridden in Configuration */
#ifndef SUEXEC_BIN
#define SUEXEC_BIN  HTTPD_ROOT "/sbin/suexec"
#endif
```

If your installation requires location of the wrapper program in a different directory, either add `-DSUEXEC_BIN=\"</your/path/to/suexec>\"` to your CFLAGS (or edit src/include/httpd.h) and recompile your Apache server. See Compiling and Installing Apache (and the INSTALL file in the source distribution) for more info on this process.

COPYING THE SUEXEC BINARY TO ITS PROPER LOCATION

Copy the ***suexec*** executable created in the exercise above to the defined location for **SUEXEC_BIN**.

`cp suexec /usr/local/apache/sbin/suexec [ENTER]`

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In order for the wrapper to set the user ID, it must be installed as owner ***root*** and must have the setuserid executi set for file modes. If you are not running a ***root*** user shell, do so now and execute the following commands.

```
chown root /usr/local/apache/sbin/suexec [ENTER]
chmod 4711 /usr/local/apache/sbin/suexec [ENTER]
```

Enabling & Disabling suEXEC

After properly installing the **suexec** wrapper executable, you must kill and restart the Apache server. A simple **`kill -1 `cat httpd.pid``** will not be enough. Upon startup of the web-server, if Apache finds a properly configured **suexec** wrapper, it will print the following message to the console (Apache 1.2):

```
Configuring Apache for use with suexec wrapper.
```

If you use Apache 1.3 the following message is printed to the error log:

```
[notice] suEXEC mechanism enabled (wrapper: /path/to/suexec)
```

If you don't see this message at server startup, the server is most likely not finding the wrapper program where it expects it, or the executable is not installed ***setuid root***. Check your installation and try again.

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Apache HTTP Server Version 1.3

Compiling and Installing Apache 1.3

This document covers compilation and installation of Apache on Unix systems only. For compiling and installation on Windows, see Using Apache with Microsoft Windows and for TPF see Installing the Apache 1.3 HTTP Server on TPF.

UnixWare users will want to consult build notes for various UnixWare versions before compiling.

Downloading Apache

Information on the latest version of Apache can be found on the Apache web server at >http://www.apache.org.. This will list the current release, any more recent beta-test release, together with details of mirror web and anonymous ftp sites.

If you downloaded a binary distribution, skip to Installing Apache. Otherwise read the next section for how to compile the server.

Compiling Apache

Compiling Apache consists of three steps: Firstly select which Apache **modules** you want to include into the server. Secondly create a configuration for your operating system. Thirdly compile the executable.

All configuration of Apache is performed in the `src` directory of the Apache distribution. Change into this directory.

1. Select modules to compile into Apache in the `Configuration` file. Uncomment lines corresponding to those optional modules you wish to include (among the AddModule lines at the bottom of the file), or add new lines corresponding to additional modules you have downloaded or written. (See API.html for preliminary docs on how to write Apache modules). Advanced users can comment out some of the default modules if they are sure they will not need them (be careful though, since many of the default modules are vital for the correct operation and security of the server).

   You should also read the instructions in the `Configuration` file to see if you need to set any of the `Rule` lines.
2. Configure Apache for your operating system. Normally you can just type run the `Configure` script as given below. However if this fails or you have any special requirements (*e.g.*, to include

an additional library required by an optional module) you might need to edit one or more of th following options in the `Configuration` file: `EXTRA_CFLAGS, LIBS, LDFLAGS, INCLUDES`.

Run the `Configure` script:

```
% Configure
Using 'Configuration' as config file
 + configured for <whatever> platform
 + setting C compiler to <whatever> *
 + setting C compiler optimization-level to <whatever> *
 + Adding selected modules
 + doing sanity check on compiler and options
Creating Makefile in support
Creating Makefile in main
Creating Makefile in os/unix
Creating Makefile in modules/standard
```

(*: Depending on Configuration and your system, Configure might not print these lines. That's OK).

This generates a Makefile for use in stage 3. It also creates a Makefile in the support directory, for compilation of the optional support programs.

(If you want to maintain multiple configurations, you can give a option to `Configure` to tell it to read an alternative Configuration file, such as `Configure -file Configuration.ai`).

3. Type `make`.

The modules we place in the Apache distribution are the ones we have tested and are used regularly by various members of the Apache development group. Additional modules contributed by members or third parties with specific needs or functions are available at http://www.apache.org/dist/contrib/modules/>. There are instructions on that page for linking these modules into the core Apache code.

Installing Apache

You will have a binary file called `httpd` in the `src` directory. A binary distribution of Apache will supply this file.

The next step is to install the program and configure it. Apache is designed to be configured and run from the same set of directories where it is compiled. If you want to run it from somewhere else, make a directory and copy the `conf`, `logs` and `icons` directories into it. In either case you should read the security tips describing how to set the permissions on the server root directory.

The next step is to edit the configuration files for the server. This consists of setting up various **directives** in up to three central configuration files. By default, these files are located in the `conf` directory and are called `srm.conf`, `access.conf` and `httpd.conf`. To help you get started there are same files in

the `conf` directory of the distribution, called `srm.conf-dist`, `access.conf-dist` and `httpd.conf-dist`. Copy or rename these files to the names without the `-dist`. Then edit each of the files. Read the comments in each file carefully. Failure to setup these files correctly could lead to your server not working or being insecure. You should also have an additional file in the `conf` directory called `mime.types`. This file usually does not need editing.

First edit `httpd.conf`. This sets up general attributes about the server: the port number, the user it runs as, *etc.* Next edit the `srm.conf` file; this sets up the root of the document tree, special functions like server-parsed HTML or internal imagemap parsing, *etc.* Finally, edit the `access.conf` file to at least set the base cases of access.

In addition to these three files, the server behavior can be configured on a directory-by-directory basis by using `.htaccess` files in directories accessed by the server.

Set your system time properly!

Proper operation of a public web server requires accurate time keeping, since elements of the HTTP protocol are expressed as the time of day. So, it's time to investigate setting up NTP or some other time synchronization system on your Unix box, or whatever the equivalent on NT would be.

Starting and Stopping the Server

To start the server, simply run `httpd`. This will look for `httpd.conf` in the location compiled into the code (by default `/usr/local/apache/conf/httpd.conf`). If this file is somewhere else, you can give the real location with the -f argument. For example:

```
/usr/local/apache/httpd -f /usr/local/apache/conf/httpd.conf
```

If all goes well this will return to the command prompt almost immediately. This indicates that the server is now up and running. If anything goes wrong during the initialization of the server you will see an error message on the screen. If the server started ok, you can now use your browser to connect to the server and read the documentation. If you are running the browser on the same machine as the server and using the default port of 80, a suitable URL to enter into your browser is

```
http://localhost/
```

Note that when the server starts it will create a number of *child* processes to handle the requests. If you started Apache as the root user, the parent process will continue to run as root while the children will change to the user as given in the httpd.conf file.

If when you run `httpd` it complained about being unable to "bind" to an address, then either some other process is already using the port you have configured Apache to use, or you are running httpd as a normal user but trying to use port below 1024 (such as the default port 80).

If the server is not running, read the error message displayed when you run httpd. You should also check the server error_log for additional information (with the default configuration, this will be located in the file `error_log` in the `logs` directory).

If you want your server to continue running after a system reboot, you should add a call to `httpd` to your system startup files (typically `rc.local` or a file in an `rc.N` directory). This will start Apache as root. Before doing this ensure that your server is properly configured for security and access restrictions.

To stop Apache send the parent process a TERM signal. The PID of this process is written to the file `httpd.pid` in the `logs` directory (unless configured otherwise). Do not attempt to kill the child processes because they will be renewed by the parent. A typical command to stop the server is:

```
kill -TERM `cat /usr/local/apache/logs/httpd.pid`
```

For more information about Apache command line options, configuration and log files, see Starting Apache. For a reference guide to all Apache directives supported by the distributed modules, see the Apache directives.

Compiling Support Programs

In addition to the main `httpd` server which is compiled and configured as above, Apache includes a number of support programs. These are not compiled by default. The support programs are in the `support` directory of the distribution. To compile the support programs, change into this directory and type

```
make
```

Apache HTTP Server Version 1.3

Using Apache With Microsoft Windows

This document explains how to install, configure and run Apache 1.3 under Microsoft Windows. Please note that at this time, Windows support is entirely experimental, and is recommended only for experienced users. The Apache Group does not guarantee that this software will work as documented, or even at all. If you find any bugs, or wish to contribute in other ways, please use our bug reporting page.

Warning: Apache on NT has not yet been optimized for performance. Apache still performs best, and is most reliable on Unix platforms. Over time we will improve NT performance. Folks doing comparative reviews of webserver performance are asked to compare against Apache on a Unix platform such as Solaris, FreeBSD, or Linux.

Most of this document assumes that you are installing Windows from a binary distribution. If you want to compile Apache yourself (possibly to help with development, or to track down bugs), see the section on Compiling Apache for Windows below.

Requirements

Apache 1.3 is designed to run on Windows NT 4.0. The binary installer will only work in Intel processors. Apache may also run on Windows 95, Windows 98 and Windows NT 3.5.1, but these have not been tested. In all cases TCP/IP networking must be installed.

If running on Windows 95, using the "Winsock2" upgrade is recommended but may not be necessary. If

running on NT 4.0, installing Service Pack 2 is recommended.

Note: "Winsock 2" is required for Apache 1.3.7 and later.

"Winsock 2" for Windows 95 is available at http://www.microsoft.com/windows95/downloads/

Downloading Apache for Windows

Information on the latest version of Apache can be found on the Apache web server at http://www.apache.org/. This will list the current release, any more recent alpha or beta-test releases, together with details of mirror web and anonymous ftp sites.

You should download the version of Apache for Windows with the `.exe` extension. This is a single file containing Apache, ready to install and run. There may also be a `.zip` file containing the source code, to compile Apache yourself. (If there is no .zip file, the source will be available in a .tar.gz file but this will contain Unix line endings. You will have to convert at least the .mak and .dsp files to have DOS line endings before MSVC will understand them).

Installing Apache for Windows

Run the Apache .exe file you downloaded above. This will ask for:

- the directory to install Apache into (the default is `\Program Files\Apache Group\Apache` although you can change this to any other directory)
- the start menu name (default is "Apache Web Server")
- the installation type. The "Typical" option installs everything except the source code. The "Minimum" option does not install the manuals or source code. Choose the "Custom" install if you want to install the source code.

During the installation, Apache will configure the files in the conf directory for your chosen installation directory. However if any of the files in this directory already exist they will **not** be overwritten. Instead the new copy of the corresponding file will be left with the extension .default. So, for example, if conf\httpd.conf already exists it will not be altered, but the version which would have been installed will be left in conf\httpd.conf.default. After the installation has finished you should manually check to see what in new in the .default file, and if necessary update your existing configuration files.

Also, if you already have a file called htdocs\index.html then it will not be overwritten (no index.html.default file will be installed either). This should mean it a safe to install Apache over an existing installation (but you will have to stop the existing server running before doing the installation, then start the new one after the installation is finished).

After installing Apache, you should edit the configuration files in the conf directory as required. These files will be configured during the install ready for Apache to be run from the directory where it was installed, with the documents served from the subdirectory htdocs. There are lots of other options which should be set before you start really using Apache. However to get started quickly the files should work as installed.

Running Apache for Windows

There are two ways you can run Apache:

- As a "service" (available on NT only). This is the best option if you want Apache to automatically start when you machine boots, and to keep Apache running when you log-off.
- From a console window. This is the only option available for Windows 95 users.

To start Apache as a service, you first need to install it as a service. Multiple Apache services can be installed, each with a different name and configuration. To install the default Apache service named "Apache", run the "Install Apache as Service (NT only)" option from the Start menu. Once this is done you can start the "Apache" service by opening the Services window (in the Control Panel), selecting Apache, then clicking on Start. Apache will now be running in the background. You can later stop Apache by clicking on Stop. As an alternative to using the Services window, you can start and stop the "Apache" service from the control line with

```
NET START APACHE
NET STOP APACHE
```

See Signalling Service Apache when Running for more information on installing and controlling Apache services.

To run Apache from a console window, select the "Start Apache as console app" option from the Start menu (in Apache 1.3.4 and earlier, this option was called "Apache Server"). This will open a console window and start Apache running inside it. The window will remain active until you stop Apache. To stop Apache running, either select the "Shutdown Apache console app" icon option from the Start menu (this is not available in Apache 1.3.4 or earlier), or see Signalling Console Apache when Running for how to control Apache from the command line.

After starting Apache running (either in a console window or as a service) if will be listening to port 80 (unless you changed the Port, Listen or BindAddress directives in the configuration files). To connect to the server and access the default page, launch a browser and enter this URL:

```
http://localhost/
```

This should respond with a welcome page, and a link to the Apache manual. If nothing happens or you get an error, look in the error_log file in the logs directory. If your host isn't connected to the net, you may have to use this URL:

```
http://127.0.0.1/
```

Once your basic installation is working, you should configure it properly by editing the files in the conf directory.

Configuring Apache for Windows

Apache is configured by files in the conf directory. These are the same as files used to configure the Unix version, but there are a few different directives for Apache on Windows. See the Apache documentation for all the available directives.

The main differences in Apache for Windows are:

- Because Apache for Windows is multithreaded, it does not use a separate process for each request, as Apache does with Unix. Instead there are usually only two Apache processes running: a parent process, and a child which handles the requests. Within the child each request is handled by a separate thread.

  So the "process"-management directives are different:

  MaxRequestsPerChild - Like the Unix directive, this controls how many requests a process will serve before exiting. However, unlike Unix, a process serves all the requests at once, not just one, so if this is set, it is recommended that a very high number is used. The recommended default, `MaxRequestsPerChild 0`, does not cause the process to ever exit.

  ThreadsPerChild - This directive is new, and tells the server how many threads it should use. This is the maximum number of connections the server can handle at once; be sure and set this number high enough for your site if you get a lot of hits. The recommended default is `ThreadsPerChild 50`.

- The directives that accept filenames as arguments now must use Windows filenames instead of Unix ones. However, because Apache uses Unix-style names internally, you must use forward slashes, not backslashes. Drive letters can be used; if omitted, the drive with the Apache executable will be assumed.

- Apache for Windows contains the ability to load modules at runtime, without recompiling the server. If Apache is compiled normally, it will install a number of optional modules in the `\Apache\modules` directory. To activate these, or other modules, the new LoadModule directive must be used. For example, to active the status module, use the following (in addition to the status-activating directives in `access.conf`):

  ```
  LoadModule status_module modules/ApacheModuleStatus.dll
  ```

  Information on creating loadable modules is also available.

- Apache can also load ISAPI Extensions (*i.e.*, Internet Server Applications), such as those used by Microsoft's IIS, and other Windows servers. More information is available.

Running Apache for Windows as a Service

Note: The -n option to specify a service name is only available with Apache 1.3.7 and later. Earlier versions of Apache only support the default service name 'Apache'.

You can install Apache as a Windows NT service as follows:

```
apache -i -n "service name"
```

To install a service to use a particular configuration, specify the configuration file when the service is installed:

```
apache -i -n "service name" -f "\my server\conf\my.conf"
```

To remove an Apache service, use

```
apache -u -n "service name"
```

The default "service name", if one is not specified, is "Apache".

Once a service is installed, you can use the -n option, in conjunction with other options, to refer to a service's configuration file. For example:
To test a service's configuration file:

```
apache -n "service name" -t
```

To start a console Apache using a service's configuration file:

```
apache -n "service name"
```

Running Apache for Windows from the Command Line

The Start menu icons and the NT Service manager can provide a simple interface for administering Apache. But in some cases it is easier to work from the command line.

When working with Apache it is important to know how it will find the configuration files. You can specify a configuration file on the command line in two ways:

- -f specifies a path to a particular configuration file

  ```
  apache -f "c:\my server\conf\my.conf"
  apache -f test\test.conf
  ```

- -n specifies the configuration file of an installed Apache service (Apache 1.3.7 and later)

  ```
  apache -n "service name"
  ```

In these cases, the proper ServerRoot should be set in the configuration file.

If you don't specify a configuration file name with -f or -n, Apache will use the file name compiled into the server, usually "conf/httpd.conf". Invoking Apache with the -V switch will display this value labeled as SERVER_CONFIG_FILE. Apache will then determine it's ServerRoot by trying the following, in this order:

- A ServerRoot directive via a -C switch.
- The -d switch on the command line.
- Current working directory
- A registry entry, created if you did a binary install.
- The server root compiled into the server.

The server root compiled into the server is usually "/apache". invoking apache with the -V switch will display this value labeled as HTTPD_ROOT.

When invoked from the start menu, Apache is usually passed no arguments, so using the registry entry is the preferred technique for console Apache.

During a binary installation, a registry key will have been installed, for example:

```
HKEY_LOCAL_MACHINE\Software\Apache Group\Apache\1.3.4\ServerRoot
```

This key is compiled into the server and can enable you to test new versions without affecting the current version. Of course you must take care not to install the new version on top of the old version in the file system.

If you did not do a binary install then Apache will in some scenarios complain that about the missing registry key. This warning can be ignored if it otherwise was able to find it's configuration files.

The value of this key is the "ServerRoot" directory, containing the conf directory. When Apache starts it will read the httpd.conf file from this directory. If this file contains a ServerRoot directive which is different from the directory obtained from the registry key above, Apache will forget the registry key and use the directory from the configuration file. If you copy the Apache directory or configuration files to a new location it is vital that you update the ServerRoot directory in the httpd.conf file to the new location.

To run Apache from the command line as a console application, use the following command:

```
apache
```

Apache will execute, and will remain running until it is stopped by pressing control-C.

Signalling Service Apache when running

On Windows NT, multiple instances of Apache can be run as services. Signal an Apache service to start, restart, or shutdown as follows:

```
apache -n "service name" -k start
apache -n "service name" -k restart
```

```
apache -n "service name" -k shutdown
```

In addition, you can use the native NT NET command to start and stop Apache services as follows:


```
NET START "service name"
NET STOP "service name"
```

Signalling Console Apache when running

On Windows 95, Apache runs as a console application. You can tell a running Apache to stop by opening another console window and running

```
apache -k shutdown
```

Note: This option is only available with Apache 1.3.3 and later. For earlier versions, you need to use Control-C in the Apache console window to shut down the server.

This should be used instead of pressing Control-C in the running Apache console window, because it lets Apache end any current transactions and cleanup gracefully.

You can also tell Apache to restart. This makes it re-read the configuration files. Any transactions in progress are allowed to complete without interruption. To restart Apache, run

```
apache -k restart
```

Note: This option is only available with Apache 1.3.3 and later. For earlier versions, you need to use Control-C in the Apache console window to shut down the server.

Note for people familiar with the Unix version of Apache: these commands provide a Windows equivalent to `kill -TERM` *`pid`* and `kill -USR1` *`pid`*. The command line option used, `-k`, was chosen as a reminder of the "kill" command used on Unix.

Compiling Apache for Windows

Compiling Apache requires Microsoft Visual C++ 5.0 to be properly installed. It is easiest to compile with the command-line tools (nmake, *etc*...). Consult the VC++ manual to determine how to install them.

First, unpack the Apache distribution into an appropriate directory. Open a command-line prompt, and change to the `src` subdirectory of the Apache distribution.

The master Apache makefile instructions are contained in the `Makefile.nt` file. To compile Apache on Windows NT, simply use one of the following commands:

- `nmake /f Makefile.nt _apacher` (release build)
- `nmake /f Makefile.nt _apached` (debug build)

(1.3.4 and later) To compile Apache on Windows 95, use one of

- `nmake /f Makefile_win32.txt` (release build)

- `nmake /f Makefile_win32_debug.txt` (debug build)

These will both compile Apache. The latter will include debugging information in the resulting files, making it easier to find bugs and track down problems.

Apache can also be compiled using VC++'s Visual Studio development environment. Although compiling Apache in this manner is not as simple, it makes it possible to easily modify the Apache source, or to compile Apache if the command-line tools are not installed. Project files (`.DSP`) are included for each of the portions of Apache. To build Apache from the these projects files you will need to build the following projects *in this order*:

1. `os\win32\ApacheOS.dsp`
2. `regex\regex.dsp`
3. `ap\ap.dsp`
4. `main\gen_uri_delims.dsp`
5. `main\gen_test_char.dsp`
6. `ApacheCore.dsp`
7. `Apache.dsp`

In addition, the `src\os\win32` subdirectory contains project files for the optional modules (see below).

Once Apache has been compiled, it needs to be installed in its server root directory. The default is the `\Apache` directory, on the current hard drive.

To install the files into the `\Apache` directory automatically, use one the following nmake commands (see above):

- `nmake /f Makefile.nt installr INSTDIR=`*`dir`* (for release build)
- `nmake /f Makefile.nt installd INSTDIR=`*`dir`* (for debug build)

or, for Windows 95 (1.3.4 and later), use one of:

- `nmake /f Makefile_win32.txt install INSTDIR=`*`dir`* (for release build)
- `nmake /f Makefile_win32_debug.txt install INSTDIR=`*`dir`* (for debug build)

The dir argument to INSTDIR gives the installation directory; it can be omitted if Apache is to be installed into \Apache.

This will install the following:

- *`dir`*`\Apache.exe` - Apache executable
- *`dir`*`\ApacheCore.dll` - Main Apache shared library
- *`dir`*`\modules\ApacheModule*.dll` - Optional Apache modules (7 files)
- *`dir`*`\conf` - Empty configuration directory
- *`dir`*`\logs` - Empty logging directory

If you do not have nmake, or wish to install in a different directory, be sure to use a similar naming scheme.

Before running the server you must fill out the conf directory. Copy the *.conf-dist-win from the distribution conf directory and rename *.conf. Edit the @@ServerRoot@@ entries to your actual server root (for example "C:\apache"). Copy over the conf/magic and conf/mime.types files as well.

Apache HTTP Server Version 1.3

Upgrading to 1.3 from 1.2

In order to assist folks upgrading we are now going to maintain a document describing information critical to existing Apache users. Note that it only lists differences between recent major releases, so for example, folks using Apache 1.1 or earlier will have to figure out what changed up to Apache 1.2 before this document can be considered relevant. Old users could look at the `src/CHANGES` file which tracks code changes.

These are intended to be brief notes, and you should be able to find more information in either the New Features document, or in the `src/CHANGES` file.

Compile-Time Configuration Changes

- The source code has been reorganized, which affects anyone with custom modules or modifications. But also, the `Module` directive has been changed to the `AddModule` directive.
- The `Configuration` variable `EXTRA_LFLAGS` has been renamed `EXTRA_LDFLAGS`.
- The `-DMAXIMUM_DNS` definition has been obsoleted by changes to `mod_access` enforcing double-reverse DNS lookups when necessary.
- The `-DSERVER_SUBVERSION=\"string\"` compile-time option has been replaced with the run-time API call `ap_add_version_component()`. Compile-time modification of the server identity by the configuration scripts is no longer supported.
- `mod_dir` has been split into two pieces `mod_autoindex`, and `mod_dir`.
- `mod_browser` has been replaced by `mod_setenvif`.
- IRIX systems with untrusted users who can write CGIs which execute as the same uid as httpd should consider using `suexec`, or adding `-DUSE_FCNTL_SERIALIZED_ACCEPT` to `EXTRA_CFLAGS`. This is slower, more information is available on the performance tuning page. There is a mild denial of service attack possible with the default config, but the default config is an order of magnitude faster.
- `mod_auth_msql` has been removed from the distribution.
- The new Apache Autoconf-style Interface (APACI) was added to the top-level to provide a real out-of-the-box build and installation procedure for the complete Apache package.

Run-Time Configuration Changes

- There have been numerous changes to the default config files. Ensure that you compare your existing configuration files with the new ones to ensure there aren't any undesired differences. In particular:
  - As of Apache 1.3.0, the current config files apply different Options and AllowOverride settings to various directories than were used in 1.2.
  - As of the release following Apache 1.3.3, the three config file templates have been merged into httpd.conf-dist and the order of the directives changed.
- As of 1.3.2, `mod_expires` will add Expires headers to content that does not come from a file on disk, unless you are using a modification time based setting. Previously, it would never add an Expires header unless content came from a file on disk. This could result in Expires headers being added in places where they were not previously added.
- Standalone **FancyIndexing** directives are now combined with the settings of any IndexOptions directive already in effect, rather than replacing them.
- **AuthName strings will need to be quoted** in .htaccess or server configuration files if they contain blank characters (like spaces). For example, if you use an AuthName directive like this:

  ```
  AuthName This and That
  ```

  you will need to change it to

  ```
  AuthName "This and That"
  ```

  This change was made for consistency in the config language.
- **As of Apache 1.3.1, methods listed in <Limit> directives must be uppercase.** Method names, such as GET, POST, and PUT are defined as being case-sensitive. That is, a GET request is different from a get request. Prior to Apache 1.3.1, the <Limit> directive parser incorrectly treated both of these as being the same. Apache's built-in method limit processing currently only understands uppercase method names, so if you've used clauses such as "<Limit Get post>" in your configuration files, you need to correct them to use uppercase names.

  Unrecognized method names in the server configuration files will result in the server logging an error message and failing to start. In .htaccess files, unknown methods will cause the server to log an error to its error log and return an 'Internal Server Error' page to the client.
- **The default Apache ServerRoot directory changed** from the NCSA-compatible /usr/local/etc/httpd/ to /usr/local/apache/. This change covers only the default setting (and the documentation); it is of course possible to override it using the *-d ServerRoot* and *-f httpd.conf* switches when starting apache.
- Folks using HTTP/1.1-style virtual hosting will need to list the ip:port pairs that are supposed to have HTTP/1.1-style virtual hosting via the `NameVirtualHost` directive (one directive per pair). Previously this support was given implicitly on the "main server address". Now it has to be

explicitly listed so as to avoid many problems that users had. Please see the Apache Virtual H documentation for further details on configuration.

- The precedence of virtual hosts has been reversed (applies mainly to vhosts using HTTP/1.1 Host: headers, and the ServerPath directive). Now the earlier vhosts in the file have precedence over the later vhosts.
- `HostnameLookups` defaults to Off.
- **REMOTE_HOST CGI variable changed.** In Apache 1.2 and earlier, the REMOTE_HOST environment variable made available to CGI scripts was set to either the full DNS name of the client, or else to the client's IP address if the name was not known. This behaviour differed from that specified by the CGI specification, which defines this variable as being NULL if the name isn't known. In Apache 1.3, we have made this correction. REMOTE_ADDR always contains the client's IP address, but REMOTE_HOST is only defined when the server has been able to determine the client's DNS name.
- The undocumented `mod_access` syntax "allow user-agents" was removed. The replacement is the more general "allow from env".
- When using wildcards in pathnames (such as * and ?) they no longer match / (slash). That is, they more closely behave how a UNIX shell behaves. This affects `<Directory>` directives, for example.
- If no `TransferLog` directive is given then nothing will be logged. (Previously it would default to `logs/access_log`.)
- Apache now has configurable error logging levels, and the default eliminates some messages that earlier versions always generated.
- When booting, Apache will now detach itself from stdin, stdout, and stderr. stderr will not be detached until after the config files have been read so you will be able to see initial error messages. After that all errors are logged in the error_log. This makes it more convenient to start Apache via rsh, ssh, or crontabs.
- <Files> sections previously could take a full pathname, and were matched against the full pathnames. This had some inconsistencies, and was removed. To emulate this older behaviour use a <Files> section nested inside a <Directory> section.
- <Location> matching behaviour with respect to slashes has changed. See the <Location> documentation for more info.

Misc Changes

- `ServerType inetd` has been deprecated. It still exists, but bugs are unlikely to be fixed.
- `httpd_monitor` has been deprecated. The replacement is to use `mod_status` and make a request to a URL such as `http://myhost/server-status?refresh=10`.
- Apache now provides an effectively unbuffered connection for CGI scripts. This means that data will be sent to the client as soon as the CGI pauses or stops output; previously, Apache would buffer the output up to a fixed buffer size before sending, which could result in the user viewing an empty page until the CGI finished or output a complete buffer. It is no longer necessary to use an "nph-" CGI to get unbuffered output. Given that most CGIs are written in a language that by

default does buffering (*e.g.*, perl) this shouldn't have a detrimental effect on performance.

"nph-" CGIs, which formerly provided a direct socket to the client without any server post-processing, were not fully compatible with HTTP/1.1 or SSL support. As such they would have had to implement the transport details, such as encryption or chunking, in order to work properly in certain situations. Now, the only difference between nph and non-nph scripts is "non-parsed headers".

- `dbmmanage` has been overhauled.

Third Party Modules

The following changes between the 1.2 and 1.3 API may require slight changes in third party modules not maintained by Apache.

- To avoid symbol clashes with third-party code compiled into the server, the general prefix `` `ap_' `` was globally applied to the following classes of symbols: Apache provided general functions (*e.g.*, `ap_cpystrn`), public API functions (*e.g.*, `palloc`, `bgets`) and private functions which can't be made static (because of cross-object usage) but should be (*e.g.*, `new_connection`). For backward source compatibility with Apache 1.2 a new header file named `compat.h` was created which provides defines for the old symbol names. You'll either have to `#include compat.h` or update the API symbols you use.
- Be sure and examine the source code reorganization page to see whether any item there affects you.
- Use of SERVER_VERSION definition. If third-party modules reference the server version string using this symbol, they should be corrected to obtain it by calling the new API routine `const char *ap_get_server_version()`.
- `ap_construct_url` prototype change. The second parameter was previously a `server_rec`, it has been changed to a `request_rec`.
- The `table` datatype has been made an opaque type. Code which assumes a `table` is the same as an `array_header` will not compile. This is actually a change to enforce the API the way it was intended, all versions of Apache have had a `table_elts()` function which is intended for code which needs to access the elements of a table. The changes required for this are pretty easy, and work with all versions of Apache.

  Suppose `t` is a table. Whenever code refers to `t->elts`, replace it with something like this:

  ```
  array_header *arr = table_elts(t);
  table_entry *elts = (table_entry *)arr->elts;
  ```

  Whenever code refers to `t->nelts` use `arr->nelts`. Many examples can be found in the standard modules, search for `table_elts`.

Apache HTTP Server Version 1.3

Source Re-organisation

As of 1.3, the Apache source directories have been re-organised. This re-organisation is designed to simplify the directory structure, make it easier to add additional modules, and to give module authors a way of specifying compile time options or distribute binary modules.

Summary of Changes

The source changes are:

- The non-module source files have moved from `src` into `src/main`
- The module source files previously in `src` have moved to `src/modules/standard`
- The `support` directory is now in `src/support`
- The existing symbol names used for global Apache function and variable identifiers have been renamed in the source. This way namespace conflicts are avoided when linking Apache with third-party libraries. See the file `src/include/compat.h` both for the list of renamed symbol names and for a way to get source backward compatibility in existing third-party module sources.

In addition, the following enhancements have been made:

- OS abstractions can be added in the `src/os` directory. Currently this contains information for unix, OS/2 and Windows 32 platforms.
- `Configuration` syntax has been simplified for adding new modules. Users no longer need to enter the module's structure name. In addition, new modules can be located anywhere on the file system, or typically in new or existing directories under `src/modules`.
- Module authors can give simpler instructions for adding their modules to Apache compilation. They can also now provide compile time information required by `Configure`, such as additional libraries required.
- Module authors can distribute pre-compiled (.a or .o) versions of their modules if required, along with a "module definition file" which contains the information required by `Configure`.
- All the sub-directories (main, modules/* and os/*) are built as libraries.
- The new Apache Autoconf-style Interface (APACI) script named `configure` replaced the old top-level `Makefile` and `src/helpers/InstallApache` stuff.

Adding Modules

Modules are added to Apache by adding a reference to them in `src/Configuration` then running `Configure` and `make`. In earlier version of Apache before 1.3, the line added to Configuration looked like this:

```
Module    status_module    mod_status.o
```

From 1.3 onwards, the `AddModule` line should be used instead, and typically looks like this:

```
AddModule    modules/standard/mod_status.o
```

The argument to AddModule is the path, relative to `src`, to the module file's source or object file.

Normally when adding a module you should follow the instructions of the module author. However if the module comes as a single source file, say mod_foo.c, then the recommended way to add the module to Apache is as follows:

- Put `mod_foo.c` into the directory `src/modules/extra`
- Go to the `src` directory and add the following line to `Configuration`
  `AddModule modules/extra/mod_foo.o`
- Run `./Configure`
- Run `make`

New Facilities for Module Authors

In previous releases of Apache, new modules were added to the `src` directory, and if the module required any additional compilation options (such as libraries) they would have to be added to `Configuration`. Also the user would have to be told the module's structure name to add on the Module line of `Configuration`.

From Apache 1.3 onwards, module authors can make use of these new features:

- Simplified `Configuration` command AddModule which only requires a path to the module source or object file
- If the module requires compile time options (such as extra libraries) these can be specified in the module file source or an external "module definition file".
- If a module is distributed as binary (.o or .a) then an external "module definition file" can also be distributed which gives the information Configure needs to add the module, such as extra libraries and the module's structure name.
- Modules can be installed anywhere on the file system, although a directory under `src/modules` is recommended.
- If the module is in its own directory, Apache can automatically create a Makefile to build the module given a file containing the module's dependencies.
- For building a third-party module **outside** the Apache source tree the new `apxs` support tool can be used to compile the module into a dynamic shared object (DSO), install it into the existing

Apache installation and optionally activating it in the Apache `httpd.conf` file. The only requirement is that Apache has DSO-support for the used platform and the module `mod_so` w built into the server binary `httpd`.

The rest of this document shows how to package modules for Apache 1.3 and later and what to tell end-users of the module.

Building a simple source distribution

Consider a simple add-on module, distributed as a single file. For example, say it is called mod_demo.c. The archive for this module should consist of two files, in a suitable directory name. For example:

- mod_demo/mod_demo.c
- mod_demo/Makefile.tmpl

(Of course end-user instructions, README's, etc can also be supplied in the archive). The end user should be told to extract this archive in the `src/modules` directory of their Apache source tree. This will create a new directory `src/modules/mod_demo`. Then they need to add the following line to the `Configuration` file:

```
AddModule  modules/mod_demo/mod_demo.o
```

then run `Configure` and `make` as normal.

The `mod_demo/Makefile.tmpl` should contain the dependencies of the module source. For example, a simple module which just interfaces to some standard Apache module API functions might look this this:

```
mod_demo.o: mod_demo.c $(INCDIR)/httpd.h $(INCDIR)/http_protocol.h
```

When the user runs `Configure` Apache will create a full makefile to build this module. If this module also requires some additional built-time options to be given, such as libraries, see the next section.

If the module also comes with header files, these can be added to the archive. If the module consists of multiple source files it can be built into a library file using a supplied makefile. In this case, distribute the makefile as `mod_demo/Makefile` and **do not** include a `mod_demo/Makefile.tmpl`. If `Configure` sees a `Makefile.tmpl` it assumes it is safe to overwrite any existing `Makefile`.

See the Apache `src/modules/standard` for an example of a module directory where the makefile is created automatically from a Makefile.tmpl file (note that this directory also shows how to distribute multiple modules in a single directory). See `src/modules/proxy` and `src/modules/example` for examples of modules built using custom makefiles (to build a library and an object file, respectively).

Adding Compile time Information

Apache source files (or module definition files, see below) can contain information used by `Configure` to add compile-time options such as additional libraries. For example, if mod_demo in the example above also requires that Apache be linked against a DBM library, then the following text could be inserted into the mod_demo.c source:


```
/*
 * Module definition information - the part between the -START and -END
 * lines below is used by Configure. This could be stored in a separate
 * instead.
 *
 * MODULE-DEFINITION-START
 * Name: demo_module
 * ConfigStart
    LIBS="$LIBS $DBM_LIB"
    if [ "X$DBM_LIB" != "X" ]; then
        echo " + using $DBM_LIB for mod_demo"
    fi
 * ConfigEnd
 * MODULE-DEFINITION-END
 */
```

Note that this is contained inside a C language comment to hide it from the compiler. Anything between the lines which contains `MODULE-DEFINITION-START` and `MODULE-DEFINITION-END` is used by `Configure`. The `Name:` line gives the module's structure name. This is not really necessary in this case since if not present `Configure` will guess at a name based on the filename (*e.g.*, given "mod_demo" it will remove the leading "mod_" and append "_module" to get a structure name. This works with all modules distributed with Apache).

The lines between `ConfigStart` and `ConfigEnd` as executed by `Configure` and can be used to add compile-time options and libraries. In this case it adds the DBM library (from $DBM_LIB) to the standard compilation libraries ($LIB) and displays a message.

See the default distribution's mod_auth_dbm.c for an example of an embedded module definition.

Module Definition Information for Binary Distribitions

If the module is to be distributed as binary (object or library) rather than source, it is not possible to add the module definition information to the source file. In this case it can be placed in a separate file which has the same base name as the object or library file, but with a `.module` extension. So, for example, if the distributed module object file is mod_demo.o, the module definition file should be called mod_demo.module. It contains the same information as above, but does not need to be inside a C comment or delimited with `MODULE-DEFINITION-START` *etc.* For example:

```
Name: demo_module
ConfigStart
 LIBS="$LIBS $DBM_LIB"
 if [ "X$DBM_LIB" != "X" ]; then
     echo " + using $DBM_LIB for mod_demo"
 fi
ConfigEnd
```

See the default distribution's mod_auth_db.module for an example of a separate module definition file.

Apache HTTP Server Version 1.3

Apache 1.3 Dynamic Shared Object (DSO) Support

Originally written by
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Background

On modern Unix derivatives there exists a nifty mechanism usually called dynamic linking/loading of *Dynamic Shared Objects* (DSO) which provides a way to build a piece of program code in a special format for loading it at run-time into the address space of an executable program.

This loading can usually be done in two ways: Automatically by a system program called `ld.so` when an executable program is started or manually from within the executing program via a programmatic system interface to the Unix loader through the system calls `dlopen()/dlsym()`.

In the first way the DSO's are usually called *shared libraries* or *DSO libraries* and named `libfoo.so` or `libfoo.so.1.2`. They reside in a system directory (usually `/usr/lib`) and the link to the executable program is established at build-time by specifying `-lfoo` to the linker command. This hard-codes library references into the executable program file so that at start-time the Unix loader is able to locate `libfoo.so` in `/usr/lib`, in paths hard-coded via linker-options like `-R` or in paths configured via the environment variable `LD_LIBRARY_PATH`. It then resolves any (yet unresolved) symbols in the executable program which are available in the DSO.

Symbols in the executable program are usually not referenced by the DSO (because it's a reusable library of general code) and hence no further resolving has to be done. The executable program has no need to do anything on its own to use the symbols from the DSO because the complete resolving is done by the Unix loader. (In fact, the code to invoke `ld.so` is part of the run-time startup code which is linked into every executable program which has been bound non-static). The advantage of dynamic loading of common library code is obvious: the library code needs to be stored only once, in a system library like `libc.so`, saving disk space for every program.

In the second way the DSO's are usually called *shared objects* or *DSO files* and can be named with an arbitrary extension (although the canonical name is `foo.so`). These files usually stay inside a program-specific directory and there is no automatically established link to the executable program where they are used. Instead the executable program manually loads the DSO at run-time into its address space via `dlopen()`. At this time no resolving of symbols from the DSO for the executable program is done. But instead the Unix loader automatically resolves any (yet unresolved) symbols in the DSO from the set of symbols exported by the executable program and its already loaded DSO libraries (especially all symbols from the ubiquitous `libc.so`). This way the DSO gets knowledge of the executable program's symbol set as if it had been statically linked with it in the first place.

Finally, to take advantage of the DSO's API the executable program has to resolve particular symbols from the DSO via `dlsym()` for later use inside dispatch tables *etc.* In other words: The executable program has to manually resolve every symbol it needs to be able to use it. The advantage of such a mechanism is that optional program parts need not be loaded (and thus do not spend memory) until they are needed by the program in question. When required, these program parts can be loaded dynamically to extend the base program's functionality.

Although this DSO mechanism sounds straightforward there is at least one difficult step here: The resolving of symbols from the executable program for the DSO when using a DSO to extend a program (the second way). Why?

Because "reverse resolving" DSO symbols from the executable program's symbol set is against the library design (where the library has no knowledge about the programs it is used by) and is neither available under all platforms nor standardized. In practice the executable program's global symbols are often not re-exported and thus not available for use in a DSO. Finding a way to force the linker to export all global symbols is the main problem one has to solve when using DSO for extending a program at run-time.

Practical Usage

The shared library approach is the typical one, because it is what the DSO mechanism was designed for, hence it is used for nearly all types of libraries the operating system provides. On the other hand using shared objects for extending a program is not used by a lot of programs.

As of 1998 there are only a few software packages available which use the DSO mechanism to actually extend their functionality at run-time: Perl 5 (via its XS mechanism and the DynaLoader module), Netscape Server, *etc.* Starting with version 1.3, Apache joined the crew, because Apache already uses a module concept to extend its functionality and internally uses a dispatch-list-based approach to link external modules into the Apache core functionality. So, Apache is really predestined for using DSO to load its modules at run-time.

As of Apache 1.3, the configuration system supports two optional features for taking advantage of the modular DSO approach: compilation of the Apache core program into a DSO library for shared usage and compilation of the Apache modules into DSO files for explicit loading at run-time.

Implementation

The DSO support for loading individual Apache modules is based on a module named `mod_so.c` which has to be statically compiled into the Apache core. It is the only module besides `http_core.c` which cannot be put into a DSO itself (bootstrapping!). Practically all other distributed Apache modules then can then be placed into a DSO by individually enabling the DSO build for them via `configure`'s `--enable-shared` option (see top-level `INSTALL` file) or by changing the `AddModule` command in your `src/Configuration` into a `SharedModule` command (see `src/INSTALL` file). After a module is compiled into a DSO named `mod_foo.so` you can use `mod_so`'s `LoadModule` command in your `httpd.conf` file to load this module at server startup or restart.

To simplify this creation of DSO files for Apache modules (especially for third-party modules) a new support program named `apxs` (*APache eXtenSion*) is available. It can be used to build DSO based modules *outside of* the Apache source tree. The idea is simple: When installing Apache the `configure`'s `make install` procedure installs the Apache C header files and puts the platform-dependent compiler and linker flags for building DSO files into the `apxs` program. This way the user can use `apxs` to compile his Apache module sources without the Apache distribution source tree and without having to fiddle with the platform-dependent compiler and linker flags for DSO support.

To place the complete Apache core program into a DSO library (only required on some of the supported platforms to force the linker to export the apache core symbols -- a prerequisite for the DSO modularization) the rule `SHARED_CORE` has to be enabled via `configure`'s `--enable-rule=SHARED_CORE` option (see top-level `INSTALL` file) or by changing the `Rule` command in your `Configuration` file to `Rule SHARED_CORE=yes` (see `src/INSTALL` file). The Apache core code is then placed into a DSO library named `libhttpd.so`. Because one cannot link a DSO against static libraries on all platforms, an additional executable program named `libhttpd.ep` is created which both binds this static code and provides a stub for the `main()` function. Finally the `httpd` executable program itself is replaced by a bootstrapping code which automatically makes sure the Unix loader is able to load and start `libhttpd.ep` by providing the `LD_LIBRARY_PATH` to `libhttpd.so`.

Supported Platforms

Apache's `src/Configure` script currently has only limited but adequate built-in knowledge on how to compile DSO files, because as already mentioned this is heavily platform-dependent. Nevertheless all major Unix platforms are supported. The definitive current state (May 1999) is this:

- Out-of-the-box supported platforms:

(actually tested versions in parenthesis)

```
o  FreeBSD            (2.1.5, 2.2.x, 3.x, 4.x)
o  OpenBSD            (2.x)
o  NetBSD             (1.3.1)
o  BSDI               (3.x, 4.x)
o  Linux              (Debian/1.3.1, RedHat/4.2)
o  Solaris            (2.4, 2.5, 2.6, 2.7)
o  SunOS              (4.1.3)
o  Digital UNIX       (4.0)
o  IRIX               (5.3, 6.2)
o  HP/UX              (10.20)
o  UnixWare           (2.01, 2.1.2)
o  SCO                (5.0.4)
o  AIX                (3.2, 4.1.5, 4.2, 4.3)
o  ReliantUNIX/SINIX  (5.43)
o  SVR4               (-)
o  Mac OS X Server    (1.0)
o  Mac OS             (10.0 preview 1)
o  OpenStep/Mach      (4.2)
o  DGUX               (??)
```

- Explicitly unsupported platforms:

```
o  Ultrix            (no dlopen-style interface under this platform)
```

Usage Summary

To give you an overview of the DSO features of Apache 1.3, here is a short and concise summary:

1. Placing the Apache core code (all the stuff which usually forms the `httpd` binary) into a DSO `libhttpd.so`, an executable program `libhttpd.ep` and a bootstrapping executable program `httpd` (Notice: this is only required on some of the supported platforms to force the linker to export the Apache core symbols, which in turn is a prerequisite for the DSO modularization):
   - Build and install via `configure` (preferred):

     ```
     $ ./configure --prefix=/path/to/install
                   --enable-rule=SHARED_CORE ...
     $ make install
     ```

   - Build and install manually:

     ```
     - Edit src/Configuration:
       << Rule SHARED_CORE=default
       >> Rule SHARED_CORE=yes
       << EXTRA_CFLAGS=
       >> EXTRA_CFLAGS= -DSHARED_CORE_DIR=\"/path/to/install/libexec\"
     $ make
     $ cp src/libhttpd.so* /path/to/install/libexec/
     $ cp src/libhttpd.ep  /path/to/install/libexec/
     $ cp src/httpd        /path/to/install/bin/
     ```

2. Build and install a *distributed* Apache module, say `mod_foo.c`, into its own DSO `mod_foo.so`:
   - Build and install via `configure` (preferred):


```
$ ./configure --prefix=/path/to/install
        --enable-shared=foo
$ make install
```

- Build and install manually:

```
- Edit src/Configuration:
  << AddModule    modules/xxxx/mod_foo.o
  >> SharedModule modules/xxxx/mod_foo.so
$ make
$ cp src/xxxx/mod_foo.so /path/to/install/libexec
- Edit /path/to/install/etc/httpd.conf
  >> LoadModule foo_module /path/to/install/libexec/mod_foo.so
```

3. Build and install a *third-party* Apache module, say `mod_foo.c`, into its own DSO `mod_foo.so`
   - Build and install via `configure` (preferred):

```
$ ./configure --add-module=/path/to/3rdparty/mod_foo.c
        --enable-shared=foo
$ make install
```

   - Build and install manually:

```
$ cp /path/to/3rdparty/mod_foo.c /path/to/apache-1.3/src/modules/extra/
- Edit src/Configuration:
  >> SharedModule modules/extra/mod_foo.so
$ make
$ cp src/xxxx/mod_foo.so /path/to/install/libexec
- Edit /path/to/install/etc/httpd.conf
  >> LoadModule foo_module /path/to/install/libexec/mod_foo.so
```

4. Build and install a *third-party* Apache module, say `mod_foo.c`, into its own DSO `mod_foo.so` *outside of* the Apache source tree:
   - Build and install via `apxs`:

```
$ cd /path/to/3rdparty
$ apxs -c mod_foo.c
$ apxs -i -a -n foo mod_foo.so
```

Advantages & Disadvantages

The above DSO based features of Apache 1.3 have the following advantages:

- The server package is more flexible at run-time because the actual server process can be assembled at run-time via `LoadModule` `httpd.conf` configuration commands instead of `Configuration` `AddModule` commands at build-time. For instance this way one is able to run different server instances (standard & SSL version, minimalistic & powered up version [mod_perl, PHP3], *etc.*) with only one Apache installation.
- The server package can be easily extended with third-party modules even after installation. This is at least a great benefit for vendor package maintainers who can create a Apache core package and additional packages

containing extensions like PHP3, mod_perl, mod_fastcgi, *etc.*

- Easier Apache module prototyping because with the DSO/`apxs` pair you can both work outside the Apache source tree and only need an `apxs -i` command followed by an `apachectl restart` to bring a new version of your currently developed module into the running Apache server.

DSO has the following disadvantages:

- The DSO mechanism cannot be used on every platform because not all operating systems support dynamic loading of code into the address space of a program.
- The server is approximately 20% slower at startup time because of the symbol resolving overhead the Unix loader now has to do.
- The server is approximately 5% slower at execution time under some platforms because position independent code (PIC) sometimes needs complicated assembler tricks for relative addressing which are not necessarily as fast as absolute addressing.
- Because DSO modules cannot be linked against other DSO-based libraries (`ld -lfoo`) on all platforms (for instance a.out-based platforms usually don't provide this functionality while ELF-based platforms do) you cannot use the DSO mechanism for all types of modules. Or in other words, modules compiled as DSO files are restricted to only use symbols from the Apache core, from the C library (`libc`) and all other dynamic or static libraries used by the Apache core, or from static library archives (`libfoo.a`) containing position independent code. The only chances to use other code is to either make sure the Apache core itself already contains a reference to it, loading the code yourself via `dlopen()` or enabling the `SHARED_CHAIN` rule while building Apache when your platform supports linking DSO files against DSO libraries.
- Under some platforms (many SVR4 systems) there is no way to force the linker to export all global symbols for use in DSO's when linking the Apache httpd executable program. But without the visibility of the Apache core symbols no standard Apache module could be used as a DSO. The only chance here is to use the `SHARED_CORE` feature because this way the global symbols are forced to be exported. As a consequence the Apache `src/Configure` script automatically enforces `SHARED_CORE` on these platforms when DSO features are used in the `Configuration` file or on the configure command line.

Apache HTTP Server Version 1.3

Module mod_so

This module is contained in the `mod_so.c` file. It is compiled in by default on Windows and is not compiled in by default on Unix. It provides for loading of executable code and modules into the server at start-up or restart time. On Unix, the loaded code typically comes from shared object files (usually with .so extension), whilst on Windows this module loads DLL files. This module is only available in Apache 1.3 and up.

In previous releases, the functionality of this module was provided for Unix by mod_dld, and for Windows by mod_dll. On Windows, mod_dll was used in beta release 1.3b1 through 1.3b5. mod_so combines these two modules into a single module for all operating systems.

Summary

This is an experimental module. On selected operating systems it can be used to load modules into Apache at runtime via the Dynamic Shared Object (DSO) mechanism, rather than requiring a recompilation.

Directives

- LoadFile
- LoadModule

LoadFile

Syntax: LoadFile *filename filename* ...
Context: server config
Status: Base
Module: mod_so

The LoadFile directive links in the named object files or libraries when the server is started or restarted; this is used to load additional code which may be required for some module to work. *Filename* is either and absolute path or relative to ServerRoot.

LoadModule

Syntax: LoadModule *module filename*
Context: server config
Status: Base
Module: mod_so

The LoadModule directive links in the object file or library *filename* and adds the module structure named *module* to the list of active modules. *Module* is the name of the external variable of type `module` in the file. Example (Unix):

```
LoadModule status_module modules/mod_status.so
```

Example (Windows):

```
LoadModule status_module modules/ApacheModuleStatus.dll
```

loads the named module from the modules subdirectory of the ServerRoot.

Creating DLL Modules for Windows

The Apache module API is unchanged between the Unix and Windows versions. Many modules will run on Windows with no or little change from Unix, although others rely on aspects of the Unix architecture which are not present in Windows, and will not work.

When a module does work, it can be added to the server in one of two ways. As with Unix, it can be compiled into the server. Because Apache for Windows does not have the `Configure` program of Apache for Unix, the module's source file must be added to the ApacheCore project file, and its symbols must be added to the `os\win32\modules.c` file.

The second way is to compile the module as a DLL, a shared library that can be loaded into the server at runtime, using the `LoadModule` directive. These module DLLs can be distributed and run on any Apache for Windows installation, without recompilation of the server.

To create a module DLL, a small change is necessary to the module's source file: The module record must be exported from the DLL (which will be created later; see below). To do this, add the `MODULE_VAR_EXPORT` (defined in the Apache header files) to your module's module record definition. For example, if your module has:

```
module foo_module;
```

Replace the above with:

```
module MODULE_VAR_EXPORT foo_module;
```

Note that this will only be activated on Windows, so the module can continue to be used, unchanged,

with Unix if needed. Also, if you are familiar with `.DEF` files, you can export the module record wit that method instead.

Now, create a DLL containing your module. You will need to link this against the ApacheCore.lib export library that is created when the ApacheCore.dll shared library is compiled. You may also have to change the compiler settings to ensure that the Apache header files are correctly located.

This should create a DLL version of your module. Now simply place it in the modules directory of your server root, and use the `LoadModule` directive to load it.

Apache Performance Notes

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Introduction

Apache is a general webserver, which is designed to be correct first, and fast second. Even so, it's performance is quite satisfactory. Most sites have less than 10Mbits of outgoing bandwidth, which Apache can fill using only a low end Pentium-based webserver. In practice sites with more bandwidth require more than one machine to fill the bandwidth due to other constraints (such as CGI or database transaction overhead). For these reasons the development focus has been mostly on correctness and configurability.

Unfortunately many folks overlook these facts and cite raw performance numbers as if they are some indication of the quality of a web server product. There is a bare minimum performance that is acceptable, beyond that extra speed only caters to a much smaller segment of the market. But in order to avoid this hurdle to the acceptance of Apache in some markets, effort was put into Apache 1.3 to bring performance up to a point where the difference with other high-end webservers is minimal.

Finally there are the folks who just plain want to see how fast something can go. The author falls into this category. The rest of this document is dedicated to these folks who want to squeeze every last bit of performance out of Apache's current model, and want to understand why it does some things which slow it down.

Note that this is tailored towards Apache 1.3 on Unix. Some of it applies to Apache on NT. Apache on NT has not been tuned for performance yet, in fact it probably performs very poorly because NT performance requires a different programming model.

Hardware and Operating System Issues

The single biggest hardware issue affecting webserver performance is RAM. A webserver should never ever have to swap, swapping increases the latency of each request beyond a point that users consider "fast enough". This causes users to hit stop and reload, further increasing the load. You can, and should, control the `MaxClients` setting so that your server does not spawn so many children it starts swapping.

Beyond that the rest is mundane: get a fast enough CPU, a fast enough network card, and fast enough disks, where "fast enough" is something that needs to be determined by experimentation.

Operating system choice is largely a matter of local concerns. But a general guideline is to always apply the latest vendor TCP/IP patches. HTTP serving completely breaks many of the assumptions built into Unix kernels up through 1994 and even 1995. Good choices include recent FreeBSD, and Linux.

Run-Time Configuration Issues

HostnameLookups

Prior to Apache 1.3, `HostnameLookups` defaulted to On. This adds latency to every request because it requires a DNS lookup to complete before the request is finished. In Apache 1.3 this setting defaults to Off. However (1.3 or later), if you use any `allow from domain` or `deny from domain` directives then you will pay for a double reverse DNS lookup (a reverse, followed by a forward to make sure that the reverse is not being spoofed). So for the highest performance avoid using these directives (it's fine to use IP addresses rather than domain names).

Note that it's possible to scope the directives, such as within a `<Location /server-status>` section. In this case the DNS lookups are only performed on requests matching the criteria. Here's an example which disables lookups except for .html and .cgi files:

```
HostnameLookups off
<Files ~ "\.(html|cgi)$>
    HostnameLookups on
</Files>
```

But even still, if you just need DNS names in some CGIs you could consider doing the `gethostbyname` call in the specific CGIs that need it.

FollowSymLinks and SymLinksIfOwnerMatch

Wherever in your URL-space you do not have an `Options FollowSymLinks`, or you do have an `Options SymLinksIfOwnerMatch` Apache will have to issue extra system calls to check up on symlinks. One extra call per filename component. For example, if you had:

```
DocumentRoot /www/htdocs
<Directory />
    Options SymLinksIfOwnerMatch
</Directory>
```

and a request is made for the URI `/index.html`. Then Apache will perform `lstat(2)` on `/www`, `/www/htdocs`, and `/www/htdocs/index.html`. The results of these `lstats` are never cached, so they will occur on every single request. If you really desire the symlinks security checking you can do something like this:

```
DocumentRoot /www/htdocs
<Directory />
    Options FollowSymLinks
</Directory>
<Directory /www/htdocs>
    Options -FollowSymLinks +SymLinksIfOwnerMatch
</Directory>
```

This at least avoids the extra checks for the `DocumentRoot` path. Note that you'll need to add similar sections if you have any `Alias` or `RewriteRule` paths outside of your document root. For highest performance, and no symlink protection, set `FollowSymLinks` everywhere, and never set `SymLinksIfOwnerMatch`.

AllowOverride

Wherever in your URL-space you allow overrides (typically `.htaccess` files) Apache will attempt to open `.htaccess` for each filename component. For example,

```
DocumentRoot /www/htdocs
<Directory />
    AllowOverride all
</Directory>
```

and a request is made for the URI `/index.html`. Then Apache will attempt to open `/.htaccess`, `/www/.htaccess`, and `/www/htdocs/.htaccess`. The solutions are similar to the previous case of `Options FollowSymLinks`. For highest performance use `AllowOverride None` everywhere in your filesystem.

Negotiation

If at all possible, avoid content-negotiation if you're really interested in every last ounce of performance. In practice the benefits of negotiation outweigh the performance penalties. There's one case where you can speed up the server. Instead of using a wildcard such as:

```
DirectoryIndex index
```

Use a complete list of options:

```
DirectoryIndex index.cgi index.pl index.shtml index.html
```

where you list the most common choice first.

Process Creation

Prior to Apache 1.3 the `MinSpareServers`, `MaxSpareServers`, and `StartServers` settings all had drastic effects on benchmark results. In particular, Apache required a "ramp-up" period in order to reach a number of children sufficient to serve the load being applied. After the initial spawning of `StartServers` children, only one child per second would be created to satisfy the `MinSpareServers` setting. So a server being accessed by 100 simultaneous clients, using the default `StartServers` of 5 would take on the order 95 seconds to spawn enough children to handle the load. This works fine in practice on real-life servers, because they aren't restarted frequently. But does really poorly on benchmarks which might only run for ten minutes.

The one-per-second rule was implemented in an effort to avoid swamping the machine with the startup of new children. If the machine is busy spawning children it can't service requests. But it has such a drastic effect on the perceived performance of Ap that it had to be replaced. As of Apache 1.3, the code will relax the one-per-second rule. It will spawn one, wait a second, then spawn two, wait a second, then spawn four, and it will continue exponentially until it is spawning 32 children per second. It will stop whenever it satisfies the `MinSpareServers` setting.

This appears to be responsive enough that it's almost unnecessary to twiddle the `MinSpareServers`, `MaxSpareServers` and `StartServers` knobs. When more than 4 children are spawned per second, a message will be emitted to the `ErrorLog`. If you see a lot of these errors then consider tuning these settings. Use the `mod_status` output as a guide.

Related to process creation is process death induced by the `MaxRequestsPerChild` setting. By default this is 0, which means that there is no limit to the number of requests handled per child. If your configuration currently has this set to some very low number, such as 30, you may want to bump this up significantly. If you are running SunOS or an old version of Solaris, limit this to 10000 or so because of memory leaks.

When keep-alives are in use, children will be kept busy doing nothing waiting for more requests on the already open connection. The default `KeepAliveTimeout` of 15 seconds attempts to minimize this effect. The tradeoff here is between network bandwidth and server resources. In no event should you raise this above about 60 seconds, as most of the benefits are lost.

Compile-Time Configuration Issues

mod_status and ExtendedStatus On

If you include `mod_status` and you also set `ExtendedStatus On` when building and running Apache, then on every request Apache will perform two calls to `gettimeofday(2)` (or `times(2)` depending on your operating system), and (pre-1.3) several extra calls to `time(2)`. This is all done so that the status report contains timing indications. For highest performance, set `ExtendedStatus off` (which is the default).

accept Serialization - multiple sockets

This discusses a shortcoming in the Unix socket API. Suppose your web server uses multiple `Listen` statements to listen on either multiple ports or multiple addresses. In order to test each socket to see if a connection is ready Apache uses `select(2)`. `select(2)` indicates that a socket has *zero* or *at least one* connection waiting on it. Apache's model includes multiple children, and all the idle ones test for new connections at the same time. A naive implementation looks something like this (these examples do not match the code, they're contrived for pedagogical purposes):

```
        for (;;) {
            for (;;) {
                fd_set accept_fds;

                FD_ZERO (&accept_fds);
                for (i = first_socket; i <= last_socket; ++i) {
                    FD_SET (i, &accept_fds);
                }
                rc = select (last_socket+1, &accept_fds, NULL, NULL, NULL);
                if (rc < 1) continue;
                new_connection = -1;
                for (i = first_socket; i <= last_socket; ++i) {
                    if (FD_ISSET (i, &accept_fds)) {
                        new_connection = accept (i, NULL, NULL);
                        if (new_connection != -1) break;
                    }
                }
                if (new_connection != -1) break;
            }
            process the new_connection;
        }
```

But this naive implementation has a serious starvation problem. Recall that multiple children execute this loop at the same time, and so multiple children will block at `select` when they are in between requests. All those blocked children will awaken and return

from `select` when a single request appears on any socket (the number of children which awaken varies depending on the operating system and timing issues). They will all then fall down into the loop and try to `accept` the connection. But only one will succeed (assuming there's still only one connection ready), the rest will be *blocked* in `accept`. This effectively locks those children into serving requests from that one socket and no other sockets, and they'll be stuck there until enough new requests appear on that socket to wake them all up. This starvation problem was first documented in PR#467. There are at least two solutions.

One solution is to make the sockets non-blocking. In this case the `accept` won't block the children, and they will be allowed to continue immediately. But this wastes CPU time. Suppose you have ten idle children in `select`, and one connection arrives. Then nine of those children will wake up, try to `accept` the connection, fail, and loop back into `select`, accomplishing nothing. Meanwhile none of those children are servicing requests that occurred on other sockets until they get back up to the `select` again. Overall this solution does not seem very fruitful unless you have as many idle CPUs (in a multiprocessor box) as you have idle children, not a very likely situation.

Another solution, the one used by Apache, is to serialize entry into the inner loop. The loop looks like this (differences highlighted):

```
    for (;;) {
        accept_mutex_on ();
        for (;;) {
            fd_set accept_fds;

            FD_ZERO (&accept_fds);
            for (i = first_socket; i <= last_socket; ++i) {
                FD_SET (i, &accept_fds);
            }
            rc = select (last_socket+1, &accept_fds, NULL, NULL, NULL);
            if (rc < 1) continue;
            new_connection = -1;
            for (i = first_socket; i <= last_socket; ++i) {
                if (FD_ISSET (i, &accept_fds)) {
                    new_connection = accept (i, NULL, NULL);
                    if (new_connection != -1) break;
                }
            }
            if (new_connection != -1) break;
        }
        accept_mutex_off ();
        process the new_connection;
    }
```

The functions `accept_mutex_on` and `accept_mutex_off` implement a mutual exclusion semaphore. Only one child can have the mutex at any time. There are several choices for implementing these mutexes. The choice is defined in `src/conf.h` (pre-1.3) or `src/include/ap_config.h` (1.3 or later). Some architectures do not have any locking choice made, on these architectures it is unsafe to use multiple `Listen` directives.

`USE_FLOCK_SERIALIZED_ACCEPT`

This method uses the `flock(2)` system call to lock a lock file (located by the `LockFile` directive).

`USE_FCNTL_SERIALIZED_ACCEPT`

This method uses the `fcntl(2)` system call to lock a lock file (located by the `LockFile` directive).

`USE_SYSVSEM_SERIALIZED_ACCEPT`

(1.3 or later) This method uses SysV-style semaphores to implement the mutex. Unfortunately SysV-style semaphores have some bad side-effects. One is that it's possible Apache will die without cleaning up the semaphore (see the `ipcs(8)` man page). The other is that the semaphore API allows for a denial of service attack by any CGIs running under the same uid as the webserver (*i.e.*, all CGIs unless you use something like suexec or cgiwrapper). For these reasons this method is not used on any architecture except IRIX (where the previous two are prohibitively expensive on most IRIX boxes).

`USE_USLOCK_SERIALIZED_ACCEPT`

(1.3 or later) This method is only available on IRIX, and uses `usconfig(2)` to create a mutex. While this method avoids the hassles of SysV-style semaphores, it is not the default for IRIX. This is because on single processor IRIX boxes (5.3 or 6.2) the uslock code is two orders of magnitude slower than the SysV-semaphore code. On multi-processor IRIX boxes the uslock code

is an order of magnitude faster than the SysV-semaphore code. Kind of a messed up situation. So if you're using a multiprocessor IRIX box then you should rebuild your webserver with `-DUSE_USLOCK_SERIALIZED_ACCEPT` on t/ `EXTRA_CFLAGS`.

`USE_PTHREAD_SERIALIZED_ACCEPT`

(1.3 or later) This method uses POSIX mutexes and should work on any architecture implementing the full POSIX threads specification, however appears to only work on Solaris (2.5 or later), and even then only in certain configurations. If you experiment with this you should watch out for your server hanging and not responding. Static content only servers may work just fine.

If your system has another method of serialization which isn't in the above list then it may be worthwhile adding code for it (and submitting a patch back to Apache).

Another solution that has been considered but never implemented is to partially serialize the loop -- that is, let in a certain number of processes. This would only be of interest on multiprocessor boxes where it's possible multiple children could run simultaneously, and the serialization actually doesn't take advantage of the full bandwidth. This is a possible area of future investigation, but priority remains low because highly parallel web servers are not the norm.

Ideally you should run servers without multiple `Listen` statements if you want the highest performance. But read on.

accept Serialization - single socket

The above is fine and dandy for multiple socket servers, but what about single socket servers? In theory they shouldn't experience any of these same problems because all children can just block in `accept(2)` until a connection arrives, and no starvation results. In practice this hides almost the same "spinning" behaviour discussed above in the non-blocking solution. The way that most TCP stacks are implemented, the kernel actually wakes up all processes blocked in `accept` when a single connection arrives. One of those processes gets the connection and returns to user-space, the rest spin in the kernel and go back to sleep when they discover there's no connection for them. This spinning is hidden from the user-land code, but it's there nonetheless. This can result in the same load-spiking wasteful behaviour that a non-blocking solution to the multiple sockets case can.

For this reason we have found that many architectures behave more "nicely" if we serialize even the single socket case. So this is actually the default in almost all cases. Crude experiments under Linux (2.0.30 on a dual Pentium pro 166 w/128Mb RAM) have shown that the serialization of the single socket case causes less than a 3% decrease in requests per second over unserialized single-socket. But unserialized single-socket showed an extra 100ms latency on each request. This latency is probably a wash on long haul lines, and only an issue on LANs. If you want to override the single socket serialization you can define `SINGLE_LISTEN_UNSERIALIZED_ACCEPT` and then single-socket servers will not serialize at all.

Lingering Close

As discussed in draft-ietf-http-connection-00.txt section 8, in order for an HTTP server to **reliably** implement the protocol it needs to shutdown each direction of the communication independently (recall that a TCP connection is bi-directional, each half is independent of the other). This fact is often overlooked by other servers, but is correctly implemented in Apache as of 1.2.

When this feature was added to Apache it caused a flurry of problems on various versions of Unix because of a shortsightedness. The TCP specification does not state that the FIN_WAIT_2 state has a timeout, but it doesn't prohibit it. On systems without the timeout, Apache 1.2 induces many sockets stuck forever in the FIN_WAIT_2 state. In many cases this can be avoided by simply upgrading to the latest TCP/IP patches supplied by the vendor, in cases where the vendor has never released patches (*i.e.*, SunOS4 -- although folks with a source license can patch it themselves) we have decided to disable this feature.

There are two ways of accomplishing this. One is the socket option `SO_LINGER`. But as fate would have it, this has never been implemented properly in most TCP/IP stacks. Even on those stacks with a proper implementation (*i.e.*, Linux 2.0.31) this method proves to be more expensive (cputime) than the next solution.

For the most part, Apache implements this in a function called `lingering_close` (in `http_main.c`). The function looks roughly like this:

```
void lingering_close (int s)
{
    char junk_buffer[2048];

    /* shutdown the sending side */
    shutdown (s, 1);
```


```
        signal (SIGALRM, lingering_death);
        alarm (30);

        for (;;) {
            select (s for reading, 2 second timeout);
            if (error) break;
            if (s is ready for reading) {
                read (s, junk_buffer, sizeof (junk_buffer));
                /* just toss away whatever is here */
            }
        }

        close (s);
    }
```

This naturally adds some expense at the end of a connection, but it is required for a reliable implementation. As HTTP/1.1 becomes more prevalent, and all connections are persistent, this expense will be amortized over more requests. If you want to play with fire and disable this feature you can define `NO_LINGCLOSE`, but this is not recommended at all. In particular, as HTTP/1.1 pipelined persistent connections come into use `lingering_close` is an absolute necessity (and pipelined connections are faster, so you want to support them).

Scoreboard File

Apache's parent and children communicate with each other through something called the scoreboard. Ideally this should be implemented in shared memory. For those operating systems that we either have access to, or have been given detailed ports for, it typically is implemented using shared memory. The rest default to using an on-disk file. The on-disk file is not only slow, but it is unreliable (and less featured). Peruse the `src/main/conf.h` file for your architecture and look for either `USE_MMAP_SCOREBOARD` or `USE_SHMGET_SCOREBOARD`. Defining one of those two (as well as their companions `HAVE_MMAP` and `HAVE_SHMGET` respectively) enables the supplied shared memory code. If your system has another type of shared memory, edit the file `src/main/http_main.c` and add the hooks necessary to use it in Apache. (Send us back a patch too please.)

Historical note: The Linux port of Apache didn't start to use shared memory until version 1.2 of Apache. This oversight resulted in really poor and unreliable behaviour of earlier versions of Apache on Linux.

DYNAMIC_MODULE_LIMIT

If you have no intention of using dynamically loaded modules (you probably don't if you're reading this and tuning your server for every last ounce of performance) then you should add `-DDYNAMIC_MODULE_LIMIT=0` when building your server. This will save RAM that's allocated only for supporting dynamically loaded modules.

Appendix: Detailed Analysis of a Trace

Here is a system call trace of Apache 1.3 running on Linux. The run-time configuration file is essentially the default plus:

```
<Directory />
    AllowOverride none
    Options FollowSymLinks
</Directory>
```

The file being requested is a static 6K file of no particular content. Traces of non-static requests or requests with content negotiation look wildly different (and quite ugly in some cases). First the entire trace, then we'll examine details. (This was generated by the `strace` program, other similar programs include `truss`, `ktrace`, and `par`.)

```
accept(15, {sin_family=AF_INET, sin_port=htons(22283),
sin_addr=inet_addr("127.0.0.1")}, [16]) = 3
flock(18, LOCK_UN)                      = 0
sigaction(SIGUSR1, {SIG_IGN}, {0x8059954, [], SA_INTERRUPT}) = 0
getsockname(3, {sin_family=AF_INET, sin_port=htons(8080),
sin_addr=inet_addr("127.0.0.1")}, [16]) = 0
```


```
setsockopt(3, IPPROTO_TCP1, [1], 4)     = 0
read(3, "GET /6k HTTP/1.0\r\nUser-Agent: "..., 4096) = 60
sigaction(SIGUSR1, {SIG_IGN}, {SIG_IGN}) = 0
time(NULL)                              = 873959960
gettimeofday({873959960, 404935}, NULL) = 0
stat("/home/dgaudet/ap/apachen/htdocs/6k", {st_mode=S_IFREG|0644, st_size=6144, ...})
= 0
open("/home/dgaudet/ap/apachen/htdocs/6k", O_RDONLY) = 4
mmap(0, 6144, PROT_READ, MAP_PRIVATE, 4, 0) = 0x400ee000
writev(3, [{"HTTP/1.1 200 OK\r\nDate: Thu, 11"..., 245},
{"\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0"..., 6144}], 2) = 6389
close(4)                                = 0
time(NULL)                              = 873959960
write(17, "127.0.0.1 - - [10/Sep/1997:23:39"..., 71) = 71
gettimeofday({873959960, 417742}, NULL) = 0
times({tms_utime=5, tms_stime=0, tms_cutime=0, tms_cstime=0}) = 446747
shutdown(3, 1 /* send */)               = 0
oldselect(4, [3], NULL, [3], {2, 0})    = 1 (in [3], left {2, 0})
read(3, "", 2048)                       = 0
close(3)                                = 0
sigaction(SIGUSR1, {0x8059954, [], SA_INTERRUPT}, {SIG_IGN}) = 0
munmap(0x400ee000, 6144)                = 0
flock(18, LOCK_EX)                      = 0
```

Notice the accept serialization:

```
flock(18, LOCK_UN)                      = 0
...
flock(18, LOCK_EX)                      = 0
```

These two calls can be removed by defining `SINGLE_LISTEN_UNSERIALIZED_ACCEPT` as described earlier.

Notice the `SIGUSR1` manipulation:

```
sigaction(SIGUSR1, {SIG_IGN}, {0x8059954, [], SA_INTERRUPT}) = 0
...
sigaction(SIGUSR1, {SIG_IGN}, {SIG_IGN}) = 0
...
sigaction(SIGUSR1, {0x8059954, [], SA_INTERRUPT}, {SIG_IGN}) = 0
```

This is caused by the implementation of graceful restarts. When the parent receives a `SIGUSR1` it sends a `SIGUSR1` to all of its children (and it also increments a "generation counter" in shared memory). Any children that are idle (between connections) will immediately die off when they receive the signal. Any children that are in keep-alive connections, but are in between requests will die off immediately. But any children that have a connection and are still waiting for the first request will not die off immediately.

To see why this is necessary, consider how a browser reacts to a closed connection. If the connection was a keep-alive connection and the request being serviced was not the first request then the browser will quietly reissue the request on a new connection. It has to do this because the server is always free to close a keep-alive connection in between requests (*i.e.*, due to a timeout or because of a maximum number of requests). But, if the connection is closed before the first response has been received the typical browser will display a "document contains no data" dialogue (or a broken image icon). This is done on the assumption that the server is broken in some way (or maybe too overloaded to respond at all). So Apache tries to avoid ever deliberately closing the connection before it has sent a single response. This is the cause of those `SIGUSR1` manipulations.

Note that it is theoretically possible to eliminate all three of these calls. But in rough tests the gain proved to be almost unnoticeable.

In order to implement virtual hosts, Apache needs to know the local socket address used to accept the connection:

```
getsockname(3, {sin_family=AF_INET, sin_port=htons(8080),
sin_addr=inet_addr("127.0.0.1")}, [16]) = 0
```

It is possible to eliminate this call in many situations (such as when there are no virtual hosts, or when `Listen` directives are used which do not have wildcard addresses). But no effort has yet been made to do these optimizations.

Apache turns off the Nagle algorithm:

```
setsockopt(3, IPPROTO_TCP1, [1], 4)     = 0
```

because of problems described in a paper by John Heidemann.

Notice the two `time` calls:

```
time(NULL)                              = 873959960
...
time(NULL)                              = 873959960
```

One of these occurs at the beginning of the request, and the other occurs as a result of writing the log. At least one of these is required to properly implement the HTTP protocol. The second occurs because the Common Log Format dictates that the log record include a timestamp of the end of the request. A custom logging module could eliminate one of the calls. Or you can use a method which moves the time into shared memory, see the patches section below.

As described earlier, `ExtendedStatus On` causes two `gettimeofday` calls and a call to `times`:

```
gettimeofday({873959960, 404935}, NULL) = 0
...
gettimeofday({873959960, 417742}, NULL) = 0
times({tms_utime=5, tms_stime=0, tms_cutime=0, tms_cstime=0}) = 446747
```

These can be removed by setting `ExtendedStatus Off` (which is the default).

It might seem odd to call `stat`:

```
stat("/home/dgaudet/ap/apachen/htdocs/6k", {st_mode=S_IFREG|0644, st_size=6144, ...})
= 0
```

This is part of the algorithm which calculates the `PATH_INFO` for use by CGIs. In fact if the request had been for the URI `/cgi-bin/printenv/foobar` then there would be two calls to `stat`. The first for `/home/dgaudet/ap/apachen/cgi-bin/printenv/foobar` which does not exist, and the second for `/home/dgaudet/ap/apachen/cgi-bin/printenv`, which does exist. Regardless, at least one `stat` call is necessary when serving static files because the file size and modification times are used to generate HTTP headers (such as `Content-Length`, `Last-Modified`) and implement protocol features (such as `If-Modified-Since`). A somewhat more clever server could avoid the `stat` when serving non-static files, however doing so in Apache is very difficult given the modular structure.

All static files are served using `mmap`:

```
mmap(0, 6144, PROT_READ, MAP_PRIVATE, 4, 0) = 0x400ee000
...
munmap(0x400ee000, 6144)                = 0
```

On some architectures it's slower to `mmap` small files than it is to simply `read` them. The define `MMAP_THRESHOLD` can be set to the minimum size required before using `mmap`. By default it's set to 0 (except on SunOS4 where experimentation has shown 8192 to be a better value). Using a tool such as lmbench you can determine the optimal setting for your environment.

You may also wish to experiment with `MMAP_SEGMENT_SIZE` (default 32768) which determines the maximum number of bytes that will be written at a time from mmap()d files. Apache only resets the client's `Timeout` in between write()s. So setting this large may lock out low bandwidth clients unless you also increase the `Timeout`.

It may even be the case that `mmap` isn't used on your architecture, if so then defining `USE_MMAP_FILES` and `HAVE_MMAP` might work (if it works then report back to us).

Apache does its best to avoid copying bytes around in memory. The first write of any request typically is turned into a `writev` which combines both the headers and the first hunk of data:

```
writev(3, [{"HTTP/1.1 200 OK\r\nDate: Thu, 11"..., 245},
{"\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0"..., 6144}], 2) = 6389
```

When doing HTTP/1.1 chunked encoding Apache will generate up to four element `writev`s. The goal is to push the byte copying

into the kernel, where it typically has to happen anyhow (to assemble network packets). On testing, various Unixes (BSDI 2.x, Solaris 2.5, Linux 2.0.31+) properly combine the elements into network packets. Pre-2.0.31 Linux will not combine, and will send a packet for each element, so upgrading is a good idea. Defining `NO_WRITEV` will disable this combining, but result in very poor chunked encoding performance.

The log write:

```
write(17, "127.0.0.1 - - [10/Sep/1997:23:39"..., 71) = 71
```

can be deferred by defining `BUFFERED_LOGS`. In this case up to `PIPE_BUF` bytes (a POSIX defined constant) of log entries are buffered before writing. At no time does it split a log entry across a `PIPE_BUF` boundary because those writes may not be atomic. (*i.e.*, entries from multiple children could become mixed together). The code does it best to flush this buffer when a child dies.

The lingering close code causes four system calls:

```
shutdown(3, 1 /* send */)               = 0
oldselect(4, [3], NULL, [3], {2, 0})    = 1 (in [3], left {2, 0})
read(3, "", 2048)                       = 0
close(3)                                = 0
```

which were described earlier.

Let's apply some of these optimizations: `-DSINGLE_LISTEN_UNSERIALIZED_ACCEPT -DBUFFERED_LOGS` and `ExtendedStatus Off`. Here's the final trace:

```
accept(15, {sin_family=AF_INET, sin_port=htons(22286),
sin_addr=inet_addr("127.0.0.1")}, [16]) = 3
sigaction(SIGUSR1, {SIG_IGN}, {0x8058c98, [], SA_INTERRUPT}) = 0
getsockname(3, {sin_family=AF_INET, sin_port=htons(8080),
sin_addr=inet_addr("127.0.0.1")}, [16]) = 0
setsockopt(3, IPPROTO_TCP1, [1], 4)     = 0
read(3, "GET /6k HTTP/1.0\r\nUser-Agent: "..., 4096) = 60
sigaction(SIGUSR1, {SIG_IGN}, {SIG_IGN}) = 0
time(NULL)                              = 873961916
stat("/home/dgaudet/ap/apachen/htdocs/6k", {st_mode=S_IFREG|0644, st_size=6144, ...})
= 0
open("/home/dgaudet/ap/apachen/htdocs/6k", O_RDONLY) = 4
mmap(0, 6144, PROT_READ, MAP_PRIVATE, 4, 0) = 0x400e3000
writev(3, [{"HTTP/1.1 200 OK\r\nDate: Thu, 11"..., 245},
{"\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0"..., 6144}], 2) = 6389
close(4)                                = 0
time(NULL)                              = 873961916
shutdown(3, 1 /* send */)               = 0
oldselect(4, [3], NULL, [3], {2, 0})    = 1 (in [3], left {2, 0})
read(3, "", 2048)                       = 0
close(3)                                = 0
sigaction(SIGUSR1, {0x8058c98, [], SA_INTERRUPT}, {SIG_IGN}) = 0
munmap(0x400e3000, 6144)                = 0
```

That's 19 system calls, of which 4 remain relatively easy to remove, but don't seem worth the effort.

Appendix: Patches Available

There are several performance patches available for 1.3.> But they may be slightly out of date by the time Apache 1.3.0 has been released, it shouldn't be difficult for someone with a little C knowledge to update them. In particular:

- A patch to remove all `time(2)` system calls.
- A patch to remove various system calls from `mod_include`, these calls are used by few sites but required for backwards compatibility.
- A patch which integrates the above two plus a few other speedups at the cost of removing some functionality.

Appendix: The Pre-Forking Model

Apache (on Unix) is a *pre-forking* model server. The *parent* process is responsible only for forking *child* processes, it does not serve any requests or service any network sockets. The child processes actually process connections, they serve multiple connections (one at a time) before dying. The parent spawns new or kills off old children in response to changes in the load on the server (it does so by monitoring a scoreboard which the children keep up to date).

This model for servers offers a robustness that other models do not. In particular, the parent code is very simple, and with a high degree of confidence the parent will continue to do its job without error. The children are complex, and when you add in third party code via modules, you risk segmentation faults and other forms of corruption. Even should such a thing happen, it only affects one connection and the server continues serving requests. The parent quickly replaces the dead child.

Pre-forking is also very portable across dialects of Unix. Historically this has been an important goal for Apache, and it continues to remain so.

The pre-forking model comes under criticism for various performance aspects. Of particular concern are the overhead of forking a process, the overhead of context switches between processes, and the memory overhead of having multiple processes. Furthermore it does not offer as many opportunities for data-caching between requests (such as a pool of `mmapped` files). Various other models exist and extensive analysis can be found in the papers of the JAWS project. In practice all of these costs vary drastically depending on the operating system.

Apache's core code is already multithread aware, and Apache version 1.3 is multithreaded on NT. There have been at least two other experimental implementations of threaded Apache, one using the 1.3 code base on DCE, and one using a custom user-level threads package and the 1.0 code base, neither are available publically. There is also an experimental port of Apache 1.3 to Netscape's Portable Run Time, which is available (but you're encouraged to join the new-httpd mailing list if you intend to use it). Part of our redesign for version 2.0 of Apache will include abstractions of the server model so that we can continue to support the pre-forking model, and also support various threaded models.

Apache HTTP Server Version 1.3

Module mod_expires

This module is contained in the `mod_expires.c` file, and is **not** compiled in by default. It provides for the generation of `Expires` headers according to user-specified criteria.

Summary

This module controls the setting of the `Expires` HTTP header in server responses. The expiration date can set to be relative to either the time the source file was last modified, or to the time of the client access.

The `Expires` HTTP header is an instruction to the client about the document's validity and persistence. If cached, the document may be fetched from the cache rather than from the source until this time has passed. After that, the cache copy is considered "expired" and invalid, and a new copy must be obtained from the source.

Directives

ExpiresActive directive

Syntax: ExpiresActive *boolean*
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Extension
Module: mod_expires

This directive enables or disables the generation of the `Expires` header for the document realm in question. (That is, if found in an `.htaccess` file, for instance, it applies only to documents generated from that directory.) If set to *`Off`*, no `Expires` header will be generated for any document in the realm (unless overridden at a lower level, such as an `.htaccess` file overriding a server config file). If set to

On, the header will be added to served documents according to the criteria defined by the ExpiresBy[illegible] and ExpiresDefault directives (*q.v.*).

Note that this directive does not guarantee that an `Expires` header will be generated. If the criteria aren't met, no header will be sent, and the effect will be as though this directive wasn't even specified.

ExpiresByType directive

Syntax: ExpiresByType *MIME-type <code>seconds*
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Extension
Module: mod_expires

This directive defines the value of the `Expires` header generated for documents of the specified type (*e.g.*, `text/html`). The second argument sets the number of seconds that will be added to a base time to construct the expiration date.

The base time is either the last modification time of the file, or the time of the client's access to the document. Which should be used is specified by the *<code>* field; **M** means that the file's last modification time should be used as the base time, and **A** means the client's access time should be used.

The difference in effect is subtle. If *M* is used, all current copies of the document in all caches will expire at the same time, which can be good for something like a weekly notice that's always found at the same URL. If *A* is used, the date of expiration is different for each client; this can be good for image files that don't change very often, particularly for a set of related documents that all refer to the same images (*i.e.*, the images will be accessed repeatedly within a relatively short timespan).

Example:

```
ExpiresActive On                    # enable expirations
ExpiresByType image/gif A2592000    # expire GIF images after a month
                                    #  in the client's cache
ExpiresByType text/html M604800     # HTML documents are good for a
                                    #  week from the time they were
                                    #  changed, period
```

Note that this directive only has effect if `ExpiresActive On` has been specified. It overrides, for the specified MIME type *only*, any expiration date set by the ExpiresDefault directive.

You can also specify the expiration time calculation using an alternate syntax, described later in this document.

ExpiresDefault directive

Syntax: ExpiresDefault *<code>seconds*
Context: server config, virtual host, directory, .htaccess
Override: Indexes
Status: Extension
Module: mod_expires

This directive sets the default algorithm for calculating the expiration time for all documents in the affected realm. It can be overridden on a type-by-type basis by the ExpiresByType directive. See the description of that directive for details about the syntax of the argument, and the alternate syntax description as well.

Alternate Interval Syntax

The ExpiresDefault and ExpiresByType directives can also be defined in a more readable syntax of the form:

```
ExpiresDefault "<base> [plus] {<num> <type>}*"
ExpiresByType type/encoding "<base> [plus] {<num> <type>}*"
```

where <base> is one of:

- access
- now (equivalent to 'access')
- modification

The 'plus' keyword is optional. <num> should be an integer value [acceptable to atoi()], and <type> is one of:

- years
- months
- weeks
- days
- hours
- minutes
- seconds

For example, any of the following directives can be used to make documents expire 1 month after being accessed, by default:

```
ExpiresDefault "access plus 1 month"
ExpiresDefault "access plus 4 weeks"
ExpiresDefault "access plus 30 days"
```

The expiry time can be fine-tuned by adding several '<num> <type>' clauses:

```
ExpiresByType text/html "access plus 1 month 15 days 2 hours"
ExpiresByType image/gif "modification plus 5 hours 3 minutes"
```

Note that if you use a modification date based setting, the Expires header will **not** be added to content that does not come from a file on disk. This is due to the fact that there is no modification time for such content.

Apache HTTP Server Version 1.3

An In-Depth Discussion of Virtual Host Matching

The virtual host code was completely rewritten in **Apache 1.3**. This document attempts to explain exactly what Apache does when deciding what virtual host to serve a hit from. With the help of the new NameVirtualHost directive virtual host configuration should be a lot easier and safer than with versions prior to 1.3.

If you just want to make it work without understanding how, here are some examples.

Config File Parsing

There is a *main_server* which consists of all the definitions appearing outside of `<VirtualHost>` sections. There are virtual servers, called *vhosts*, which are defined by <VirtualHost> sections.

The directives Port, ServerName, ServerPath, and ServerAlias can appear anywhere within the definition of a server. However, each appearance overrides the previous appearance (within that server).

The default value of the `Port` field for main_server is 80. The main_server has no default `ServerPath`, or `ServerAlias`. The default `ServerName` is deduced from the servers IP address.

The main_server Port directive has two functions due to legacy compatibility with NCSA configuration files. One function is to determine the default network port Apache will bind to. This default is overridden by the existence of any `Listen` directives. The second function is to specify the port number which is used in absolute URIs during redirects.

Unlike the main_server, vhost ports *do not* affect what ports Apache listens for connections on.

Each address appearing in the `VirtualHost` directive can have an optional port. If the port is unspecified it defaults to the value of the main_server's most recent `Port` statement. The special port * indicates a wildcard that matches any port. Collectively the entire set of addresses (including multiple A record results from DNS lookups) are called the vhost's *address set*.

Unless a NameVirtualHost directive is used for a specific IP address the first vhost with that address is treated as an IP-based vhost.

If name-based vhosts should be used a `NameVirtualHost` directive *must* appear with the IP address set to be used for the name-based vhosts. In other words, you must specify the IP address that holds the

hostname aliases (CNAMEs) for your name-based vhosts via a `NameVirtualHost` directive in yo configuration file.

Multiple `NameVirtualHost` directives can be used each with a set of `VirtualHost` directives but only one `NameVirtualHost` directive should be used for each specific IP:port pair.

The ordering of `NameVirtualHost` and `VirtualHost` directives is not important which makes the following two examples identical (only the order of the `VirtualHost` directives for *one* address set is important, see below):

```
                                |
NameVirtualHost 111.22.33.44    | <VirtualHost 111.22.33.44>
<VirtualHost 111.22.33.44>      | # server A
# server A                      | </VirtualHost>
...                             | <VirtualHost 111.22.33.55>
</VirtualHost>                  | # server C
<VirtualHost 111.22.33.44>      | ...
# server B                     | </VirtualHost>
...                             | <VirtualHost 111.22.33.44>
</VirtualHost>                  | # server B
                                | ...
NameVirtualHost 111.22.33.55    | </VirtualHost>
<VirtualHost 111.22.33.55>      | <VirtualHost 111.22.33.55>
# server C                      | # server D
...                             | ...
</VirtualHost>                  | </VirtualHost>
<VirtualHost 111.22.33.55>      |
# server D                     | NameVirtualHost 111.22.33.44
...                             | NameVirtualHost 111.22.33.55
</VirtualHost>                  |
                                |
```

(To aid the readability of your configuration you should prefer the left variant.)

After parsing the `VirtualHost` directive, the vhost server is given a default `Port` equal to the port assigned to the first name in its `VirtualHost` directive.

The complete list of names in the `VirtualHost` directive are treated just like a `ServerAlias` (but are not overridden by any `ServerAlias` statement) if all names resolve to the same address set. Note that subsequent `Port` statements for this vhost will not affect the ports assigned in the address set.

During initialization a list for each IP address is generated and inserted into an hash table. If the IP address is used in a `NameVirtualHost` directive the list contains all name-based vhosts for the given IP address. If there are no vhosts defined for that address the `NameVirtualHost` directive is ignored and an error is logged. For an IP-based vhost the list in the hash table is empty.

Due to a fast hashing function the overhead of hashing an IP address during a request is minimal and almost not existent. Additionally the table is optimized for IP addresses which vary in the last octet.

For every vhost various default values are set. In particular:

1. If a vhost has no `ServerAdmin`, `ResourceConfig`, `AccessConfig`, `Timeout`, `KeepAliveTimeout`, `KeepAlive`, `MaxKeepAliveRequests`, or `SendBufferSize` directive then the respective value is inherited from the main_server. (That is, inherited from whatever the final setting of that value is in the main_server.)
2. The "lookup defaults" that define the default directory permissions for a vhost are merged with those of the main_server. This includes any per-directory configuration information for any module.
3. The per-server configs for each module from the main_server are merged into the vhost server.

Essentially, the main_server is treated as "defaults" or a "base" on which to build each vhost. But the positioning of these main_server definitions in the config file is largely irrelevant -- the entire config of the main_server has been parsed when this final merging occurs. So even if a main_server definition appears after a vhost definition it might affect the vhost definition.

If the main_server has no `ServerName` at this point, then the hostname of the machine that httpd is running on is used instead. We will call the *main_server address set* those IP addresses returned by a DNS lookup on the `ServerName` of the main_server.

For any undefined `ServerName` fields, a name-based vhost defaults to the address given first in the `VirtualHost` statement defining the vhost.

Any vhost that includes the magic _default_ wildcard is given the same `ServerName` as the main_server.

Virtual Host Matching

The server determines which vhost to use for a request as follows:

Hash table lookup

When the connection is first made by a client, the IP address to which the client connected is looked up in the internal IP hash table.

If the lookup fails (the IP address wasn't found) the request is served from the _default_ vhost if there is such a vhost for the port to which the client sent the request. If there is no matching _default_ vhost the request is served from the main_server.

If the lookup succeeded (a corresponding list for the IP address was found) the next step is to decide if we have to deal with an IP-based or a name-base vhost.

IP-based vhost

If the entry we found has an empty name list then we have found an IP-based vhost, no further actions are performed and the request is served from that vhost.

Name-based vhost

If the entry corresponds to a name-based vhost the name list contains one or more vhost structures. The list contains the vhosts in the same order as the `VirtualHost` directives appear in the config file.

The first vhost on this list (the first vhost in the config file with the specified IP address) has the highest priority and catches any request to an unknown server name or a request without a `Host:` header field.

If the client provided a `Host:` header field the list is searched for a matching vhost and the first hit on a `ServerName` or `ServerAlias` is taken and the request is served from that vhost. A `Host:` header field can contain a port number, but Apache always matches against the real port to which the client sent the request.

If the client submitted a HTTP/1.0 request without `Host:` header field we don't know to what server the client tried to connect and any existing `ServerPath` is matched against the URI from the request. The first matching path on the list is used and the request is served from that vhost.

If no matching vhost could be found the request is served from the first vhost with a matching port number that is on the list for the IP to which the client connected (as already mentioned before).

Persistent connections

The IP lookup described above is only done *once* for a particular TCP/IP session while the name lookup is done on *every* request during a KeepAlive/persistent connection. In other words a client may request pages from different name-based vhosts during a single persistent connection.

Absolute URI

If the URI from the request is an absolute URI, and its hostname and port match the main server or one of the configured virtual hosts *and* match the address and port to which the client sent the request, then the scheme/hostname/port prefix is stripped off and the remaining relative URI is served by the corresponding main server or virtual host. If it does not match, then the URI remains untouched and the request is taken to be a proxy request.

Observations

- A name-based vhost can never interfere with an IP-base vhost and vice versa. IP-based vhosts can only be reached through an IP address of its own address set and never through any other address. The same applies to name-based vhosts, they can only be reached through an IP address of the corresponding address set which must be defined with a `NameVirtualHost` directive.
- `ServerAlias` and `ServerPath` checks are never performed for an IP-based vhost.
- The order of name-/IP-based, the _default_ vhost and the `NameVirtualHost` directive within the config file is not important. Only the ordering of name-based vhosts for a specific address set is significant. The one name-based vhosts that comes first in the configuration file has the highest priority for its corresponding address set.
- For security reasons the port number given in a `Host:` header field is never used during the matching process. Apache always uses the real port to which the client sent the request.
- If a `ServerPath` directive exists which is a prefix of another `ServerPath` directive that

appears later in the configuration file, then the former will always be matched and the latter w never be matched. (That is assuming that no `Host:` header field was available to disambigua two.)

- If two IP-based vhosts have an address in common, the vhost appearing first in the config file is always matched. Such a thing might happen inadvertently. The server will give a warning in the error logfile when it detects this.
- A `_default_` vhost catches a request only if there is no other vhost with a matching IP address *and* a matching port number for the request. The request is only caught if the port number to which the client sent the request matches the port number of your `_default_` vhost which is your standard `Port` by default. A wildcard port can be specified (*i.e.*, `_default_:*`) to catch requests to any available port.
- The main_server is only used to serve a request if the IP address and port number to which the client connected is unspecified and does not match any other vhost (including a `_default_` vhost). In other words the main_server only catches a request for an unspecified address/port combination (unless there is a `_default_` vhost which matches that port).
- A `_default_` vhost or the main_server is *never* matched for a request with an unknown or missing `Host:` header field if the client connected to an address (and port) which is used for name-based vhosts, *e.g.*, in a `NameVirtualHost` directive.
- You should never specify DNS names in `VirtualHost` directives because it will force your server to rely on DNS to boot. Furthermore it poses a security threat if you do not control the DNS for all the domains listed. There's more information available on this and the next two topics.
- `ServerName` should always be set for each vhost. Otherwise A DNS lookup is required for each vhost.

Tips

In addition to the tips on the DNS Issues page, here are some further tips:

- Place all main_server definitions before any `VirtualHost` definitions. (This is to aid the readability of the configuration -- the post-config merging process makes it non-obvious that definitions mixed in around virtual hosts might affect all virtual hosts.)
- Group corresponding `NameVirtualHost` and `VirtualHost` definitions in your configuration to ensure better readability.
- Avoid `ServerPaths` which are prefixes of other `ServerPaths`. If you cannot avoid this then you have to ensure that the longer (more specific) prefix vhost appears earlier in the configuration file than the shorter (less specific) prefix (*i.e.*, "ServerPath /abc" should appear after "ServerPath /abc/def").

Apache HTTP Server Version 1.3

Issues Regarding DNS and Apache

This page could be summarized with the statement: *don't require Apache to use DNS for any parsing of the configuration files*. If Apache has to use DNS to parse the configuration files then your server may be subject to reliability problems (it might not boot), or denial and theft of service attacks (including users able to steal hits from other users).

A Simple Example

Consider this configuration snippet:

```
<VirtualHost www.abc.dom>
ServerAdmin webgirl@abc.dom
DocumentRoot /www/abc
</VirtualHost>
```

In order for Apache to function properly it absolutely needs to have two pieces of information about each virtual host: the `ServerName` and at least one IP address that the server responds to. This example does not include the IP address, so Apache must use DNS to find the address of `www.abc.dom`. If for some reason DNS is not available at the time your server is parsing its config file, then this virtual host **will not be configured**. It won't be able to respond to any hits to this virtual host (prior to Apache version 1.2 the server would not even boot).

Suppose that `www.abc.dom` has address 10.0.0.1. Then consider this configuration snippet:

```
<VirtualHost 10.0.0.1>
ServerAdmin webgirl@abc.dom
DocumentRoot /www/abc
</VirtualHost>
```

Now Apache needs to use reverse DNS to find the `ServerName` for this virtualhost. If that reverse lookup fails then it will partially disable the virtualhost (prior to Apache version 1.2 the server would not even boot). If the virtual host is name-based then it will effectively be totally disabled, but if it is IP-based then it will mostly work. However if Apache should ever have to generate a full URL for the server which includes the server name then it will fail to generate a valid URL.

Here is a snippet that avoids both of these problems.


```
<VirtualHost 10.0.0.1>
ServerName www.abc.dom
ServerAdmin webgirl@abc.dom
DocumentRoot /www/abc
</VirtualHost>
```

Denial of Service

There are (at least) two forms that denial of service can come in. If you are running a version of Apache prior to version 1.2 then your server will not even boot if one of the two DNS lookups mentioned above fails for any of your virtual hosts. In some cases this DNS lookup may not even be under your control. For example, if `abc.dom` is one of your customers and they control their own DNS then they can force your (pre-1.2) server to fail while booting simply by deleting the `www.abc.dom` record.

Another form is far more insidious. Consider this configuration snippet:

```
<VirtualHost www.abc.dom>
ServerAdmin webgirl@abc.dom
DocumentRoot /www/abc
</VirtualHost>

<VirtualHost www.def.dom>
ServerAdmin webguy@def.dom
DocumentRoot /www/def
</VirtualHost>
```

Suppose that you've assigned 10.0.0.1 to `www.abc.dom` and 10.0.0.2 to `www.def.dom`. Furthermore, suppose that `def.com` has control of their own DNS. With this config you have put `def.com` into a position where they can steal all traffic destined to `abc.com`. To do so, all they have to do is set `www.def.dom` to 10.0.0.1. Since they control their own DNS you can't stop them from pointing the `www.def.com` record wherever they wish.

Requests coming in to 10.0.0.1 (including all those where users typed in URLs of the form `http://www.abc.dom/whatever`) will all be served by the `def.com` virtual host. To better understand why this happens requires a more in-depth discussion of how Apache matches up incoming requests with the virtual host that will serve it. A rough document describing this is available.

The "main server" Address

The addition of name-based virtual host support in Apache 1.1 requires Apache to know the IP address(es) of the host that httpd is running on. To get this address it uses either the global `ServerName` (if present) or calls the C function `gethostname` (which should return the same as typing "hostname" at the command prompt). Then it performs a DNS lookup on this address. At present there is no way to avoid this lookup.

If you fear that this lookup might fail because your DNS server is down then you can insert the hostname

in `/etc/hosts` (where you probably already have it so that the machine can boot properly). Then ensure that your machine is configured to use `/etc/hosts` in the event that DNS fails. Depending what OS you are using this might be accomplished by editing `/etc/resolv.conf`, or maybe `/etc/nsswitch.conf`.

If your server doesn't have to perform DNS for any other reason then you might be able to get away with running Apache with the `HOSTRESORDER` environment variable set to "local". This all depends on what OS and resolver libraries you are using. It also affects CGIs unless you use `mod_env` to control the environment. It's best to consult the man pages or FAQs for your OS.

Tips to Avoid these problems

- use IP addresses in `<VirtualHost>`
- use IP addresses in `Listen`
- use IP addresses in `BindAddress`
- ensure all virtual hosts have an explicit `ServerName`
- create a `<VirtualHost _default_:*>` server that has no pages to serve

Appendix: Future Directions

The situation regarding DNS is highly undesirable. For Apache 1.2 we've attempted to make the server at least continue booting in the event of failed DNS, but it might not be the best we can do. In any event requiring the use of explicit IP addresses in configuration files is highly undesirable in today's Internet where renumbering is a necessity.

A possible work around to the theft of service attack described above would be to perform a reverse DNS lookup on the ip address returned by the forward lookup and compare the two names. In the event of a mismatch the virtualhost would be disabled. This would require reverse DNS to be configured properly (which is something that most admins are familiar with because of the common use of "double-reverse" DNS lookups by FTP servers and TCP wrappers).

In any event it doesn't seem possible to reliably boot a virtual-hosted web server when DNS has failed unless IP addresses are used. Partial solutions such as disabling portions of the configuration might be worse than not booting at all depending on what the webserver is supposed to accomplish.

As HTTP/1.1 is deployed and browsers and proxies start issuing the `Host` header it will become possible to avoid the use of IP-based virtual hosts entirely. In this event a webserver has no requirement to do DNS lookups during configuration. But as of March 1997 these features have not been deployed widely enough to be put into use on critical webservers.

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Apache module mod_env

This module is contained in the `mod_env.c` file, and is compiled in by default. It provides for passing environment variables to CGI/SSI scripts. Is is only available in Apache 1.1 and later.

Summary

This module allows Apache's CGI and SSI environment to inherit environment variables from the shell which invoked the httpd process. CERN web-servers are able to do this, so this module is especially useful to web-admins who wish to migrate from CERN to Apache without rewriting all their scripts

Directives

PassEnv

Syntax: PassEnv *variable variable* ...
Context: server config, virtual host
Status: Base
Module: mod_env
Compatibility: PassEnv is only available in Apache 1.1 and later.

Specifies one or more environment variables to pass to CGI scripts from the server's own environment. Example:

```
PassEnv LD_LIBRARY_PATH
```

SetEnv

Syntax: SetEnv *variable value*
Context: server config, virtual host
Status: Base
Module: mod_env
Compatibility: SetEnv is only available in Apache 1.1 and later.

Sets an environment variable, which is then passed on to CGI scripts. Example:

```
SetEnv SPECIAL_PATH /foo/bin
```

UnsetEnv

Syntax: UnsetEnv *variable variable* ...
Context: server config, virtual host
Status: Base
Module: mod_env
Compatibility: UnsetEnv is only available in Apache 1.1 and later.

Removes one or more environment variables from those passed on to CGI scripts. Example:

```
UnsetEnv LD_LIBRARY_PATH
```

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File Descriptor Limits

When using a large number of Virtual Hosts, Apache may run out of available file descriptors (sometimes called file handles if each Virtual Host specifies different log files. The total number of file descriptors used by Apache is one for each distinct error log file, one for every other log file directive, plus 10-20 for internal use. Unix operating systems limit the number of file descriptors that may be used by a process; the limit is typically 64, and may usually be increased up to a large hard-limit.

Although Apache attempts to increase the limit as required, this may not work if:

1. Your system does not provide the setrlimit() system call.
2. The setrlimit(RLIMIT_NOFILE) call does not function on your system (such as Solaris 2.3)
3. The number of file descriptors required exceeds the hard limit.
4. Your system imposes other limits on file descriptors, such as a limit on stdio streams only using file descriptors below 256. (Solaris 2)

In the event of problems you can:

- Reduce the number of log files; don't specify log files in the VirtualHost sections, but only log to the main log files.
- If you system falls into 1 or 2 (above), then increase the file descriptor limit before starting Apache, using a script like

```
#!/bin/sh
ulimit -S -n 100
exec httpd
```

Please see the Descriptors and Apache document containing further details about file descriptor problems and how they can be solved on your operating system.

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Descriptors and Apache

A *descriptor*, also commonly called a *file handle* is an object that a program uses to read or write an open file, or open network socket, or a variety of other devices. It is represented by an integer, and you may be familiar with `stdin`, `stdout`, and `stderr` which are descriptors 0, 1, and 2 respectively. Apache needs a descriptor for each log file, plus one for each network socket that it listens on, plus a handful of others. Libraries that Apache uses may also require descriptors. Normal programs don't open up many descriptors at all, and so there are some latent problems that you may experience should you start running Apache with many descriptors (*i.e.*, with many virtual hosts).

The operating system enforces a limit on the number of descriptors that a program can have open at a time. There are typically three limits involved here. One is a kernel limitation, depending on your operating system you will either be able to tune the number of descriptors available to higher numbers (this is frequently called *FD_SETSIZE*). Or you may be stuck with a (relatively) low amount. The second limit is called the *hard resource* limit, and it is sometimes set by root in an obscure operating system file, but frequently is the same as the kernel limit. The third limit is called the *soft resource* limit. The soft limit is always less than or equal to the hard limit. For example, the hard limit may be 1024, but the soft limit only 64. Any user can raise their soft limit up to the hard limit. Root can raise the hard limit up to the system maximum limit. The soft limit is the actual limit that is used when enforcing the maximum number of files a process can have open.

To summarize:

```
#open files  <=  soft limit  <=  hard limit  <=  kernel limit
```

You control the hard and soft limits using the `limit` (csh) or `ulimit` (sh) directives. See the respective man pages for more information. For example you can probably use `ulimit -n unlimited` to raise your soft limit up to the hard limit. You should include this command in a shell script which starts your webserver.

Unfortunately, it's not always this simple. As mentioned above, you will probably run into some system limitations that will need to be worked around somehow. Work was done in version 1.2.1 to improve the situation somewhat. Here is a partial list of systems and workarounds (assuming you are using 1.2.1 or later):

BSDI 2.0

Under BSDI 2.0 you can build Apache to support more descriptors by adding `-DFD_SETSIZE=nnn` to `EXTRA_CFLAGS` (where nnn is the number of descriptors you wish to support, keep it less than the hard limit). But it will run into trouble if more than approximately

240 Listen directives are used. This may be cured by rebuilding your kernel with a higher FD_SETSIZE.

FreeBSD 2.2, BSDI 2.1+

Similar to the BSDI 2.0 case, you should define `FD_SETSIZE` and rebuild. But the extra Listen limitation doesn't exist.

Linux

By default Linux has a kernel maximum of 256 open descriptors per process. There are several patches available for the 2.0.x series which raise this to 1024 and beyond, and you can find them in the "unofficial patches" section of http://www.linuxhq.com the Linux Information HQ. None of these patches are perfect, and an entirely different approach is likely to be taken during the 2.1.x development. Applying these patches will raise the FD_SETSIZE used to compile all programs, and unless you rebuild all your libraries you should avoid running any other program with a soft descriptor limit above 256. As of this writing the patches available for increasing the number of descriptors do not take this into account. On a dedicated webserver you probably won't run into trouble.

Solaris through 2.5.1

Solaris has a kernel hard limit of 1024 (may be lower in earlier versions). But it has a limitation that files using the stdio library cannot have a descriptor above 255. Apache uses the stdio library for the ErrorLog directive. When you have more than approximately 110 virtual hosts (with an error log and an access log each) you will need to build Apache with `-DHIGH_SLACK_LINE=256` added to `EXTRA_CFLAGS`. You will be limited to approximately 240 error logs if you do this.

AIX

AIX version 3.2?? appears to have a hard limit of 128 descriptors. End of story. Version 4.1.5 has a hard limit of 2000.

Others

If you have details on another operating system, please submit it through our Bug Report Page.

In addition to the problems described above there are problems with many libraries that Apache uses. The most common example is the bind DNS resolver library that is used by pretty much every unix, which fails if it ends up with a descriptor above 256. We suspect there are other libraries that similar limitations. So the code as of 1.2.1 takes a defensive stance and tries to save descriptors less than 16 for use while processing each request. This is called the *low slack line*.

Note that this shouldn't waste descriptors. If you really are pushing the limits and Apache can't get a descriptor above 16 when it wants it, it will settle for one below 16.

In extreme situations you may want to lower the low slack line, but you shouldn't ever need to. For example, lowering it can increase the limits 240 described above under Solaris and BSDI 2.0. But you'll play a delicate balancing game with the descriptors needed to serve a request. Should you want to play this game, the compile time parameter is `LOW_SLACK_LINE` and there's a tiny bit of documentation in the header file `httpd.h`.

Finally, if you suspect that all this slack stuff is causing you problems, you can disable it. Add

`-DNO_SLACK` to `EXTRA_CFLAGS` and rebuild. But please report it to our Bug Report Page so that can investigate.

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Dynamically configured mass virtual hosting

This document describes how to efficiently serve an arbitrary number of virtual hosts with Apache 1.3.

Contents:

Motivation

The techniques described here are of interest if your `httpd.conf` contains many `<VirtualHost>` sections that are substantially the same, for example:

```
NameVirtualHost 111.22.33.44
<VirtualHost 111.22.33.44>
        ServerName                      www.customer-1.com
        DocumentRoot            /www/hosts/www.customer-1.com/docs
        ScriptAlias  /cgi-bin/  /www/hosts/www.customer-1.com/cgi-bin
</VirtualHost>
<VirtualHost 111.22.33.44>
        ServerName                      www.customer-2.com
```


```
        DocumentRoot            /www/hosts/www.customer-2.com/docs
        ScriptAlias  /cgi-bin/  /www/hosts/www.customer-2.com/cgi-bi
</VirtualHost>
# blah blah blah
<VirtualHost 111.22.33.44>
        ServerName                          www.customer-N.com
        DocumentRoot            /www/hosts/www.customer-N.com/docs
        ScriptAlias  /cgi-bin/  /www/hosts/www.customer-N.com/cgi-bin
</VirtualHost>
```

The basic idea is to replace all of the static `<VirtualHost>` configuration with a mechanism that works it out dynamically. This has a number of advantages:

1. Your configuration file is smaller so Apache starts faster and uses less memory.
2. Adding virtual hosts is simply a matter of creating the appropriate directories in the filesystem and entries in the DNS - you don't need to reconfigure or restart Apache.

The main disadvantage is that you cannot have a different log file for each virtual host; however if you have very many virtual hosts then doing this is dubious anyway because it eats file descriptors. It is better to log to a pipe or a fifo and arrange for the process at the other end to distribute the logs to the customers (it can also accumulate statistics, etc.).

Overview

A virtual host is defined by two pieces of information: its IP address, and the contents of the `Host:` header in the HTTP request. The dynamic mass virtual hosting technique is based on automatically inserting this information into the pathname of the file that is used to satisfy the request. This is done most easily using `mod_vhost_alias`, but if you are using a version of Apache up to 1.3.6 then you must use `mod_rewrite`. Both of these modules are disabled by default; you must enable one of them when configuring and building Apache if you want to use this technique.

A couple of things need to be `faked' to make the dynamic virtual host look like a normal one. The most important is the server name which is used by Apache to generate self-referential URLs, etc. It is configured with the `ServerName` directive, and it is available to CGIs via the `SERVER_NAME` environment variable. The actual value used at run time is controlled by the `UseCanonicalName` setting. With `UseCanonicalName Off` the server name comes from the contents of the `Host:` header in the request. With `UseCanonicalName DNS` it comes from a reverse DNS lookup of the virtual host's IP address. The former setting is used for name-based dynamic virtual hosting, and the latter is used for IP-based hosting. If Apache cannot work out the server name because there is no `Host:` header or the DNS lookup fails then the value configured with `ServerName` is used instead.

The other thing to `fake' is the document root (configured with `DocumentRoot` and available to CGIs via the `DOCUMENT_ROOT` environment variable). This setting is used by the core module when mapping URIs to filenames, but when the server is configured to do dynamic virtual hosting that job is taken over by another module. If any CGIs or SSI documents make use of the `DOCUMENT_ROOT` environment variable they will therefore get a misleading value; there isn't any way to change `DOCUMENT_ROOT` dynamically.

Simple dynamic virtual hosts

This extract from `httpd.conf` implements the virtual host arrangement outlined in the Motivation section above, but in a generic fashion using `mod_vhost_alias`.

```
# get the server name from the Host: header
UseCanonicalName Off

# this log format can be split per-virtual-host based on the first field
LogFormat "%V %h %l %u %t \"%r\" %s %b" vcommon
CustomLog logs/access_log vcommon

# include the server name in the filenames used to satisfy requests
VirtualDocumentRoot /www/hosts/%0/docs
VirtualScriptAlias  /www/hosts/%0/cgi-bin
```

This configuration can be changed into an IP-based virtual hosting solution by just turning `UseCanonicalName Off` into `UseCanonicalName DNS`. The server name that is inserted into the filename is then derived from the IP address of the virtual host.

A virtually hosted homepages system

This is an adjustment of the above system tailored for an ISP's homepages server. Using a slightly more complicated configuration we can select substrings of the server name to use in the filename so that e.g. the documents for www.user.isp.com are found in `/home/user/`. It uses a single `cgi-bin` directory instead of one per virtual host.

```
# all the preliminary stuff is the same as above, then

# include part of the server name in the filenames
VirtualDocumentRoot /www/hosts/%2/docs

# single cgi-bin directory
ScriptAlias  /cgi-bin/  /www/std-cgi/
```

There are examples of more complicated `VirtualDocumentRoot` settings in the `mod_vhost_alias` documentation.

Using more than one virtual hosting system on the same server

With more complicated setups you can use Apache's normal `<VirtualHost>` directives to control the scope of the various virtual hosting configurations. For example, you could have one IP address for homepages customers and another for commercial customers with the following setup. This can of course be combined with conventional `<VirtualHost>` configuration sections.

```
UseCanonicalName Off

LogFormat "%V %h %l %u %t \"%r\" %s %b" vcommon

<Directory /www/commercial>
        Options FollowSymLinks
        AllowOverride All
</Directory>

<Directory /www/homepages>
        Options FollowSymLinks
        AllowOverride None
</Directory>

<VirtualHost 111.22.33.44>
        ServerName www.commercial.isp.com

        CustomLog logs/access_log.commercial vcommon

        VirtualDocumentRoot /www/commercial/%0/docs
        VirtualScriptAlias  /www/commercial/%0/cgi-bin
</VirtualHost>

<VirtualHost 111.22.33.45>
        ServerName www.homepages.isp.com

        CustomLog logs/access_log.homepages vcommon

        VirtualDocumentRoot /www/homepages/%0/docs
        ScriptAlias         /cgi-bin/ /www/std-cgi/
</VirtualHost>
```

More efficient IP-based virtual hosting

After the first example I noted that it is easy to turn it into an IP-based virtual hosting setup. Unfortunately that configuration is not very efficient because it requires a DNS lookup for every request. This can be avoided by laying out the filesystem according to the IP addresses themselves rather than the corresponding names and changing the logging similarly. Apache will then usually not need to work out the server name and so incur a DNS lookup.

```
# get the server name from the reverse DNS of the IP address
UseCanonicalName DNS

# include the IP address in the logs so they may be split
LogFormat "%A %h %l %u %t \"%r\" %s %b" vcommon
CustomLog logs/access_log vcommon

# include the IP address in the filenames
VirtualDocumentRootIP /www/hosts/%0/docs
VirtualScriptAliasIP  /www/hosts/%0/cgi-bin
```

Using older versions of Apache

The examples above rely on `mod_vhost_alias` which appeared after version 1.3.6. If you are using a version of Apache without `mod_vhost_alias` then you can implement this technique with `mod_rewrite` as illustrated below, but only for Host:-header-based virtual hosts.

In addition there are some things to beware of with logging. Apache 1.3.6 is the first version to include the %V log format directive; in versions 1.3.0 - 1.3.3 the `%v` option did what %V does; version 1.3.4 has no equivalent. In all these versions of Apache the `UseCanonicalName` directive can appear in `.htaccess` files which means that customers can cause the wrong thing to be logged. Therefore the best thing to do is use the `%{Host}i` directive which logs the `Host:` header directly; note that this may include `:port` on the end which is not the case for %V.

Simple dynamic virtual hosts using `mod_rewrite`

This extract from `httpd.conf` does the same thing as the first example. The first half is very similar to the corresponding part above but with some changes for backward compatibility and to make the `mod_rewrite` part work properly; the second half configures `mod_rewrite` to do the actual work.

There are a couple of especially tricky bits: By default, `mod_rewrite` runs before the other URI translation modules (`mod_alias` etc.) so if they are used then `mod_rewrite` must be configured to accommodate them. Also, mome magic must be performed to do a per-dynamic-virtual-host equivalent of `ScriptAlias`.


```
# get the server name from the Host: header
UseCanonicalName Off

# splittable logs
LogFormat "%{Host}i %h %l %u %t \"%r\" %s %b" vcommon
CustomLog logs/access_log vcommon

<Directory /www/hosts>
        # ExecCGI is needed here because we can't force
        # CGI execution in the way that ScriptAlias does
        Options FollowSymLinks ExecCGI
</Directory>

# now for the hard bit

RewriteEngine On

# a ServerName derived from a Host: header may be any case at all
RewriteMap  lowercase  int:tolower

## deal with normal documents first:
# allow Alias /icons/ to work - repeat for other aliases
RewriteCond  %{REQUEST_URI}  !^/icons/
# allow CGIs to work
RewriteCond  %{REQUEST_URI}  !^/cgi-bin/
# do the magic
RewriteRule  ^/(.*)$  /www/hosts/${lowercase:%{SERVER_NAME}}/docs/$1

## and now deal with CGIs - we have to force a MIME type
RewriteCond  %{REQUEST_URI}  ^/cgi-bin/
RewriteRule  ^/(.*)$  /www/hosts/${lowercase:%{SERVER_NAME}}/cgi-bin/$1
[T=application/x-httpd-cgi]

# that's it!
```

A homepages system using `mod_rewrite`

This does the same thing as the second example.

```
RewriteEngine on

RewriteMap   lowercase  int:tolower

# allow CGIs to work
RewriteCond  %{REQUEST_URI}  !^/cgi-bin/
```


```
# check the hostname is right so that the RewriteRule works
RewriteCond  ${lowercase:%{SERVER_NAME}}  ^www\.[a-z-]+\.isp\.com$

# concatenate the virtual host name onto the start of the URI
# the [C] means do the next rewrite on the result of this one
RewriteRule  ^(.+)  ${lowercase:%{SERVER_NAME}}$1  [C]

# now create the real file name
RewriteRule  ^www\.([a-z-]+)\.isp\.com/(.*) /home/$1/$2

# define the global CGI directory
ScriptAlias  /cgi-bin/  /www/std-cgi/
```

Using a separate virtual host configuration file

This arrangement uses more advanced `mod_rewrite` features to get the translation from virtual host to document root from a separate configuration file. This provides more flexibility but requires more complicated configuration.

The `vhost.map` file contains something like this:

```
www.customer-1.com  /www/customers/1
www.customer-2.com  /www/customers/2
# ...
www.customer-N.com  /www/customers/N
```

The `http.conf` contains this:

```
RewriteEngine on

RewriteMap   lowercase  int:tolower

# define the map file
RewriteMap   vhost      txt:/www/conf/vhost.map

# deal with aliases as above
RewriteCond  %{REQUEST_URI}              !^/icons/
RewriteCond  %{REQUEST_URI}              !^/cgi-bin/
RewriteCond  ${lowercase:%{SERVER_NAME}}  ^(.+)$
# this does the file-based remap
RewriteCond  ${vhost:%1}                 ^(/.*)$
RewriteRule  ^/(.*)$                     %1/docs/$1

RewriteCond  %{REQUEST_URI}              ^/cgi-bin/
```

```
RewriteCond  ${lowercase:%{SERVER_NAME}}  ^(.+)$
RewriteCond  ${vhost:%1}                  ^(/.*)$
RewriteRule  ^/(.*)$                      %1/cgi-bin/$1
```

Apache HTTP Server Version 1.3

Module mod_vhost_alias

This module is contained in the `mod_vhost_alias.c` file and is not compiled in by default. It should be mentioned near the start of the `Configuration` file so that it doesn't override the behaviour of other modules that do filename translation, *e.g.*, `mod_userdir` and `mod_alias`. It provides support for dynamically configured mass virtual hosting.

Directory Name Interpolation

All the directives in this module interpolate a string into a pathname. The interpolated string (henceforth called the "name") may be either the server name (see the `UseCanonicalName` directive for details on how this is determined) or the IP address of the virtual host on the server in dotted-quad format. The interpolation is controlled by specifiers inspired by `printf` which have a number of formats:

`%%`
: insert a `%`

`%p`
: insert the port number of the virtual host

`%N.M`
: insert (part of) the name

`N` and `M` are used to specify substrings of the name. `N` selects from the dot-separated components of the name, and `M` selects characters within whatever `N` has selected. `M` is optional and defaults to zero if it isn't present; the dot must be present if and only if `M` is present. The interpretation is as follows:

`0`
: the whole name

`1`
: the first part

`2`
: the second part

`-1`
: the last part

`-2`
: the penultimate part

`2+`
: the second and all subsequent parts

`-2+`
: the penultimate and all preceding parts

`1+` and `-1+`
: the same as `0`

If N or M is greater than the number of parts available a single underscore is interpolated.

Examples

For simple name-based virtual hosts you might use the following directives in your server configuration file:

```
UseCanonicalName        Off
VirtualDocumentRoot     /usr/local/apache/vhosts/%0
```

A request for `http://www.example.com/directory/file.html` will be satisfied by the file `/usr/local/apache/vhosts/www.example.com/directory/file.html`.

For a very large number of virtual hosts it is a good idea to arrange the files to reduce the size of the `vhosts` directory. To do this you might use the following in your configuration file:

```
UseCanonicalName        Off
VirtualDocumentRoot     /usr/local/apache/vhosts/%3+/%2.1/%2.2/%2.3/%2
```

A request for `http://www.example.isp.com/directory/file.html` will be satisfied by the file `/usr/local/apache/isp.com/e/x/a/example/directory/file.html`. A more even spread of files can be achieved by hashing from the end of the name, for example:

```
VirtualDocumentRoot     /usr/local/apache/vhosts/%3+/%2.-1/%2.-2/%2.-3/%2
```

The example request would come from `/usr/local/apache/vhosts/isp.com/e/l/p/example/directory/file.html`. Alternatively you might use:

```
VirtualDocumentRoot     /usr/local/apache/vhosts/%3+/%2.1/%2.2/%2.3/%2.4+
```

The example request would come from `/usr/local/apache/vhosts/isp.com/e/x/a/mple/directory/file.html`.

For IP-based virtual hosting you might use the following in your configuration file:

```
UseCanonicalName DNS
VirtualDocumentRootIP   /usr/local/apache/vhost/%1/%2/%3/%4/docs
VirtualScriptAliasIP    /usr/local/apache/vhost/%1/%2/%3/%4/cgi-bin
```

A request for `http://www.example.isp.com/directory/file.html` would be satisfied by the file `/usr/local/apache/10/20/30/40/docs/directory/file.html` if the IP address of `www.example.com` were 10.20.30.40. A request for `http://www.example.isp.com/cgi-bin/script.pl` would be satisfied by executing the program `/usr/local/apache/10/20/30/40/cgi-bin/script.pl`.

The LogFormat directives %V and %A are useful in conjunction with this module.

Directives

- VirtualDocumentRoot
- VirtualDocumentRootIP
- VirtualScriptAlias
- VirtualScriptAliasIP

VirtualDocumentRoot directive

Syntax: VirtualDocumentRoot *interpolated-directory*
Default: None
Context: server config, virtual host
Status: Extension
Module: mod_vhost_alias
Compatibility: VirtualDocumentRoot is only available in 1.3.7 and later.

The `VirtualDocumentRoot` directive allows you to determine where Apache will find your documents based on the value of the server name. The result of expanding *interpolated-directory* is used as the root of the document tree in a similar manner to the `DocumentRoot` directive's argument. If *interpolated-directory* is `none` then `VirtaulDocumentRoot` is turned off. This directive cannot be used in the same context as `VirtualDocumentRootIP`.

VirtualDocumentRootIP directive

Syntax: VirtualDocumentRootIP *interpolated-directory*
Default: None
Context: server config, virtual host
Status: Extension
Module: mod_vhost_alias
Compatibility: VirtualDocumentRootIP is only available in 1.3.7 and later.

The `VirtualDocumentRootIP` directive is like the `VirtualDocumentRoot` directive, except that it uses the IP address of the server end of the connection instead of the server name.

VirtualScriptAlias directive

Syntax: VirtualScriptAlias *interpolated-directory*
Default: None
Context: server config, virtual host
Status: Extension
Module: mod_vhost_alias
Compatibility: VirtualScriptAlias is only available in 1.3.7 and later.

The `VirtualScriptAlias` directive allows you to determine where Apache will find CGI scripts in a similar manner to `VirtualDocumentRoot` does for other documents. It matches requests for URIs starting `/cgi-bin/`, much like `ScriptAlias /cgi-bin/` would.

VirtualScriptAliasIP directive

Syntax: VirtualScriptAliasIP *interpolated-directory*
Default: None

Context: server config, virtual host
Status: Extension
Module: mod_vhost_alias
Compatibility: VirtualScriptAliasIP is only available in 1.3.7 and later.

The `VirtualScriptAliasIP` directibe is like the `VirtualScriptAlias` directive, except that it uses the IP address of the server end of the connection instead of the server name.

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Module mod_userdir

This module is contained in the `mod_userdir.c` file, and is compiled in by default. It provides for user-specific directories.

UserDir

Syntax: UserDir *directory/filename*
Default: `UserDir public_html`
Context: server config, virtual host
Status: Base
Module: mod_userdir
Compatibility: All forms except the `UserDir public_html` form are only available in Apache 1.1 or above. Use of the enabled keyword, or disabled with a list of usernames, is only available in Apache 1.3 and above.

The UserDir directive sets the real directory in a user's home directory to use when a request for a document for a user is received. *Directory/filename* is one of the following:

- The name of a directory or a pattern such as those shown below.
- The keyword disabled. This turns off *all* username-to-directory translations except those explicitly named with the enabled keyword (see below).
- The keyword disabled followed by a space-delimited list of usernames. Usernames that appear in such a list will *never* have directory translation performed, even if they appear in an enabled clause.
- The keyword enabled followed by a space-delimited list of usernames. These usernames will have directory translation performed even if a global disable is in effect, but not if they also appear in a disabled clause.

If neither the enabled nor the disabled keywords appear in the Userdir directive, the argument is treated as a filename pattern, and is used to turn the name into a directory specification. A request for `http://www.foo.com/~bob/one/two.html` will be translated to:

```
UserDir public_html      -> ~bob/public_html/one/two.html
UserDir /usr/web         -> /usr/web/bob/one/two.html
UserDir /home/*/www      -> /home/bob/www/one/two.html
```

The following directives will send redirects to the client:

```
UserDir http://www.foo.com/users -> http://www.foo.com/users/bob/one/two.html
UserDir http://www.foo.com/*/usr -> http://www.foo.com/bob/usr/one/two.html
UserDir http://www.foo.com/~*/   -> http://www.foo.com/~bob/one/two.html
```

Be careful when using this directive; for instance, "UserDir ./" would map "/~root" to "/" - which is probably undesirable. If you are running Apache 1.3 or above, it is strongly recommended that your configuration include a "UserDir disabled root" declaration. See also the <Directory> directive and the Security Tips page for more information.

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Module mod_log_config

This module is contained in the `mod_log_config.c` file, and is compiled in by default in Apache 1.2. mod_log_config replaces mod_log_common in Apache 1.2. Prior to version 1.2, mod_log_config was an optional module. It provides for logging of the requests made to the server, using the Common Log Format or a user-specified format.

Summary

Three directives are provided by this module: `TransferLog` to create a log file, `LogFormat` to set a custom format, and `CustomLog` to define a log file and format in one go. The `TransferLog` and `CustomLog` directives can be used multiple times in each server to cause each request to be logged to multiple files.

Compatibility notes

- This module is based on mod_log_config distributed with previous Apache releases, now updated to handle multiple logs. There is now no need to re-configure Apache to use configuration log formats.
- The module also implements the `CookieLog` directive, used to log user-tracking information created by mod_usertrack. The use of `CookieLog` is deprecated, and a `CustomLog` should be defined to log user-tracking information instead.
- As of Apache 1.3.5, this module allows conditional logging based upon the setting of environment variables. That is, you can control whether a request should be logged or not based upon whether an arbitrary environment variable is defined or not. This is settable on a *per*-logfile basis.
- Beginning with Apache 1.3.5, the mod_log_config module has also subsumed the `RefererIgnore` functionality from mod_log_referer. The effect of `RefererIgnore` can be achieved by combinations of `SetEnvIf` directives and conditional `CustomLog` definitions.

Log File Formats

Unless told otherwise with `LogFormat` the log files created by `TransferLog` will be in standard "Common Log Format" (CLF). The contents of each line in a CLF file are explained below. Alternatively, the log file can be customized (and if multiple log files are used, each can have a different format). Custom formats are set with `LogFormat` and `CustomLog`.

Common Log Format

The Common Log Format (CLF) file contains a separate line for each request. A line is composed of several tokens separated by spaces:

host ident authuser date request status bytes

If a token does not have a value then it is represented by a hyphen (-). The meanings and values of these tokens are as follows:

host

The fully-qualified domain name of the client, or its IP number if the name is not available.

ident

If IdentityCheck is enabled and the client machine runs identd, then this is the identity information reported by client.

authuser

If the request was for an password protected document, then this is the userid used in the request.

date

The date and time of the request, in the following format:

```
date = [day/month/year:hour:minute:second zone]
day = 2*digit
month = 3*letter
year = 4*digit
hour = 2*digit
minute = 2*digit
second = 2*digit
zone = (`+' | `-') 4*digit
```

request

The request line from the client, enclosed in double quotes (").

status

The three digit status code returned to the client.

bytes

The number of bytes in the object returned to the client, not including any headers.

Custom Log Formats

The format argument to the `LogFormat` and `CustomLog` is a string. This string is logged to the log file for each request. It can contain literal characters copied into the log files, and `%' directives which are replaced in the log file by the values as follows:

```
%...b:          Bytes sent, excluding HTTP headers.
%...f:          Filename
%...{FOOBAR}e:  The contents of the environment variable FOOBAR
%...h:          Remote host
%...a:          Remote IP-address
%...A:          Local IP-address
%...{Foobar}i:  The contents of Foobar: header line(s) in the request
                sent to the server.
%...l:          Remote logname (from identd, if supplied)
%...{Foobar}n:  The contents of note "Foobar" from another module.
%...{Foobar}o:  The contents of Foobar: header line(s) in the reply.
%...p:          The canonical Port of the server serving the request
%...P:          The process ID of the child that serviced the request.
%...r:          First line of request
%...s:          Status.  For requests that got internally redirected, this
                is status of the *original* request --- %...>s for the last.
%...t:          Time, in common log format time format (standard english format)
%...{format}t:  The time, in the form given by format, which should
                be in strftime(3) format. (potentially localised)
%...T:          The time taken to serve the request, in seconds.
%...u:          Remote user (from auth; may be bogus if return status (%s) is 401)
%...U:          The URL path requested.
```


```
%...v:          The canonical ServerName of the server serving the request.
%...V:          The server name according to the UseCanonicalName setting.
```

The `...' can be nothing at all (*e.g.*, `"%h %u %r %s %b"`), or it can indicate conditions for inclusion of the item (which will cause it to be replaced with `-' if the condition is not met). Note that there is no escaping performed on the strings from %r, %...i and %...o; some with long memories may remember that I thought this was a bad idea, once upon a time, and I'm still not comfortable with it, but it is difficult to see how to `do the right thing' with all of `%..i', unless we URL-escape everything and break with CLF.

The forms of condition are a list of HTTP status codes, which may or may not be preceded by `!'. Thus, `%400,501{User-agent}i' logs User-agent: on 400 errors and 501 errors (Bad Request, Not Implemented) only; `%!200,304,302{Referer}i' logs Referer: on all requests which did **not** return some sort of normal status.

Note that the common log format is defined by the string `"%h %l %u %t \"%r\" %s %b"`, which can be used as the basis for extending for format if desired (*e.g.*, to add extra fields at the end). NCSA's extended/combined log format would be `"%h %l %u %t \"%r\" %s %b \"%{Referer}i\" \"%{User-agent}i\""`.

Note that the canonical ServerName and Port of the server serving the request are used for `%v` and `%p` respectively. This happens regardless of the UseCanonicalName setting because otherwise log analysis programs would have to duplicate the entire vhost matching algorithm in order to decide what host really served the request.

Using Multiple Log Files

The `TransferLog` and `CustomLog` directives can be given more than once to log requests to multiple log files. Each request will be logged to all the log files defined by either of these directives.

Use with Virtual Hosts

If a <VirtualHost> section does not contain any `TransferLog` or `CustomLog` directives, the logs defined for the main server will be used. If it does contain one or more of these directives, requests serviced by this virtual host will only be logged in the log files defined within its definition, not in any of the main server's log files. See the examples below.

Security Considerations

See the security tips document for details on why your security could be compromised if the directory where logfiles are stored is writable by anyone other than the user that starts the server.

Directives

CookieLog

Syntax: CookieLog *filename*
Context: server config, virtual host

Module: mod_cookies
Compatibility: Only available in Apache 1.2 and above

The CookieLog directive sets the filename for logging of cookies. The filename is relative to the ServerRoot. This directive is included only for compatibility with mod_cookies, and is deprecated.

CustomLog

Syntax: CustomLog *file-pipe format-or-nickname*
Context: server config, virtual host
Status: Base
Compatibility: Nickname only available in Apache 1.3 or later
Module: mod_log_config

The first argument is the filename to which log records should be written. This is used exactly like the argument to TransferLog; that is, it is either a full path or relative to the current server root.

The format argument specifies a format for each line of the log file. The options available for the format are exactly the same as for the argument of the `LogFormat` directive. If the format includes any spaces (which it will do in almost all cases) it should be enclosed in double quotes.

Instead of an actual format string, you can use a format nickname defined with the LogFormat directive.

CustomLog (conditional)

Syntax: CustomLog *file-pipe format-or-nickname* env=[!]*environment-variable*
Context: server config, virtual host
Status: Base
Compatibility: Only available in Apache 1.3.5 or later
Module: mod_log_config

The behaviour of this form of the CustomLog directive is almost identical to the standard `CustomLog` directive. The difference is that the '`env=`' clause controls whether a particular request will be logged in the specified file or not. If the specified environment variable is set for the request (or is not set, in the case of a '`env=!`*name*' clause), then the request will be logged.

Environment variables can be set on a *per*-request basis using the mod_setenvif and/or mod_rewrite modules. For example, if you don't want to record requests for all GIF images on your server in a separate logfile but not your main log, you can use:

```
SetEnvIf Request_URI \.gif$ gif-image
CustomLog gif-requests.log common env=gif-image
CustomLog nongif-requests.log common env=!gif-image
```

LogFormat

Syntax: LogFormat *format* [*nickname*]
Default: `LogFormat "%h %l %u %t \"%r\" %s %b"`
Context: server config, virtual host
Status: Base
Compatibility: Nickname only available in Apache 1.3 or later
Module: mod_log_config

This sets the format of the default logfile named by the TransferLog directive . See the section on Custom Log Formats for details on the format arguments.

If you include a nickname for the format on the directive line, you can use it in other LogFormat and CustomLog directives rather than repeating the entire format string.

A LogFormat directive which defines a nickname **does nothing else** -- that is, it *only* defines the nickname, it doesn't actually apply the format and make it the default.

TransferLog

Syntax: TransferLog *file-pipe*
Default: none
Context: server config, virtual host
Status: Base
Module: mod_log_config

The TransferLog directive adds a log file in the format defined by the most recent LogFormat directive, or Common Log Format if no other default format has been specified. *File-pipe* is one of

A filename

> A filename relative to the ServerRoot.

`|' followed by a command

> A program to receive the agent log information on its standard input. Note the a new program will not be started for a VirtualHost if it inherits the TransferLog from the main server.

Security: if a program is used, then it will be run under the user who started httpd. This will be root if the server was started by root; be sure that the program is secure.

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Module mod_usertrack

Previous releases of Apache have included a module which generates a 'clickstream' log of user activity on a site using cookies. This was called the "cookies" module, mod_cookies. In Apache 1.2 and later this module has been renamed the "user tracking" module, mod_usertrack. This module has been simplified and new directives added.

Logging

Previously, the cookies module (now the user tracking module) did its own logging, using the `CookieLog` directive. In this release, this module does no logging at all. Instead, a configurable log format file should be used to log user click-streams. This is possible because the logging module now allows multiple log files. The cookie itself is logged by using the text `%{cookie}n` in the log file format. For example:

```
CustomLog logs/clickstream "%{cookie}n %r %t"
```

For backward compatibility the configurable log module implements the old `CookieLog` directive, but this should be upgraded to the above `CustomLog` directive.

Directives

- CookieExpires
- CookieName
- CookieTracking

CookieExpires

Syntax: CookieExpires *expiry-period*
Context: server config, virtual host
Status: optional
Module: mod_usertrack

When used, this directive sets an expiry time on the cookie generated by the usertrack module. The *expiry-period* can be given either as a number of seconds, or in the format such as "2 weeks 3 days 7 hours". Valid denominations are: years, months, weeks, hours, minutes and seconds. If the expiry time is in any format other than one number indicating the number of seconds, it must be enclosed by double quotes.

If this directive is not used, cookies last only for the current browser session.

CookieName

Syntax: CookieName *token*
Default: *Apache*
Context: server config, virtual host, directory, .htaccess
Status: optional
Module: mod_usertrack
Compatibility: Apache 1.3.7 and later

This directive allows you to change the name of the cookie this module uses for its tracking purposes. By default the cookie is named "`Apache`".

You must specify a valid cookie name; results are unpredictable if you use a name containing unusual characters. Valid characters include A-Z, a-z, 0-9, "_", and "-".

CookieTracking

Syntax: CookieTracking *on* | *off*
Context: server config, virtual host, directory, .htaccess
Override: FileInfo
Status: optional
Module: mod_usertrack

When the user track module is compiled in, and "CookieTracking on" is set, Apache will start sending a user-tracking cookie for all new requests. This directive can be used to turn this behavior on or off on a per-server or per-directory basis. By default, compiling mod_usertrack will not activate cookies.

2-digit or 4-digit dates for cookies?

(the following is from message <022701bda43d$9d32bbb0$1201a8c0@christian.office.sane.com> in the new-httpd archives)

```
From: "Christian Allen" <christian@sane.com>
Subject: Re: Apache Y2K bug in mod_usertrack.c
Date: Tue, 30 Jun 1998 11:41:56 -0400

Did some work with cookies and dug up some info that might be useful.

True, Netscape claims that the correct format NOW is four digit dates, and
four digit dates do in fact work... for Netscape 4.x (Communicator), that
is.  However, 3.x and below do NOT accept them.  It seems that Netscape
originally had a 2-digit standard, and then with all of the Y2K hype and
probably a few complaints, changed to a four digit date for Communicator.
Fortunately, 4.x also understands the 2-digit format, and so the best way to
ensure that your expiration date is legible to the client's browser is to
use 2-digit dates.
```

However, this does not limit expiration dates to the year 2000; if you u an expiration year of "13", for example, it is interpreted as 2013, NOT 1913! In fact, you can use an expiration year of up to "37", and it will be understood as "2037" by both MSIE and Netscape versions 3.x and up (not sure about versions previous to those). Not sure why Netscape used that particular year as its cut-off point, but my guess is that it was in respect to UNIX's 2038 problem. Netscape/MSIE 4.x seem to be able to understand 2-digit years beyond that, at least until "50" for sure (I think they understand up until about "70", but not for sure).

Summary: Mozilla 3.x and up understands two digit dates up until "37" (2037). Mozilla 4.x understands up until at least "50" (2050) in 2-digit form, but also understands 4-digit years, which can probably reach up until 9999. Your best bet for sending a long-life cookie is to send it for some time late in the year "37".

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Multiple Log Files

It is now possible to specify multiple log files, each with a fully customizable format. This is compatible with existing configurations. Multiple log files are implemented as part of the mod_log_config module which as of Apache 1.2 is the default log module.

Using Multiple Log Files

Multiple log files be created with either the `TransferLog` or `CustomLog` directive. These directives can be repeated to create more than one log file (in previous releases, only one logfile could be given per server configuration). The `TransferLog` directive creates a log file in the standard "common log format", although this can be customized with `LogFormat`. The syntax of these two directives is the same as for the config log module in previous Apache releases.

The real power of multiple log files come from the ability to create log files in different formats. For example, as well as a CLF transfer log, the server could log the user agent of each client, or the referrer information, or any other aspect of the request, such as the language preferences of the user.

The new `CustomLog` directive takes both a filename to log to, and a log file format.

Syntax: CustomLog *filename "format"*
Context: server config, virtual host
Status: base
Module: mod_log_config

The first argument is the filename to log to. This is used exactly like the argument to `TransferLog`, that is, it is either a file as a full path or relative to the current server root, or |programname. Be aware that anyone who can write to the directory where a log file is written can gain access to the uid that starts the server. See the security tips document for details.

The format argument specifies a format for each line of the log file. The options available for the format are exactly the same as for the argument of the `LogFormat` directive. If the format includes any spaces (which it will do in almost all cases) it should be enclosed in double quotes.

Use with Virtual Hosts

If a <VirtualHost> section does not contain any `TransferLog` or `CustomLog` directives, the logs defined for the main server will be used. If it does contain one or more of these directives, requests serviced by this virtual host will only be logged in the log files defined within its definition, not in any of the main server's log files. See the examples below.

Examples

To create a normal (CLF) format log file in logs/access_log, and a log of user agents:

```
TransferLog logs/access_log
CustomLog   logs/agents     "%{user-agent}i"
```

To define a CLF transfer log and a referrer log which log all accesses to both the main server and a virtual host:

```
TransferLog logs/access_log
CustomLog   logs/referer    "%{referer}i"

<VirtualHost>
  DocumentRoot   /whatever
  ServerName     my.virtual.host
</VirtualHost>
```

Since no TransferLog or CustomLog directives appear inside the <VirtualHost> section, any requests for this virtual host will be logged in the main server's log files. If however the directive

```
TransferLog logs/vhost_access_log
```

was added inside the virtual host definition, then accesses to this virtual host will be logged in vhost_access_log file (in common log format), and *not* in logs/access_log or logs/referer.

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Module mod_log_referer

This module is contained in the `mod_log_referer.c` file, and is not compiled in by default. It provides for logging of the documents which reference documents on the server. As of Apache 1.3.5 it is deprecated. Use CustomLog (conditional) instead.

Log file format

The log file contains a separate line for each refer. Each line has the format

uri -> document

where *uri* is the (%-escaped) URI for the document that references the one requested by the client, and *document* is the (%-decoded) local URL to the document being referred to.

Directives

- RefererIgnore
- RefererLog

RefererIgnore

Syntax: RefererIgnore *string string* ...
Context: server config, virtual host
Status: Extension
Module: mod_log_referer

The RefererIgnore directive adds to the list of strings to ignore in Referer headers. If any of the strings in the list is contained in the Referer header, then no referrer information will be logged for the request. Example:

```
RefererIgnore www.ncsa.uiuc.edu
```

This avoids logging references from www.ncsa.uiuc.edu.

RefererLog

Syntax: RefererLog *file-pipe*
Default: `RefererLog logs/referer_log`
Context: server config, virtual host
Status: Extension
Module: mod_log_referer

The RefererLog directive sets the name of the file to which the server will log the Referer header of incoming requests. *File-pipe* is one of

A filename

A filename relative to the ServerRoot.

`|' followed by a command

A program to receive the referrer log information on its standard input. Note the a new program will not be started for a VirtualHost if it inherits the RefererLog from the main server.

Security: if a program is used, then it will be run under the user who started httpd. This will be root if the server was started by root; be sure that the program is secure.

Security: See the security tips document for details on why your security could be compromised if the directory where logfiles are stored is writable by anyone other than the user that starts the server.

This directive is provided for compatibility with NCSA 1.4.

Apache HTTP Server Version 1.3

Module mod_cookies

This module is obsolete. As of version 1.2 of Apache, it has been replaced with mod_usertrack.

This module is contained in the `mod_cookies.c` file, and is not compiled in by default. It provides for Netscape(TM) cookies. There is no documentation available for this module.

- CookieLog

CookieLog

Syntax: CookieLog *filename*
Context: server config, virtual host
Status: Experimental
Module: mod_cookies

The CookieLog directive sets the filename for logging of cookies. The filename is relative to the ServerRoot.

Apache HTTP Server Version 1.3

Module mod_access

This module is contained in the `mod_access.c` file, and is compiled in by default. It provides access control based on client hostname or IP address.

---

allow directive

Syntax: allow from *host host* ...
Context: directory, .htaccess
Override: Limit
Status: Base
Module: mod_access

The allow directive affects which hosts can access a given directory. *Host* is one of the following:

`all`
: All hosts are allowed access

A (partial) domain-name
: Hosts whose names match, or end in, this string are allowed access.

A full IP address
: An IP address of a host allowed access

A partial IP address
: The first 1 to 3 bytes of an IP address, for subnet restriction.

A network/netmask pair (**Apache 1.3 and later**)
: A network a.b.c.d, and a netmask w.x.y.z. For more fine-grained subnet restriction. (*i.e.*, 10.1.0.0/255.255.0.0)

A network/nnn CIDR specification (**Apache 1.3 and later**)

Similar to the previous case, except the netmask consists of nnn high-order 1 bits. (*i.e.*, 10.1.0.0/16 is the same as 10.1.0.0/255.255.0.0)

Example:

```
allow from .ncsa.uiuc.edu
```

All hosts in the specified domain are allowed access.

Note that this compares whole components; `bar.edu` would not match `foobar.edu`.

See also deny, order, and BrowserMatch.

Syntax: allow from env=*variablename*
Context: directory, .htaccess
Override: Limit
Status: Base
Module: mod_access
Compatibility: Apache 1.2 and above

The allow from env directive controls access to a directory by the existence (or non-existence) of an environment variable.

Example:

```
BrowserMatch ^KnockKnock/2.0 let_me_in
<Directory /docroot>
    order deny,allow
    deny from all
    allow from env=let_me_in
</Directory>
```

In this case browsers with the user-agent string `KnockKnock/2.0` will be allowed access, and all others will be denied.

See also deny from env and order.

---

deny directive

Syntax: deny from *host host* ...
Context: directory, .htaccess
Override: Limit
Status: Base
Module: mod_access

The deny directive affects which hosts can access a given directory. *Host* is one of the following:

`all`

all hosts are denied access

A (partial) domain-name

host whose name is, or ends in, this string are denied access.

A full IP address

An IP address of a host denied access

A partial IP address

The first 1 to 3 bytes of an IP address, for subnet restriction.

A network/netmask pair (**Apache 1.3 and later**)

A network a.b.c.d, and a netmask w.x.y.z. For more fine-grained subnet restriction. (*i.e.*, 10.1.0.0/255.255.0.0)

A network/nnn CIDR specification (**Apache 1.3 and later**)

Similar to the previous case, except the netmask consists of nnn high-order 1 bits. (*i.e.*, 10.1.0.0/16 is the same as 10.1.0.0/255.255.0.0)

Example:

```
deny from 16
```

All hosts in the specified network are denied access.

Note that this compares whole components; `bar.edu` would not match `foobar.edu`.

See also allow and order.

Syntax: deny from env=*variablename*
Context: directory, .htaccess
Override: Limit
Status: Base
Module: mod_access
Compatibility: Apache 1.2 and above

The deny from env directive controls access to a directory by the existence (or non-existence) of an environment variable.

Example:

```
BrowserMatch ^BadRobot/0.9 go_away
<Directory /docroot>
    order allow,deny
    allow from all
    deny from env=go_away
</Directory>
```

In this case browsers with the user-agent string `BadRobot/0.9` will be denied access, and all others will be allowed.

See also allow from env and order.

order directive

Syntax: order *ordering*
Default: `order deny,allow`
Context: directory, .htaccess
Override: Limit
Status: Base
Module: mod_access

The order directive controls the order in which allow and deny directives are evaluated. *Ordering* is one of

deny,allow
: the deny directives are evaluated before the allow directives. (The initial state is OK.)

allow,deny
: the allow directives are evaluated before the deny directives. (The initial state is FORBIDDEN.)

mutual-failure
: Only those hosts which appear on the allow list and do not appear on the deny list are granted access. (The initial state is irrelevant.)

Keywords may only be separated by a comma; no whitespace is allowed between them. **Note that in all cases every `allow` and `deny` statement is evaluated, there is no "short-circuiting".**

Example:

```
order deny,allow
deny from all
allow from .ncsa.uiuc.edu
```

Hosts in the ncsa.uiuc.edu domain are allowed access; all other hosts are denied access.

Apache HTTP Server Version 1.3

Apache module mod_proxy

This module is contained in the `mod_proxy.c` file for Apache 1.1.x, or the `modules/proxy` subdirectory for Apache 1.2, and is not compiled in by default. It provides for an **HTTP 1.0** caching proxy server. It is only available in Apache 1.1 and later. Common configuration questions are addressed after the directive descriptions.

Note:

This module was experimental in Apache 1.1.x. As of Apache 1.2, mod_proxy stability is *greatly* improved.

Summary

This module implements a proxy/cache for Apache. It implements proxying capability for `FTP`, `CONNECT` (for SSL), `HTTP/0.9`, and `HTTP/1.0`. The module can be configured to connect to other proxy modules for these and other protocols.

Directives

- CacheMaxExpire
- CacheDefaultExpire
- CacheLastModifiedFactor
- CacheGcInterval
- CacheDirLevels
- CacheDirLength
- CacheForceCompletion
- NoCache

ProxyRequests

Syntax: ProxyRequests *on/off*
Default: `ProxyRequests Off`
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: ProxyRequests is only available in Apache 1.1 and later.

This allows or prevents Apache from functioning as a proxy server. Setting ProxyRequests to 'off' does not disable use of the ProxyPass directive.

ProxyRemote

Syntax: ProxyRemote *<match> <remote-server>*
Default: *None*
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: ProxyRemote is only available in Apache 1.1 and later.

This defines remote proxies to this proxy. <match> is either the name of a URL-scheme that the remote server supports, or a partial URL for which the remote server should be used, or '*' to indicate the server should be contacted for all requests. <remote-server> is a partial URL for the remote server. Syntax:

```
<remote-server> = <protocol>://<hostname>[:port]
```

<protocol> is the protocol that should be used to communicate with the remote server; only "http" is

supported by this module.

Example:


```
ProxyRemote http://goodguys.com/ http://mirrorguys.com:8000
ProxyRemote * http://cleversite.com
ProxyRemote ftp http://ftpproxy.mydomain.com:8080
```

In the last example, the proxy will forward FTP requests, encapsulated as yet another HTTP proxy request, to another proxy which can handle them.

ProxyPass

Syntax: ProxyPass <*path*> <*url*>
Default: *None*
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: ProxyPass is only available in Apache 1.1 and later.

This directive allows remote servers to be mapped into the space of the local server; the local server does not act as a proxy in the conventional sense, but appears to be a mirror of the remote server. <path> is the name of a local virtual path; <url> is a partial URL for the remote server.

Suppose the local server has address http://wibble.org/; then

```
ProxyPass /mirror/foo/ http://foo.com/
```

will cause a local request for the <http://wibble.org/mirror/foo/bar> to be internally converted into a proxy request to <http://foo.com/bar>.

ProxyPassReverse

Syntax: ProxyPassReverse <*path*> <*url*>
Default: *None*
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: ProxyPassReverse is only available in Apache 1.3b6 and later.

This directive lets Apache adjust the URL in the `Location` header on HTTP redirect responses. For instance this is essential when Apache is used as a reverse proxy to avoid by-passing the reverse proxy

because of HTTP redirects on the backend servers which stay behind the reverse proxy.

<path> is the name of a local virtual path.
<url> is a partial URL for the remote server - the same way they are used for the `ProxyPass` directive.

Example:
Suppose the local server has address http://wibble.org/; then

```
ProxyPass        /mirror/foo/ http://foo.com/
ProxyPassReverse /mirror/foo/ http://foo.com/
```

will not only cause a local request for the <http://wibble.org/mirror/foo/bar> to be internally converted into a proxy request to <http://foo.com/bar> (the functionality ProxyPass provides here). It also takes care of redirects the server foo.com sends: when http://foo.com/bar is redirected by him to http://foo.com/quux Apache adjusts this to http://wibble.org/mirror/foo/quux before forwarding the HTTP redirect response to the client.

Note that this ProxyPassReverse directive can also be used in conjunction with the proxy pass-through feature ("RewriteRule ... [P]") from `mod_rewrite` because its doesn't depend on a corresponding ProxyPass directive.

AllowCONNECT

Syntax: AllowCONNECT *<port list>*
Default: *AllowCONNECT 443 563*
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: AllowCONNECT is only available in Apache 1.3.2 and later.

The AllowCONNECT directive specifies a list of port numbers to which the proxy CONNECT method may connect. Today's browsers use this method when a *https* connection is requested and proxy tunneling over *http* is in effect.
By default, only the default https port (443) and the default snews port (563) are enabled. Use the AllowCONNECT directive to overrride this default and allow connections to the listed ports only.

ProxyBlock

Syntax: ProxyBlock *<word/host/domain list>*
Default: *None*
Context: server config, virtual host
Override: *Not applicable*

Status: Base
Module: mod_proxy
Compatibility: ProxyBlock is only available in Apache 1.2 and later.

The ProxyBlock directive specifies a list of words, hosts and/or domains, separated by spaces. HTTP, HTTPS, and FTP document requests to sites whose names contain matched words, hosts or domains are *blocked* by the proxy server. The proxy module will also attempt to determine IP addresses of list items which may be hostnames during startup, and cache them for match test as well. Example:

```
ProxyBlock joes-garage.com some-host.co.uk rocky.wotsamattau.edu
```

'rocky.wotsamattau.edu' would also be matched if referenced by IP address.

Note that 'wotsamattau' would also be sufficient to match 'wotsamattau.edu'.

Note also that

```
ProxyBlock *
```

blocks connections to all sites.

ProxyReceiveBufferSize

Syntax: ProxyReceiveBufferSize <*bytes*>
Default: *None*
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: ProxyReceiveBufferSize is only available in Apache 1.3 and later.

The ProxyReceiveBufferSize directive specifies an explicit network buffer size for outgoing HTTP and FTP connections, for increased throughput. It has to be greater than 512 or set to 0 to indicate that the system's default buffer size should be used.

Example:

```
ProxyReceiveBufferSize 2048
```

NoProxy

Syntax: NoProxy { *<Domain>* | *<SubNet>* | *<IpAddr>* | *<Hostname>* }
Default: *None*
Context: server config, virtual host

Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: NoProxy is only available in Apache 1.3 and later.

This directive is only useful for Apache proxy servers within intranets. The NoProxy directive specifies a list of subnets, IP addresses, hosts and/or domains, separated by spaces. A request to a host which matches one or more of these is always served directly, without forwarding to the configured ProxyRemote proxy server(s).

Example:

```
ProxyRemote  *  http://firewall.mycompany.com:81
NoProxy         .mycompany.com 192.168.112.0/21
```

The arguments to the NoProxy directive are one of the following type list:

Domain

A *Domain* is a partially qualified DNS domain name, preceded by a period. It represents a list of hosts which logically belong to the same DNS domain or zone (*i.e.*, the suffixes of the hostnames are all ending in *Domain*).
Examples: .com .apache.org.
To distinguish *Domain*s from *Hostname*s (both syntactically and semantically; a DNS domain can have a DNS A record, too!), *Domain*s are always written with a leading period.
Note: Domain name comparisons are done without regard to the case, and *Domain*s are always assumed to be anchored in the root of the DNS tree, therefore two domains .MyDomain.com and .mydomain.com. (note the trailing period) are considered equal. Since a domain comparison does not involve a DNS lookup, it is much more efficient than subnet comparison.

SubNet

A *SubNet* is a partially qualified internet address in numeric (dotted quad) form, optionally followed by a slash and the netmask, specified as the number of significant bits in the *SubNet*. It is used to represent a subnet of hosts which can be reached over a common network interface. In the absence of the explicit net mask it is assumed that omitted (or zero valued) trailing digits specify the mask. (In this case, the netmask can only be multiples of 8 bits wide.)
Examples:

192.168 or 192.168.0.0

the subnet 192.168.0.0 with an implied netmask of 16 valid bits (sometimes used in the netmask form 255.255.0.0)

192.168.112.0/21

the subnet 192.168.112.0/21 with a netmask of 21 valid bits (also used in the form 255.255.248.0)

As a degenerate case, a *SubNet* with 32 valid bits is the equivalent to an *IPAddr*, while a *SubNet* with zero valid bits (*e.g.*, 0.0.0.0/0) is the same as the constant *_Default_*, matching any IP address.

IPAddr

A *IPAddr* represents a fully qualified internet address in numeric (dotted quad) form. Usually, address represents a host, but there need not necessarily be a DNS domain name connected wi the address.
Example: 192.168.123.7
Note: An *IPAddr* does not need to be resolved by the DNS system, so it can result in more effective apache performance.

See Also: DNS Issues

Hostname

A *Hostname* is a fully qualified DNS domain name which can be resolved to one or more *IPAddrs* via the DNS domain name service. It represents a logical host (in contrast to *Domain*s, see above) and must be resolvable to at least one *IPAddr* (or often to a list of hosts with different *IPAddr*'s).
Examples: prep.ai.mit.edu www.apache.org.
Note: In many situations, it is more effective to specify an *IPAddr* in place of a *Hostname* since a DNS lookup can be avoided. Name resolution in Apache can take a remarkable deal of time when the connection to the name server uses a slow PPP link.
Note: *Hostname* comparisons are done without regard to the case, and *Hostname*s are always assumed to be anchored in the root of the DNS tree, therefore two hosts WWW.MyDomain.com and www.mydomain.com. (note the trailing period) are considered equal.

See Also: DNS Issues

ProxyDomain

Syntax: ProxyDomain <*Domain*>
Default: *None*
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: ProxyDomain is only available in Apache 1.3 and later.

This directive is only useful for Apache proxy servers within intranets. The ProxyDomain directive specifies the default domain which the apache proxy server will belong to. If a request to a host without a domain name is encountered, a redirection response to the same host with the configured *Domain* appended will be generated.

Example:

```
ProxyRemote  *  http://firewall.mycompany.com:81
NoProxy         .mycompany.com 192.168.112.0/21
ProxyDomain     .mycompany.com
```

ProxyVia

Syntax: ProxyVia { *off* | *on* | *full* | *block* }
Default: *ProxyVia off*
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: ProxyVia is only available in Apache 1.3.2 and later.

This directive controls the use of the Via: HTTP header by the proxy. Its intended use is to control the flow of of proxy requests along a chain of proxy servers. See RFC2068 (HTTP/1.1) for an explanation of Via: header lines.

- If set to *off*, which is the default, no special processing is performed. If a request or reply contains a Via: header, it is passed through unchanged.
- If set to *on*, each request and reply will get a Via: header line added for the current host.
- If set to *full*, each generated Via: header line will additionally have the Apache server version shown as a Via: comment field.
- If set to *block*, every proxy request will have all its Via: header lines removed. No new Via: header will be generated.

CacheForceCompletion

Syntax: CacheForceCompletion <*percentage*>
Default: *90*
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: CacheForceCompletion is only available in Apache 1.3.1 and later.

If an http transfer that is being cached is cancelled, the proxy module will complete the transfer to cache if more than the percentage specified has already been transferred.

This is a percentage, and must be a number between 1 and 100, or 0 to use the default. 100 will cause a document to be cached only if the transfer was allowed to complete. A number between 60 and 90 is recommended.

CacheRoot

Syntax: CacheRoot <*directory*>
Default: *None*
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: CacheRoot is only available in Apache 1.1 and later.

Sets the name of the directory to contain cache files; this must be writable by the httpd server. (see the `User` directive).
Setting `CacheRoot` enables proxy cacheing; without defining a `CacheRoot`, proxy functionality will be available if `ProxyRequests` are set to `On`, but no cacheing will be available.

CacheSize

Syntax: CacheSize <*size*>
Default: `CacheSize 5`
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: CacheSize is only available in Apache 1.1 and later.

Sets the desired space usage of the cache, in KB (1024-byte units). Although usage may grow above this setting, the garbage collection will delete files until the usage is at or below this setting.
Depending on the expected proxy traffic volume and `CacheGcInterval`, use a value which is at least 20 to 40 % lower than the available space.

CacheGcInterval

Syntax: CacheGcInterval <*time*>
Default: *None*
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: CacheGcinterval is only available in Apache 1.1 and later.

Check the cache every <time> hours, and delete files if the space usage is greater than that set by

CacheSize. Note that <time> accepts a float value, you could for example use `CacheGcInterval 1.5` to check the cache every 90 minutes. (If unset, no garbage collection will be performed, and the cache will grow indefinitely.) Note also that the larger the `CacheGcInterval`, the more extra space beyond the configured `CacheSize` will be needed for the cache between garbage collections.

CacheMaxExpire

Syntax: CacheMaxExpire <*time*>
Default: `CacheMaxExpire 24`
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: CacheMaxExpire is only available in Apache 1.1 and later.

Cachable HTTP documents will be retained for at most <time> hours without checking the origin server. Thus documents can be at most <time> hours out of date. This restriction is enforced even if an expiry date was supplied with the document.

CacheLastModifiedFactor

Syntax: CacheLastModifiedFactor <*factor*>
Default: `CacheLastModifiedFactor 0.1`
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: CacheLastModifiedFactor is only available in Apache 1.1 and later.

If the origin HTTP server did not supply an expiry date for the document, then estimate one using the formula

```
expiry-period = time-since-last-modification * <factor>
```

For example, if the document was last modified 10 hours ago, and <factor> is 0.1, then the expiry period will be set to 10*0.1 = 1 hour.

If the expiry-period would be longer than that set by CacheMaxExpire, then the latter takes precedence.

CacheDirLevels

Syntax: CacheDirLevels <*levels*>
Default: `CacheDirLevels 3`
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: CacheDirLevels is only available in Apache 1.1 and later.

CacheDirLevels sets the number of levels of subdirectories in the cache. Cached data will be saved this many directory levels below CacheRoot.

CacheDirLength

Syntax: CacheDirLength <*length*>
Default: `CacheDirLength 1`
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: CacheDirLength is only available in Apache 1.1 and later.

CacheDirLength sets the number of characters in proxy cache subdirectory names.

CacheDefaultExpire

Syntax: CacheDefaultExpire <*time*>
Default: `CacheDefaultExpire 1`
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: CacheDefaultExpire is only available in Apache 1.1 and later.

If the document is fetched via a protocol that does not support expiry times, then use <time> hours as the expiry time. CacheMaxExpire does **not** override this setting.

NoCache

Syntax: NoCache *<word/host/domain list>*
Default: *None*
Context: server config, virtual host
Override: *Not applicable*
Status: Base
Module: mod_proxy
Compatibility: NoCache is only available in Apache 1.1 and later.

The NoCache directive specifies a list of words, hosts and/or domains, separated by spaces. HTTP and non-passworded FTP documents from matched words, hosts or domains are *not* cached by the proxy server. The proxy module will also attempt to determine IP addresses of list items which may be hostnames during startup, and cache them for match test as well. Example:

```
NoCache joes-garage.com some-host.co.uk bullwinkle.wotsamattau.edu
```

'bullwinkle.wotsamattau.edu' would also be matched if referenced by IP address.

Note that 'wotsamattau' would also be sufficient to match 'wotsamattau.edu'.

Note also that

```
NoCache *
```

disables caching completely.

Common configuration topics

- Controlling access to your proxy
- Using Netscape hostname shortcuts
- Why doesn't file type *xxx* download via FTP?
- Why does Apache start more slowly when using the proxy module?
- Can I use the Apache proxy module with my SOCKS proxy?
- What other functions are useful for an intranet proxy server?

Controlling access to your proxy

You can control who can access your proxy via the normal <Directory> control block using the following example:


```
<Directory proxy:*>
order deny,allow
deny from [machines you'd like *not* to allow by IP address or name]
allow from [machines you'd like to allow by IP address or name]
</Directory>
```

A <Files> block will also work, and is the only method known to work for all possible URLs in Apache versions earlier than 1.2b10.

Using Netscape hostname shortcuts

There is an optional patch to the proxy module to allow Netscape-like hostname shortcuts to be used. It's available from the contrib/patches/1.2 directory on the Apache Web site.

Why doesn't file type *xxx* download via FTP?

You probably don't have that particular file type defined as *application/octet-stream* in your proxy's mime.types configuration file. A useful line can be

```
application/octet-stream        bin dms lha lzh exe class tgz taz
```

How can I force an FTP ASCII download of File *xxx*?

In the rare situation where you must download a specific file using the FTP **ASCII** transfer method (while the default transfer is in **binary** mode), you can override mod_proxy's default by suffixing the request with ;type=a to force an ASCII transfer.

Why does Apache start more slowly when using the proxy module?

If you're using the `ProxyBlock` or `NoCache` directives, hostnames' IP addresses are looked up and cached during startup for later match test. This may take a few seconds (or more) depending on the speed with which the hostname lookups occur.

Can I use the Apache proxy module with my SOCKS proxy?

Yes. Just build Apache with the rule `SOCKS4=yes` in your *Configuration* file, and follow the instructions there. SOCKS5 capability can be added in a similar way (there's no `SOCKS5` rule yet), so

use the EXTRA_LDFLAGS definition, or build Apache normally and run it with the *runsocks* wrappe provided with SOCKS5, if your OS supports dynamically linked libraries.

Some users have reported problems when using SOCKS version 4.2 on Solaris. The problem was solved by upgrading to SOCKS 4.3.

Remember that you'll also have to grant access to your Apache proxy machine by permitting connections on the appropriate ports in your SOCKS daemon's configuration.

What other functions are useful for an intranet proxy server?

An Apache proxy server situated in an intranet needs to forward external requests through the company's firewall. However, when it has to access resources within the intranet, it can bypass the firewall when accessing hosts. The NoProxy directive is useful for specifying which hosts belong to the intranet and should be accessed directly.

Users within an intranet tend to omit the local domain name from their WWW requests, thus requesting "http://somehost/" instead of "http://somehost.my.dom.ain/". Some commercial proxy servers let them get away with this and simply serve the request, implying a configured local domain. When the ProxyDomain directive is used and the server is configured for proxy service, Apache can return a redirect response and send the client to the correct, fully qualified, server address. This is the preferred method since the user's bookmark files will then contain fully qualified hosts.

Installing the Apache 1.3 HTTP Server on TPF

[Download | Compilation | Installation | VisualAge]

This document outlines the steps needed to install Apache onto a TPF system.

You should first read htdocs/manual/readme-tpf.html for basic information on the port of Apache to TPF including required PUT level and supported functions & modules.

Download

Releases of the Apache server are compressed into a "tarball" file and stored on the Apache web site. You will need to choose a version and download the corresponding tarball to your PC. Additionally the source code from the tarball will need to be copied onto an MVS OS/390 Open Edition machine (later referred to simply as "Open Edition") for compiling. So here are all the details on how to get Apache and how to get it where it needs to be:

1. >Download the gzipped Apache files (the "tarball") to your PC. The file name on the web site will be something like *apache_1.3.x.tar.gz*.
   TIP: Be sure to keep the *.tar.gz* extension when choosing the name of the PC file.

2. Decompress the tarball on your PC using WinZip or some other PC decompression tool.
   TIP: If you are using WinZip verify that the *"TAR File Smart CR/LF Conversion"* option (under Options, Configuration) is NOT checked.
   This is what you can expect if you use WinZip:
   - open the tarball with WinZip (this can usually be done simply by double-clicking on the downloaded tarball)
   - you will be told that the archive contains one file (such as *apache_1.3.x.tar*) - allow WinZip to decompress it to a temporary folder
   - extract the archived files onto your PC - you'll be using files from the `conf, htdocs,` and `icons` directories later in the install phase

3. FTP the tarball to your Open Edition machine using binary mode:
   - activate FTP in an MSDOS window: **`ftp`** ***`your.open.edition.machine.com`***
   - sign in
   - set mode to binary: **`binary`**
   - send the file to Open Edition:
     `send` ***`c:\downloaded_filename.tar.gz open_edition_filename.tar.gz`***
   - exit FTP: **`bye`**

   TIP: Open Edition and UNIX file names are case sensitive. If you use an NFS client to transfer files from your PC to Open Edition (instead of using FTP as described above) verify that the NFS drive will transfer the file names with upper/lower case preserved.

4. Decompress the gzipped file on Open Edition: **`gunzip`** ***`open_edition_filename.tar.gz`***
   Note that the *.tar.gz* file will be replaced by the gunzipped *.tar* archive file.

5. Extract the archived files necessary for compiling Apache:
   - **`pax -rvkf`** ***`open_edition_filename.tar`*** **`-o from=ISO8859-1,to=IBM-1047 "*/src"`**
   - switch to the source code subdirectory of the newly extracted apache directory: **`cd`** ***`apache-1.3`*****`/src`**

- remove various subdirectories: **`rm -r lib/expat-lite os/bs2000 os/os2 os/win32`**

TIP: The "`make`" step (shown below) will fail if the `lib/expat-lite` directory is not removed.

Compilation

Apache supports the notion of "optional modules". However, the server has to know which modules are compiled into it. In order for those modules to be effective, it is necessary to generate a short bit of code (modules.c) which simply has a list of them. If you are using the `Configure` utility and `make`, modules.c and other necessary files will be created for you automatically.

The provided scripts assume a c89 compiler and have only been tested on an Open Edition environment. If you are using a platform other that Open Edition you may need to modify src/os/tpf/TPFExport and src/Configure to match your environment.

TIP: Editing files on your PC prior to moving them to Open Edition may result in the loss/addition of unprintable characters. Files of concern include shell scripts and src/Configuration. The most common problems are with tab characters and CR/LF characters. Most editors will handle the CR/LF problem correctly but none seem to handle tab characters. If you need to edit files prior to moving them to Open Edition, edit them in a UNIX editor such as vi or emacs.

Note that Open Edition commands in this section are shown in **`bold`**, are case sensitive, and must be made from the "src" directory.

1. Overlay src/Configuration with src/Configuration.tmpl: **`cp Configuration.tmpl Configuration`**

2. Edit src/Configuration. It contains the list and settings of various "Rules" and an additional section at the bottom that determines which modules to compile:

   - Adjust the Rules and `EXTRA_CFLAGS|LIBS|LDFLAGS|INCLUDES` if you feel so inclined.

   - Comment out (by preceding the line with a "#") lines corresponding to those modules you DO NOT wish to include.

   - Uncomment (by removing the initial "#", if present) lines corresponding to those optional modules you wish to include or add new lines corresponding to any custom modules you have written. The htdocs/manual/readme-tpf.html document lists the modules that have been tested on TPF.

   The modules placed in the Apache distribution are the ones that have been tested and are used regularly by various members of the Apache development group. Additional modules contributed by members or third parties with specific needs or functions are available at http://www.apache.org/dist/contrib/modules/. There are instructions on that page for linking these modules into the core Apache code.

3. Set the TPF environment variables: **`. os/tpf/TPFExport`**
   (The initial period and blank on the command are required to ensure the environment variables exist beyond the scope of the shell script.) This script will set the environment variables required to compile the programs for TPF. Verify that the export variables are valid for your installation, in particular, the system include file directories. The system include files must reside on your Open Edition system in the appropriate file structure similar to /usr/include and /usr/include/sys. DO NOT modify the `TPF=YES` export variable. If this is changed, the "Configure" script will not recognize TPF.

4. Run the "Configure" script: **`Configure`**
   This generates modules.c, include/ap_config_auto.h, and necessary Makefiles:

```
Using config file: Configuration
Creating Makefile
 + configured for TPF platform
 + setting C compiler to c89
 + setting C pre-processor to c89 -E
 + checking for system header files
```


```
 + adding selected modules
 + checking sizeof various data types
Creating Makefile in support
Creating Makefile in regex
Creating Makefile in os/tpf
Creating Makefile in ap
Creating Makefile in main
Creating Makefile in modules/standard
$ _
```

If you want to maintain multiple configurations, you can say, *e.g.*,
`Configure -file Configuration.ai`

```
Using config file: Configuration.ai
Creating Makefile
 + configured for <whatever> platform
 + setting C compiler to <whatever>
et cetera
```

If you receive an error such as "`Configure 146: FSUM7351 not found`" the most likely explanation is that one or more of the `make` related files were edited on a non-UNIX platform, corrupting the end-of-line marks. Verify that lines ending with "\" in the flagged file do not have trailing spaces. Using the vi editor and the sample error above as an example...

```
pull up the flagged file:       vi Configure
turn on punctuation:            :set list
go to the line in question:     146G
   or find a line with a "\":   /\\
```

The end of line should display as "`\$`". If it is displayed as "`\ $`" (with a blank between \ and $) then you should revert to the distributed version of the file and make the site-specific changes again using a UNIX compatible editor such as vi or emacs. Then try the Configure command again.

```
close the file:                 :q  (or :quit!)
```

5. Edit include/ap_config.h if you would like the scoreboard kept in shared memory instead of file or system heap.
   The default behavior for Apache on all platforms *except* TPF is to use the file system for maintaining the scoreboard (which holds current Apache children status). The default behavior for Apache on TPF is to use system heap. Available with PUT10 is the use of shared memory for the scoreboard in place of the file system. This reduces file activity for the parent Apache ECB and improves performance. To activate shared memory, uncomment or *add* the directive **`#define USE_SHMGET_SCOREBOARD`** and comment out or *remove* the directive **`#define USE_TPF_SCOREBOARD`** both of which are in the TPF section in ap_config.h. This change will only take effect after Apache is (re)compiled.

   If you prefer to use the file system instead of system heap or shared memory, ensure that both `USE_TPF_SCOREBOARD` and `USE_SHMGET_SCOREBOARD` are commented out or removed. This change will only take effect after Apache is (re)compiled.

6. Edit include/ap_config.h if you plan on using the ZINET DAEMON model instead of the NOLISTEN model.
   The default behavior is to let Apache check the server status (active/inactive) with ZINET and shut itself down when appropriate. The default behavior also includes checking Apache's activation number. Available with PUT11 (PJ25761) ZINET can perform these functions instead of Apache by using the DAEMON model. This model offers increased reliability and is preferred over the NOLISTEN model. If Apache goes down while running under the NOLISTEN model ZINET will not reactivate it nor alert the operator. To use the DAEMON model you must modify the default behavior of Apache by uncommenting or adding the directive **`#define USE_TPF_DAEMON`** within the TPF section in ap_config.h. This directive is also recommend when starting Apache from the command line (APAR PJ26515). This change will only take effect after Apache is (re)compiled.

7. Now compile the programs: **`make`**

TOC

Besides compiling, `make` also runs main/gen_test_char.c and main/gen_uri_delims.c in order to create main/test_char.h main/uri_delims.h respectively

If during compilation you get a warning about a missing 'regex.h', set `WANTHSREGEX=yes` in the src/Configuration file and start back at the **`Configure`** step.

Installation

1. Link the compiled object files into a DLL. Sample link JCL has been included as src/os/tpf/samples/linkdll.jcl. You will need to modify this JCL:
   - Change the IDs, data set names, and libraries for your particular site.
   - Add/remove `mod_`*`xxx`*`.o` files so they correspond to the `mod_`*`xxx`*`.o` lines in your src/Configuration file.

   TIP: Do NOT include gen_test_char.o or gen_uri_delims.o in the link JCL since these files are only used during the `make` step.

2. Create a loadset. Sample loadset JCL has been included as src/os/tpf/samples/loadset.jcl. You will need to modify this JCL for your particular site.

3. Load (`ZOLDR LOAD`) and activate (`ZOLDR ACT`) the loadset on your test system.

4. Ensure that the program name you are using for Apache has `RESTRICT` and `KEY0` authorization. **`zdpat `*`pppp`*` (c-c)`** will display allocation information. You can use **`zapat `*`pppp`*` restrict key0 (c-c)`** to alter the authorization. Note that if the program name is unallocated, you must have the loadset for it activated or you will receive INVALID PROGRAM NAME from the `zdpat/zapat` entries.

5. Apache requires a configuration file to initialize itself during activation. (Previously three configuration files were used.) Copy the distribution version, /conf/httpd.conf-dist, to /conf/httpd.conf and then edit the /conf/httpd.conf copy with your site specific information.

   General documentation for Apache is located at http://www.apache.org/docs/ and in the HTML pages included with the distribution (tarball) under the /htdocs/manual directory.

6. On TPF activate ZCLAW and update INETD using ZINET entries, the common case:

   ```
   ZINET ADD S-TFTP PGM-CTFT PORT-69 PROTOCOL-UDP MODEL-NOWAIT

   ZINET ADD S-APACHE PGM-pppp MODEL-NOLISTEN PROTOCOL-TCP
   or ZINET ADD S-APACHE PGM-pppp MODEL-DAEMON USER-root (see notes above regarding the DAEMON model)
   ```

   Please refer to *IBM Transaction Processing Facility Transmission Control Protocol/Internet Protocol Version 4 Release 1* for more information on ZCLAW, INETD, and TFTP.

7. Prior to sending a request to your Apache server from a browser, TFTP the configuration file, log, icons and web pages to your TPF system. A typical directory structure for Apache is as follows:

   ```
   /usr/local/apache/conf
   /usr/local/apache/logs
   /usr/local/apache/icons
   /usr/local/apache/htdocs
   ```

   All gif, jpg, and zip files should be TFTP'd as binary; conf files and html pages should be TFTP'd as text.

The logs directory must exist in order to avoid an `fopen` error while running Apache. If you're running a PUT10 or hi version of TPF make the directory using the **`zfile mkdir /usr/local/apache/logs`** functional entry. If you running TPF version PUT09 TFTP an empty file into the logs subdirectory to create it.

8. Start the server using the **`ZINET START S-APACHE`** command.

Compiling with VisualAge TPF

It is not required that `make` be used to compile Apache for TPF: Individual programs may be compiled using IBM's VisualAge TPF product. This is particularly useful when compiling selected programs for the Debug Tool.

The following VisualAge compile settings are required:

- *"DEFINE - Define preprocessor macro name(s)"* must include **`TPF, CHARSET_EBCDIC, _POSIX_SOURCE,`** and **`USE_HSREGEX`**
- *"LSEARCH - Path for user include files"* must include **`../src/include`** and **`../src/os/tpf`**
- *"DLL - Generate DLL code"* must be checked
- *"LONGNAME - Support long names"* must be checked

Overview of the Apache TPF Port

[Configuration Files | What's Available | Porting Notes]

This version of Apache includes changes allowing it to run on IBM's EBCDIC-based TPF (Transaction Processing Facility) operating system. Unless otherwise noted TPF version 4.1 PUT09 is required.

Refer to htdocs/manual/install-tpf.html for step-by-step installation instructions.

As this is the first cut at making Apache run on TPF, performance tuning has not been done.

This port builds upon the EBCDIC changes previously made to Apache.

Apache Configuration Files

The distributed configuration files (httpd.conf-dist and mime.types, both located in the conf subdirectory) work on TPF. Performance considerations may dictate setting KeepAlive to "Off" (the default is "On") or lowering the Timeout value from the default 300 seconds (5 minutes) in order to reduce the number of active ECBs on your system.

What's Available in this Version

(The Apache organization provides >online documentation describing the various modules and components of the server.)

Components/modules tested on TPF:

- alloc.c
- ap_base64.c
- ap_checkpass.c
- ap_cpystrn.c
- ap_fnmatch.c
- ap_md5c.c
- ap_sha1.c
- ap_signal.c
- ap_slack.c

- ap_snprintf.c
- buff.c
- buildmark.c
- ebcdic.c
- gen_test.char.c
- gen_uri_delims.c
- htpasswd.c *(requires PUT10)*
- http_config.c
- http_core.c
- http_log.c
- http_main.c
- http_protocol.c
- http_request.c
- http_vhost.c
- logresolve.c *(requires PUT10)*
- mod_access.c *(see note 1)*
- mod_actions.c
- mod_alias.c
- mod_asis.c
- mod_auth.c
- mod_auth_anon.c
- mod_autoindex.c
- mod_cern_meta.c
- mod_cgi.c *(requires PUT10)*
- mod_dir.c
- mod_env.c
- mod_example.c
- mod_expires.c
- mod_headers.c
- mod_imap.c
- mod_include.c *(see note 2)*
- mod_info.c
- mod_log_agent.c
- mod_log_config.c
- mod_log_referer.c
- mod_mime.c

- mod_mime_magic.c
- mod_negotiation.c
- mod_put.c *(third party module)*
- mod_setenvif.c
- mod_speling.c
- mod_status.c
- mod_tpf_shm_static.c *(third party module, requires PUT10)*
- mod_unique_id.c *(requires PUT10)*
- mod_userdir.c
- mod_usertrack.c
- os.c
- os-inline.c
- regular expression parser
- regular expression test tool *(requires PUT10)*
- rfc1413.c
- rotatelogs.c *(requires PUT10)*
- util.c
- util_date.c
- util_md5.c
- util_script.c
- util_uri.c

Notes:

1. Use of mod_access directives "`allow from`" & "`deny from`" with host *names* (verses ip addresses) requires TPF version 4.1 PUT10
2. CGI execution requires TPF version 4.1 PUT10

Components/modules not yet supported on TPF:

- htdigest.c
- lib/expat-lite
- mod_digest.c
- mod_rewrite.c
- mod_vhost_alias.c
- proxy server code

Components/modules that don't apply or that probably won't ever be available on TPF:

- ab.c
- ap_getpass.c
- mod_auth_db.c
- mod_auth_dbm.c
- mod_auth_db.module
- mod_mmap_static.c
- mod_so.c
- suexec.c

Porting Notes

Changes made due to differences between UNIX and TPF's process models:

- **Signals**: On TPF a signal that is sent to a process remains unhandled until the process explicitly requests that signals be handled using the `tpf_process_signals()` function. Additionally, the default action for an alarm on TPF is to take an OPR-7777 dump and exit. (On UNIX the default is the equivalent of `exit()` with no dump taken.) These differences necessitated a few modifications:
    - bypass the use of `ap_block_alarms()` & `ap_unblock_alarms()`
    - add `tpf_process_signals()` calls
    - add `select()` calls to prevent blocking.

Find that function...

Some simple functions & definitions initially needed to be added on TPF, such as `FD_SET()`. We've put these in src/os/tpf/os.h for now.

EBCDIC changes:

TPF-specific conversion tables between US-ASCII and EBCDIC (character set IBM-1047 to be exact) were created and put into ebcdic.c in the src/os/tpf directory.

Miscellaneous, minor changes:

Various minor changes (such as casting) were made due to differences in how some functions are implemented on TPF.

[top | Configuration Files | What's Available | Porting Notes]

Apache HTTP Server Version 1.3

Overview of the Apache EBCDIC Port

Version 1.3 of the Apache HTTP Server is the first version which includes a port to a (non-ASCII) mainframe machine which uses the EBCDIC character set as its native codeset.
(It is the SIEMENS family of mainframes running the BS2000/OSD operating system. This mainframe OS nowadays features a SVR4-derived POSIX subsystem).

The port was started initially to

- prove the feasibility of porting the Apache HTTP server to this platform
- find a "worthy and capable" successor for the venerable CERN-3.0 daemon (which was ported a couple of years ago), and to
- prove that Apache's preforking process model can on this platform easily outperform the accept-fork-serve model used by CERN by a factor of 5 or more.

This document serves as a rationale to describe some of the design decisions of the port to this machine.

Design Goals

One objective of the EBCDIC port was to maintain enough backwards compatibility with the (EBCDIC) CERN server to make the transition to the new server attractive and easy. This required the addition of a configurable method to define whether a HTML document was stored in ASCII (the only format accepted by the old server) or in EBCDIC (the native document format in the POSIX subsystem, and therefore the only realistic format in which the other POSIX tools like grep or sed could operate on the documents). The current solution to this is a "pseudo-MIME-format" which is intercepted and interpreted by the Apache server (see below). Future versions might solve the problem by defining an "ebcdic-handler" for all documents which must be converted.

Technical Solution

Since all Apache input and output is based upon the BUFF data type and its methods, the easiest solution was to add the conversion to the BUFF handling routines. The conversion must be settable at any time, so a BUFF flag was added which defines whether a BUFF object has currently enabled conversion or not. This flag is modified at several points in the HTTP protocol:

- **set** before a request is received (because the request and the request header lines are always in ASCII format)
- **set/unset** when the request body is received - depending on the content type of the request body

(because the request body may contain ASCII text or a binary file)

- **set** before a reply header is sent (because the response header lines are always in ASCII format)
- **set/unset** when the response body is sent - depending on the content type of the response body (because the response body may contain text or a binary file)

Porting Notes

1. The relevant changes in the source are #ifdef'ed into two categories:

   `#ifdef CHARSET_EBCDIC`

   Code which is needed for any EBCDIC based machine. This includes character translations, differences in contiguity of the two character sets, flags which indicate which part of the HTTP protocol has to be converted and which part doesn't *etc.*

   `#ifdef _OSD_POSIX`

   Code which is needed for the SIEMENS BS2000/OSD mainframe platform only. This deals with include file differences and socket implementation topics which are only required on the BS2000/OSD platform.

2. The possibility to translate between ASCII and EBCDIC at the socket level (on BS2000 POSIX, there is a socket option which supports this) was intentionally *not* chosen, because the byte stream at the HTTP protocol level consists of a mixture of protocol related strings and non-protocol related raw file data. HTTP protocol strings are always encoded in ASCII (the GET request, any Header: lines, the chunking information *etc.*) whereas the file transfer parts (*i.e.*, GIF images, CGI output *etc.*) should usually be just "passed through" by the server. This separation between "protocol string" and "raw data" is reflected in the server code by functions like bgets() or rvputs() for strings, and functions like bwrite() for binary data. A global translation of everything would therefore be inadequate.
   (In the case of text files of course, provisions must be made so that EBCDIC documents are always served in ASCII)
3. This port therefore features a built-in protocol level conversion for the server-internal strings (which the compiler translated to EBCDIC strings) and thus for all server-generated documents. The hard coded ASCII escapes \012 and \015 which are ubiquitous in the server code are an exception: they are already the binary encoding of the ASCII \n and \r and must not be converted to ASCII a second time. This exception is only relevant for server-generated strings; and *external* EBCDIC documents are not expected to contain ASCII newline characters.
4. By examining the call hierarchy for the BUFF management routines, I added an "ebcdic/ascii conversion layer" which would be crossed on every puts/write/get/gets, and a conversion flag which allowed enabling/disabling the conversions on-the-fly. Usually, a document crosses this layer twice from its origin source (a file or CGI output) to its destination (the requesting client): file -> Apache, and Apache -> client.
   The server can now read the header lines of a CGI-script output in EBCDIC format, and then find out that the remainder of the script's output is in ASCII (like in the case of the output of a WWW Counter program: the document body contains a GIF image). All header processing is done in the

native EBCDIC format; the server then determines, based on the type of document being serv whether the document body (except for the chunking information, of course) is in ASCII alre or must be converted from EBCDIC.

5. For Text documents (MIME types text/plain, text/html *etc.*), an implicit translation to ASCII can be used, or (if the users prefer to store some documents in raw ASCII form for faster serving, or because the files reside on a NFS-mounted directory tree) can be served without conversion.
   Example:

   to serve files with the suffix .ahtml as a raw ASCII text/html document without implicit conversion (and suffix .ascii as ASCII text/plain), use the directives:

   ```
   AddType  text/x-ascii-html  .ahtml
   AddType  text/x-ascii-plain .ascii
   ```

   Similarly, any text/XXXX MIME type can be served as "raw ASCII" by configuring a MIME type "text/x-ascii-XXXX" for it using AddType.
6. Non-text documents are always served "binary" without conversion. This seems to be the most sensible choice for, *.e.g.*, GIF/ZIP/AU file types. This of course requires the user to copy them to the mainframe host using the "rcp -b" binary switch.
7. Server parsed files are always assumed to be in native (*i.e.*, EBCDIC) format as used on the machine, and are converted after processing.
8. For CGI output, the CGI script determines whether a conversion is needed or not: by setting the appropriate Content-Type, text files can be converted, or GIF output can be passed through unmodified. An example for the latter case is the wwwcount program which we ported as well.

Document Storage Notes

Binary Files

All files with a Content-Type: which does not start with text/ are regarded as *binary files* by the server and are not subject to any conversion. Examples for binary files are GIF images, gzip-compressed files and the like.

When exchanging binary files between the mainframe host and a Unix machine or Windows PC, be sure to use the ftp "binary" (TYPE I) command, or use the rcp -b command from the mainframe host (the -b switch is not supported in unix rcp's).

Text Documents

The default assumption of the server is that Text Files (*i.e.*, all files whose Content-Type: starts with text/) are stored in the native character set of the host, EBCDIC.

Server Side Included Documents

SSI documents must currently be stored in EBCDIC only. No provision is made to convert it from ASCII before processing.

Apache Modules' Status

Module	Status	Notes
http_core	+	
mod_access	+	
mod_actions	+	
mod_alias	+	
mod_asis	+	
mod_auth	+	
mod_auth_anon	+	
mod_auth_db	?	with own libdb.a
mod_auth_dbm	?	with own libdb.a
mod_autoindex	+	
mod_cern_meta	?	
mod_cgi	+	
mod_digest	+	
mod_dir	+	
mod_so	-	no shared libs
mod_env	+	
mod_example	-	(test bed only)
mod_expires	+	
mod_headers	+	
mod_imap	+	
mod_include	+	
mod_info	+	
mod_log_agent	+	
mod_log_config	+	
mod_log_referer	+	
mod_mime	+	
mod_mime_magic	?	not ported yet
mod_negotiation	+	

mod_proxy	+	
mod_rewrite	+	untested
mod_setenvif	+	
mod_speling	+	
mod_status	+	
mod_unique_id	+	
mod_userdir	+	
mod_usertrack	?	untested

Third Party Modules' Status

Module	Status	Notes
mod_jserv	-	JAVA still being ported.
mod_php3	+	mod_php3 runs fine, with LDAP and GD and FreeType libraries
mod_put	?	untested
>mod_session	-	untested

Apache HTTP Server Version 1.3

Compiling Apache under UnixWare

To compile a working copy of Apache under UnixWare, there are several other steps you may need to take. These prevent such problems as zombie processes, bind errors, and accept errors, to name a few.

UnixWare 1.x

Make sure that USE_FCNTL_SERIALIZE_ACCEPT is defined (if not defined by Apache autoconfiguration). If using the UnixWare *cc* compiler, and you still see accept() errors, don't use compiler optimization, or get *gcc*.

UnixWare 2.0.x

SCO patch tf2163 is required in order for Apache to work correctly on UnixWare 2.0.x. See http://www.sco.com for UnixWare patch information.

In addition, make sure that USE_FCNTL_SERIALIZE_ACCEPT is defined (if not defined by Apache autoconfiguration). To reduce instances of connections in FIN_WAIT_2 state, you may also want to define NO_LINGCLOSE (Apache 1.2 only).

UnixWare 2.1.x

SCO patch ptf3123 is required in order for Apache to work correctly on UnixWare 2.1.x. See http://www.sco.com for UnixWare patch information.

NOTE: Unixware 2.1.2 and later already have patch ptf3123 included

In addition, make sure that USE_FCNTL_SERIALIZE_ACCEPT is defined (if not defined by Apache autoconfiguration). To reduce instances of connections in FIN_WAIT_2 state, you may also want to define NO_LINGCLOSE (Apache 1.2 only).

Thanks to Joe Doupnik <JRD@cc.usu.edu> and Rich Vaughn <rvaughn@aad.com> for additional info for UnixWare builds.

Apache HTTP Server Version 1.3

Starting Apache

Invoking Apache

On Unix, the `httpd` program is usually run as a daemon which executes continuously, handling requests. It is possible to invoke Apache by the Internet daemon `inetd` each time a connection to the HTTP service is made (use the ServerType directive) but this is not recommended.

On Windows, Apache is normally run as a service on Windows NT, or as a console application on Windows 95. See also running Apache for Windows.

Command line options

The following options are recognized on the httpd command line:

`-d` *serverroot*

Set the initial value for the ServerRoot variable to *serverroot*. This can be overridden by the ServerRoot command in the configuration file. The default is `/usr/local/apache` on Unix, `/apache` on Windows and `/os2httpd` on OS/2.

`-D` *name*

Define a name for use in in IfDefine directives. This option can be used to optionally enable certain functionality in the configuration file, or to use a common configuration for several independent hosts, where host specific information is enclosed in <IfDefine> sections.

`-f` *config*

Execute the commands in the file *config* on startup. If *config* does not begin with a `/`, then it is taken to be a path relative to the ServerRoot. The default is `conf/httpd.conf`.

`-C` *"directive"*

Process the given apache "directive" (just as if it had been part of a configuration file) **before** actually reading the regular configuration files.

`-c` *"directive"*

Process the given apache "directive" **after** reading all the regular configuration files.

`-X`

Run in single-process mode, for internal debugging purposes only; the daemon does not detach from the terminal or fork any children. Do *NOT* use this mode to provide ordinary web service.

`-v`

Print the version of httpd and its build date, and then exit.

`-V`

Print the base version of httpd, its build date, and a list of compile time settings which influence the behavior and performance of the apache server (*e.g.*, -DUSE_MMAP_FILES), then exit.

`-L`

Give a list of directives together with expected arguments and places where the directive is valid, then exit. (Apache 1.3.4 and later. Earlier versions used -l instead).

`-l`

Give a list of all modules compiled into the server, then exit. (Apache 1.3.4 and later. Earlier versions used -h instead).
Give a list of directives together with expected arguments and places where the directive is valid, then exit. (Apache 1.2 to 1.3.3. Later versions use -L instead).

`-h`

Print a list of the httpd options, then exit. (Apache 1.3.4 and later. Earlier versions used -? instead).
Give a list of all modules compiled into the server, then exit. (Up to Apache 1.3.3. Later versions use -l instead).

`-S`

Show the settings as parsed from the config file (currently only shows a breakdown of the vhost settings) but do not start the server. (Up to Apache 1.3.3, this option also started the server).

`-t`

Test the configuration file syntax (*i.e.*, read all configuration files and interpret them) but do not start the server. If the configuration contains errors, display an error message and exit with a non-zero exit status, otherwise display "Syntax OK" and terminate with a zero exit status. This command checks to see if all DocumentRoot entries exist and are directories. For sites with many vhosts, this is expensive; consider the `-T` command instead.

`-T`

Test the configuration file syntax (*i.e.*, read all configuration files and interpret them) but do not start the server. If the configuration contains errors, display an error message and exit with a non-zero exit status, otherwise display "Syntax OK" and terminate with a zero exit status. This command does not perform any checking of the DocumentRoot entries.

`-k` *option*

Windows only: signal Apache to restart or shutdown. *option* is one of "shutdown" or "restart". (Apache 1.3.3 and later).

`-?`

Print a list of the httpd options, and then exit (up to Apache 1.3.3. Later version use -h instead).

Configuration files

The server will read three files for configuration directives. Any directive may appear in any of these files. The the names of these files are taken to be relative to the server root; this is set by the ServerRoot directive, the `-d` command line flag, or (on Windows only) the registry (see Running Apache for Windows). Conventionally, the files are:

`conf/httpd.conf`
: Contains directives that control the operation of the server daemon. The filename may be overridden with the `-f` command line flag.

`conf/srm.conf`
: Contains directives that control the specification of documents that the server can provide to clients. The filename may be overridden with the ResourceConfig directive.

`conf/access.conf`
: Contains directives that control access to documents. The filename may be overridden with the AccessConfig directive.

However, these conventions need not be adhered to.

The server also reads a file containing mime document types; the filename is set by the TypesConfig directive, and is `conf/mime.types` by default.

Log files

security warning

Anyone who can write to the directory where Apache is writing a log file can almost certainly gain access to the uid that the server is started as, which is normally root. Do *NOT* give people write access to the directory the logs are stored in without being aware of the consequences; see the security tips document for details.

pid file

On startup, Apache saves the process id of the parent httpd process to the file `logs/httpd.pid`. This filename can be changed with the PidFile directive. The process-id is for use by the administrator in restarting and terminating the daemon: on Unix, a HUP or USR1 signal causes the daemon to re-read its configuration files and a TERM signal causes it to die gracefully; on Windows, use the -k command line option instead. For more information see the Stopping and Restarting page.

If the process dies (or is killed) abnormally, then it will be necessary to kill the children httpd processes.

Error log

The server will log error messages to a log file, by default `logs/error_log` on Unix or `logs/error.log` on Windows and OS/2. The filename can be set using the ErrorLog directive; different error logs can be set for different virtual hosts.

Transfer log

The server will typically log each request to a transfer file, by default `logs/access_log` on Unix or `logs/access.log` on Windows and OS/2. The filename can be set using a TransferLog directive or additional log files created with the CustomLog directive; different transfer logs can be set for different virtual hosts.

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Apache HTTP Server Version 1.3

Stopping and Restarting Apache

This document covers stopping and restarting Apache on Unix only. Windows users should see Signalling Apache when running.

You will notice many `httpd` executables running on your system, but you should not send signals to any of them except the parent, whose pid is in the PidFile. That is to say you shouldn't ever need to send signals to any process except the parent. There are three signals that you can send the parent: `TERM`, `HUP`, and `USR1`, which will be described in a moment.

To send a signal to the parent you should issue a command such as:

```
kill -TERM `cat /usr/local/apache/logs/httpd.pid`
```

You can read about its progress by issuing:

```
tail -f /usr/local/apache/logs/error_log
```

Modify those examples to match your ServerRoot and PidFile settings.

As of Apache 1.3 we provide a script `src/support/apachectl` which can be used to start, stop, and restart Apache. It may need a little customization for your system, see the comments at the top of the script.

TERM Signal: stop now

Sending the `TERM` signal to the parent causes it to immediately attempt to kill off all of its children. It may take it several seconds to complete killing off its children. Then the parent itself exits. Any requests in progress are terminated, and no further requests are served.

HUP Signal: restart now

Sending the `HUP` signal to the parent causes it to kill off its children like in `TERM` but the parent doesn't exit. It re-reads its configuration files, and re-opens any log files. Then it spawns a new set of children and continues serving hits.

Users of the status module will notice that the server statistics are set to zero when a `HUP` is sent.

Note: If your configuration file has errors in it when you issue a restart then your parent will not restart, it will exit with an error. See below for a method of avoiding this.

USR1 Signal: graceful restart

Note: prior to release 1.2b9 this code is quite unstable and shouldn't be used at all.

The USR1 signal causes the parent process to *advise* the children to exit after their current request (or to exit immediately if they're not serving anything). The parent re-reads its configuration files and re-opens its log files. As each child dies off the parent replaces it with a child from the new *generation* of the configuration, which begins serving new requests immediately.

This code is designed to always respect the MaxClients, MinSpareServers, and MaxSpareServers settings. Furthermore, it respects StartServers in the following manner: if after one second at least StartServers new children have not been created, then create enough to pick up the slack. This is to say that the code tries to maintain both the number of children appropriate for the current load on the server, and respect your wishes with the StartServers parameter.

Users of the status module will notice that the server statistics are **not** set to zero when a USR1 is sent. The code was written to both minimize the time in which the server is unable to serve new requests (they will be queued up by the operating system, so they're not lost in any event) and to respect your tuning parameters. In order to do this it has to keep the *scoreboard* used to keep track of all children across generations.

The status module will also use a G to indicate those children which are still serving requests started before the graceful restart was given.

At present there is no way for a log rotation script using USR1 to know for certain that all children writing the pre-restart log have finished. We suggest that you use a suitable delay after sending the USR1 signal before you do anything with the old log. For example if most of your hits take less than 10 minutes to complete for users on low bandwidth links then you could wait 15 minutes before doing anything with the old log.

Note: If your configuration file has errors in it when you issue a restart then your parent will not restart, it will exit with an error. In the case of graceful restarts it will also leave children running when it exits. (These are the children which are "gracefully exiting" by handling their last request.) This will cause problems if you attempt to restart the server -- it will not be able to bind to its listening ports. Before doing a restart, you can check the syntax of the configuration files with the `-t` command line argument (see Starting Apache). This still will not guarantee that the server will restart correctly. To check the semantics of the configuration files as well as the syntax, you can try starting httpd as a non-root user. If there are no errors it will attempt to open its sockets and logs and fail because it's not root (or because the currently running httpd already has those ports bound). If it fails for any other reason then it's probably a config file error and the error should be fixed before issuing the graceful restart.

Appendix: signals and race conditions

Prior to Apache 1.2b9 there were several *race conditions* involving the restart and die signals (a simple description of race condition is: a time-sensitive problem, as in if something happens at just the wrong time it won't behave as expected). For those architectures that have the "right" feature set we have

eliminated as many as we can. But it should be noted that there still do exist race conditions on certa architectures.

Architectures that use an on disk ScoreBoardFile have the potential to corrupt their scoreboards. This can result in the "bind: Address already in use" (after HUP) or "long lost child came home!" (after USR1). The former is a fatal error, while the latter just causes the server to lose a scoreboard slot. So it might be advisable to use graceful restarts, with an occasional hard restart. These problems are very difficult to work around, but fortunately most architectures do not require a scoreboard file. See the ScoreBoardFile documentation for a method to determine if your architecture uses it.

NEXT and MACHTEN (68k only) have small race conditions which can cause a restart/die signal to be lost, but should not cause the server to do anything otherwise problematic.

All architectures have a small race condition in each child involving the second and subsequent requests on a persistent HTTP connection (KeepAlive). It may exit after reading the request line but before reading any of the request headers. There is a fix that was discovered too late to make 1.2. In theory this isn't an issue because the KeepAlive client has to expect these events because of network latencies and server timeouts. In practice it doesn't seem to affect anything either -- in a test case the server was restarted twenty times per second and clients successfully browsed the site without getting broken images or empty documents.

Apache HTTP Server Version 1.3

Apache Directives

Each Apache directive available in the standard Apache distribution is listed here. They are described using a consistent format, and there is a dictionary of the terms used in their descriptions available.

Apache HTTP Server Version 1.3

Module mod_log_agent

This module is contained in the `mod_log_agent.c` file, and is not compiled in by default. It provides for logging of the client user agents. mod_log_agent is deprecated. Use mod_log_config instead.

- AgentLog

AgentLog

Syntax: AgentLog *file-pipe*
Default: `AgentLog logs/agent_log`
Context: server config, virtual host
Status: Extension
Module: mod_log_agent

The AgentLog directive sets the name of the file to which the server will log the UserAgent header of incoming requests. *File-pipe* is one of

A filename

A filename relative to the ServerRoot.

`|' followed by a command

A program to receive the agent log information on its standard input. Note the a new program will not be started for a VirtualHost if it inherits the AgentLog from the main server.

Security: if a program is used, then it will be run under the user who started httpd. This will be root if the server was started by root; be sure that the program is secure.

Security: See the security tips document for details on why your security could be compromised if the directory where logfiles are stored is writable by anyone other than the user that starts the server.

This directive is provided for compatibility with NCSA 1.4.

Apache HTTP Server Version 1.3

Module mod_digest

This module is contained in the `mod_digest.c` file, and is not compiled in by default. It is only available in Apache 1.1 and later. It provides for user authentication using MD5 Digest Authentication.

- AuthDigestFile

AuthDigestFile

Syntax: AuthDigestFile *filename*
Context: directory, .htaccess
Override: AuthConfig
Status: Base
Module: mod_digest

The AuthDigestFile directive sets the name of a textual file containing the list of users and encoded passwords for digest authentication. *Filename* is the absolute path to the user file.

The digest file uses a special format. Files in this format can be created using the "htdigest" utility found in the support/ subdirectory of the Apache distribution.

Using Digest Authentication

Using MD5 Digest authentication is very simple. Simply set up authentication normally. However, use "AuthType Digest" and "AuthDigestFile" instead of the normal "AuthType Basic" and "AuthUserFile". Everything else should remain the same.

MD5 authentication provides a more secure password system, but only works with supporting browsers. As of this writing (July 1996), the majority of browsers do not support digest authentication. Therefore, we do not recommend using this feature on a large Internet site. However, for personal and intra-net use, where browser users can be controlled, it is ideal.

Apache HTTP Server Version 1.3

Module mod_speling

This module is contained in the `mod_speling.c` file, and is **not** compiled in by default. It attempts to correct misspellings of URLs that users might have entered, by ignoring capitalization and by allowing up to one misspelling.
This catches the majority of misspelled requests. An automatic "spelling corrected" redirection is returned if only one matching document was found, and a list of matches is returned if more than one document with a sufficiently similar name is found.

Summary

Requests to documents sometimes cannot be served by the core apache server because the request was misspelled or miscapitalized. This module addresses this problem by trying to find a matching document, even after all other modules gave up. It does its work by comparing each document name in the requested directory against the requested document name **without regard to case**, and allowing **up to one misspelling** (character insertion / omission / transposition or wrong character). A list is built with all document names which were matched using this strategy.

If, after scanning the directory,

- no matching document was found, Apache will proceed as usual and return a "document not found" error.
- only one document is found that "almost" matches the request, then it is returned in the form of a redirection response.
- more than one document with a close match was found, then the list of the matches is returned to the client, and the client can select the correct candidate.

Directives

- CheckSpelling

CheckSpelling

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Syntax: CheckSpelling *on/off*
Default: `CheckSpelling Off`
Context: server config, virtual host, directory, .htaccess
Override: Options
Status: Base
Module: mod_speling
Compatibility: CheckSpelling was available as a separately available module for Apache 1.1, but was limited to miscapitalizations. As of Apache 1.3, it is part of the Apache distribution. Prior to Apache 1.3.2, the CheckSpelling directive was only available in the "server" and "virtual host" contexts.

This directive enables or disables the spelling module. When enabled, keep in mind that

- the directory scan which is necessary for the spelling correction will have an impact on the server's performance when many spelling corrections have to be performed at the same time.
- the document trees should not contain sensitive files which could be matched inadvertently by a spelling "correction".
- the module is unable to correct misspelled user names (as in `http://my.host/~apahce/`), just file names or directory names.
- spelling corrections apply strictly to existing files, so a request for the <Location /status> may get incorrectly treated as the negotiated file "/stats.html".

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Apache HTTP Server Version 1.3

Module mod_example

This module is contained in the `modules/mod_example.c` file, and **is not** compiled in by default. It illustrates many of the aspects of the Apache 1.2 API and, when used, demonstrates the manner in which module callbacks are triggered by the server.

Summary

The files in the `src/modules/example directory` under the Apache distribution directory tree are provided as an example to those that wish to write modules that use the Apache API.

The main file is `mod_example.c`, which illustrates all the different callback mechanisms and call syntaxes. By no means does an add-on module need to include routines for all of the callbacks - quite the contrary!

The example module is an actual working module. If you link it into your server, enable the "example-handler" handler for a location, and then browse to that location, you will see a display of some of the tracing the example module did as the various callbacks were made.

To include the example module in your server, follow the steps below:

1. Uncomment the "AddModule modules/example/mod_example" line near the bottom of the `src/Configuration` file. If there isn't one, add it; it should look like this:

```
AddModule modules/example/mod_example.o
```

2. Run the `src/Configure` script ("cd src; ./Configure"). This will build the Makefile for the server itself, and update the `src/modules/Makefile` for any additional modules you have requested from beneath that subdirectory.
3. Make the server (run "make" in the `src` directory).

To add another module of your own:

. mkdir src/modules/*mymodule*

B. cp src/modules/example/* src/modules/*mymodule*

C. Modify the files in the new directory.

D. Follow steps [1] through [3] above, with appropriate changes.

Using the mod_example Module

To activate the example module, include a block similar to the following in your srm.conf file:

```
<Location /example-info>
    SetHandler example-handler
</Location>
```

As an alternative, you can put the following into a .htaccess file and then request the file "test.example" from that location:

```
AddHandler example-handler .example
```

After reloading/restarting your server, you should be able to browse to this location and see the brief display mentioned earlier.

Directives

- Example

Example

Syntax: Example
Default: None
Context: server config, virtual host, directory, .htaccess
Override: Options
Status: Extension
Module: mod_example
Compatibility: Example is only available in Apache 1.2 and later.

The Example directive just sets a demonstration flag which the example module's content handler displays. It takes no arguments. If you browse to an URL to which the example content-handler applies, you will get a display of the routines within the module and how and in what order they were called to service the document request. The effect of this directive one can observe under the point "Example directive declared here: YES/NO".

Apache HTTP Server Version 1.3

Module mod_headers

The optional headers module allows for the customization of HTTP response headers. Headers can be merged, replaced or removed. The directives described in this document are only available if Apache is compiled with **mod_headers.c**.

Directive

- Header

Header

Syntax: Header [set | append | add] *header value*
Syntax: Header unset *header*
Context: server config, virtual host, access.conf, .htaccess
Status: optional
Module: mod_header

This directive can replace, merge or remove HTTP response headers. The action it performs is determined by the first argument. This can be one of the following values:

- **set**
  The response header is set, replacing any previous header with this name
- **append**
  The response header is appended to any existing header of the same name. When a new value is merged onto an existing header it is separated from the existing header with a comma. This is the HTTP standard way of giving a header multiple values.
- **add**
  The response header is added to the existing set of headers, even if this header already exists. This can result in two (or more) headers having the same name. This can lead to unforeseen consequences, and in general "append" should be used instead.
- **unset**
  The response header of this name is removed, if it exists. If there are multiple headers of the same name, all will be removed.

This argument is followed by a header name, which can include the final colon, but it is not required. Case is ignored. For add, append and set a value is given as the third argument. If this value contains spaces, it should be surrounded by double quotes. For unset, no value should be given.

Order of Processing

The Header directive can occur almost anywhere within the server configuration. It is valid in the main server config and virtual host sections, inside <Directory>, <Location> and <Files> sections, and within .htaccess files.

The Header directives are processed in the following order:

1. main server
2. virtual host
3. <Directory> sections and .htaccess
4. <Location>
5. <Files>

Order is important. These two headers have a different effect if reversed:

```
Header append Author "John P. Doe"
Header unset Author
```

This way round, the Author header is not set. If reversed, the Author header is set to "John P. Doe".

The Header directives are processed just before the response is sent by its handler. These means that some headers that are added just before the response is sent cannot be unset or overridden. This includes headers such as "Date" and "Server".

Apache HTTP Server Version 1.3

Apache module mod_cern_meta

This module is contained in the `mod_cern_meta.c` file, and is not compiled in by default. It provides for CERN httpd metafile semantics. It is only available in Apache 1.1 and later.

Summary

Emulate the CERN HTTPD Meta file semantics. Meta files are HTTP headers that can be output in addition to the normal range of headers for each file accessed. They appear rather like the Apache .asis files, and are able to provide a crude way of influencing the Expires: header, as well as providing other curiosities. There are many ways to manage meta information, this one was chosen because there is already a large number of CERN users who can exploit this module.

More information on the CERN metafile semantics is available.

Directives

MetaFiles

Syntax: MetaFiles *on/off*
Default: `MetaFiles off`
Context: per-directory config
Status: Base
Module: mod_cern_meta
Compatibility: MetaFiles is only available in Apache 1.3 and later.

Turns on/off Meta file processing on a per-directory basis. This option was introduced in Apache 1.3.

MetaDir

Syntax: MetaDir *directory name*
Default: `MetaDir .web`
Context: (Apache prior to 1.3) server config
Context: (Apache 1.3) per-directory config
Status: Base
Module: mod_cern_meta
Compatibility: MetaDir is only available in Apache 1.1 and later.

Specifies the name of the directory in which Apache can find meta information files. The directory is usually a 'hidden' subdirectory of the directory that contains the file being accessed. Set to "`.`" to look in the same directory as the file.

MetaSuffix

Syntax: MetaSuffix *suffix*
Default: `MetaSuffix .meta`
Context: (Apache prior to 1.3) server config
Context: (Apache 1.3) per-directory config
Status: Base
Module: mod_cern_meta
Compatibility: MetaSuffix is only available in Apache 1.1 and later.

Specifies the file name suffix for the file containing the meta information. For example, the default values for the two directives will cause a request to `DOCUMENT_ROOT/somedir/index.html` to look in `DOCUMENT_ROOT/somedir/.web/index.html.meta` and will use its contents to generate additional MIME header information.

Module mod_mime_magic

This module is contained in the mod_mime_magic.c file, and is an optional extension to the Apache HTTPD server. It can be used to determine the MIME type of a file by looking at a few bytes of its contents, the same way the Unix file(1) command works. To use mod_mime_magic you have to enable the following line in the server build `Configuration` file:

```
AddModule modules/standard/mod_mime_magic.o
```

This should be listed *before* mod_mime in the build `Configuration` file so that it will be used after mod_mime. mod_mime_magic is intended as a "second line of defense" for cases mod_mime cannot resolve.

Summary

This module is derived from a free version of the `file(1)` command for Unix, which uses "magic numbers" and other hints from a file's contents to figure out what the contents are. In the case of this module, it tries to figure out the MIME type of the file.

This module active only if the magic file is specified by the `MimeMagicFile` directive.

The contents of the file are plain ASCII text in 4-5 columns. Blank lines are allowed but ignored. Commented lines use a hash mark "#". The remaining lines are parsed for the following columns:

<table>
<tr><th>Column</th><th>Description</th></tr>
<tr><td>1</td><td>byte number to begin checking from
">" indicates a dependency upon the previous non-">" line</td></tr>
<tr><td>2</td><td>type of data to match
<table>
<tr><td>byte</td><td>single character</td></tr>
<tr><td>short</td><td>machine-order 16-bit integer</td></tr>
<tr><td>long</td><td>machine-order 32-bit integer</td></tr>
<tr><td>string</td><td>arbitrary-length string</td></tr>
<tr><td>date</td><td>long integer date (seconds since Unix epoch/1970)</td></tr>
<tr><td>beshort</td><td>big-endian 16-bit integer</td></tr>
<tr><td>belong</td><td>big-endian 32-bit integer</td></tr>
<tr><td>bedate</td><td>big-endian 32-bit integer date</td></tr>
<tr><td>leshort</td><td>little-endian 16-bit integer</td></tr>
<tr><td>lelong</td><td>little-endian 32-bit integer</td></tr>
<tr><td>ledate</td><td>little-endian 32-bit integer date</td></tr>
</table></td></tr>
<tr><td>3</td><td>contents of data to match</td></tr>
</table>

4	MIME type if matched
5	MIME encoding if matched (optional)

For example, the following magic file lines would recognize some audio formats.

```
# Sun/NeXT audio data
0       string          .snd
>12     belong          1               audio/basic
>12     belong          2               audio/basic
>12     belong          3               audio/basic
>12     belong          4               audio/basic
>12     belong          5               audio/basic
>12     belong          6               audio/basic
>12     belong          7               audio/basic
>12     belong          23              audio/x-adpcm
```

Or these would recognize the difference between "*.doc" files containing Microsoft Word or FrameMaker documents. (These are incompatible file formats which use the same file suffix.)

```
# Frame
0       string          \<MakerFile     application/x-frame
0       string          \<MIFFile       application/x-frame
0       string          \<MakerDictionary       application/x-frame
0       string          \<MakerScreenFon        application/x-frame
0       string          \<MML           application/x-frame
0       string          \<Book          application/x-frame
0       string          \<Maker         application/x-frame

# MS-Word
0       string          \376\067\0\043                  application/msword
0       string          \320\317\021\340\241\261        application/msword
0       string          \333\245-\0\0\0                 application/msword
```

An optional MIME encoding can be included as a fifth column. For example, this can recognize gzipped files and set the encoding for them.

```
# gzip (GNU zip, not to be confused with [Info-ZIP/PKWARE] zip archiver)
0       string          \037\213        application/octet-stream        x-gzip
```

Performance Issues

This module is not for every system. If your system is barely keeping up with its load or if you're performing a web server benchmark, you may not want to enable this because the processing is not free.

However, an effort was made to improve the performance of the original file(1) code to make it fit in a busy web server. It was designed for a server where there are thousands of users who publish their own documents. This is probably very common on intranets. Many times, it's helpful if the server can make more intelligent decisions about a file's contents than the file name allows ...even if just to reduce the "why doesn't my page work" calls when users improperly name their own files. You have to decide if the extra work suits your environment.

When compiling an Apache server, this module should be at or near the top of the list of modules in the Configuration file. The modules are listed in increasing priority so that will mean this one is used only as a last

resort, just like it was designed to.

Directives

MimeMagicFile

Syntax: MimeMagicFile *magic-file-name*
Default: none
Context: server config, virtual host
Status: Extension
Module: mod_mime_magic

The `MimeMagicFile` directive can be used to enable this module, the default file is distributed at `conf/magic`. Non-rooted paths are relative to the ServerRoot. Virtual hosts will use the same file as the main server unless a more specific setting is used, in which case the more specific setting overrides the main server's file.

Notes

The following notes apply to the mod_mime_magic module and are included here for compliance with contributors' copyright restrictions that require their acknowledgment.

```
/*
 * mod_mime_magic: MIME type lookup via file magic numbers
 * Copyright (c) 1996-1997 Cisco Systems, Inc.
 *
 * This software was submitted by Cisco Systems to the Apache Group in July
 * 1997.  Future revisions and derivatives of this source code must
 * acknowledge Cisco Systems as the original contributor of this module.
 * All other licensing and usage conditions are those of the Apache Group.
 *
 * Some of this code is derived from the free version of the file command
 * originally posted to comp.sources.unix.  Copyright info for that program
 * is included below as required.
 * ------------------------------------------------------------------------
 * - Copyright (c) Ian F. Darwin, 1987. Written by Ian F. Darwin.
 *
 * This software is not subject to any license of the American Telephone and
 * Telegraph Company or of the Regents of the University of California.
 *
 * Permission is granted to anyone to use this software for any purpose on any
 * computer system, and to alter it and redistribute it freely, subject to
 * the following restrictions:
 *
 * 1. The author is not responsible for the consequences of use of this
```


```
* software, no matter how awful, even if they arise from flaws in it.
*
* 2. The origin of this software must not be misrepresented, either by
* explicit claim or by omission.  Since few users ever read sources, credits
* must appear in the documentation.
*
* 3. Altered versions must be plainly marked as such, and must not be
* misrepresented as being the original software.  Since few users ever read
* sources, credits must appear in the documentation.
*
* 4. This notice may not be removed or altered.
* --------------------------------------------------------------------------
*
* For compliance with Mr Darwin's terms: this has been very significantly
* modified from the free "file" command.
* - all-in-one file for compilation convenience when moving from one
*   version of Apache to the next.
* - Memory allocation is done through the Apache API's pool structure.
* - All functions have had necessary Apache API request or server
*   structures passed to them where necessary to call other Apache API
*   routines.  (i.e., usually for logging, files, or memory allocation in
*   itself or a called function.)
* - struct magic has been converted from an array to a single-ended linked
*   list because it only grows one record at a time, it's only accessed
*   sequentially, and the Apache API has no equivalent of realloc().
* - Functions have been changed to get their parameters from the server
*   configuration instead of globals.  (It should be reentrant now but has
*   not been tested in a threaded environment.)
* - Places where it used to print results to stdout now saves them in a
*   list where they're used to set the MIME type in the Apache request
*   record.
* - Command-line flags have been removed since they will never be used here.
*
*/
```

Apache HTTP Server Version 1.3

Module mod_mmap_static

This module is contained in the `mod_mmap_static.c` file, with Apache 1.3 and later. It provides mmap()ing of a statically configured list of frequently requested but not changed files. It is not compiled into the server by default. To use `mod_mmap_static` you have to enable the following line in the server build `Configuration` file:

```
AddModule  modules/experimental/mod_mmap_static.o
```

Summary

This is an **experimental** module and should be used with care. You can easily create a broken site using this module, read this document carefully. `mod_mmap_static` maps a list of statically configured files (via `MMapFile` directives in the main server configuration) into memory through the system call `mmap()`. This system call is available on most modern Unix derivates, but not on all. There are sometimes system-specific limits on the size and number of files that can be mmap()d, experimentation is probably the easiest way to find out.

This mmap()ing is done once at server start or restart, only. So whenever one of the mapped files changes on the filesystem you *have* to restart the server by at least sending it a HUP or USR1 signal (see the Stopping and Restarting documentation). To reiterate that point: if the files are modified *in place* without restarting the server you may end up serving requests that are completely bogus. You should update files by unlinking the old copy and putting a new copy in place. Most tools such as `rdist` and `mv` do this. The reason why this modules doesn't take care of changes to the files is that this check would need an extra `stat()` every time which is a waste and against the intent of I/O reduction.

Directives

- MMapFile

MMapFile

Syntax: MMapFile *filename* ...
Default: *None*
Context: server-config
Override: *Not applicable*
Status: Experimental
Module: mod_mmap_static
Compatibility: Only available in Apache 1.3 or later

The `MMapFile` directive maps one or more files (given as whitespace separated arguments) into memory at server startup time. They are automatically unmapped on a server shutdown. When the files have changed on the filesystem at least a HUP or USR1 signal should be send to the server to re-mmap them.

Be careful with the *filename* arguments: They have to literally match the filesystem path Apache's URL-to-filename translation handlers create. We cannot compare inodes or other stuff to match paths through symbolic links *etc.* because that again would cost extra `stat()` system calls which is not acceptable. This module may or may not work with filenames rewritten by `mod_alias` or `mod_rewrite`... it is an experiment after all.

Notice: You cannot use this for speeding up CGI programs or other files which are served by special content handlers. It can only be used for regular files which are usually served by the Apache core content handler.

Example:

```
MMapFile /usr/local/apache/htdocs/index.html
```

Note: don't bother asking for a for a `MMapDir` directive which recursively maps all the files in a directory. Use Unix the way it was meant to be used. For example, see the Include directive, and consider this command:

```
find /www/htdocs -type f -print \
| sed -e 's/.*/mmapfile &/' > /www/conf/mmap.conf
```

Apache HTTP Server Version 1.3

Module mod_unique_id

This module provides a magic token for each request which is guaranteed to be unique across "all" requests under very specific conditions. The unique identifier is even unique across multiple machines in a properly configured cluster of machines. The environment variable `UNIQUE_ID` is set to the identifier for each request. Unique identifiers are useful for various reasons which are beyond the scope of this document.

Theory

First a brief recap of how the Apache server works on Unix machines. This feature currently isn't supported on Windows NT. On Unix machines, Apache creates several children, the children process requests one at a time. Each child can serve multiple requests in its lifetime. For the purpose of this discussion, the children don't share any data with each other. We'll refer to the children as httpd processes.

Your website has one or more machines under your administrative control, together we'll call them a cluster of machines. Each machine can possibly run multiple instances of Apache. All of these collectively are considered "the universe", and with certain assumptions we'll show that in this universe we can generate unique identifiers for each request, without extensive communication between machines in the cluster.

The machines in your cluster should satisfy these requirements. (Even if you have only one machine you should synchronize its clock with NTP.)

- The machines' times are synchronized via NTP or other network time protocol.
- The machines' hostnames all differ, such that the module can do a hostname lookup on the hostname and receive a different IP address for each machine in the cluster.

As far as operating system assumptions go, we assume that pids (process ids) fit in 32-bits. If the operating system uses more than 32-bits for a pid, the fix is trivial but must be performed in the code.

Given those assumptions, at a single point in time we can identify any httpd process on any machine in the cluster from all other httpd processes. The machine's IP address and the pid of the httpd process are sufficient to do this. So in order to generate unique identifiers for requests we need only distinguish between different points in time.

To distinguish time we will use a Unix timestamp (seconds since January 1, 1970 UTC), and a 16-bit counter. The timestamp has only one second granularity, so the counter is used to represent up to 65536

values during a single second. The quadruple *(ip_addr, pid, time_stamp, counter)* is sufficient to enumerate 65536 requests per second per httpd process. There are issues however with pid reuse over time, and the counter is used to alleviate this issue.

When an httpd child is created, the counter is initialized with (current microseconds divided by 10) modulo 65536 (this formula was chosen to eliminate some variance problems with the low order bits of the microsecond timers on some systems). When a unique identifier is generated, the time stamp used is the time the request arrived at the web server. The counter is incremented every time an identifier is generated (and allowed to roll over).

The kernel generates a pid for each process as it forks the process, and pids are allowed to roll over (they're 16-bits on many Unixes, but newer systems have expanded to 32-bits). So over time the same pid will be reused. However unless it is reused within the same second, it does not destroy the uniqueness of our quadruple. That is, we assume the system does not spawn 65536 processes in a one second interval (it may even be 32768 processes on some Unixes, but even this isn't likely to happen).

Suppose that time repeats itself for some reason. That is, suppose that the system's clock is screwed up and it revisits a past time (or it is too far forward, is reset correctly, and then revisits the future time). In this case we can easily show that we can get pid and time stamp reuse. The choice of initializer for the counter is intended to help defeat this. Note that we really want a random number to initialize the counter, but there aren't any readily available numbers on most systems (*i.e.*, you can't use rand() because you need to seed the generator, and can't seed it with the time because time, at least at one second resolution, has repeated itself). This is not a perfect defense.

How good a defense is it? Well suppose that one of your machines serves at most 500 requests per second (which is a very reasonable upper bound at this writing, because systems generally do more than just shovel out static files). To do that it will require a number of children which depends on how many concurrent clients you have. But we'll be pessimistic and suppose that a single child is able to serve 500 requests per second. There are 1000 possible starting counter values such that two sequences of 500 requests overlap. So there is a 1.5% chance that if time (at one second resolution) repeats itself this child will repeat a counter value, and uniqueness will be broken. This was a very pessimistic example, and with real world values it's even less likely to occur. If your system is such that it's still likely to occur, then perhaps you should make the counter 32 bits (by editing the code).

You may be concerned about the clock being "set back" during summer daylight savings. However this isn't an issue because the times used here are UTC, which "always" go forward. Note that x86 based Unixes may need proper configuration for this to be true -- they should be configured to assume that the motherboard clock is on UTC and compensate appropriately. But even still, if you're running NTP then your UTC time will be correct very shortly after reboot.

The `UNIQUE_ID` environment variable is constructed by encoding the 112-bit (32-bit IP address, 32 bit pid, 32 bit time stamp, 16 bit counter) quadruple using the alphabet `[A-Za-z0-9@-]` in a manner similar to MIME base64 encoding, producing 19 characters. The MIME base64 alphabet is actually `[A-Za-z0-9+/]` however `+` and `/` need to be specially encoded in URLs, which makes them less desirable. All values are encoded in network byte ordering so that the encoding is comparable across architectures of different byte ordering. The actual ordering of the encoding is: time stamp, IP address, pid, counter. This ordering has a purpose, but it should be emphasized that applications should not dissect the encoding. Applications should treat the entire encoded `UNIQUE_ID` as an opaque token,

which can be compared against other `UNIQUE_ID`s for equality only.

The ordering was chosen such that it's possible to change the encoding in the future without worrying about collision with an existing database of `UNIQUE_ID`s. The new encodings should also keep the time stamp as the first element, and can otherwise use the same alphabet and bit length. Since the time stamps are essentially an increasing sequence, it's sufficient to have a *flag second* in which all machines in the cluster stop serving and request, and stop using the old encoding format. Afterwards they can resume requests and begin issuing the new encodings.

This we believe is a relatively portable solution to this problem. It can be extended to multithreaded systems like Windows NT, and can grow with future needs. The identifiers generated have essentially an infinite life-time because future identifiers can be made longer as required. Essentially no communication is required between machines in the cluster (only NTP synchronization is required, which is low overhead), and no communication between httpd processes is required (the communication is implicit in the pid value assigned by the kernel). In very specific situations the identifier can be shortened, but more information needs to be assumed (for example the 32-bit IP address is overkill for any site, but there is no portable shorter replacement for it).

Directives

`mod_unique_id` has no directives.

Apache HTTP Server Version 1.3

Apache modules

Below is a list of all of the modules that come as part of the Apache distribution. See also the complete alphabetical list of all Apache directives.

Core

Core Apache features.

mod_access

Host based access control.

mod_actions Apache 1.1 and later.

Filetype/method-based script execution

mod_alias

Aliases and redirects.

mod_asis

The .asis file handler.

mod_auth

User authentication using text files.

mod_auth_anon

Anonymous user authentication, FTP-style.

mod_auth_db

User authentication using Berkeley DB files.

mod_auth_dbm

User authentication using DBM files.

mod_auth_digest

MD5 authentication (experimental)

mod_autoindex

Automatic directory listings.

mod_browser Apache 1.2.* only

Set environment variables based on User-Agent strings. Replaced by mod_setenvif in Apache 1.3 and up

mod_cern_meta

Support for HTTP header metafiles.

mod_cgi

Invoking CGI scripts.

mod_cookies up to Apache 1.1.1

Support for Netscape-like cookies. Replaced in Apache 1.2 by mod_usertrack

mod_digest

MD5 authentication

mod_dir

Basic directory handling.

mod_dld Apache 1.2.* and earlier

Start-time linking with the GNU libdld. Replaced in Apache 1.3 by mod_so

mod_dll Apache 1.3b1 to 1.3b5 only

Replaced in 1.3b6 by mod_so

mod_env

Passing of environments to CGI scripts

mod_example Apache 1.2 and up

Demonstrates Apache API

mod_expires Apache 1.2 and up

Apply Expires: headers to resources

mod_headers Apache 1.2 and up

Add arbitrary HTTP headers to resources

mod_imap

The imagemap file handler.

mod_include

Server-parsed documents.

mod_info

Server configuration information

mod_isapi

Windows ISAPI Extension support

mod_log_agent

Logging of User Agents.

mod_log_common up to Apache 1.1.1

Standard logging in the Common Logfile Format. Replaced by the mod_log_config module in Apache 1.2 and up

mod_log_config

User-configurable logging replacement for mod_log_common.

mod_log_referer

Logging of document references.

mod_mime

Determining document types using file extensions.

mod_mime_magic

Determining document types using "magic numbers".

mod_mmap_static

Mapping files into memory for faster serving.

mod_negotiation

Content negotiation.

mod_proxy

Caching proxy abilities

mod_rewrite Apache 1.2 and up

Powerful URI-to-filename mapping using regular expressions

mod_setenvif Apache 1.3 and up

Set environment variables based on client information

mod_so Apache 1.3 and up

Experimental support for loading modules (DLLs on Windows) at runtime

mod_speling Apache 1.3 and up

Automatically correct minor typos in URLs

mod_status

Server status display

mod_userdir

User home directories.

mod_unique_id Apache 1.3 and up

Generate unique request identifier for every request

mod_usertrack Apache 1.2 and up

User tracking using Cookies (replacement for mod_cookies.c)

mod_vhost_alias Apache 1.3.7 and up

Support for dynamically configured mass virtual hosting

Apache HTTP Server Version 1.3

Module mod_auth_digest

This module is contained in the `mod_auth_digest.c` file, and is not compiled in by default. It is only available in Apache 1.3.8 and later. It provides for user authentication using MD5 Digest Authentication.

Note this is an updated version of mod_digest. However, it has not been extensively tested and is therefore marked experimental. If you use this module, you must make sure to *not* use mod_digest (because they share some of the same configuration directives).

AuthDigestFile

Syntax: AuthDigestFile *filename*
Context: directory, .htaccess
Override: AuthConfig
Status: Base
Module: mod_auth_digest

The AuthDigestFile directive sets the name of a textual file containing the list of users and encoded passwords for digest authentication. *Filename* is the absolute path to the user file.

The digest file uses a special format. Files in this format can be created using the "htdigest" utility found in the support/ subdirectory of the Apache distribution.

AuthDigestGroupFile

Syntax: AuthDigestGroupFile *filename*
Context: directory, .htaccess
Override: AuthConfig
Status: Base
Module: mod_auth_digest
Compatibility: Available in Apache 1.3.8 and later

The AuthDigestGroupFile directive sets the name of a textual file containing the list of groups and their members (user names). *Filename* is the absolute path to the group file.

Each line of the group file contains a groupname followed by a colon, followed by the member usernames separated by spaces. Example:

```
mygroup: bob joe anne
```

Note that searching large text files is *very* inefficient.

Security: make sure that the AuthGroupFile is stored outside the document tree of the web-server; do *not* put it in the directory that it protects. Otherwise, clients will be able to download the AuthGroupFile.

AuthDigestQop

Syntax: AuthDigestQop *none* | *1*{ auth* | *auth-int }*
Default: `AuthDigestQop auth`
Context: directory, .htaccess
Override: AuthConfig
Status: Base
Module: mod_auth_digest
Compatibility: Available in Apache 1.3.8 and later

The AuthDigestQop directive determines the quality-of-protection to use. *auth* will only do authentication (username/password); *auth-int* is authentication plus integrity checking (an MD5 hash of the entity is also computed and checked); *none* will cause the module to use the old RFC-2069 digest algorithm (which does not include integrity checking). Both *auth* and *auth-int* may be specified, in which the case the browser will choose which of these to use. *none* should only be used if the browser for some reason does not like the challenge it receives otherwise.

***auth-int* is not implemented yet**.

AuthDigestNonceLifetime

Syntax: AuthDigestNonceLifetime *<time>*
Default: `AuthDigestNonceLifetime 300`
Context: directory, .htaccess
Override: AuthConfig
Status: Base
Module: mod_auth_digest
Compatibility: Available in Apache 1.3.8 and later

The AuthDigestNonceLifetime directive controls how long the server nonce is valid. When the client contacts the server using an expired nonce the server will send back a 401 with `stale=true`. If *<time>* is greater than 0 then it specifies the number of seconds the nonce is valid; this should probably never be set to less than 10 seconds. If *<time>* is less than 0 then the nonce never expires.

AuthDigestNonceFormat

Syntax: AuthDigestNonceFormat *???*
Default: `AuthDigestNonceFormat ???`
Context: directory, .htaccess
Override: AuthConfig
Status: Base
Module: mod_auth_digest
Compatibility: Available in Apache 1.3.8 and later

Not implemented yet.

AuthDigestNcCheck

Syntax: AuthDigestNcCheck *On/Off*
Default: `AuthDigestNcCheck Off`
Context: server config
Override: *Not applicable*
Status: Base
Module: mod_auth_digest
Compatibility: Available in Apache 1.3.8 and later

Not implemented yet.

AuthDigestAlgorithm

Syntax: AuthDigestAlgorithm *MD5* | *MD5-sess*
Default: `AuthDigestAlgorithm MD5`
Context: directory, .htaccess
Override: AuthConfig
Status: Base
Module: mod_auth_digest
Compatibility: Available in Apache 1.3.8 and later

The AuthDigestAlgorithm directive selects the algorithm used to calculate the challenge and response hashes.

***MD5-sess* is not correctly implemented yet**.

AuthDigestDomain

Syntax: AuthDigestDomain *URI URI* ...
Context: directory, .htaccess
Override: AuthConfig
Status: Base
Module: mod_auth_digest
Compatibility: Available in Apache 1.3.8 and later

The AuthDigestDomain directive allows you to specify one or more URIs which are in the same protection space (i.e. use the same realm and username/password info). The specified URIs are prefixes, i.e. the client will assume that all URIs "below" these are also protected by the same username/password. The URIs may be either absolute URIs (i.e. inluding a scheme, host, port, etc) or relative URIs.

This directive *should* always be specified and contain at least the (set of) root URI(s) for this space. Omiting to do so will cause the client to send the Authorization header for *every request* sent to this server. Apart from increasing the size of the request, it may also have a detrimental effect on performance if "AuthDigestNcCheck" is on.

The URIs specified can also point to different servers, in which case clients (which understand this) will then share username/password info across multiple servers without prompting the user each time.

Using Digest Authentication

Using MD5 Digest authentication is very simple. Simply set up authentication normally, using "AuthType Digest" and "AuthDigestFile" instead of the normal "AuthType Basic" and "AuthUserFile"; also, replace any "AuthGroupFile" with "AuthDigestGroupFile". Then add a "AuthDigestDomain" directive containing at least the root URI(s) for this protection space. Example:


```
<Location /private/>
AuthType Digest
AuthName "private area"
AuthDigestDomain /private/ http://mirror.my.dom/private2/
AuthDigestFile /web/auth/.digest_pw
require valid-user
</Location>
```

Note: MD5 authentication provides a more secure password system than Basic authentication, but only works with supporting browsers. As of this writing (July 1999), the only major browsers which support digest authentication are Internet Exploder 5.0 and Amaya. Therefore, we do not recommend using this feature on a large Internet site. However, for personal and intra-net use, where browser users can be controlled, it is ideal.

Apache HTTP Server Version 1.3

Module mod_dld

This module is obsolete. As of version 1.3 of Apache, it has been replaced with mod_so. This module is contained in the `mod_dld.c` file, and is not compiled in by default. It provides for loading of executable code and modules into the server at start-up time, using the GNU dld library.

Summary

The optional dld module is a proof-of-concept piece of code which loads other modules into the server as it is configuring itself (the first time only; for now, rereading the config files cannot affect the state of loaded modules), using the GNU dynamic linking library, DLD. It isn't compiled into the server by default, since not everyone has DLD, but it works when I try it. (Famous last words.)

Note that for some reason, `LoadFile /lib/libc.a` seems to be required for just about everything.

Note: that DLD needs to read the symbol table out of the server binary when starting up; these commands will fail if the server can't find its own binary when it starts up, or if that binary is stripped.

Directives

- LoadFile
- LoadModule

LoadFile

Syntax: LoadFile *filename filename* ...
Context: server config
Status: Experimental
Module: mod_dld

The LoadFile directive links in the named object files or libraries when the server is started; this is used to load additional code which may be required for some module to work. *Filename* is relative to ServerRoot.

LoadModule

TOC

Syntax: LoadModule *module filename*
Context: server config
Status: Experimental
Module: mod_dld

The LoadModule directive links in the object file or library *filename* and adds the module structure named *module* to the list of active modules. *Module* is the name of the external variable of type `module` in the file. Example:

```
LoadModule ai_backcompat_module modules/mod_ai_backcompat.o
LoadFile /lib/libc.a
```

loads the module in the modules subdirectory of the ServerRoot.

Apache HTTP Server Version 1.3

Module mod_dll

This module is obsolete. As of version 1.3b6 of Apache, it has been replaced with mod_so.

This module is contained in the `mod_dll.c` file, and is compiled in by default for Windows. It provides for loading of executable code and modules into the server at start-up time, when they are contained in Win32 DLLs.

Summary

The DLL module loads other modules into the server as it is configuring itself (the first time only, rereading the config files cannot affect the state of loaded modules), when these modules are compiled into DLL files.

This module is included with Apache 1.3 and later, and is available only when using Microsoft Windows.

Creating DLL Modules

The Apache module API is unchanged between the Unix and Windows versions. Many modules will run on Windows with no or little change from Unix, although others rely on aspects of the Unix architecture which are not present in Windows, and will not work.

When a module does work, it can be added to the server in one of two ways. As with Unix, it can be compiled into the server. Because Apache for Windows does not have the `Configure` program of Apache for Unix, the module's source file must be added to the ApacheCore project file, and its symbols must be added to the `nt\modules.c` file.

The second way is to compile the module as a DLL, a shared library that can be loaded into the server at runtime, using the `LoadModule` directive. These module DLLs can be distributed and run on any Apache for Windows installation, without recompilation of the server.

To create a module DLL, a small change is necessary to the module's source file: The module record must be exported from the DLL (which will be created later; see below). To do this, add the `MODULE_VAR_EXPORT` (defined in the Apache header files) to your module's module record definition. For example, if your module has:

```
module foo_module;
```

Replace the above with:

```
module MODULE_VAR_EXPORT foo_module;
```

Note that this will only be activated on Windows, so the module can continue to be used, unchanged, with Unix if needed. Also, if you are familiar with `.DEF` files, you can export the module record with that method instead.

Now, create a DLL containing your module. You will need to link this against the ApacheCore.lib export library that is created when the ApacheCore.dll shared library is compiled. You may also have to change the compiler settings to ensure that the Apache header files are correctly located.

This should create a DLL version of your module. Now simply place it in the server root, and use the `LoadModule` directive to load it.

Directives

- LoadFile
- LoadModule

LoadFile

Syntax: LoadFile *filename filename* ...
Context: server config
Status: Core (Windows)
Module: mod_dll

The LoadFile directive links in the named object files or libraries when the server is started; this is used to load additional code which may be required for some module to work. *Filename* is relative to ServerRoot.

LoadModule

Syntax: LoadModule *module filename*
Context: server config
Status: Core (Windows)
Module: mod_dll

The LoadModule directive links in the object file or library *filename* and adds the module structure named *module* to the list of active modules. *Module* is the name of the external variable of type `module`

in the file. Example:

```
LoadModule status_module modules/ApacheModuleStatus.dll
```

loads the ApacheModuleStatus.dll module in the modules subdirectory of the ServerRoot.

Apache HTTP Server Version 1.3

Module mod_isapi

This module is contained in the `mod_isapi.c` file, and is compiled in by default. It provides support for ISAPI Extensions when running under Microsoft Windows. Any document with a handler of `isapi-isa` will be processed by this module.

Purpose

This module implements the ISAPI Extension API. It allows Internet Server Applications (*i.e.*, ISAPI Extensions) to be used with Apache for Windows.

Usage

In the server configuration file, add a handler called `isapi-isa`, and map it to files with a `.DLL` extension. In other words:

```
AddHandler isapi-isa dll
```

Now simply place the ISA DLLs into your document root, and they will be loaded when their URLs are accessed.

ISAPI Extensions are governed by the same restrictions as CGI scripts. That is, `Options ExecCGI` must be active in the directory that contains the ISA.

Notes

Apache's ISAPI implementation conforms to all of the ISAPI 2.0 specification, except for the "Microsoft-specific" extensions dealing with asynchronous I/O. Apache's I/O model does not allow asynchronous reading and writing in a manner that the ISAPI could access. If an ISA tries to access async I/O, a message will be place in the error log, to help with debugging.

Some servers, like Microsoft IIS, load the ISA into the server, and keep it loaded until memory usage is too high, and it is unloaded. Apache currently loads and unloads the ISA for each request. This is inefficient, but Apache's request model makes this method the only method that currently works. A future release may use a more effective loading method.

Apache 1.3a1 currently limits POST and PUT input to 48k per request. This is to work around a problem

with the ISAPI implementation that could result in a denial of service attack. It is expected that supp for larger uploads will be added soon.

Also, remember that while Apache supports ISAPI Extensions, it does not support ISAPI Filters. Support for filters may be added at a later date, but no support is planned at this time.

Apache HTTP Server Version 1.3

Module mod_log_common

This module is contained in the `mod_log_common.c` file, and is compiled in by default. It provides for logging of the requests made to the server using the Common Logfile Format. This module has been replaced by mod_log_config in Apache 1.2

Log file format

The log file contains a separate line for each request. A line is composed of several tokens separated by spaces:

host ident authuser date request status bytes

If a token does not have a value then it is represented by a hyphen (-). The meanings and values of these tokens are as follows:

host

The fully-qualified domain name of the client, or its IP number if the name is not available.

ident

If IdentityCheck is enabled and the client machine runs identd, then this is the identity information reported by the client.

authuser

If the request was for an password protected document, then this is the userid used in the request.

date

The date and time of the request, in the following format:

```
date = [day/month/year:hour:minute:second zone]
day = 2*digit
month = 3*letter
year = 4*digit
hour = 2*digit
minute = 2*digit
second = 2*digit
zone = (`+' | `-') 4*digit
```

request

The request line from the client, enclosed in double quotes (").

status

The three digit status code returned to the client.

bytes

The number of bytes in the object returned to the client, not including any headers.

Directives

- TransferLog

TransferLog

Syntax: TransferLog *file-pipe*
Default: `TransferLog logs/transfer_log`
Context: server config, virtual host
Status: Base
Module: mod_log_common

The TransferLog directive sets the name of the file to which the server will log the incoming requests. *File-pipe* is one of

A filename

A filename relative to the ServerRoot.

`|' followed by a command

A program to receive the agent log information on its standard input. Note the a new program will not be started for a VirtualHost if it inherits the TransferLog from the main server.

Security: if a program is used, then it will be run under the user who started httpd. This will be root if the server was started by root; be sure that the program is secure.

Security: See the security tips document for details on why your security could be compromised if the directory where logfiles are stored is writable by anyone other than the user that starts the server.

Apache HTTP Server Version 1.3

Special Purpose Environment Variables

Interoperability problems have led to the introduction of mechanisms to modify the way Apache behaves when talking to particular clients. To make these mechanisms as flexible as possible, they are invoked by defining environment variables, typically with BrowserMatch, though SetEnv and PassEnv could also be used, for example.

downgrade-1.0

This forces the request to be treated as a HTTP/1.0 request even if it was in a later dialect.

force-no-vary

This causes any `Vary` fields to be removed from the response header before it is sent back to the client. Some clients don't interpret this field correctly (see the known client problems page); setting this variable can work around this problem. Setting this variable also implies **force-response-1.0**.

force-response-1.0

This forces an HTTP/1.0 response when set. It was originally implemented as a result of a problem with AOL's proxies. Some clients may not behave correctly when given an HTTP/1.1 response, and this can be used to interoperate with them.

nokeepalive

This disables KeepAlive when set. Because of problems with Netscape 2.x and KeepAlive, we recommend the following directive be used:

```
BrowserMatch Mozilla/2 nokeepalive
```

Apache HTTP Server Version 1.3

Apache Server Frequently Asked Questions

$Revision: 1.145 $ ($Date: 1999/06/24 15:02:53 $)

The latest version of this FAQ is always available from the main Apache web site, at <http://www.apache.org/docs/misc/FAQ.html>.

If you are reading a text-only version of this FAQ, you may find numbers enclosed in brackets (such as "[12]"). These refer to the list of reference URLs to be found at the end of the document. These references do not appear, and are not needed, for the hypertext version.

The Questions

TOC

The Answers

A. Background

1. **What is Apache?**

   Apache was originally based on code and ideas found in the most popular HTTP server of the time.. NCSA httpd 1.3 (early 1995). It has since evolved into a far superior system which can rival (and probably surpass) almost any other UNIX based HTTP server in terms of functionality, efficiency and speed.

   Since it began, it has been completely rewritten, and includes many new features. Apache is, as of January 1997, the most popular WWW server on the Internet, according to the Netcraft Survey.

---

2. **Why was Apache created?**

   To address the concerns of a group of WWW providers and part-time httpd programmers that httpd didn't behave as they wanted it to behave. Apache is an entirely volunteer effort, completely funded by its members, not by commercial sales.

---

3. **How does The Apache Group's work relate to other server efforts, such as NCSA's?**

   We, of course, owe a great debt to NCSA and their programmers for making the server Apache was based on. We now, however, have our own server, and our project is mostly our own. The Apache Project is an entirely independent venture.

---

4. **Why the name "Apache"?**

   A cute name which stuck. Apache is "**A PAtCHy** server". It was based on some existing code and a series of "patch files".

---

5. **OK, so how does Apache compare to other servers?**

   For an independent assessment, seeht Web Compare's comparison chart.

Apache has been shown to be substantially faster than many other free servers. Although certain commercial servers have c to surpass Apache's speed (it has not been demonstrated that any of these "benchmarks" are a good way of measuring WW server speed at any rate), we feel that it is better to have a mostly-fast free server than an extremely-fast server that costs thousands of dollars. Apache is run on sites that get millions of hits per day, and they have experienced no performance difficulties.

---

6. **How thoroughly tested is Apache?**

   Apache is run on over 3 million Internet servers (as of June 1999). It has been tested thoroughly by both developers and users. The Apache Group maintains rigorous standards before releasing new versions of their server, and our server runs without a hitch on over one half of all WWW servers available on the Internet. When bugs do show up, we release patches and new versions as soon as they are available.

   The Apache project's web site includes a page with a partial list of sites running Apache.

---

7. **What are the future plans for Apache?**
   - to continue to be an "open source" no-charge-for-use HTTP server,
   - to keep up with advances in HTTP protocol and web developments in general,
   - to collect suggestions for fixes/improvements from its users,
   - to respond to needs of large volume providers as well as occasional users.

---

8. **Whom do I contact for support?**

   There is no official support for Apache. None of the developers want to be swamped by a flood of trivial questions that can be resolved elsewhere. Bug reports and suggestions should be sent *via* the bug report page. Other questions should be directed to the comp.infosystems.www.servers.unix or comp.infosystems.www.servers.ms-windows newsgroup (as appropriate for the platform you use), where some of the Apache team lurk, in the company of many other httpd gurus who should be able to help.

   Commercial support for Apache is, however, available from a number of third parties.

---

9. **Is there any more information available on Apache?**

   Indeed there is. See the main Apache web site. There is also a regular electronic publication called Apache Week available. Links to relevant Apache Week articles are included below where appropriate. There are also some Apache-specific books available.

---

10. **Where can I get Apache?**

    You can find out how to download the source for Apache at the project's main web page.

B. General Technical Questions

1. **"Why can't I ...? Why won't ... work?" What to do in case of problems**

   If you are having trouble with your Apache server software, you should take the following steps:

   1. **Check the errorlog!**

      Apache tries to be helpful when it encounters a problem. In many cases, it will provide some details by writing one or messages to the server error log. Sometimes this is enough for you to diagnose & fix the problem yourself (such as file permissions or the like). The default location of the error log is /usr/local/apache/logs/error_log, but see the ErrorLog directive in your config files for the location on your server.

   2. **Check the FAQ!**

      The latest version of the Apache Frequently-Asked Questions list can always be found at the main Apache web site.

   3. **Check the Apache bug database**

      Most problems that get reported to The Apache Group are recorded in the bug database. ***Please*** *check the existing reports, open* ***and*** *closed, before adding one.* If you find that your issue has already been reported, please *don't* add a "me, too" report. If the original report isn't closed yet, we suggest that you check it periodically. You might also consider contacting the original submitter, because there may be an email exchange going on about the issue that isn't getting recorded in the database.

4. **Ask in the comp.infosystems.www.servers.unix or comp.infosystems.www.servers.ms-windows USENET news (as appropriate for the platform you use).**

   A lot of common problems never make it to the bug database because there's already high Q&A traffic about them in the comp.infosystems.www.servers.unix newsgroup. Many Apache users, and some of the developers, can be found roaming its virtual halls, so it is suggested that you seek wisdom there. The chances are good that you'll get a faster answer there than from the bug database, even if you *don't* see your question already posted.

5. **If all else fails, report the problem in the bug database**

   If you've gone through those steps above that are appropriate and have obtained no relief, then please *do* let The Apache Group know about the problem by logging a bug report.

   If your problem involves the server crashing and generating a core dump, please include a backtrace (if possible). As an example,

   ```
   # cd ServerRoot
   # dbx httpd core
   (dbx) where
   ```

   (Substitute the appropriate locations for your ServerRoot and your httpd and core files. You may have to use `gdb` instead of `dbx`.)

---

2. **How compatible is Apache with my existing NCSA 1.3 setup?**

   Apache attempts to offer all the features and configuration options of NCSA httpd 1.3, as well as many of the additional features found in NCSA httpd 1.4 and NCSA httpd 1.5.

   NCSA httpd appears to be moving toward adding experimental features which are not generally required at the moment. Some of the experiments will succeed while others will inevitably be dropped. The Apache philosophy is to add what's needed as and when it is needed.

   Friendly interaction between Apache and NCSA developers should ensure that fundamental feature enhancements stay consistent between the two servers for the foreseeable future.

---

3. **Is Apache Year 2000 compliant?**

   Yes, Apache is Year 2000 compliant.

   Apache internally never stores years as two digits. On the HTTP protocol level RFC1123-style addresses are generated which is the only format a HTTP/1.1-compliant server should generate. To be compatible with older applications Apache recognizes ANSI C's `asctime()` and RFC850-/RFC1036-style date formats, too. The `asctime()` format uses four-digit years, but the RFC850 and RFC1036 date formats only define a two-digit year. If Apache sees such a date with a value less than 70 it assumes that the century is 20 rather than 19.

   Although Apache is Year 2000 compliant, you may still get problems if the underlying OS has problems with dates past year 2000 (*e.g.*, OS calls which accept or return year numbers). Most (UNIX) systems store dates internally as signed 32-bit integers which contain the number of seconds since 1st January 1970, so the magic boundary to worry about is the year 2038 and not 2000. But modern operating systems shouldn't cause any trouble at all.

   Users of Apache 1.2.x should upgrade to a current version of Apache 1.3 (see year-2000 improvements in Apache 1.3 for details).

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   The Apache HTTP server software is distributed with the following disclaimer, found in the software license:

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STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED
OF THE POSSIBILITY OF SUCH DAMAGE.
```

---

4. **How do I submit a patch to the Apache Group?**

   The Apache Group encourages patches from outside developers. There are 2 main "types" of patches: small bugfixes and general improvements. Bugfixes should be submitting using the Apache bug report page. Improvements, modifications, and additions should follow the instructions below.

   In general, the first course of action is to be a member of the new-httpd@apache.org mailing list. This indicates to the Group that you are closely following the latest Apache developments. Your patch file should be generated using either '`diff -c`' or '`diff -u`' against the latest CVS tree. To submit your patch, send email to new-httpd@apache.org with a Subject: line that starts with [PATCH] and includes a general description of the patch. In the body of the message, the patch should be clearly described and then included at the end of the message. If the patch-file is long, you can note a URL to the file instead of the file itself. Use of MIME enclosures/attachments should be avoided.

   Be prepared to respond to any questions about your patches and possibly defend your code. If your patch results in a lot of discussion, you may be asked to submit an updated patch that incorporate all changes and suggestions.

---

5. **Why has Apache stolen my favourite site's Internet address?**

   The simple answer is: "It hasn't." This misconception is usually caused by the site in question having migrated to the Apache Web server software, but not having migrated the site's content yet. When Apache is installed, the default page that gets installed tells the Webmaster the installation was successful. The expectation is that this default page will be replaced with the site's real content. If it doesn't, complain to the Webmaster, not to the Apache project -- we just make the software and aren't responsible for what people do (or don't do) with it.

---

6. **Why am I getting spam mail from the Apache site?**

   The short answer is: "You aren't." Usually when someone thinks the Apache site is originating spam, it's because they've traced the spam to a Web site, and the Web site says it's using Apache. See the previous FAQ entry for more details on this phenomenon.

   No marketing spam originates from the Apache site. The only mail that comes from the site goes only to addresses that have been *requested* to receive the mail.

---

7. **May I include the Apache software on a CD or other package I'm distributing?**

   The detailed answer to this question can be found in the Apache license, which is included in the Apache distribution in the file `LICENSE`. You can also find it on the Web at <http://www.apache.org/LICENSE.txt>.

---

8. **What's the best hardware/operating system/... How do I get the most out of my Apache Web server?**

   Check out Dean Gaudet's performance tuning page.

---

9. **What are "regular expressions"?**

   Regular expressions are a way of describing a pattern - for example, "all the words that begin with the letter A" or "every 10-digit phone number" or even "Every sentence with two commas in it, and no capital letter Q". Regular expressions (aka "regexp"s) are useful in Apache because they let you apply certain attributes against collections of files or resources in very flexible ways - for example, all .gif and .jpg files under any "images" directory could be written as /.*\/images\/.*[jpg|gif]/.

   The best overview around is probably the one which comes with Perl. We implement a simple subset of Perl's regexp support, but it's still a good way to learn what they mean. You can start by going to the CPAN page on regular expressions, and branching out from there.

C. Building Apache

1. **Why do I get an error about an undefined reference to "__inet_ntoa" or other __inet_* symbols?**

   If you have installed BIND-8 then this is normally due to a conflict between your include files and your libraries. BIND-8 installs its include files and libraries `/usr/local/include/` and `/usr/local/lib/`, while the resolver that comes with your system is probably installed in `/usr/include/` and `/usr/lib/`. If your system uses the header files in `/usr/local/include/` before those in `/usr/include/` but you do not use the new resolver library, then the two versions will conflict.

   To resolve this, you can either make sure you use the include files and libraries that came with your system or make sure to use the new include files and libraries. Adding `-lbind` to the `EXTRA_LDFLAGS` line in your Configuration file, then re-running Configure, should resolve the problem. (Apache versions 1.2.* and earlier use `EXTRA_LFLAGS` instead.)

   Note: As of BIND 8.1.1, the bind libraries and files are installed under /usr/local/bind by default, so you should not run into this problem. Should you want to use the bind resolvers you'll have to add the following to the respective lines:

   ```
   EXTRA_CFLAGS=-I/usr/local/bind/include
   EXTRA_LDFLAGS=-L/usr/local/bind/lib
   EXTRA_LIBS=-lbind
   ```

---

2. **Why won't Apache compile with my system's cc?**

   If the server won't compile on your system, it is probably due to one of the following causes:

   - **The Configure script doesn't recognize your system environment.**
     This might be either because it's completely unknown or because the specific environment (include files, OS version, *et cetera*) isn't explicitly handled. If this happens, you may need to port the server to your OS yourself.
   - **Your system's C compiler is garbage.**
     Some operating systems include a default C compiler that is either not ANSI C-compliant or suffers from other deficiencies. The usual recommendation in cases like this is to acquire, install, and use gcc.
   - **Your include files may be confused.**
     In some cases, we have found that a compiler installation or system upgrade has left the C header files in an inconsistent state. Make sure that your include directory tree is in sync with the compiler and the operating system.
   - **Your operating system or compiler may be out of revision.**
     Software vendors (including those that develop operating systems) issue new releases for a reason; sometimes to add functionality, but more often to fix bugs that have been discovered. Try upgrading your compiler and/or your operating system.

   The Apache Group tests the ability to build the server on many different platforms. Unfortunately, we can't test all of the OS platforms there are. If you have verified that none of the above issues is the cause of your problem, and it hasn't been reported before, please submit a problem report. Be sure to include *complete* details, such as the compiler & OS versions and exact error messages.

---

3. **Why do I get complaints about redefinition of "`struct iovec`" when compiling under Linux?**

   This is a conflict between your C library includes and your kernel includes. You need to make sure that the versions of both are matched properly. There are two workarounds, either one will solve the problem:

   - Remove the definition of `struct iovec` from your C library includes. It is located in `/usr/include/sys/uio.h`. **Or,**
   - Add `-DNO_WRITEV` to the `EXTRA_CFLAGS` line in your Configuration and reconfigure/rebuild. This hurts performance and should only be used as a last resort.

---

4. **I'm using gcc and I get some compilation errors, what is wrong?**

   GCC parses your system header files and produces a modified subset which it uses for compiling. This behaviour ties GCC tightly to the version of your operating system. So, for example, if you were running IRIX 5.3 when you built GCC and then upgrade to IRIX 6.2 later, you will have to rebuild GCC. Similarly for Solaris 2.4, 2.5, or 2.5.1 when you upgrade to 2.6. Sometimes you can type "gcc -v" and it will tell you the version of the operating system it was built against.

   If you fail to do this, then it is very likely that Apache will fail to build. One of the most common errors is with `readv`, `writev`, or `uio.h`. This is **not** a bug with Apache. You will need to re-install GCC.

5. **I'm using RedHat Linux 5.0, or some other glibc-based Linux system, and I get errors with the `crypt` function wh attempt to build Apache 1.2.**

   glibc puts the `crypt` function into a separate library. Edit your `src/Configuration` file and set this:

   ```
   EXTRA_LIBS=-lcrypt
   ```

   Then re-run src/Configure and re-execute the make.

D. Error Log Messages and Problems Starting Apache

1. **Why do I get "setgid: Invalid argument" at startup?**

   Your Group directive (probably in conf/httpd.conf) needs to name a group that actually exists in the /etc/group file (or your system's equivalent). This problem is also frequently seen when a negative number is used in the `Group` directive (*e.g.*, "`Group #-1`"). Using a group name -- not group number -- found in your system's group database should solve this problem in all cases.

---

2. **Why am I getting "httpd: could not set socket option TCP_NODELAY" in my error log?**

   This message almost always indicates that the client disconnected before Apache reached the point of calling `setsockopt()` for the connection. It shouldn't occur for more than about 1% of the requests your server handles, and it's advisory only in any case.

---

3. **Why am I getting "connection reset by peer" in my error log?**

   This is a normal message and nothing about which to be alarmed. It simply means that the client canceled the connection before it had been completely set up - such as by the end-user pressing the "Stop" button. People's patience being what it is, sites with response-time problems or slow network links may experiences this more than high-capacity ones or those with large pipes to the network.

---

4. **The errorlog says Apache dumped core, but where's the dump file?**

   In Apache version 1.2, the error log message about dumped core includes the directory where the dump file should be located. However, many Unixes do not allow a process that has called `setuid()` to dump core for security reasons; the typical Apache setup has the server started as root to bind to port 80, after which it changes UIDs to a non-privileged user to serve requests.

   Dealing with this is extremely operating system-specific, and may require rebuilding your system kernel. Consult your operating system documentation or vendor for more information about whether your system does this and how to bypass it. If there *is* a documented way of bypassing it, it is recommended that you bypass it only for the httpd server process if possible.

   The canonical location for Apache's core-dump files is the ServerRoot directory. As of Apache version 1.3, the location can be set *via* the CoreDumpDirectory directive to a different directory. Make sure that this directory is writable by the user the server runs as (as opposed to the user the server is *started* as).

---

5. **When I run it under Linux I get "shmget: function not found", what should I do?**

   Your kernel has been built without SysV IPC support. You will have to rebuild the kernel with that support enabled (it's under the "General Setup" submenu). Documentation for kernel building is beyond the scope of this FAQ; you should consult the Kernel HOWTO, or the documentation provided with your distribution, or a Linux newsgroup/mailing list. As a last-resort workaround, you can comment out the `#define USE_SHMGET_SCOREBOARD` definition in the LINUX section of src/conf.h and rebuild the server (prior to 1.3b4, simply removing `#define HAVE_SHMGET` would have sufficed). This will produce a server which is slower and less reliable.

---

6. **Server hangs, or fails to start, and/or error log fills with "fcntl: F_SETLKW: No record locks available" or similar messages**

   These are symptoms of a fine locking problem, which usually means that the server is trying to use a synchronization file on an NFS filesystem.

   Because of its parallel-operation model, the Apache Web server needs to provide some form of synchronization when accessing certain resources. One of these synchronization methods involves taking out locks on a file, which means that the filesystem

whereon the lockfile resides must support locking. In many cases this means it *can't* be kept on an NFS-mounted filesystem.

To cause the Web server to work around the NFS locking limitations, include a line such as the following in your server configuration files:

```
LockFile /var/run/apache-lock
```

The directory should not be generally writable (*e.g.*, don't use /var/tmp). See the LockFile documentation for more information.

---

7. **Why am I getting "Expected </Directory> but saw </Directory>" when I try to start Apache?**

   This is a known problem with certain versions of the AIX C compiler. IBM are working on a solution, and the issue is being tracked by problem report #2312.

---

8. **I'm using RedHat Linux and I have problems with httpd dying randomly or not restarting properly**

   RedHat Linux versions 4.x (and possibly earlier) RPMs contain various nasty scripts which do not stop or restart Apache properly. These can affect you even if you're not running the RedHat supplied RPMs.

   If you're using the default install then you're probably running Apache 1.1.3, which is outdated. From RedHat's ftp site you can pick up a more recent RPM for Apache 1.2.x. This will solve one of the problems.

   If you're using a custom built Apache rather than the RedHat RPMs then you should `rpm -e apache`. In particular you want the mildly broken `/etc/logrotate.d/apache` script to be removed, and you want the broken `/etc/rc.d/init.d/httpd` (or `httpd.init`) script to be removed. The latter is actually fixed by the apache-1.2.5 RPMs but if you're building your own Apache then you probably don't want the RedHat files.

   We can't stress enough how important it is for folks, *especially vendors* to follow the stopping Apache directions given in our documentation. In RedHat's defense, the broken scripts were necessary with Apache 1.1.x because the Linux support in 1.1.x was very poor, and there were various race conditions on all platforms. None of this should be necessary with Apache 1.2 and later.

---

9. **I upgraded from an Apache version earlier than 1.2.0 and suddenly I have problems with Apache dying randomly or not restarting properly**

   You should read the previous note about problems with RedHat installations. It is entirely likely that your installation has start/stop/restart scripts which were built for an earlier version of Apache. Versions earlier than 1.2.0 had various race conditions that made it necessary to use `kill -9` at times to take out all the httpd servers. But that should not be necessary any longer. You should follow the directions on how to stop and restart Apache.

   As of Apache 1.3 there is a script `src/support/apachectl` which, after a bit of customization, is suitable for starting, stopping, and restarting your server.

---

10. **When I try to start Apache from a DOS window, I get a message like "Cannot determine host name. Use ServerName directive to set it manually." What does this mean?**

    It means what it says; the Apache software can't determine the hostname of your system. Edit your conf\httpd.conf file, look for the string "ServerName", and make sure there's an uncommented directive such as

    ```
    ServerName localhost
    ```

    or

    ```
    ServerName www.foo.com
    ```

    in the file. Correct it if there one there with wrong information, or add one if you don't already have one. Then try to start the server again.

E. Configuration Questions

1. **Why can't I run more than <*n*> virtual hosts?**

   You are probably running into resource limitations in your operating system. The most common limitation is the *per*-process limit on **file descriptors**, which is almost always the cause of problems seen when adding virtual hosts. Apache often does not give an intuitive error message because it is normally some library routine (such as `gethostbyname()`) which needs file descriptors and doesn't complain intelligibly when it can't get them.

Each log file requires a file descriptor, which means that if you are using separate access and error logs for each virtual host, each virtual host needs two file descriptors. Each Listen directive also needs a file descriptor.

Typical values for <*n*> that we've seen are in the neighborhood of 128 or 250. When the server bumps into the file descriptor limit, it may dump core with a SIGSEGV, it might just hang, or it may limp along and you'll see (possibly meaningful) errors in the error log. One common problem that occurs when you run into a file descriptor limit is that CGI scripts stop being executed properly.

As to what you can do about this:

1. Reduce the number of Listen directives. If there are no other servers running on the machine on the same port then you normally don't need any Listen directives at all. By default Apache listens to all addresses on port 80.
2. Reduce the number of log files. You can use mod_log_config to log all requests to a single log file while including the name of the virtual host in the log file. You can then write a script to split the logfile into separate files later if necessary. Such a script is provided with the Apache 1.3 distribution in the src/support/split-logfile file.
3. Increase the number of file descriptors available to the server (see your system's documentation on the `limit` or `ulimit` commands). For some systems, information on how to do this is available in the performance hints page. There is a specific note for FreeBSD below.

   For Windows 95, try modifying your C:\CONFIG.SYS file to include a line like

   ```
   FILES=300
   ```

   Remember that you'll need to reboot your Windows 95 system in order for the new value to take effect.
4. "Don't do that" - try to run with fewer virtual hosts
5. Spread your operation across multiple server processes (using Listen for example, but see the first point) and/or ports.

Since this is an operating-system limitation, there's not much else available in the way of solutions.

As of 1.2.1 we have made attempts to work around various limitations involving running with many descriptors. More information is available.

---

2. **Can I increase FD_SETSIZE on FreeBSD?**

   On versions of FreeBSD before 3.0, the FD_SETSIZE define defaults to 256. This means that you will have trouble usefully using more than 256 file descriptors in Apache. This can be increased, but doing so can be tricky.

   If you are using a version prior to 2.2, you need to recompile your kernel with a larger FD_SETSIZE. This can be done by adding a line such as:

   ```
   options FD_SETSIZE nnn
   ```

   to your kernel config file. Starting at version 2.2, this is no longer necessary.

   If you are using a version of 2.1-stable from after 1997/03/10 or 2.2 or 3.0-current from before 1997/06/28, there is a limit in the resolver library that prevents it from using more file descriptors than what FD_SETSIZE is set to when libc is compiled. To increase this, you have to recompile libc with a higher FD_SETSIZE.

   In FreeBSD 3.0, the default FD_SETSIZE has been increased to 1024 and the above limitation in the resolver library has been removed.

   After you deal with the appropriate changes above, you can increase the setting of FD_SETSIZE at Apache compilation time by adding "-DFD_SETSIZE=*nnn*" to the EXTRA_CFLAGS line in your Configuration file.

---

3. **Why doesn't my `ErrorDocument 401` work?**

   You need to use it with a URL in the form "/foo/bar" and not one with a method and hostname such as "http://host/foo/bar". See the ErrorDocument documentation for details. This was incorrectly documented in the past.

---

4. **Why does Apache send a cookie on every response?**

   Apache does *not* automatically send a cookie on every response, unless you have re-compiled it with the mod_usertrack module, and specifically enabled it with the CookieTracking directive. This module has been in Apache since version 1.2. This module may help track users, and uses cookies to do this. If you are not using the data generated by mod_usertrack, do not compile it into

Apache.

---

5. **Why don't my cookies work, I even compiled in mod_cookies?**

   Firstly, you do *not* need to compile in mod_cookies in order for your scripts to work (see the previous question for more about mod_cookies). Apache passes on your Set-Cookie header fine, with or without this module. If cookies do not work it will be because your script does not work properly or your browser does not use cookies or is not set-up to accept them.

---

6. **Why do my Java app[let]s give me plain text when I request an URL from an Apache server?**

   As of version 1.2, Apache is an HTTP/1.1 (HyperText Transfer Protocol version 1.1) server. This fact is reflected in the protocol version that's included in the response headers sent to a client when processing a request. Unfortunately, low-level Web access classes included in the Java Development Kit (JDK) version 1.0.2 expect to see the version string "HTTP/1.0" and do not correctly interpret the "HTTP/1.1" value Apache is sending (this part of the response is a declaration of what the server can do rather than a declaration of the dialect of the response). The result is that the JDK methods do not correctly parse the headers, and include them with the document content by mistake.

   This is definitely a bug in the JDK 1.0.2 foundation classes from Sun, and it has been fixed in version 1.1. However, the classes in question are part of the virtual machine environment, which means they're part of the Web browser (if Java-enabled) or the Java environment on the client system - so even if you develop *your* classes with a recent JDK, the eventual users might encounter the problem. The classes involved are replaceable by vendors implementing the Java virtual machine environment, and so even those that are based upon the 1.0.2 version may not have this problem.

   In the meantime, a workaround is to tell Apache to "fake" an HTTP/1.0 response to requests that come from the JDK methods; this can be done by including a line such as the following in your server configuration files:

   ```
   BrowserMatch Java1.0 force-response-1.0
   BrowserMatch JDK/1.0 force-response-1.0
   ```

   More information about this issue can be found in the Java and HTTP/1.1 page at the Apache web site.

---

7. **How do I get Apache to send a MIDI file so the browser can play it?**

   Even though the registered MIME type for MIDI files is audio/midi, some browsers are not set up to recognize it as such; instead, they look for audio/x-midi. There are two things you can do to address this:

   1. Configure your browser to treat documents of type audio/midi correctly. This is the type that Apache sends by default. This may not be workable, however, if you have many client installations to change, or if some or many of the clients are not under your control.
   2. Instruct Apache to send a different Content-type header for these files by adding the following line to your server's configuration files:

      ```
      AddType audio/x-midi .mid .midi .kar
      ```

      Note that this may break browsers that *do* recognize the audio/midi MIME type unless they're prepared to also handle audio/x-midi the same way.

---

8. **How do I add browsers and referrers to my logs?**

   Apache provides a couple of different ways of doing this. The recommended method is to compile the mod_log_config module into your configuration and use the CustomLog directive.

   You can either log the additional information in files other than your normal transfer log, or you can add them to the records already being written. For example:

   ```
   CustomLog logs/access_log "%h %l %u %t \"%r\" %s %b \"%{Referer}i\" \"%{User-Agent}i\""
   ```

   This will add the values of the User-agent: and Referer: headers, which indicate the client and the referring page, respectively, to the end of each line in the access log.

   You may want to check out the Apache Week article entitled: "Gathering Visitor Information: Customizing Your Logfiles".

---

9. **Why does accessing directories only work when I include the trailing "/" (*e.g.*, http://foo.domain.com/~user/) but not when I omit it (*e.g.*, http://foo.domain.com/~user)?**

   When you access a directory without a trailing "/", Apache needs to send what is called a redirect to the client to tell it to add the

trailing slash. If it did not do so, relative URLs would not work properly. When it sends the redirect, it needs to know the name of the server so that it can include it in the redirect. There are two ways for Apache to find this out; either it can guess, or you can tell it. If your DNS is configured correctly, it can normally guess without any problems. If it is not, however, then you need to tell it.

Add a ServerName directive to the config file to tell it what the domain name of the server is.

---

10. **Why doesn't mod_info list any directives?**

    The mod_info module allows you to use a Web browser to see how your server is configured. Among the information it displays is the list modules and their configuration directives. The "current" values for the directives are not necessarily those of the running server; they are extracted from the configuration files themselves at the time of the request. If the files have been changed since the server was last reloaded, the display will will not match the values actively in use. If the files and the path to the files are not readable by the user as which the server is running (see the User directive), then mod_info cannot read them in order to list their values. An entry *will* be made in the error log in this event, however.

---

11. **I upgraded to Apache 1.3 and now my virtual hosts don't work!**

    In versions of Apache prior to 1.3b2, there was a lot of confusion regarding address-based virtual hosts and (HTTP/1.1) name-based virtual hosts, and the rules concerning how the server processed <VirtualHost> definitions were very complex and not well documented.

    Apache 1.3b2 introduced a new directive, NameVirtualHost, which simplifies the rules quite a bit. However, changing the rules like this means that your existing name-based <VirtualHost> containers probably won't work correctly immediately following the upgrade.

    To correct this problem, add the following line to the beginning of your server configuration file, before defining any virtual hosts:

    ```
    NameVirtualHost n.n.n.n
    ```

    Replace the "n.n.n.n" with the IP address to which the name-based virtual host names resolve; if you have multiple name-based hosts on multiple addresses, repeat the directive for each address.

    Make sure that your name-based <VirtualHost> blocks contain ServerName and possibly ServerAlias directives so Apache can be sure to tell them apart correctly.

    Please see the Apache Virtual Host documentation for further details about configuration.

---

12. **I'm using RedHat Linux and my .htm files are showing up as HTML source rather than being formatted!**

    RedHat messed up and forgot to put a content type for `.htm` files into `/etc/mime.types`. Edit `/etc/mime.types`, find the line containing `html` and add `htm` to it. Then restart your httpd server:

    ```
    kill -HUP `cat /var/run/httpd.pid`
    ```

    Then **clear your browsers' caches**. (Many browsers won't re-examine the content type after they've reloaded a page.)

---

13. **My `.htaccess` files are being ignored.**

    This is almost always due to your AllowOverride directive being set incorrectly for the directory in question. If it is set to `None` then .htaccess files will not even be looked for. If you do have one that is set, then be certain it covers the directory you are trying to use the .htaccess file in. This is normally accomplished by ensuring it is inside the proper Directory container.

---

14. **Why do I get a "Forbidden" message whenever I try to access a particular directory?**

    This message is generally caused because either

    - The underlying file system permissions do not allow the User/Group under which Apache is running to access the necessary files; or
    - The Apache configuration has some access restrictions in place which forbid access to the files.

    You can determine which case applies to your situation by checking the error log.

    In the case where file system permission are at fault, remember that not only must the directory and files in question be readable, but also all parent directories must be at least searchable by the web server in order for the content to be accessible.

F. Dynamic Content (CGI and SSI)

1. **How do I enable CGI execution in directories other than the ScriptAlias?**

   Apache recognizes all files in a directory named as a ScriptAlias as being eligible for execution rather than processing as normal documents. This applies regardless of the file name, so scripts in a ScriptAlias directory don't need to be named "*.cgi" or "*.pl" or whatever. In other words, *all* files in a ScriptAlias directory are scripts, as far as Apache is concerned.

   To persuade Apache to execute scripts in other locations, such as in directories where normal documents may also live, you must tell it how to recognize them - and also that it's okay to execute them. For this, you need to use something like the AddHandler directive.

   1. In an appropriate section of your server configuration files, add a line such as

      ```
      AddHandler cgi-script .cgi
      ```

      The server will then recognize that all files in that location (and its logical descendants) that end in ".cgi" are script files, not documents.
   2. Make sure that the directory location is covered by an Options declaration that includes the ExecCGI option.

   In some situations, you might not want to actually allow all files named "*.cgi" to be executable. Perhaps all you want is to enable a particular file in a normal directory to be executable. This can be alternatively accomplished *via* mod_rewrite and the following steps:

   1. Locally add to the corresponding .htaccess file a ruleset similar to this one:

      ```
      RewriteEngine on
      RewriteBase /~foo/bar/
      RewriteRule ^quux\.cgi$ - [T=application/x-httpd-cgi]
      ```
   2. Make sure that the directory location is covered by an Options declaration that includes the ExecCGI and FollowSymLinks option.

---

2. **What does it mean when my CGIs fail with "Premature end of script headers"?**

   It means just what it says: the server was expecting a complete set of HTTP headers (one or more followed by a blank line), and didn't get them.

   The most common cause of this problem is the script dying before sending the complete set of headers, or possibly any at all, to the server. To see if this is the case, try running the script standalone from an interactive session, rather than as a script under the server. If you get error messages, this is almost certainly the cause of the "premature end of script headers" message. Even if the CGI runs fine from the command line, remember that the environment and permissions may be different when running under the web server. The CGI can only access resources allowed for the `User` and `Group` specified in your Apache configuration. In addition, the environment will not be the same as the one provided on the command line, but it can be adjusted using the directives provided by mod_env.

   The second most common cause of this (aside from people not outputting the required headers at all) is a result of an interaction with Perl's output buffering. To make Perl flush its buffers after each output statement, insert the following statements around the `print` or `write` statements that send your HTTP headers:

   ```
   {
    local ($oldbar) = $|;
    $cfh = select (STDOUT);
    $| = 1;
    #
    # print your HTTP headers here
    #
    $| = $oldbar;
    select ($cfh);
   }
   ```

   This is generally only necessary when you are calling external programs from your script that send output to stdout, or if there will be a long delay between the time the headers are sent and the actual content starts being emitted. To maximize performance, you should turn buffer-flushing back *off* (with `$| = 0` or the equivalent) after the statements that send the headers, as displayed

above.

If your script isn't written in Perl, do the equivalent thing for whatever language you *are* using (*e.g.*, for C, call `fflush()` writing the headers).

Another cause for the "premature end of script headers" message are the RLimitCPU and RLimitMEM directives. You may get the message if the CGI script was killed due to a resource limit.

In addition, a configuration problem in suEXEC, mod_perl, or another third party module can often interfere with the execution of your CGI and cause the "premature end of script headers" message.

---

3. **Why do I keep getting "Method Not Allowed" for form POST requests?**

   This is almost always due to Apache not being configured to treat the file you are trying to POST to as a CGI script. You can not POST to a normal HTML file; the operation has no meaning. See the FAQ entry on CGIs outside ScriptAliased directories for details on how to configure Apache to treat the file in question as a CGI.

---

4. **How can I get my script's output without Apache buffering it? Why doesn't my server push work?**

   As of Apache 1.3, CGI scripts are essentially not buffered. Every time your script does a "flush" to output data, that data gets relayed on to the client. Some scripting languages, for example Perl, have their own buffering for output - this can be disabled by setting the `$|` special variable to 1. Of course this does increase the overall number of packets being transmitted, which can result in a sense of slowness for the end user.

   Prior to 1.3, you needed to use "nph-" scripts to accomplish non-buffering. Today, the only difference between nph scripts and normal scripts is that nph scripts require the full HTTP headers to be sent.

---

5. **Where can I find the "CGI specification"?**

   The Common Gateway Interface (CGI) specification can be found at the original NCSA site < http://hoohoo.ncsa.uiuc.edu/cgi/interface.html>. This version hasn't been updated since 1995, and there have been some efforts to update it.

   A new draft is being worked on with the intent of making it an informational RFC; you can find out more about this project at >http://web.golux.com/coar/cgi/>.

---

6. **Why isn't FastCGI included with Apache any more?**

   The simple answer is that it was becoming too difficult to keep the version being included with Apache synchronized with the master copy at the FastCGI web site. When a new version of Apache was released, the version of the FastCGI module included with it would soon be out of date.

   You can still obtain the FastCGI module for Apache from the master FastCGI web site.

---

7. **How do I enable SSI (parsed HTML)?**

   SSI (an acronym for Server-Side Include) directives allow static HTML documents to be enhanced at run-time (*e.g.*, when delivered to a client by Apache). The format of SSI directives is covered in the mod_include manual; suffice it to say that Apache supports not only SSI but xSSI (eXtended SSI) directives.

   Processing a document at run-time is called *parsing* it; hence the term "parsed HTML" sometimes used for documents that contain SSI instructions. Parsing tends to be *extremely* resource-consumptive, and is not enabled by default. It can also interfere with the cachability of your documents, which can put a further load on your server. (see the next question for more information about this.)

   To enable SSI processing, you need to

   - Build your server with the mod_include module. This is normally compiled in by default.
   - Make sure your server configuration files have an Options directive which permits Includes.
   - Make sure that the directory where you want the SSI documents to live is covered by the "server-parsed" content handler, either explicitly or in some ancestral location. That can be done with the following AddHandler directive:

     ```
     AddHandler server-parsed .shtml
     ```

This indicates that all files ending in ".shtml" in that location (or its descendants) should be parsed. Note that using '. will cause all normal HTML files to be parsed, which may put an inordinate load on your server.

For additional information, see the Apache Week article on Using Server Side Includes.

---

8. **Why don't my parsed files get cached?**

   Since the server is performing run-time processing of your SSI directives, which may change the content shipped to the client, it can't know at the time it starts parsing what the final size of the result will be, or whether the parsed result will always be the same. This means that it can't generate Content-Length or Last-Modified headers. Caches commonly work by comparing the Last-Modified of what's in the cache with that being delivered by the server. Since the server isn't sending that header for a parsed document, whatever's doing the caching can't tell whether the document has changed or not - and so fetches it again to be on the safe side.

   You can work around this in some cases by causing an Expires header to be generated. (See the mod_expires documentation for more details.) Another possibility is to use the XBitHack Full mechanism, which tells Apache to send (under certain circumstances detailed in the XBitHack directive description) a Last-Modified header based upon the last modification time of the file being parsed. Note that this may actually be lying to the client if the parsed file doesn't change but the SSI-inserted content does; if the included content changes often, this can result in stale copies being cached.

---

9. **How can I have my script output parsed?**

   So you want to include SSI directives in the output from your CGI script, but can't figure out how to do it? The short answer is "you can't." This is potentially a security liability and, more importantly, it can not be cleanly implemented under the current server API. The best workaround is for your script itself to do what the SSIs would be doing. After all, it's generating the rest of the content.

   This is a feature The Apache Group hopes to add in the next major release after 1.3.

---

10. **SSIs don't work for VirtualHosts and/or user home directories.**

    This is almost always due to having some setting in your config file that sets "Options Includes" or some other setting for your DocumentRoot but not for other directories. If you set it inside a Directory section, then that setting will only apply to that directory.

---

11. **How can I use `ErrorDocument` and SSI to simplify customized error messages?**

    Have a look at this document. It shows in example form how you can a combination of XSSI and negotiation to tailor a set of `ErrorDocuments` to your personal taste, and returning different internationalized error responses based on the client's native language.

---

12. **Why is the environment variable REMOTE_USER not set?**

    This variable is set and thus available in SSI or CGI scripts **if and only if** the requested document was protected by access authentication. For an explanation on how to implement these restrictions, see Apache Week's articles on Using User Authentication or DBM User Authentication.

    Hint: When using a CGI script to receive the data of a HTML FORM notice that protecting the document containing the FORM is not sufficient to provide REMOTE_USER to the CGI script. You have to protect the CGI script, too. Or alternatively only the CGI script (then authentication happens only after filling out the form).

G. Authentication and Access Restrictions

1. **Why isn't restricting access by host or domain name working correctly?**

   Two of the most common causes of this are:

   1. **An error, inconsistency, or unexpected mapping in the DNS registration**
      This happens frequently: your configuration restricts access to Host.FooBar.Com, but you can't get in from that host. The usual reason for this is that Host.FooBar.Com is actually an alias for another name, and when Apache performs the address-to-name lookup it's getting the *real* name, not Host.FooBar.Com. You can verify this by checking the reverse lookup yourself. The easiest way to work around it is to specify the correct host name in your configuration.

2. **Inadequate checking and verification in your configuration of Apache**
   If you intend to perform access checking and restriction based upon the client's host or domain name, you really need to configure Apache to double-check the origin information it's supplied. You do this by adding the -DMAXIMUM_DNS clause to the EXTRA_CFLAGS definition in your Configuration file. For example:

   ```
   EXTRA_CFLAGS=-DMAXIMUM_DNS
   ```

   This will cause Apache to be very paranoid about making sure a particular host address is *really* assigned to the name it claims to be. Note that this *can* incur a significant performance penalty, however, because of all the name resolution requests being sent to a nameserver.

---

2. **How do I set up Apache to require a username and password to access certain documents?**

   There are several ways to do this; some of the more popular ones are to use the mod_auth, mod_auth_db, or mod_auth_dbm modules.

   For an explanation on how to implement these restrictions, see Apache Week's articles on Using User Authentication or DBM User Authentication.

---

3. **How do I set up Apache to allow access to certain documents only if a site is either a local site *or* the user supplies a password and username?**

   Use the Satisfy directive, in particular the `Satisfy Any` directive, to require that only one of the access restrictions be met. For example, adding the following configuration to a .htaccess or server configuration file would restrict access to people who either are accessing the site from a host under domain.com or who can supply a valid username and password:

   ```
   deny from all
   allow from .domain.com
   AuthType Basic
   AuthUserFile /usr/local/apache/conf/htpasswd.users
   AuthName "special directory"
   require valid-user
   satisfy any
   ```

   See the user authentication question and the mod_access module for details on how the above directives work.

---

4. **Why does my authentication give me a server error?**

   Under normal circumstances, the Apache access control modules will pass unrecognized user IDs on to the next access control module in line. Only if the user ID is recognized and the password is validated (or not) will it give the usual success or "authentication failed" messages.

   However, if the last access module in line 'declines' the validation request (because it has never heard of the user ID or because it is not configured), the http_request handler will give one of the following, confusing, errors:

   - check access
   - check user. No user file?
   - check access. No groups file?

   This does *not* mean that you have to add an 'AuthUserFile /dev/null' line as some magazines suggest!

   The solution is to ensure that at least the last module is authoritative and **CONFIGURED**. By default, mod_auth is authoritative and will give an OK/Denied, but only if it is configured with the proper AuthUserFile. Likewise, if a valid group is required. (Remember that the modules are processed in the reverse order from that in which they appear in your compile-time Configuration file.)

   A typical situation for this error is when you are using the mod_auth_dbm, mod_auth_msql, mod_auth_mysql, mod_auth_anon or mod_auth_cookie modules on their own. These are by default **not** authoritative, and this will pass the buck on to the (non-existent) next authentication module when the user ID is not in their respective database. Just add the appropriate '*XXX*Authoritative yes' line to the configuration.

   In general it is a good idea (though not terribly efficient) to have the file-based mod_auth a module of last resort. This allows you to access the web server with a few special passwords even if the databases are down or corrupted. This does cost a file open/seek/close for each request in a protected area.

5. **Do I have to keep the (mSQL) authentication information on the same machine?**

   Some organizations feel very strongly about keeping the authentication information on a different machine than the webser
   With the mod_auth_msql, mod_auth_mysql, and other SQL modules connecting to (R)DBMses this is quite possible. Just
   configure an explicit host to contact.

   Be aware that with mSQL and Oracle, opening and closing these database connections is very expensive and time consuming. You might want to look at the code in the auth_* modules and play with the compile time flags to alleviate this somewhat, if your RDBMS licences allow for it.

---

6. **Why is my mSQL authentication terribly slow?**

   You have probably configured the Host by specifying a FQHN, and thus the libmsql will use a full blown TCP/IP socket to talk to the database, rather than a fast internal device. The libmsql, the mSQL FAQ, and the mod_auth_msql documentation warn you about this. If you have to use different hosts, check out the mod_auth_msql code for some compile time flags which might - or might not - suit you.

---

7. **Can I use my /etc/passwd file for Web page authentication?**

   Yes, you can - but it's a **very bad idea**. Here are some of the reasons:

   - The Web technology provides no governors on how often or how rapidly password (authentication failure) retries can be made. That means that someone can hammer away at your system's root password using the Web, using a dictionary or similar mass attack, just as fast as the wire and your server can handle the requests. Most operating systems these days include attack detection (such as *n* failed passwords for the same account within *m* seconds) and evasion (breaking the connection, disabling the account under attack, disabling *all* logins from that source, *et cetera*), but the Web does not.
   - An account under attack isn't notified (unless the server is heavily modified); there's no "You have 19483 login failures" message when the legitimate owner logs in.
   - Without an exhaustive and error-prone examination of the server logs, you can't tell whether an account has been compromised. Detecting that an attack has occurred, or is in progress, is fairly obvious, though - *if* you look at the logs.
   - Web authentication passwords (at least for Basic authentication) generally fly across the wire, and through intermediate proxy systems, in what amounts to plain text. "O'er the net we go/Caching all the way;/O what fun it is to surf/Giving my password away!"
   - Since HTTP is stateless, information about the authentication is transmitted *each and every time* a request is made to the server. Essentially, the client caches it after the first successful access, and transmits it without asking for all subsequent requests to the same server.
   - It's relatively trivial for someone on your system to put up a page that will steal the cached password from a client's cache without them knowing. Can you say "password grabber"?

   If you still want to do this in light of the above disadvantages, the method is left as an exercise for the reader. It'll void your Apache warranty, though, and you'll lose all accumulated UNIX guru points.

H. URL Rewriting

1. **Where can I find mod_rewrite rulesets which already solve particular URL-related problems?**

   There is a collection of Practical Solutions for URL-Manipulation where you can find all typical solutions the author of mod_rewrite currently knows of. If you have more interesting rulesets which solve particular problems not currently covered in this document, send it to Ralf S. Engelschall for inclusion. The other webmasters will thank you for avoiding the reinvention of the wheel.

---

2. **Where can I find any published information about URL-manipulations and mod_rewrite?**

   There is an article from Ralf S. Engelschall about URL-manipulations based on mod_rewrite in the "iX Multiuser Multitasking Magazin" issue #12/96. The german (original) version can be read online at <http://www.heise.de/ix/artikel/9612149/>, the English (translated) version can be found at <http://www.heise.de/ix/artikel/E/9612149/>.

---

3. **Why is mod_rewrite so difficult to learn and seems so complicated?**

   Hmmm... there are a lot of reasons. First, mod_rewrite itself is a powerful module which can help you in really **all** aspects of URL

rewriting, so it can be no trivial module per definition. To accomplish its hard job it uses software leverage and makes use of powerful regular expression library by Henry Spencer which is an integral part of Apache since its version 1.2. And regular expressions itself can be difficult to newbies, while providing the most flexible power to the advanced hacker.

On the other hand mod_rewrite has to work inside the Apache API environment and needs to do some tricks to fit there. For instance the Apache API as of 1.x really was not designed for URL rewriting at the `.htaccess` level of processing. Or the problem of multiple rewrites in sequence, which is also not handled by the API per design. To provide this features mod_rewrite has to do some special (but API compliant!) handling which leads to difficult processing inside the Apache kernel. While the user usually doesn't see anything of this processing, it can be difficult to find problems when some of your RewriteRules seem not to work.

---

4. **What can I do if my RewriteRules don't work as expected?**

   Use "RewriteLog somefile" and "RewriteLogLevel 9" and have a precise look at the steps the rewriting engine performs. This is really the only one and best way to debug your rewriting configuration.

---

5. **Why don't some of my URLs get prefixed with DocumentRoot when using mod_rewrite?**

   If the rule starts with /somedir/... make sure that really no /somedir exists on the filesystem if you don't want to lead the URL to match this directory, *i.e.*, there must be no root directory named somedir on the filesystem. Because if there is such a directory, the URL will not get prefixed with DocumentRoot. This behaviour looks ugly, but is really important for some other aspects of URL rewriting.

---

6. **How can I make all my URLs case-insensitive with mod_rewrite?**

   You can't! The reason is: First, case translations for arbitrary length URLs cannot be done *via* regex patterns and corresponding substitutions. One need a per-character pattern like sed/Perl tr|..|..| feature. Second, just making URLs always upper or lower case will not resolve the complete problem of case-INSENSITIVE URLs, because actually the URLs had to be rewritten to the correct case-variant residing on the filesystem because in later processing Apache needs to access the file. And Unix filesystem is always case-SENSITIVE.

   But there is a module named `mod_speling.c` (yes, it is named this way!) out there on the net. Try this one.

---

7. **Why are RewriteRules in my VirtualHost parts ignored?**

   Because you have to enable the engine for every virtual host explicitly due to security concerns. Just add a "RewriteEngine on" to your virtual host configuration parts.

---

8. **How can I use strings with whitespaces in RewriteRule's ENV flag?**

   There is only one ugly solution: You have to surround the complete flag argument by quotation marks ("[E=...]"). Notice: The argument to quote here is not the argument to the E-flag, it is the argument of the Apache config file parser, *i.e.*, the third argument of the RewriteRule here. So you have to write "[E=any text with whitespaces]".

I. Features

1. **Does or will Apache act as a Proxy server?**

   Apache version 1.1 and above comes with a proxy module. If compiled in, this will make Apache act as a caching-proxy server.

---

2. **What are "multiviews"?**

   "Multiviews" is the general name given to the Apache server's ability to provide language-specific document variants in response to a request. This is documented quite thoroughly in the content negotiation description page. In addition, Apache Week carried an article on this subject entitled "Content Negotiation Explained".

---

3. **Why can't I publish to my Apache server using PUT on Netscape Gold and other programs?**

   Because you need to install and configure a script to handle the uploaded files. This script is often called a "PUT" handler. There are several available, but they may have security problems. Using FTP uploads may be easier and more secure, at least for now. For more information, see the Apache Week article Publishing Pages with PUT.

4. **Why doesn't Apache include SSL?**

   SSL (Secure Socket Layer) data transport requires encryption, and many governments have restrictions upon the import, export, and use of encryption technology. If Apache included SSL in the base package, its distribution would involve all sorts of legal and bureaucratic issues, and it would no longer be freely available. Also, some of the technology required to talk to current clients using SSL is patented by RSA Data Security, who restricts its use without a license.

   Some SSL implementations of Apache are available, however; see the "related projects" page at the main Apache web site.

   You can find out more about this topic in the Apache Week article about Apache and Secure Transactions.

---

5. **How can I attach a footer to my documents without using SSI?**

   You can make arbitrary changes to static documents by configuring an Action which launches a CGI script. The CGI is then responsible for setting a content-type and delivering the requested document (the location of which is passed in the PATH_TRANSLATED environment variable), along with whatever footer is needed.

   Busy sites may not want to run a CGI script on every request, and should consider using an Apache module to add the footer. There are several third party modules available through the Apache Module Registry which will add footers to documents. These include mod_trailer, PHP (php3_auto_append_file), and mod_perl (Apache::Sandwich).

---

6. **Does Apache include a search engine?**

   Apache does not include a search engine, but there are many good commercial and free search engines which can be used easily with Apache. Some of them are listed on the Web Site Search Tools page. Open source search engines that are often used with Apache include ht://Dig and SWISH-E.

Apache HTTP Server Version 1.3

Hints on Running a High-Performance Web Server

Running Apache on a heavily loaded web server, one often encounters problems related to the machine and OS configuration. "Heavy" is relative, of course - but if you are seeing more than a couple hits per second on a sustained basis you should consult the pointers on this page. In general the suggestions involve how to tune your kernel for the heavier TCP load, hardware/software conflicts that arise, *etc*.

A/UX (Apple's UNIX)

If you are running Apache on A/UX, a page that gives some helpful performance hints (concerning the *listen()* queue and using virtual hosts) can be found here

---

BSD-based (BSDI, FreeBSD, etc)

Quick and detailed performance tuning hints for BSD-derived systems.

Digital UNIX

- DIGITAL UNIX Tuning Parameters for Web Servers
- We have some newsgroup postings on how to tune Digital UNIX 3.2 and 4.0.

Linux

There are no known problems with heavily loaded systems running Linux kernels 2.0.32 or later. Earlier kernels have some problems, and an upgrade to the latest 2.0.x is a good idea to eliminate various security and denial of service attacks.

Solaris 2.4

The Solaris 2.4 TCP implementation has a few inherent limitations that only became apparent under heavy loads. This has been fixed to some extent in 2.5 (and completely revamped in 2.6), but for now consult the following URL for tips on how to expand the capabilities if you are finding slowdowns and lags are hurting performance.

Other links:

- World Wide Web Server Performance, <http://www.sun.com/sun-on-net/performance.html>
- Solaris 2.x - tuning your TCP/IP stack contains some good technical information about tuning various Solaris TCP/IP parameters.

SunOS 4.x

More information on tuning SOMAXCONN on SunOS can be found at http://www.islandnet.com/~mark/somaxconn.html.

SVR4

Some SVR4 versions waste three system calls on every gettimeofday() call. Depending on the syntactic form of the TZ environment variable, these systems have several different algorithms to determine the local time zone (presumably *compatible* with something). The following example uses the central european time zone to demonstrate this:

TZ=:MET

This form delegates the knowledge of the time zone information to an external compiled zoneinfo file (à la BSD).
Caveat: Each time the gettimeofday() function is called, the external zone info is read in again (at least on some SVR4 systems). That results in three wasted system calls with every apache request served.

```
open("/usr/lib/locale/TZ/MET", O_RDONLY) = 3
read(3, "\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0"..., 7944) = 778
close(3)                                = 0
```

TZ=MET-1MDT,M3.5.0/02:00:00,M10.5.0/03:00:00

> This syntax form (à la SYSV) contains all the knowledge about time zone beginning and ending times in its external representation. It has to be parsed each time it is evaluated, resulting in a slight computing overhead, but it requires no system call. Though the table lookup à la BSD is the more sophisticated technical solution, the bad SVR4 implementation makes this the preferred syntax on systems which otherwise access the external zone info file repeatedly.

You should use the truss utility on a single-process apache server (started with the -X debugging switch) to determine whether your system can profit from the second form of the TZ environment variable. If it does, you could integrate the setting of the preferred TZ syntax into the httpd startup script, which is usually simply a copy of (or symbolic link to) the apachectl utility script, or into the system's /etc/TIMEZONE script.

More welcome!

If you have tips to contribute, send mail to apache@apache.org

Apache HTTP Server Version 1.3

Running a High-Performance Web Server for HPUX

```
Date: Wed, 05 Nov 1997 16:59:34 -0800
From: Rick Jones <raj@cup.hp.com>
Reply-To: raj@cup.hp.com
Organization: Network Performance
Subject: HP-UX tuning tips
```

Here are some tuning tips for HP-UX to add to the tuning page.

For HP-UX 9.X: Upgrade to 10.20
For HP-UX 10.[00|01|10]: Upgrade to 10.20

For HP-UX 10.20:

Install the latest cumulative ARPA Transport Patch. This will allow you to configure the size of the TCP connection lookup hash table. The default is 256 buckets and must be set to a power of two. This is accomplished with adb against the *disc* image of the kernel. The variable name is tcp_hash_size. Notice that it's critically important that you use "W" to write a 32 bit quantity, not "w" to write a 16 bit value when patching the disc image because the tcp_hash_size variable is a 32 bit quantity.

How to pick the value? Examine the output of ftp://ftp.cup.hp.com/dist/networking/tools/connhist and see how many total TCP connections exist on the system. You probably want that number divided by the hash table size to be reasonably small, say less than 10. Folks can look at HP's SPECweb96 disclosures for some common settings. These can be found at http://www.specbench.org/. If an HP-UX system was performing at 1000 SPECweb96 connections per second, the TIME_WAIT time of 60 seconds would mean 60,000 TCP "connections" being tracked.

Folks can check their listen queue depths with ftp://ftp.cup.hp.com/dist/networking/misc/listenq.

If folks are running Apache on a PA-8000 based system, they should consider "chatr'ing" the Apache executable to have a large page size. This would be "chatr +pi L <BINARY>." The GID of the running executable must have MLOCK privileges. Setprivgrp(1m) should be consulted for assigning MLOCK. The change can be validated by running Glance and examining the memory regions of the server(s) to make sure that they show a non-trivial fraction of the text segment being locked.

If folks are running Apache on MP systems, they might consider writing a small program that uses mpctl() to bind processes to processors. A simple pid % numcpu algorithm is probably sufficient. They might even go into the source code.

If folks are concerned about the number of FIN_WAIT_2 connections, they can use nettune to shrink the value of tcp_keepstart. However, they should be careful there - certainly do not make it less than oh two to four minutes. If tcp_hash_size has been set well, it is probably OK to let the FIN_WAIT_2's take longer to timeout (perhaps even the default two hours) - they will not on average have a big impact on performance.

There are other things that could go into the code base, but that might be left for another email. Feel free to drop me a message if you or others are interested.

sincerely,

rick jones
http://www.cup.hp.com/netperf/NetperfPage.html

Apache HTTP Server Version 1.3

Running a High-Performance Web Server for BSD

Like other OS's, the listen queue is often the **first limit hit**. The following are comments from "Aaron Gifford <agifford@InfoWest.COM>" on how to fix this on BSDI 1.x, 2.x, and FreeBSD 2.0 (and earlier):

Edit the following two files:

```
/usr/include/sys/socket.h
/usr/src/sys/sys/socket.h
```

In each file, look for the following:

```
/*
 * Maximum queue length specifiable by listen.
 */
#define SOMAXCONN       5
```

Just change the "5" to whatever appears to work. I bumped the two machines I was having problems with up to 32 and haven't noticed the problem since.

After the edit, recompile the kernel and recompile the Apache server then reboot.

FreeBSD 2.1 seems to be perfectly happy, with SOMAXCONN set to 32 already.

Addendum for *very* heavily loaded BSD servers
from Chuck Murcko <chuck@telebase.com>

If you're running a really busy BSD Apache server, the following are useful things to do if the system is acting sluggish:

- Run vmstat to check memory usage, page/swap rates, *etc.*
- Run netstat -m to check mbuf usage
- Run fstat to check file descriptor usage

These utilities give you an idea what you'll need to tune in your kernel, and whether it'll help to buy more RAM. Here are some BSD kernel config parameters (actually BSDI, but pertinent to FreeBSD and other 4.4-lite derivatives) from a system getting heavy usage. The tools mentioned above were used, and the system memory was increased to 48 MB before these tuneups. Other system parameters remained unchanged.

```
maxusers        256
```

Maxusers drives a *lot* of other kernel parameters:

- Maximum # of processes

- Maximum # of processes per user
- System wide open files limit
- Per-process open files limit
- Maximum # of mbuf clusters
- Proc/pgrp hash table size

The actual formulae for these derived parameters are in */usr/src/sys/conf/param.c*. These calculated parameters can also be overridden (in part) by specifying your own values in the kernel configuration file:

```
# Network options. NMBCLUSTERS defines the number of mbuf clusters and
# defaults to 256. This machine is a server that handles lots of traffic,
# so we crank that value.
options         NMBCLUSTERS=4096        # mbuf clusters at 4096

#
# Misc. options
#
options         CHILD_MAX=512           # maximum number of child processes
options         OPEN_MAX=512            # maximum fds (breaks RPC svcs)
```

In many cases, NMBCLUSTERS must be set much larger than would appear necessary at first glance. The reason for this is that if the browser disconnects in mid-transfer, the socket fd associated with that particular connection ends up in the TIME_WAIT state for several minutes, during which time its mbufs are not yet freed. Another reason is that, on server timeouts, some connections end up in FIN_WAIT_2 state forever, because this state doesn't time out on the server, and the browser never sent a final FIN. For more details see the FIN_WAIT_2 page.

Some more info on mbuf clusters (from sys/mbuf.h):

```
/*
 * Mbufs are of a single size, MSIZE (machine/machparam.h), which
 * includes overhead.  An mbuf may add a single "mbuf cluster" of size
 * MCLBYTES (also in machine/machparam.h), which has no additional overhead
 * and is used instead of the internal data area; this is done when
 * at least MINCLSIZE of data must be stored.
 */
```

CHILD_MAX and OPEN_MAX are set to allow up to 512 child processes (different than the maximum value for processes per user ID) and file descriptors. These values may change for your particular configuration (a higher OPEN_MAX value if you've got modules or CGI scripts opening lots of connections or files). If you've got a lot of other activity besides httpd on the same machine, you'll have to set NPROC higher still. In this example, the NPROC value derived from maxusers proved sufficient for our load.

To increase the size of the `listen()` queue, you need to adjust the value of SOMAXCONN. SOMAXCONN is not derived from maxusers, so you'll always need to increase that yourself. We use a value guaranteed to be larger than Apache's default for the listen() of 128, currently. The actual value for SOMAXCONN is set in `sys/socket.h`. The best way to adjust this parameter is run-time, rather than changing it in this header file and thus hardcoding a value in the kernel and elsewhere. To do this, edit `/etc/rc.local` and add the following line:


```
/usr/sbin/sysctl -w kern.somaxconn=256
```

We used `256` but you can tune it for your own setup. In many cases, however, even the default value of `128` (for later versions of FreeBSD) is OK.

Caveats

Be aware that your system may not boot with a kernel that is configured to use more resources than you have available system RAM. **ALWAYS** have a known bootable kernel available when tuning your system this way, and use the system tools beforehand to learn if you need to buy more memory before tuning.

RPC services will fail when the value of OPEN_MAX is larger than 256. This is a function of the original implementations of the RPC library, which used a byte value for holding file descriptors. BSDI has partially addressed this limit in its 2.1 release, but a real fix may well await the redesign of RPC itself.

Finally, there's the hard limit of child processes configured in Apache.

For versions of Apache later than 1.0.5 you'll need to change the definition for **HARD_SERVER_LIMIT** in *httpd.h* and recompile if you need to run more than the default 150 instances of httpd.

From conf/httpd.conf-dist:

```
# Limit on total number of servers running, i.e., limit on the number
# of clients who can simultaneously connect --- if this limit is ever
# reached, clients will be LOCKED OUT, so it should NOT BE SET TOO LOW.
# It is intended mainly as a brake to keep a runaway server from taking
# Unix with it as it spirals down...

MaxClients 150
```

Know what you're doing if you bump this value up, and make sure you've done your system monitoring, RAM expansion, and kernel tuning beforehand. Then you're ready to service some serious hits!

Thanks to *Tony Sanders* and *Chris Torek* at BSDI for their helpful suggestions and information.

"M. Teterin" <mi@ALDAN.ziplink.net> writes:

> It really does help if your kernel and frequently used utilities are fully optimized. Rebuilding the FreeBSD kernel on an AMD-133 (486-class CPU) web-server with
> `-m486 -fexpensive-optimizations -fomit-frame-pointer -O2`
> helped reduce the number of "unable" errors, because the CPU was often maxed out.

More welcome!

If you have tips to contribute, send mail to apache@apache.org

Apache HTTP Server Version 1.3

Connections in the FIN_WAIT_2 state and Apache

1. What is the FIN_WAIT_2 state?

Starting with the Apache 1.2 betas, people are reporting many more connections in the FIN_WAIT_2 state (as reported by `netstat`) than they saw using older versions. When the server closes a TCP connection, it sends a packet with the FIN bit sent to the client, which then responds with a packet with the ACK bit set. The client then sends a packet with the FIN bit set to the server, which responds with an ACK and the connection is closed. The state that the connection is in during the period between when the server gets the ACK from the client and the server gets the FIN from the client is known as FIN_WAIT_2. See the TCP RFC for the technical details of the state transitions.

The FIN_WAIT_2 state is somewhat unusual in that there is no timeout defined in the standard for it. This means that on many operating systems, a connection in the FIN_WAIT_2 state will stay around until the system is rebooted. If the system does not have a timeout and too many FIN_WAIT_2 connections build up, it can fill up the space allocated for storing information about the connections and crash the kernel. The connections in FIN_WAIT_2 do not tie up an httpd process.

2. But why does it happen?

There are numerous reasons for it happening, some of them may not yet be fully clear. What is known follows.

Buggy clients and persistent connections

Several clients have a bug which pops up when dealing with persistent connections (aka keepalives). When the connection is idle and the server closes the connection (based on the KeepAliveTimeout), the client is programmed so that the client does not send back a FIN and ACK to the server. This means that the connection stays in the FIN_WAIT_2 state until one of the following happens:

- The client opens a new connection to the same or a different site, which causes it to fully close the older connection on that socket.

- The user exits the client, which on some (most?) clients causes the OS to fully shutdown connection.
- The FIN_WAIT_2 times out, on servers that have a timeout for this state.

If you are lucky, this means that the buggy client will fully close the connection and release the resources on your server. However, there are some cases where the socket is never fully closed, such as a dialup client disconnecting from their provider before closing the client. In addition, a client might sit idle for days without making another connection, and thus may hold its end of the socket open for days even though it has no further use for it. **This is a bug in the browser or in its operating system's TCP implementation.**

The clients on which this problem has been verified to exist:

- Mozilla/3.01 (X11; I; FreeBSD 2.1.5-RELEASE i386)
- Mozilla/2.02 (X11; I; FreeBSD 2.1.5-RELEASE i386)
- Mozilla/3.01Gold (X11; I; SunOS 5.5 sun4m)
- MSIE 3.01 on the Macintosh
- MSIE 3.01 on Windows 95

This does not appear to be a problem on:

- Mozilla/3.01 (Win95; I)

It is expected that many other clients have the same problem. What a client **should do** is periodically check its open socket(s) to see if they have been closed by the server, and close their side of the connection if the server has closed. This check need only occur once every few seconds, and may even be detected by a OS signal on some systems (*e.g.*, Win95 and NT clients have this capability, but they seem to be ignoring it).

Apache **cannot** avoid these FIN_WAIT_2 states unless it disables persistent connections for the buggy clients, just like we recommend doing for Navigator 2.x clients due to other bugs. However, non-persistent connections increase the total number of connections needed per client and slow retrieval of an image-laden web page. Since non-persistent connections have their own resource consumptions and a short waiting period after each closure, a busy server may need persistence in order to best serve its clients.

As far as we know, the client-caused FIN_WAIT_2 problem is present for all servers that support persistent connections, including Apache 1.1.x and 1.2.

A necessary bit of code introduced in 1.2

While the above bug is a problem, it is not the whole problem. Some users have observed no FIN_WAIT_2 problems with Apache 1.1.x, but with 1.2b enough connections build up in the FIN_WAIT_2 state to crash their server. The most likely source for additional FIN_WAIT_2 states is a function called `lingering_close()` which was added between 1.1 and 1.2. This function is necessary for the proper handling of persistent connections and any request which includes content in the message body (*e.g.*, PUTs and POSTs). What it does is read any data sent by the client for a certain time after the server closes the connection. The exact reasons for doing

this are somewhat complicated, but involve what happens if the client is making a request at the same time the server sends a response and closes the connection. Without lingering, the client might be forced to reset its TCP input buffer before it has a chance to read the server's response, and thus understand why the connection has closed. See the appendix for more details.

The code in `lingering_close()` appears to cause problems for a number of factors, including the change in traffic patterns that it causes. The code has been thoroughly reviewed and we are not aware of any bugs in it. It is possible that there is some problem in the BSD TCP stack, aside from the lack of a timeout for the FIN_WAIT_2 state, exposed by the `lingering_close` code that causes the observed problems.

3. What can I do about it?

There are several possible workarounds to the problem, some of which work better than others.

Add a timeout for FIN_WAIT_2

The obvious workaround is to simply have a timeout for the FIN_WAIT_2 state. This is not specified by the RFC, and could be claimed to be a violation of the RFC, but it is widely recognized as being necessary. The following systems are known to have a timeout:

- FreeBSD versions starting at 2.0 or possibly earlier.
- NetBSD version 1.2(?)
- OpenBSD all versions(?)
- BSD/OS 2.1, with the K210-027 patch installed.
- Solaris as of around version 2.2. The timeout can be tuned by using `ndd` to modify `tcp_fin_wait_2_flush_interval`, but the default should be appropriate for most servers and improper tuning can have negative impacts.
- Linux 2.0.x and earlier(?)
- HP-UX 10.x defaults to terminating connections in the FIN_WAIT_2 state after the normal keepalive timeouts. This does not refer to the persistent connection or HTTP keepalive timeouts, but the `SO_LINGER` socket option which is enabled by Apache. This parameter can be adjusted by using `nettune` to modify parameters such as `tcp_keepstart` and `tcp_keepstop`. In later revisions, there is an explicit timer for connections in FIN_WAIT_2 that can be modified; contact HP support for details.
- SGI IRIX can be patched to support a timeout. For IRIX 5.3, 6.2, and 6.3, use patches 1654, 1703 and 1778 respectively. If you have trouble locating these patches, please contact your SGI support channel for help.
- NCR's MP RAS Unix 2.xx and 3.xx both have FIN_WAIT_2 timeouts. In 2.xx it is non-tunable at 600 seconds, while in 3.xx it defaults to 600 seconds and is calculated based on the tunable "max keep alive probes" (default of 8) multiplied by the "keep alive interval" (default 75 seconds).
- Sequent's ptx/TCP/IP for DYNIX/ptx has had a FIN_WAIT_2 timeout since around release

4.1 in mid-1994.

The following systems are known to not have a timeout:

- SunOS 4.x does not and almost certainly never will have one because it as at the very end of its development cycle for Sun. If you have kernel source should be easy to patch.

There is a patch available for adding a timeout to the FIN_WAIT_2 state; it was originally intended for BSD/OS, but should be adaptable to most systems using BSD networking code. You need kernel source code to be able to use it. If you do adapt it to work for any other systems, please drop me a note at marc@apache.org.

Compile without using `lingering_close()`

It is possible to compile Apache 1.2 without using the `lingering_close()` function. This will result in that section of code being similar to that which was in 1.1. If you do this, be aware that it can cause problems with PUTs, POSTs and persistent connections, especially if the client uses pipelining. That said, it is no worse than on 1.1, and we understand that keeping your server running is quite important.

To compile without the `lingering_close()` function, add `-DNO_LINGCLOSE` to the end of the `EXTRA_CFLAGS` line in your `Configuration` file, rerun `Configure` and rebuild the server.

Use `SO_LINGER` as an alternative to `lingering_close()`

On most systems, there is an option called `SO_LINGER` that can be set with `setsockopt(2)`. It does something very similar to `lingering_close()`, except that it is broken on many systems so that it causes far more problems than `lingering_close`. On some systems, it could possibly work better so it may be worth a try if you have no other alternatives.

To try it, add `-DUSE_SO_LINGER -DNO_LINGCLOSE` to the end of the `EXTRA_CFLAGS` line in your `Configuration` file, rerun `Configure` and rebuild the server.

NOTE: Attempting to use `SO_LINGER` and `lingering_close()` at the same time is very likely to do very bad things, so don't.

Increase the amount of memory used for storing connection state

BSD based networking code:

> BSD stores network data, such as connection states, in something called an mbuf. When you get so many connections that the kernel does not have enough mbufs to put them all in, your kernel will likely crash. You can reduce the effects of the problem by increasing the number of mbufs that are available; this will not prevent the problem, it will just make the server go longer before crashing.
>
> The exact way to increase them may depend on your OS; look for some reference to the

number of "mbufs" or "mbuf clusters". On many systems, this can be done by adding the line `NMBCLUSTERS="n"`, where `n` is the number of mbuf clusters you want to your kernel config file and rebuilding your kernel.

Disable KeepAlive

If you are unable to do any of the above then you should, as a last resort, disable KeepAlive. Edit your httpd.conf and change "KeepAlive On" to "KeepAlive Off".

4. Feedback

If you have any information to add to this page, please contact me at marc@apache.org.

5. Appendix

Below is a message from Roy Fielding, one of the authors of HTTP/1.1.

Why the lingering close functionality is necessary with HTTP

The need for a server to linger on a socket after a close is noted a couple times in the HTTP specs, but not explained. This explanation is based on discussions between myself, Henrik Frystyk, Robert S. Thau, Dave Raggett, and John C. Mallery in the hallways of MIT while I was at W3C.

If a server closes the input side of the connection while the client is sending data (or is planning to send data), then the server's TCP stack will signal an RST (reset) back to the client. Upon receipt of the RST, the client will flush its own incoming TCP buffer back to the un-ACKed packet indicated by the RST packet argument. If the server has sent a message, usually an error response, to the client just before the close, and the client receives the RST packet before its application code has read the error message from its incoming TCP buffer and before the server has received the ACK sent by the client upon receipt of that buffer, then the RST will flush the error message before the client application has a chance to see it. The result is that the client is left thinking that the connection failed for no apparent reason.

There are two conditions under which this is likely to occur:

1. sending POST or PUT data without proper authorization
2. sending multiple requests before each response (pipelining) and one of the middle requests resulting in an error or other break-the-connection result.

The solution in all cases is to send the response, close only the write half of the connection (what shutdown is supposed to do), and continue reading on the socket until it is either closed by the client (signifying it has finally read the response) or a timeout occurs. That is what the kernel is supposed to do if SO_LINGER is set. Unfortunately, SO_LINGER has no effect on some systems; on some other systems, it does not have its own timeout and thus the TCP memory segments just pile-up until the next reboot (planned or not).

Please note that simply removing the linger code will not solve the problem -- it only moves it to a

different and much harder one to detect.

Apache HTTP Server Version 1.3

Apache Keep-Alive Support

What is Keep-Alive?

The Keep-Alive extension to HTTP, as defined by the `HTTP/1.1` draft, allows persistent connections. These long-lived HTTP sessions allow multiple requests to be send over the same TCP connection, and in some cases have been shown to result in an almost 50% speedup in latency times for HTML documents with lots of images.

Enabling Keep-Alive Support

Apache 1.1 comes with Keep-Alive support on by default, however there are some directives you can use to modify Apache's behavior:

Note: Apache 1.2 uses a different syntax for the KeepAlive directive.

KeepAlive

Syntax: KeepAlive *max-requests*
Default: `KeepAlive 5`
Context: server config
Status: Core

This directive enables Keep-Alive support. Set *max-requests* to the maximum number of requests you want Apache to entertain per connection. A limit is imposed to prevent a client from hogging your server resources. Set this to `0` to disable support.

KeepAliveTimeout

Syntax: KeepAliveTimeout *seconds*
Default: `KeepAliveTimeout 15`
Context: server config
Status: Core

The number of seconds Apache will wait for a subsequent request before closing the connection. On request has been received, the timeout value specified by the `Timeout` directive applies.

When Keep-Alive Is Used

In order for Keep-Alive support to be used, first the browser must support it. Many current browsers, including Netscape Navigator 2.0, and Spyglass Mosaic-based browsers (including Microsoft Internet Explorer) do. Note, however, that some Windows 95-based browsers misbehave with Keep-Alive-supporting servers; they may occasionally hang on a connect. This has been observed with several Windows browsers, and occurs when connecting to any Keep-Alive server, not just Apache. Netscape 3.0b5 and later versions are known to work around this problem.

However, Keep-Alive support only is active with files where the length is known beforehand. This means that most CGI scripts, server-side included files and directory listings will not use the Keep-Alive protocol. While this should be completely transparent to the end user, it is something the web-master may want to keep in mind.

TOC

Apache HTTP Server Version 1.3

Performance Tuning Tips for Digital Unix

Below is a set of newsgroup posts made by an engineer from DEC in response to queries about how to modify DEC's Digital Unix OS for more heavily loaded web sites. Copied with permission.

Update

From: Jeffrey Mogul <mogul@pa.dec.com>
Date: Fri, 28 Jun 96 16:07:56 MDT

1. The advice given in the README file regarding the "tcbhashsize" variable is incorrect. The largest value this should be set to is 1024. Setting it any higher will have the perverse result of disabling the hashing mechanism.
2. Patch ID OSF350-146 has been superseded by

   Patch ID OSF350-195 for V3.2C
   Patch ID OSF360-350195 for V3.2D

   Patch IDs for V3.2E and V3.2F should be available soon. There is no known reason why the Patch ID OSF360-350195 won't work on these releases, but such use is not officially supported by Digital. This patch kit will not be needed for V3.2G when it is released.

```
From            mogul@pa.dec.com (Jeffrey Mogul)
Organization    DEC Western Research
Date            30 May 1996 00:50:25 GMT
Newsgroups      comp.unix.osf.osf1
Message-ID      <4oirch$bc8@usenet.pa.dec.com>
Subject         Re: Web Site Performance
References      1



In article <skoogDs54BH.9pF@netcom.com> skoog@netcom.com (Jim Skoog) writes:
>Where are the performance bottlenecks for Alpha AXP running the
>Netscape Commerce Server 1.12 with high volume internet traffic?
>We are evaluating network performance for a variety of Alpha AXP
>runing DEC UNIX 3.2C, which run DEC's seal firewall and behind
>that Alpha 1000 and 2100 webservers.

Our experience (running such Web servers as altavista.digital.com
and www.digital.com) is that there is one important kernel tuning
knob to adjust in order to get good performance on V3.2C.  You
```

need to patch the kernel global variable "somaxconn" (use dbx -k
to do this) from its default value of 8 to something much larger.

How much larger? Well, no larger than 32767 (decimal). And
probably no less than about 2048, if you have a really high volume
(millions of hits per day), like AltaVista does.

This change allows the system to maintain more than 8 TCP
connections in the SYN_RCVD state for the HTTP server. (You
can use "netstat -An |grep SYN_RCVD" to see how many such
connections exist at any given instant).

If you don't make this change, you might find that as the load gets
high, some connection attempts take a very long time. And if a lot
of your clients disconnect from the Internet during the process of
TCP connection establishment (this happens a lot with dialup
users), these "embryonic" connections might tie up your somaxconn
quota of SYN_RCVD-state connections. Until the kernel times out
these embryonic connections, no other connections will be accepted,
and it will appear as if the server has died.

The default value for somaxconn in Digital UNIX V4.0 will be quite
a bit larger than it has been in previous versions (we inherited
this default from 4.3BSD).

Digital UNIX V4.0 includes some other performance-related changes
that significantly improve its maximum HTTP connection rate. However,
we've been using V3.2C systems to front-end for altavista.digital.com
with no obvious performance bottlenecks at the millions-of-hits-per-day
level.

We have some Webstone performance results available at
        http://www.digital.com/info/alphaserver/news/webff.html

[The document referenced above is no longer at that URL -- Ed.]

I'm not sure if these were done using V4.0 or an earlier version
of Digital UNIX, although I suspect they were done using a test
version of V4.0.

-Jeff

From   mogul@pa.dec.com (Jeffrey Mogul)
Organization   DEC Western Research
Date   31 May 1996 21:01:01 GMT
Newsgroups   comp.unix.osf.osf1

Message-ID <4onmmd$mmd@usenet.pa.dec.com>
Subject Digital UNIX V3.2C Internet tuning patch info

Something that probably few people are aware of is that Digital has a patch kit available for Digital UNIX V3.2C that may improve Internet performance, especially for busy web servers.

This patch kit is one way to increase the value of somaxconn, which I discussed in a message here a day or two ago.

I've included in this message the revised README file for this patch kit below. Note that the original README file in the patch kit itself may be an earlier version; I'm told that the version below is the right one.

Sorry, this patch kit is NOT available for other versions of Digital UNIX. Most (but not quite all) of these changes also made it into V4.0, so the description of the various tuning parameters in this README file might be useful to people running V4.0 systems.

This patch kit does not appear to be available (yet?) from
>http://www.service.digital.com/html/patch_service.html
so I guess you'll have to call Digital's Customer Support to get it.

-Jeff

DESCRIPTION: Digital UNIX Network tuning patch

Patch ID: OSF350-146

SUPERSEDED PATCHES: OSF350-151, OSF350-158

This set of files improves the performance of the network subsystem on a system being used as a web server. There are additional tunable parameters included here, to be used cautiously by an informed system administrator.

TUNING

To tune the web server, the number of simultaneous socket connection requests are limited by:

somaxconn — Sets the maximum number of pending requests allowed to wait on a listening socket. The default value in Digital UNIX V3.2 is 8. This patch kit increases the default to 1024, which matches the value in Digital UNIX V4.0.

sominconn — Sets the minimum number of pending connections

allowed on a listening socket. When a user process calls listen with a backlog less than sominconn, the backlog will be set to sominconn. sominconn overrides somaxconn. The default value is 1.

The effectiveness of tuning these parameters can be monitored by the sobacklog variables available in the kernel:

sobacklog_hiwat — Tracks the maximum pending requests to any socket. The initial value is 0.

sobacklog_drops — Tracks the number of drops exceeding the socket set backlog limit. The initial value is 0.

somaxconn_drops — Tracks the number of drops exceeding the somaxconn limit. When sominconn is larger than somaxconn, tracks the number of drops exceeding sominconn. The initial value is 0.

TCP timer parameters also affect performance. Tuning the following require some knowledge of the characteristics of the network.

tcp_msl — Sets the tcp maximum segment lifetime. This is the maximum lifetime in half seconds that a packet can be in transit on the network. This value, when doubled, is the length of time a connection remains in the TIME_WAIT state after a incoming close request is processed. The unit is specified in 1/2 seconds, the initial value is 60.

tcp_rexmit_interval_min — Sets the minimum TCP retransmit interval. For some WAN networks the default value may be too short, causing unnecessary duplicate packets to be sent. The unit is specified in 1/2 seconds, the initial value is 1.

tcp_keepinit — This is the amount of time a partially established connection will sit on the listen queue before timing out (*e.g.*, if a client sends a SYN but never answers our SYN/ACK). Partially established connections tie up slots on the listen queue. If the queue starts to fill with connections in SYN_RCVD state, tcp_keepinit can be decreased to make those partial connects time out sooner. This should be used with caution, since there might be

legitimate clients that are taking a while to respond to SYN/ACK. The unit is specified in 1/2 seconds, the default value is 150 (ie. 75 seconds).

The hashlist size for the TCP inpcb lookup table is regulated by:

tcbhashsize — The number of hash buckets used for the TCP connection table used in the kernel. The initial value is 32. For best results, should be specified as a power of 2. For busy Web servers, set this to 2048 or more.

The hashlist size for the interface alias table is regulated by:

inifaddr_hsize — The number of hash buckets used for the interface alias table used in the kernel. The initial value is 32. For best results, should be specified as a power of 2.

ipport_userreserved — The maximum number of concurrent non-reserved, dynamically allocated ports. Default range is 1025-5000. The maximum value is 65535. This limits the numer of times you can simultaneously telnet or ftp out to connect to other systems.

tcpnodelack — Don't delay acknowledging TCP data; this can sometimes improve performance of locally run CAD packages. Default is value is 0, the enabled value is 1.

Digital UNIX version:

Feature	V3.2C	V3.2C patch	V4.0
somaxconn	X	X	X
sominconn	-	X	X
sobacklog_hiwat	-	X	-
sobacklog_drops	-	X	-
somaxconn_drops	-	X	-
tcpnodelack	X	X	X
tcp_keepidle	X	X	X
tcp_keepintvl	X	X	X
tcp_keepcnt	-	X	X
tcp_keepinit	-	X	X
TCP keepalive per-socket	-	-	X
tcp_msl	-	X	-
tcp_rexmit_interval_min	-	X	-
TCP inpcb hashing	-	X	X

tcbhashsize	-	X	X
interface alias hashing	-	X	X
inifaddr_hsize	-	X	X
ipport_userreserved	-	X	-
sysconfig -q inet	-	-	X
sysconfig -q socket	-	-	X

Apache HTTP Server Version 1.3

Apache HOWTO documentation

How to:

How to redirect an entire server or directory to a single URL

There are two chief ways to redirect all requests for an entire server to a single location: one which requires the use of `mod_rewrite`, and another which uses a CGI script.

First: if all you need to do is migrate a server from one name to another, simply use the `Redirect` directive, as supplied by `mod_alias`:

```
Redirect / http://www.apache.org/
```

Since `Redirect` will forward along the complete path, however, it may not be appropriate - for example, when the directory structure has changed after the move, and you simply want to direct people to the home page.

The best option is to use the standard Apache module `mod_rewrite`. If that module is compiled in, the following lines

```
RewriteEngine On
RewriteRule /.* http://www.apache.org/ [R]
```

This will send an HTTP 302 Redirect back to the client, and no matter what they gave in the original URL, they'll be sent to "http://www.apache.org". The second option is to set up a `ScriptAlias` pointing to a **CGI script** which outputs a 301 or 302 status and the location of the other server.

By using a **CGI script** you can intercept various requests and treat them specially, *e.g.*, you might want to intercept **POST** requests, so that the client isn't redirected to a script on the other server which expects POST information (a redirect will lose the POST information.) You might also want to use a CGI script

if you don't want to compile mod_rewrite into your server.

Here's how to redirect all requests to a script... In the server configuration file,

```
ScriptAlias / /usr/local/httpd/cgi-bin/redirect_script/
```

and here's a simple perl script to redirect requests:

```
#!/usr/local/bin/perl

print "Status: 302 Moved Temporarily\r\n" .
      "Location: http://www.some.where.else.com/\r\n" .
      "\r\n";
```

How to reset your log files

Sooner or later, you'll want to reset your log files (access_log and error_log) because they are too big, or full of old information you don't need.

`access.log` typically grows by 1Mb for each 10,000 requests.

Most people's first attempt at replacing the logfile is to just move the logfile or remove the logfile. This doesn't work.

Apache will continue writing to the logfile at the same offset as before the logfile moved. This results in a new logfile being created which is just as big as the old one, but it now contains thousands (or millions) of null characters.

The correct procedure is to move the logfile, then signal Apache to tell it to reopen the logfiles.

Apache is signaled using the **SIGHUP** (-1) signal. *e.g.*

```
mv access_log access_log.old
kill -1 `cat httpd.pid`
```

Note: `httpd.pid` is a file containing the **p**rocess **id** of the Apache httpd daemon, Apache saves this in the same directory as the log files.

Many people use this method to replace (and backup) their logfiles on a nightly or weekly basis.

How to stop or restrict robots

Ever wondered why so many clients are interested in a file called `robots.txt` which you don't have, and never did have?

These clients are called **robots** (also known as crawlers, spiders and other cute name) - special automated clients which wander around the web looking for interesting resources.

Most robots are used to generate some kind of *web index* which is then used by a *search engine* to help locate information.

`robots.txt` provides a means to request that robots limit their activities at the site, or more often than not, to leave the site alone.

When the first robots were developed, they had a bad reputation for sending hundreds/thousands of requests to each site, often resulting in the site being overloaded. Things have improved dramatically since then, thanks to Guidelines for Robot Writers, but even so, some robots may exhibit unfriendly behavior which the webmaster isn't willing to tolerate, and will want to stop.

Another reason some webmasters want to block access to robots, is to stop them indexing dynamic information. Many search engines will use the data collected from your pages for months to come - not much use if your serving stock quotes, news, weather reports or anything else that will be stale by the time people find it in a search engine.

If you decide to exclude robots completely, or just limit the areas in which they can roam, create a `robots.txt` file; refer to the robot information pages provided by Martijn Koster for the syntax.

How to proxy SSL requests *through* your non-SSL Apache server

(*submitted by David Sedlock*)

SSL uses port 443 for requests for secure pages. If your browser just sits there for a long time when you attempt to access a secure page over your Apache proxy, then the proxy may not be configured to handle SSL. You need to instruct Apache to listen on port 443 in addition to any of the ports on which it is already listening:

```
Listen 80
Listen 443
```

Then set the security proxy in your browser to 443. That might be it!

If your proxy is sending requests to another proxy, then you may have to set the directive ProxyRemote differently. Here are my settings:

```
ProxyRemote http://nicklas:80/ http://proxy.mayn.franken.de:8080
ProxyRemote http://nicklas:443/ http://proxy.mayn.franken.de:443
```

Requests on port 80 of my proxy nicklas are forwarded to proxy.mayn.franken.de:8080, while requests on port 443 are forwarded to proxy.mayn.franken.de:443. If the remote proxy is not set up to handle port 443, then the last directive can be left out. SSL requests will only go over the first proxy.

Note that your Apache does NOT have to be set up to serve secure pages with SSL. Proxying SSL is a different thing from using it.

Apache HTTP Server Version 1.3

Setting which addresses and ports Apache uses

When Apache starts, it connects to some port and address on the local machine and waits for incoming requests. By default, it listens to all addresses on the machine, and to the port as specified by the `Port` directive in the server configuration. However, it can be told to listen to more the one port, or to listen to only selected addresses, or a combination. This is often combined with the Virtual Host feature which determines how Apache responds to different IP addresses, hostnames and ports.

There are two directives used to restrict or specify which addresses and ports Apache listens to.

- BindAddress is used to restrict the server to listening to a single address, and can be used to permit multiple Apache servers on the same machine listening to different IP addresses.
- Listen can be used to make a single Apache server listen to more than one address and/or port.

BindAddress

Syntax: BindAddress *[* | IP-address | hostname]*
Default: `BindAddress *`
Context: server config
Status: Core

Makes the server listen to just the specified address. If the argument is *, the server listens to all addresses. The port listened to is set with the `Port` directive. Only one BindAddress should be used.

Listen

Syntax: Listen *[port | IP-address:port]*
Default: `none`
Context: server config
Status: Core

`Listen` can be used instead of `BindAddress` and `Port`. It tells the server to accept incoming requests on the specified port or address-and-port combination. If the first format is used, with a port number only, the server listens to the given port on all interfaces, instead of the port given by the `Port` directive. If an IP address is given as well as a port, the server will listen on the given port and interface.

Multiple Listen directives may be used to specify a number of addresses and ports to listen to. The s
will respond to requests from any of the listed addresses and ports.

For example, to make the server accept connections on both port 80 and port 8000, use:

```
Listen 80
Listen 8000
```

To make the server accept connections on two specified interfaces and port numbers, use

```
Listen 192.170.2.1:80
Listen 192.170.2.5:8000
```

How this works with Virtual Hosts

BindAddress and Listen do not implement Virtual Hosts. They tell the main server what addresses and ports to listen to. If no <VirtualHost> directives are used, the server will behave the same for all accepted requests. However, <VirtualHost> can be used to specify a different behavior for one or more of the addresses and ports. To implement a VirtualHost, the server must first be told to listen to the address and port to be used. Then a <VirtualHost> section should be created for a specified address and port to set the behavior of this virtual host. Note that if the <VirtualHost> is set for an address and port that the server is not listening to, it cannot be accessed.

See also

See also the documentation on Virtual Hosts, BindAddress directive, Port directive, DNS Issues and <VirtualHost> section.

Apache HTTP Server Version 1.3

Custom error responses

Purpose

Additional functionality. Allows webmasters to configure the response of Apache to some error or problem.

Customizable responses can be defined to be activated in the event of a server detected error or problem.

e.g. if a script crashes and produces a "500 Server Error" response, then this response can be replaced with either some friendlier text or by a redirection to another URL (local or external).

Old behavior

NCSA httpd 1.3 would return some boring old error/problem message which would often be meaningless to the user, and would provide no means of logging the symptoms which caused it.

New behavior

The server can be asked to;

1. Display some other text, instead of the NCSA hard coded messages, or
2. redirect to a local URL, or
3. redirect to an external URL.

Redirecting to another URL can be useful, but only if some information can be passed which can then be used to explain and/or log the error/problem more clearly.

To achieve this, Apache will define new CGI-like environment variables, *e.g.*

```
REDIRECT_HTTP_ACCEPT=*/*, image/gif, image/x-xbitmap,
image/jpeg
REDIRECT_HTTP_USER_AGENT=Mozilla/1.1b2 (X11; I; HP-UX
A.09.05 9000/712)
REDIRECT_PATH=.:/bin:/usr/local/bin:/etc
REDIRECT_QUERY_STRING=
REDIRECT_REMOTE_ADDR=121.345.78.123
REDIRECT_REMOTE_HOST=ooh.ahhh.com
REDIRECT_SERVER_NAME=crash.bang.edu
REDIRECT_SERVER_PORT=80
REDIRECT_SERVER_SOFTWARE=Apache/0.8.15
REDIRECT_URL=/cgi-bin/buggy.pl
```

note the `REDIRECT_` prefix.

At least REDIRECT_URL and REDIRECT_QUERY_STRING will be passed to the new URL (assuming it's a cgi-script or a cgi-include). The other variables will exist only if they existed prio the error/problem. **None** of these will be set if your ErrorDocument is an *external* redirect (*i.e.*, anything starting with a scheme name like `http:`, even if it refers to the same host as the server).

Configuration

Use of "ErrorDocument" is enabled for .htaccess files when the "FileInfo" override is allowed.

Here are some examples...

```
ErrorDocument 500 /cgi-bin/crash-recover
ErrorDocument 500 "Sorry, our script crashed. Oh dear
ErrorDocument 500 http://xxx/
ErrorDocument 404 /Lame_excuses/not_found.html
ErrorDocument 401 /Subscription/how_to_subscribe.html
```

The syntax is,

ErrorDocument <3-digit-code> action

where the action can be,

1. Text to be displayed. Prefix the text with a quote ("). Whatever follows the quote is displayed. *Note: the (") prefix isn't displayed.*
2. An external URL to redirect to.
3. A local URL to redirect to.

Custom error responses and redirects

Purpose

Apache's behavior to redirected URLs has been modified so that additional environment variables are available to a script/server-include.

Old behavior

Standard CGI vars were made available to a script which has been redirected to. No indication of where the redirection came from was provided.

New behavior

A new batch of environment variables will be initialized for use by a script which has been redirected to. Each new variable will have the prefix REDIRECT_. REDIRECT_ environment variables are created from the CGI environment variables which existed prior to the redirect, they are renamed with a REDIRECT_ prefix, *i.e.*, HTTP_USER_AGENT becomes REDIRECT_HTTP_USER_AGENT. In addition to these new variables, Apache will define REDIRECT_URL and REDIRECT_STATUS to help the script trace its origin. Both the original URL and the URL being redirected to can be logged in the access log.

If the ErrorDocument specifies a local redirect to a CGI script, the script should include a "Status:" header field in its output in order to ensure the propagation all the way back to the client of the error condition that caused it to be invoked. For instance, a Perl ErrorDocument script might include the following:


```
  :
print  "Content-type: text/html\n";
printf "Status: %s Condition Intercepted\n", $ENV{"REDIRECT_STATUS"};
  :
```

If the script is dedicated to handling a particular error condition, such as 404 Not Found, it can use the specific code and error text instead.

TOC

Apache HTTP Server Version 1.3

Configuring Multiple IP Addresses

This material is originally from John Ioannidis (ji@polaris.ctr.columbia.edu)
I have condensed it some and applied some corrections for SunOS 4.1.x
courtesy of Chuck Smoko (csmoko@relay.nswc.navy.mil).

Bob Baggerman (bob@bizweb.com)
12 Jan 94

=-=
John Ionnidis writes:

This is a topic that comes up once in a while on comp.protocols.tcp-ip
and other newsgroups. The question is, how to get a machine with one
network interface to respond to more than one IP addresses.

I have a solution than might suit you. For my doctoral work (there's
a paper about it in this year's ('91) SIGCOMM, also available for
anonymous FTP from cs.columbia.edu:/pub/ji/sigcomm*.ps.Z), I've
developed what I call the "Virtual Interface" (VIF). To the networking
code, it looks like an interface. It gets ifattach()ed when you open
the /dev/vif* device, and then you can ifconfig it as you like. It
does not have an if_input procedure; it only has an if_output. Packets
that it receives (from higher-level protocols) which have its
IP address, it simply loops back (like any well-behaved if driver).
Packets that it receives that are destined for some other address, it
encapsulates in an encapsulation protocol I call IPIP (IP-within-IP,
protocol number IPPROTO_IPIP == 94), and sends it to another machine
that groks that encapsulation protocol. This feature you won't need,
but here's how to have multiple IP addresses on a machine with a
single real interface:

Let's say your primary interface's IP address is 198.3.2.1, and you
also want it to respond to addresses 198.4.3.2 and 198.5.4.3 (note
that these are three distinct class C addresses in three distinct
class C nets). Here are the ifconfigs:

```
  ifconfig le0 198.3.2.1 up -trailers   # config primary interface

  ifconfig vif0 198.4.3.2 up            # config first virtual interface
  route delete net 198.4.3 198.4.3.2    # delete spurious route
```


```
  route add host 198.4.3.2 198.4.3.2 0  # add route for this i/f

  ifconfig vif1 198.5.4.3 up            # config second virtual interface
  route delete net 198.5.4 198.5.4.3    # delete spurious route
  route add host 198.5.4.3 198.5.4.3 0  # add route for this i/f
```

The route deletes are needed because the ifconfig creates a default route to the interface's network, which can cause problems; all that's needed is the (host) route to the interface's address.

Now, get le0's ethernet address (say, 8:0:20:3:2:1), and add the following static ARP entries:

```
  arp -s 198.4.3.2 8:0:20:3:2:1 pub
  arp -s 198.5.4.3 8:0:20:3:2:1 pub
```

This will cause any ARP requests for the VIF addresses to be replied with your machine's ethernet address.

Now, make sure your default route is to your segment's gateway, through the real interface. Finally, make sure your routers and/or hosts on the same segment as yours know that 198.4.3.2 and 198.5.4.3 are on that cable.

Here's what you've accomplished.

ARP requests for any of your host's addresses will be replied to with the host's ethernet address (the real one, because that's what it is, the virtual ones because of the public static arp entries). Packets reaching your host with any of these addresses will be accepted by the ip_input routine because they match the address of one of the host's interfaces. Packets leaving your host can have any of its addresses (real and virtual).

The code for vif follows. To use it, put the stuff in netinet/if_vif.c and netinet/if_vif.h, configure your kernel with the number of virtual interfaces you want using a line like:

```
pseudo-device   vif4            # Virtual IP interface
```

in your configuration file, and the line

```
netinet/if_vif.c        optional vif device-driver
```

in the "files" file. Also, add the appropriate entries in conf.c, so that you can access the if_attach() routine when you open the device:

```
------------------------- conf.c----------------------------------------
```

add this in the appropriate place in the headers of conf.c:


```
--------------------
#include "vif.h"
#if NVIF > 0
int     vifopen(), vifclose(), vifread(), vifwrite(), vifselect(), vifioctl();
#else
#define vifopen         nodev
#define vifclose        nodev
#define vifread         nodev
#define vifwrite        nodev
#define vifselect       nodev
#define vifioctl        nodev
#endif
--------------------
```

then, way down in the definition for cdevsw[]:

```
--------------------
        vifopen,        vifclose,       vifread,        vifwrite,       /*14*/
        vifioctl,       nodev,          nodev,          0,
        0,      nodev,
--------------------
```

Make sure you remember the correct major device number, 14 in this case!

Finally, here's the code. It has the tunneling pieces removed (you need more code to use that anyway), and it comes from a Mach 2.6 kernel; it should compile on any Berkeley-derived unix with minor changes (most likely only in the includes).

```
---------------------netinet/if_vif.h-------------------------------------
typedef struct
{
        struct ifnet    vif_if;
        struct ifnet    *vif_sif;       /* slave interface */
        int             vif_flags;
} vif_softc_t;

#define VIFMTU  (1024+512)
--------------------------------------------------------------------------
```

and

```
---------------------netinet/if_vif.c-------------------------------------
/*
 * Virtual IP interface module.
 */

#include "param.h"
```


```
#include "../sys/systm.h"
#include "../sys/mbuf.h"
#include "../sys/socket.h"
#include "../sys/errno.h"
#include "../sys/ioctl.h"

#include "../net/if.h"
#include "../net/netisr.h"
#include "../net/route.h"

#ifdef  INET
#include "../netinet/in.h"
#include "../netinet/in_systm.h"
#include "../netinet/in_var.h"
#include "../netinet/ip.h"
#endif

#include "in_pcb.h"
#include "vif.h"

typedef struct
{
        struct ifnet    vif_if;
        struct ifnet    *vif_sif;       /* slave interface */
        int             vif_flags;
} vif_softc_t;

#define VIFMTU  (1024+512)

vif_softc_t vif_softc[NVIF];

int vifs_inited = 0;


vifattach()
{
        register int i;
        register struct ifnet *ifp;
        int     vifoutput(), vififioctl();

        for (i=0; i<NVIF; i++)
        {
                ifp = &vif_softc[i].vif_if;
                ifp->if_name = "vif";
                ifp->if_unit = i;
                ifp->if_mtu = VIFMTU;
                ifp->if_flags = IFF_LOOPBACK | IFF_NOARP;
                ifp->if_ioctl = vififioctl;
                ifp->if_output = vifoutput;
                if_attach(ifp);
        }
```


```
}

vifopen(dev, flag)
int dev, flag;
{
        int unit;

        if (!vifs_inited)
        {
                vifattach();
                vifs_inited = 1;
                printf("vif initialized\n");
        }

        unit = minor(dev);
        if ((unit < 0) || (unit >= NVIF))
        {
                return ENXIO;
        }

        return 0;
}

vifclose(dev, flag)
int dev, flag;
{
        return 0;
}

vifread()
{
        return ENXIO;
}

vifwrite()
{
        return ENXIO;
}

vifselect()
{
        return ENXIO;
}

vifoutput(ifp, m0, dst)
        struct ifnet *ifp;
        register struct mbuf *m0;
        struct sockaddr *dst;
{
        int s;
        register struct ifqueue *ifq;
```


```
struct mbuf *m;
struct sockaddr_in *din;

if (dst->sa_family != AF_INET)
{
        printf("%s%d: can't handle af%d\n",
               ifp->if_name, ifp->if_unit,
               dst->sa_family);
        m_freem(m0);
        return (EAFNOSUPPORT);
}

din = (struct sockaddr_in *)dst;

if (din->sin_addr.s_addr == IA_SIN(ifp->if_addrlist)->sin_addr.s_addr)
{
        /* printf("%s%d: looping\n", ifp->if_name, ifp->if_unit); */

        /*
         * Place interface pointer before the data
         * for the receiving protocol.
         */
        if (m0->m_off <= MMAXOFF &&
            m0->m_off >= MMINOFF + sizeof(struct ifnet *)) {
                m0->m_off -= sizeof(struct ifnet *);
                m0->m_len += sizeof(struct ifnet *);
        } else {
                MGET(m, M_DONTWAIT, MT_HEADER);
                if (m == (struct mbuf *)0)
                  return (ENOBUFS);
                m->m_off = MMINOFF;
                m->m_len = sizeof(struct ifnet *);
                m->m_next = m0;
                m0 = m;
        }
        *(mtod(m0, struct ifnet **)) = ifp;
        s = splimp();
        ifp->if_opackets++;
        ifq = &ipintrq;
        if (IF_QFULL(ifq)) {
                IF_DROP(ifq);
                m_freem(m0);
                splx(s);
                return (ENOBUFS);
        }
        IF_ENQUEUE(ifq, m0);
        schednetisr(NETISR_IP);
        ifp->if_ipackets++;
        splx(s);
        return (0);
}
```


```
        return EHOSTUNREACH;
}

/*
 * Process an ioctl request.
 */
/* ARGSUSED */
vifioctl(ifp, cmd, data)
        register struct ifnet *ifp;
        int cmd;
        caddr_t data;
{
        int error = 0;

        switch (cmd) {

        case SIOCSIFADDR:
                ifp->if_flags |= IFF_UP;
                /*
                 * Everything else is done at a higher level.
                 */
                break;

        default:
                error = EINVAL;
        }
        return (error);
}

vifioctl(dev, cmd, arg, mode)
dev_t dev;
int cmd;
caddr_t arg;
int mode;
{
        int unit;

        unit = minor(dev);
        if ((unit < 0) || (unit >= NVIF))
          return ENXIO;

        return EINVAL;
}
```

To use it, compile your kernel, and reboot. Then create the vif device:

```
# mknod /dev/vif c 14 0
```

(or whatever major number it ended up being), and echo something into it:

```
# echo > /dev/vif
```

This will cause the device to be opened, which will if_attach the interfaces. If you feel like playing with the code, you may want to kmem_alloc() the vif_softc structure at open time, and use the minor number of the device to tell it how many interfaces to create.

Now you can go ahead and ifconfig *etc.*

I'll be happy to answer minor questions, and hear about success and failure stories, but I cannot help you if you don't already know how to hack kernels.

Good luck!

/ji

In-Real-Life: John "Heldenprogrammer" Ioannidis
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V-Mail-To: +1 212 854 8120
P-Mail-To: 450 Computer Science \n Columbia University \n New York, NY 10027

Note: there is also a commercial-product-turned-freeware called "Col. Patch" which does this as a loadable kernel module for SunOS 4.1.3_U1.


```
/* ====================================================================
 * Copyright (c) 1995-1999 The Apache Group.  All rights reserved.
 *
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 * modification, are permitted provided that the following conditions
 * are met:
 *
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 *
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 *
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 * ====================================================================
 *
 * This software consists of voluntary contributions made by many
 * individuals on behalf of the Apache Group and was originally based
 * on public domain software written at the National Center for
 * Supercomputing Applications, University of Illinois, Urbana-Champaign.
 * For more information on the Apache Group and the Apache HTTP server
 * project, please see <http://www.apache.org/>.
 *
 */
```