iPlanet Web Server Performance Tuning, Sizing, and Scaling

This guide is intended for advanced administrators only. Be cautious when you tune your server. Do not change any values except in exceptional circumstances. Read this guide and other relevant server documentation before making any changes. Always backup your configuration files first.

Note Some internal iPlanet Web Server, Enterprise Edition 4.0 tuning parameters are different from those in previous versions of Netscape Enterprise Server.

This guide includes the following sections:

- About Server Performance
- The perfdump Utility
- Using perfdump Statistics to Tune Your Server
- Performance Buckets
- File and Accelerator Caches
- Unix Platform-Specific Issues
- Miscellaneous magnus.conf Directives
- Improving Servlet Performance
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About Server Performance

Web servers have become increasingly important for both internal and external business communications. As web servers become more and more business-critical, server performance takes on added significance. The iPlanet Web Server, Enterprise Edition continues to lead in this area, by setting a new standard for performance.

iPlanet Web Server was designed to meet the needs of the most demanding, high traffic sites in the world. It flexibly runs on both Unix and Windows NT and can serve both static and dynamically generated content. iPlanet Web Server can also run in SSL mode, enabling the secure transfer of information.

Because iPlanet Web Server is such a flexible tool for publishing, customer needs vary significantly. This document guides you through the process of defining your server workload and sizing a system to meet your performance needs. This document addresses miscellaneous configuration and Unix platform-specific issues. It also describes the `perfdump` performance utility and tuning parameters that are built into the server. The document concludes with sizing and scaling information and studies.

Performance Issues

The first step toward sizing your server is to determine your requirements. Performance means different things to users and to webmasters. Users want fast response times (typically less than 100 ms), high availability (no "connection refused" messages), and as much interface control as possible. Webmasters and system administrators, on the other hand, want to see high connection rates, high data throughput, and uptime approaching 100%. You need to define what performance means for your particular situation.

Here are some areas to consider:

- Peak concurrent users
- Security requirements

  Encrypting your iPlanet Web Server's data streams with SSL makes an enormous difference to your site's credibility for electronic commerce and other security-conscious applications, but it also can seriously impact your CPU's performance. Note that SSL always has a significant impact on

throughput, so minimize your use of SSL for best performance. Also, multiple CPUs help SSL, so consider buying a multi-CPU server if you need to use SSL.

- Size of document tree
- Dynamic vs. static content

  The content you serve affects your server's performance. An iPlanet Web Server delivering mostly static HTML can run much faster than a server that has to execute CGIs for every query.

Monitoring Performance

To help you monitor the performance of your server, use the following tools:

- The perfdump Utility
- Performance Buckets
- File Cache Dynamic Control and Monitoring

These tools are explained in more detail in the following sections of this document.

The perfdump Utility

The `perfdump` utility is a service function built into iPlanet Web Server. It collects various pieces of performance data from the web server internal statistics and displays them in ASCII text.

To install `perfdump`, you need to make the following modifications in `obj.conf` in the `netscape/server4/https-`*`server_name`*`/config` directory:

1. Add the following object to your `obj.conf` file (after the default object):

```
<Object ppath="/usr/netscape/server4/docs/.perf">
Service fn = "service-dump"
</Object>
```

2. Edit the `ppath=` line if your document root is different than the example above. Make sure to put `.perf` after the path to the document root, as shown above.

3. Restart your server software, and access `perfdump` by accessing this URL:

   ```
   http://yourhost/.perf
   ```

You can request the `perfdump` statistics and inform the browser to automatically refresh the statistics every *n* seconds by using this URL, which sets the refresh to every 5 seconds:

```
http://yourhost/.perf?refresh=5
```

Sample Output

```
ns-httpd pid: 133
ListenSocket #0:
------------------
Address           https:\\INADDR_ANY:80
ActiveThreads     48
WaitingThreads    47
BusyThreads       1
Thread limits     48/512
KeepAliveInfo:
------------------
KeepAliveCount        0/200
KeepAliveHits         0
KeepAliveFlushes      0
KeepAliveTimeout      30 seconds
CacheInfo:
------------------
enabled             yes
CacheEntries        2/8192
CacheSize(bytes)    0/0
```

```
Hit Ratio           474254/474264 (100.00)
pollInterval        7200
Native Thread Pool Data:
------------------------
Idle/Peak/Limit          1/1/100
Work queue length/Limit  0/2147483647
Peak work queue length   1
Work queue rejections    0
Server DNS cache disabled
```

Using perfdump Statistics to Tune Your Server

This section describes the information available through the `perfdump` utility and discusses how to tune some parameters to improve your server's performance. The default tuning parameters are appropriate for all sites except those with very high volume. The only parameter that large sites may regularly need to change is the `RqThrottle` parameter, which is tunable from the Server Manager.

The `perfdump` utility monitors these statistics:

- ListenSocket Information
- KeepAlive Information
- Cache Information
- Native Threads Pool
- Asynchronous DNS Lookup (Unix)

ListenSocket Information

The `ListenSocket` is the listen-queue size which is a socket-level parameter that specifies the number of incoming connections the system will accept for that socket. The default setting is 128 (for Unix) or 100 (for Windows NT) incoming connections.

Make sure your system's listen-queue size is large enough to accommodate the `ListenSocket` size set in iPlanet Web Server. The `ListenSocket` size set from iPlanet Web Server changes the listen-queue size requested by your system. If iPlanet Web Server requests a `ListenSocket` size larger than your system's maximum listen-queue size, the size defaults to the system's maximum.

Warning Setting `ListenSocket` too high can degrade server performance. `ListenSocket` was designed to prevent the server from becoming overloaded with connections it cannot handle. If your server is overloaded and you increase `ListenSocket`, the server will only fall further behind.

The first set of `perfdump` statistics is the `ListenSocket` information. For each hardware virtual server you have enabled in your server, there is one `ListenSocket` structure. For most sites, only one is listed.

```
ListenSocket #0:
------------------
Address           https:\\INADDR_ANY:80
ActiveThreads     48
WaitingThreads    47
BusyThreads       1
Thread limits     48/512
```

Note The "thread" fields specify the current thread use counts and limits for this listen socket. Keep in mind that the idea of a "thread" does not necessarily reflect the use of a thread known to the operating system. "Thread" in these fields really means an HTTP session. If you check the operating system to see how many threads are running in the process, it is not going to be the same as the numbers reported in these fields.

Tuning

There are two ways to create virtual servers: Using the `virtual.conf` file and using the `obj.conf` file. If you use the `virtual.conf` method, the 512 default maximum threads are available to all virtual servers on an as-needed basis. If you use the `obj.conf` method, the 512 threads are allocated equally to each of the defined virtual servers. For example, if you had two servers, each would have 256 threads available. This is less efficient. To maximize performance in this area, use the `virtual.conf` method. You can also configure the listen-queue size in the Performance Tuning page of the Server Manager.

Address

This field contains the base address that this listen socket is listening to. For most sites that are not using hardware virtual servers, the URL is:

`http://INADDR_ANY:80`"

The constant value "INADDR_ANY" is known internally to the server that specifies that this listen socket is listening on all IP addresses for this machine.

Tuning

This setting is not tunable except as described above.

ActiveThreads

The total number of "threads" (HTTP sessions) that are in any state for this listen socket. This is equal to `WaitingThreads` + `BusyThreads`. This setting is not tunable.

WaitingThreads

The number of "threads" (HTTP sessions) waiting for a new TCP connection for this listen socket.

Tuning

This is not directly tunable, but it is loosely equivalent to the `RqThrottleMinPerSocket`. See Thread limits <min/max>.

BusyThreads

The number of "threads" (HTTP sessions) actively processing requests which arrived on this listen socket.

This setting is not tunable.

Thread limits <min/max>

The minimum thread limit is a goal for how many threads the server attempts to keep in the WaitingThreads state. This number is just a goal. The number of actual threads in this state may go slightly above or below this value.

The maximum threads represents a hard limit for the maximum number of active threads that can run simultaneously, which can become a bottleneck for performance. iPlanet Web Server, Enterprise Edition 4.0 has default limits of 48/512. For more information, see About RqThrottle.

Tuning

See About RqThrottle.

KeepAlive Information

```
KeepAliveInfo:
------------------
KeepAliveCount        0/200
KeepAliveHits         0
KeepAliveFlushes      0
KeepAliveTimeout      30 seconds
```

This section reports statistics about the server's HTTP-level KeepAlive system.

Note The name "KeepAlive" should not be confused with TCP "KeepAlives." Also, note that the name "KeepAlive" was changed to "Persistent Connections" in HTTP/1.1, but for clarity this document continues to refer to them as "KeepAlive" connections.

Both HTTP/1.0 and HTTP/1.1 support the ability to send multiple requests across a single HTTP session. A web server can receive hundreds of new HTTP requests per second. If every request was allowed to keep the connection open indefinitely, the server could become overloaded with connections. On Unix systems, this could lead to a file table overflow very easily.

To deal with this problem, the server maintains a "Maximum number of 'waiting' keepalive connections" counter. A 'waiting' keepalive connection is a connection that has fully completed processing of the previous request over the connection and is now waiting for a new request to arrive on the same connection. If the server has more than the maximum waiting connections

open when a new connection starts to wait for a keepalive request, the server closes the oldest connection. This algorithm keeps an upper bound on the number of open, waiting keepalive connections that the server can maintain.

iPlanet Web Server does not always honor a KeepAlive request from a client. The following conditions cause the server to close a connection even if the client has requested a KeepAlive connection:

- `KeepAliveTimeout` is set to 0.
- `MaxKeepAlive` count is exceeded.
- Dynamic content, such as CGI, does not have an HTTP `content_length` header set or the header is not lowercase.
- Request is not `HTTP GET` or `HEAD`.
- HTTP 1.1 pipelined request.
- The request was determined to be bad-- if have bad client sends only headers, no content.

KeepAliveCount <KeepAliveCount/ KeepAliveMaxCount>

The number of sessions currently waiting for a keepalive connection and the maximum number of sessions that the server allows to wait at one time.

Tuning

Edit the `MaxKeepAliveConnections` parameter in the `magnus.conf` file.

KeepAliveHits

The number of times a request was successfully received from a connection that had been kept alive.

This setting is not tunable.

KeepAliveFlushes

The number of times the server had to close a connection because the `KeepAliveCount` exceeded the `KeepAliveMaxCount`.

This setting is not tunable.

KeepAliveTimeout

Specifies the number of seconds the server will allow a client connection to remain open with no activity. A web client may keep a connection to the server open so that multiple requests to one server can be serviced by one network connection. Since a given server can handle a finite number of open connections (limited by active threads), a high number of open connections will prevent new clients from connecting. Setting the timeout to a lower value, however, may prevent the transfer of large files as timeout does not refer to the time that the connection has been idle. For example, if you are using a 2400 baud modem, and the request timeout is set to 180 seconds, then the maximum file size that can be transferred before the connection is closed is 432000 bits (2400 multiplied by 180).

When SSL is enabled, `KeepAliveTimeout` defaults to 0, which effectively disables persistent connections. If you want to use persistent connections with SSL, set `KeepAliveTimeout` to a non-zero value.

Tuning

You can change `KeepAliveTimeout` in the Performance Tuning page in the Server Manager.

Cache Information

This information applies to the accelerator cache, not the file cache. For an explanation of the caches, see File and Accelerator Caches.

```
CacheInfo:
------------------
enabled             yes
CacheEntries        2/8192
CacheSize(bytes)    0/0
Hit Ratio           474254/474264 (100.00)
pollInterval        7200
```

This section describes the server's cache information. The contents of a file are cached to a specific static file on disk, with the keys being the file's URI. If multiple virtual servers are set up, the key also includes the virtual server's host ID and the port number.

enabled

If the cache is disabled, the rest of this section is not displayed.

Tuning

To disable the server accelerator cache, add the following line to the `obj.conf` file:

```
Init fn=cache-init disable=true
```

CacheEntries <CurrentCacheEntries / MaxCacheEntries>

The number of current cache entries and the maximum number of cache entries. A single cache entry represents a single URI.

Tuning

To set the maximum number of cached files in the cache, add the following line to the `obj.conf` file:

```
Init fn=cache-init MaxNumberOfCachedFiles=xxxxx
```

CacheSize <CurrentCacheSize / MaxCacheSize>

The CacheSize has been deprecated for this release, since the files are cached in the file cache, not the accelerator cache. For more information, see File and Accelerator Caches.

Hit Ratio <CacheHits / CacheLookups (Ratio)>

The hit ratio value tells you how efficient your site is. The hit ratio should be above 90%. If the number is 0, you need to optimize your site. See the troubleshooting section for more information on how to improve your site.

This setting is not tunable.

pollInterval

Since `pollInterval` is deprecated for this release, this field displays `MaxAge` from nsfc.conf. If you have not tuned `MaxAge`, it defaults to 30 seconds.

For tuning information on this setting, see MaxAge.

DNS Cache Information

`Server DNS cache disabled`

The DNS cache caches IP addresses and DNS names.

Is the DNS Cache section of perfdump part of the Cache information section, or a separate section?

enabled

If the cache is disabled, the rest of this section is not displayed.

Tuning

By default, the DNS cache is off. Add the following line to `obj.conf` to enable the cache:

```
Init fn=dns-cache-init
```

CacheEntries <CurrentCacheEntries / MaxCacheEntries>

The number of current cache entries and the maximum number of cache entries. A single cache entry represents a single IP address or DNS name lookup.

Tuning

To set the maximum size of the DNS cache, add the following line to the `obj.conf` file:

```
Init fn=dns-cache-init cache-size=xxxxx
```

HitRatio <CacheHits / CacheLookups (Ratio)>

The hit ratio is displays the number of cache hits and the number of cache lookups. A good hit ratio for the DNS cache is ~60-70%.

This setting is not tunable.

Native Threads Pool

```
Native Thread Pool Data:
------------------------
Idle/Peak/Limit          1/1/100
Work queue length/Limit  0/2147483647
Peak work queue length   1
Work queue rejections    0
```

The native thread pool is used internally by the server to execute NSAPI functions that require a native thread for execution.

iPlanet Web Server uses NSPR, which is an underlying portability layer that provides access to the host OS services. This layer provides abstractions for threads that are not always the same as those for the OS-provided threads. These non-native threads have lower scheduling overhead so their use improves performance. However, these threads are sensitive to blocking calls to the OS, such as I/O calls. To make it easier to write NSAPI extensions that can make use of blocking calls, the server keeps a pool of threads that safely support blocking calls (usually this means it is a native OS thread). During request processing, any NSAPI function that is not marked as being safe for execution on a non-native thread is scheduled for execution on one of the threads in the native thread pool.

If you have written your own NSAPI plug-ins such as `NameTrans`, `Service`, or `PathCheck` functions, these execute by default on a thread from the native thread pool. If your plug-in makes use of the NSAPI functions for I/O exclusively or does not use the NSAPI I/O functions at all, then it can execute on a non-native thread. For this to happen, the function must be loaded with a "`NativeThread=no`" option indicating that it does not require a native thread. To do this, add this to the "`load-modules`" Init line in the `obj.conf` file:

```
Init funcs="pcheck_uri_clean_fixed_init" shlib="C:/Netscape/p186244/
P186244.dll" fn="load-modules" NativeThread="no"
```

The `NativeThread` flag affects all functions in the `funcs` list, so if you have more than one function in a library but only some of them use native threads, use separate Init lines.

Idle/Peak/Limit

Idle indicates the number of threads that are currently idle. Peak indicates the peak number in the pool. Limit indicates the maximum number of native threads allowed in the thread pool, and is determined by the setting of the `NSCP_POOL_THREADMAX` environment variable.

Tuning

Modify the `NSCP_POOL_THREADMAX` environment variable.

Work queue length/Limit

These numbers refer to a queue of server requests that are waiting for the use of a native thread from the pool. The Work Queue Length is the current number of requests waiting for a native thread. Limit is the maximum number of requests that can be queued at one time to wait for a native thread., and is determined by the setting of the `NSCP_POOL_WORKQUEUEMAX` environment variable.

Tuning

Modify the `NSCP_POOL_WORKQUEUEMAX` environment variable.

Peak work queue length

This is the highest number of requests that were ever queued up simultaneously for the use of a native thread since the server was started. This value can be viewed as the maximum concurrency for requests requiring a native thread.

This setting is not tunable.

Work queue rejections

This is the cumulative number of requests that have needed the use of a native thread, but that have been rejected due to the work queue being full. By default, these requests are rejected with a "503 - Service Unavailable" response.

This setting is not tunable.

PostThreadsEarly

This advanced tuning parameter changes the thread allocation algorithm by causing the server to check for threads available for accept before executing a request. The default is set to Off. Recommended only in those situations when the load on the server is primarily comprised of lengthy transactions such as LiveWire and the Netscape Application Server or custom applications that access databases and other complex back-end systems. Turning this on allows the server to grow its thread pool more rapidly.

Tuning

Turn this parameter on by adding this directive to `magnus.conf`:

```
PostThreadsEarly 1
```

Thread Pool Environmental Variables

NSCP_POOL_WORKQUEUEMAX

This value defaults to 0x7FFFFFFF (a very large number). Setting this *below* the `RqThrottle` value causes the server to execute a busy function instead of the intended NSAPI function whenever the number of requests waiting for service by pool threads exceeds this value. The default returns a "503 Service Unavailable" response and logs a message if `LogVerbose` is enabled. Setting this *above* `RqThrottle` causes the server to reject connections before a busy function can execute.

This value represents the maximum number of concurrent requests for service which require a native thread. If your system is unable to fulfill requests due to load, letting more requests queue up increases the latency for requests and could result in all available request threads waiting for a native thread. In

general, set this value to be high enough to avoid rejecting requests under "normal" conditions, which would be the anticipated maximum number of concurrent users who would execute requests requiring a native thread.

The difference between this value and `RqThrottle` is the number of requests reserved for non-native thread requests (such as static HTML, gif, and jpeg files). Keeping a reserve (and rejecting requests) ensures that your server continues to fill requests for static files, which prevents it from becoming unresponsive during periods of very heavy dynamic content load. If your server consistently rejects connections, this value is set too low or your server hardware is overloaded.

NSCP_POOL_THREADMAX

This value represents the maximum number of threads in the pool. Set this value as low as possible to sustain the optimal volume of requests. A higher value allows more requests to execute concurrently, but has more overhead due to context switching, so "bigger is not always better." If you are not saturating your CPU but you are seeing requests queue up, then increase this number. Typically, you will not need to increase this number.

Busy Functions

The default busy function returns a "503 Service Unavailable" response and logs a message if `LogVerbose` is enabled. You may wish to modify this behavior for your application. You can specify your own busy functions for any NSAPI function in the `obj.conf` file by including a service function in the configuration file in this format:

```
busy="<my-busy-function>"
```

For example, you could use this sample service function:

```
Service fn="send-cgi" busy="service-toobusy"
```

This allows different responses if the server become too busy in the course of processing a request that includes a number of types (such as `Service`, `AddLog`, and `PathCheck`). Note that your busy function will apply to all functions that require a native thread to execute when the default thread type is non-native.

To use your own busy function instead of the default busy function for the entire server, you can write an NSAPI init function that includes a `func_insert` call as shown below:

```
extern "C" NSAPI_PUBLIC int my_custom_busy_function(pblock *pb, Session *sn,
Request *rq);

my_init(pblock *pb, Session *, Request *)

    func_insert("service-toobusy", my_custom_busy_function);
```

Busy functions are never executed on a pool thread, so you must be careful to avoid using function calls that could cause the thread to block.

Asynchronous DNS Lookup (Unix)

You can configure the server to use Domain Name System (DNS) lookups during normal operation. By default, DNS is not enabled; if you enable DNS, the server looks up the host name for a system's IP address. Although DNS lookups can be useful for server administrators when looking at logs, they can impact performance. When the server receives a request from a client, the client's IP address is included in the request. If DNS is enabled, the server must look up the hostname for the IP address for every client making a request.

DNS causes multiple threads to be serialized when you use DNS services. If you do not want serialization, enable asynchronous DNS. You can enable it only if you have also enabled DNS. Enabling asynchronous DNS can improve your system's performance if you are using DNS.

Note If you turn off DNS lookups on your server, host name restrictions will not work, and hostnames will not appear in your log files. Instead, you'll see IP addresses.

You can also specify whether to cache the DNS entries. If you enable the DNS cache, the server can store hostname information after receiving it. If the server needs information about the client in the future, the information is cached and available without further querying. You can specify the size of the DNS cache and an expiration time for DNS cache entries. The DNS cache can contain 32 to 32768 entries; the default value is 1024 entries. Values for the time it takes for a cache entry to expire can range from 1 second to 1 year (specified in seconds); the default value is 1200 seconds (20 minutes).

It is recommended that you do not use DNS lookups in server processes because they are so resource intensive. If you must include DNS lookups, be sure to make them asynchronous. For more information on asynchronous DNS, see the Performance Tuning page in the online help.

enabled

If asynchronous DNS is disabled, the rest of this section will not be displayed.

Tuning

Add "AsyncDNS on" to `magnus.conf`.

NameLookups

The number of name lookups (DNS name to IP address) that have been done since the server was started.

This setting is not tunable.

AddrLookups

The number of address loops (IP address to DNS name) that have been done since the server was started.

This setting is not tunable.

LookupsInProgress

The current number of lookups in progress.

This setting is not tunable.

Performance Buckets

Performance buckets allow you to define buckets, and link them to various server functions. Every time one of these functions is invoked, the server collects statistical data and adds it to the bucket. For example, `send-cgi` and `NSServletService` are functions used to serve the CGI and Java servlet

requests respectively. You can either define two buckets to maintain separate counters for CGI and servlet requests, or create one bucket that counts requests for both types of dynamic content. The cost of collecting this information is little and impact on the server performance is negligible. This information can later be accessed using The perfdump Utility. The following information is stored in a bucket:

- **Name of the bucket.** This name is used for associating the bucket with a function.
- **Description.** A description of the functions that the bucket is associated with.
- **Number of requests for this function.** The total number of times that this function was requested to be invoked.
- **Number of times the function was invoked.** This number may not coincide with the number of requests for the function because some functions may be executed more than once for a single request.
- **Function latency or the dispatch time.** The time taken by the server to invoke the function.
- **Function time.** The time spent in the function itself.

The following buckets are pre-defined by the server:

- `cache-bucket`.

  Records the statistics for accelerated cache functions. All the static content requests served using the accelerator cache are counted in this bucket.

- `default-bucket`.

  Records statistics for the functions not associated with any user defined or built-in bucket.

Configuration

Specify all the configuration information for performance buckets in the `obj.conf` file. By default the feature is disabled. To enable performance measurement add the following line in `obj.conf`:

```
Init fn="perf-init" enable=true
```

The following examples show how to define new buckets.

```
Init fn="define-perf-bucket" name="acl-bucket" description="ACL bucket"
Init fn="define-perf-bucket" name="file-bucket" description="Non-cached
responses"
Init fn="define-perf-bucket" name="cgi-bucket" description="CGI Stats"
```

The prior example creates three buckets: `acl-bucket`, `file-bucket`, and `cgi-bucket`. To associate these buckets with functions, add `bucket=`*`bucket-name`* in front of the `obj.conf` function for which you wish to measure performance.

```
PathCheck fn="check-acl" acl="default" bucket="acl-bucket"
Service method="(GET|HEAD|POST)" type="*~magnus-internal/*" fn="send-
file" bucket="file-bucket"
<Object name="cgi">
     ObjectType fn="force-type" type="magnus-internal/cgi"
     Service fn="send-cgi" bucket="cgi-bucket"
</Object>
```

Performance Report

The server statistics in buckets can be accessed using The perfdump Utility. The performance buckets information is located in the last section of the report that `perfdump` returns. To enable reports on performance buckets, complete the following steps:

1. Define an extension for the performance bucket report. Add the following line to the `mime.types` file:

   ```
   type=perf exts=perf
   ```

2. Associate the type you declared in `mime.types` with the `service-dump` function in the `obj.conf` file:

   ```
   Service fn=service-dump type=perf
   ```

3. Use the URL `http://`*`server_name`*`:port_number/.perf` to view the performance report.

Note You must include a period (`.`) before the extension you defined in the `mime.types` file (in this case, `.perf`).

The report contains the following information:

- **Average** column shows per request statistics.
- **Request processing time** is the total time the required by the server to process all the requests it has received so far. Even on the busiest of the servers this number will be very small compared to the server uptime.
- **Number of Requests** is the total number of requests for the function.
- **Number of Invocations** is the total number that the function was invoked. This differs from the number of requests in that a function could be called multiple times while processing one request. The percentage column for this row is calculated in reference to the total number of invocations for all the buckets.
- **Latency** (in seconds) The time iPlanet Web Server takes to prepare for calling "send-cgi."
- **Function Processing Time** (in seconds) The percentage of Function Processing Time and Total Response Time is calculated with reference to the total Request processing time. (The time spent in "send-cgi" (that is, the time required to fork/exec the CGI program plus the execution time of the program itself.)
- **Total Response Time** (in seconds) The sum of Function Processing Time and Latency.
- **Percent** column displays of Number of Requests is calculated with reference to the Total number of requests.

The following is an example of the performance bucket information available through perfdump:

```
Performance Counters:

-----------------------------------------------

Server start time:         Mon Oct 11 15:37:26 1999



                           Average         Total      Percent
```

```
Total number of requests:                 474851
Request processing time:    0.0010      485.3198

Cache Bucket (cache-bucket)
Number of Requests:                       474254    ( 99.87%)
Number of Invocations:                    474254    ( 98.03%)
Latency:                    0.0001        48.7520   ( 10.05%)
Function Processing Time:   0.0003      142.7596    ( 29.42%)
Total Response Time:        0.0004      191.5116    ( 39.46%)

Default Bucket (default-bucket)
Number of Requests:                          597    (  0.13%)
Number of Invocations:                      9554    (  1.97%)
Latency:                    0.0000        0.1526    (  0.03%)
Function Processing Time:   0.0256      245.0459    ( 50.49%)
Total Response Time:        0.0257      245.1985    ( 50.52%)
```

File and Accelerator Caches

In iPlanet Web Server, Enterprise Edition 4.0 there are two caches: a front-end accelerator cache that caches response headers and contains pointers to the static file cache, and a static file cache which holds static file information as well as content. The `cache-init` directive initializes the accelerator cache whereas the `nsfc.conf` configures the file cache.

The file cache is implemented using a new file cache module, NSFC, which caches static HTML, image and sound files. In previous versions of the server, the file cache was integrated with the accelerator cache for static pages. Therefore, an HTTP request was serviced by the accelerator, or passed to the NSAPI engine for full processing, and requests that could not be accelerated did not have the benefit of file caching. This prevented many sites with NSAPI plug-ins, customized logs, or used server-parsed HTML from taking advantage of the accelerator.

The NSFC module implements an independent file cache used in the NSAPI engine to cache static files that could not be accelerated. It is also used by the accelerator cache, replacing its previously integrated file cache. NSFC caches information that is used to speed up processing of server-parsed HTML.

Configuring the Accelerator Cache

The `cache-init` function controls the accelerator caching. To optimize server speed, you should have enough RAM for the server and cache because swapping can be slow. Do not allocate a cache that is greater in size than the amount of memory on the system.

Table 1.1 The cache-init parameters

`disable`	(optional) Specifies whether the file cache is disabled or not. If set to anything but "false" the cache is disabled. By default, the cache is enabled.
`MaxNumberOfCachedFiles`	(optional) Maximum number of entries in the accelerator cache. The default is 4096, minimum is 32, maximum is 32768.
`MaxNumberOfOpenCachedFiles`	(optional) Maximum number of accel_file_cache entries with file_cache entries. Default is 512, minimum is 32, maximum is 32768.
`CacheHashSize`	(optional) size of hash table for the accelerator cache. Default is 8192K, minimum is 32K, max is 32768.
`NoOverflow`	(optional) IRIX only.
`IsGlobal`	(optional) IRIX only.

Example

```
Init fn="cache-init" MaxNumberOfCachedFiles=15000
MaxNumberOfOpenCachedFiles=15000 CacheHashSize=15101
```

Configuring the File Cache

The file cache is configured in the `nsfc.conf` configuration file located in the *`server_root`*`/https-`*`server-id`*`/config` directory. You can tune the file cache configuration parameters for improved performance.

FileCacheEnable

Whether the file cache is enabled or not.

By default, this is set to true.

```
FileCacheEnable=true
```

MaxAge

The maximum age (in seconds) of a valid cache entry. This setting controls how long cached information will continue to be used once a file has been cached. An entry older than `MaxAge` is replaced by a new entry for the same file if the same file is referenced through the cache.

Set `MaxAge` based on whether the content is updated (existing files are modified) on a regular schedule or not. For example, if content is updated four times a day at regular intervals, `MaxAge` could be set to 21600 seconds (6 hours). Otherwise, consider setting `MaxAge` to the longest time you are willing to serve the previous version of a content file, after the file has been modified.

By default, this is set to 30.

```
MaxAge=30
```

MaxFiles

The maximum number of files that may be in the cache at once.

By default, this is set to 1024

```
MaxFiles=1024
```

SmallFileSizeLimit (Unix)

The size (in bytes) of the largest file considered to be "small." The contents of "small" files are cached by allocating heap space and reading the file into it.

The idea of distinguishing between small files and medium files is to avoid wasting part of many pages of virtual memory when there are lots of small files. So the `SmallFileSizeLimit` would typically be a slightly lower value than the VM page size.

By default, this is set to 2048.

```
SmallFileSizeLimit=2048
```

SmallFileSpace

The size of heap space (in bytes) used for the cache, including heap space used to cache small files.

By default, this is set to 1MB for Unix, 0 for Windows NT.

```
SmallFileSpace=1000000
```

MediumFileSizeLimit (Unix)

The size (in bytes) of the largest file that is not a "small" file that is considered to be "medium" size. The contents of medium files are cached by mapping the file into virtual memory (currently only on Unix platforms). The contents of "large" files (larger than "medium") are not cached, although information about large files is cached.

By default, this is set to 525000 (525 KB).

```
MediumFileSizeLimit=525000
```

MediumFileSpace

The size (in bytes) of the virtual memory used to map all medium sized files.

By default, this is set to 10000000(10MB).

```
MediumFileSpace=10000000
```

CopyFiles

When CopyFiles is set to "true," the file is copied to a temporary file. When users access the file, the server displays the copy. Defaults to "false" on Unix and "true" on Windows NT.

```
CopyFiles="true"
```

TempDir

TempDir sets the directory name where the temporary files are copied if CopyFiles is set to "true." Defaults to s*ystem_temp_dir*/netscape/*server_instance*.

```
TempDir=c:/Temp
```

TransmitFile

When `TransmitFile` is set to "true," open file descriptors are cached for files in the file cache, rather than the file contents, and `PR_TransmitFile` is used to send the file contents to a client. When set to "true," the distinction normally made by the file cache between small, medium, and large files no longer applies, since only the open file descriptor is being cached. By default, TransmitFile is "false" on Unix and "true" on Windows NT.

This directive is intended to be used on Unix platforms that have native OS support for `PR_TransmitFile`, which currently includes HPUX and AIX. It is not recommended for other Unix platforms.

```
TransmitFile="true"
```

File Cache Dynamic Control and Monitoring

An object can be added to `obj.conf` to enable the NSFC file cache to be dynamically monitored and controlled while the server is running. Typically this would be done by first adding a `NameTrans` directive to the "default" object:

```
NameTrans fn="assign-name" from="/nsfc" name="nsfc"
```

Then add a new object definition:

```
<Object name=nsfc>
     Service fn=service-nsfc-dump
</Object>
```

This enables the file cache control and monitoring function (`nsfc-dump`) to be accessed via the URI, "`/nsfc`." By changing the "from" parameter in the `NameTrans` directive, a different URI can be used.

The following is an example of the information you receive when you access the URI:

```
Netscape Enterprise Server File Cache Status (pid 7960)


The file cache is enabled.


Cache resource utilization


Number of cached file entries = 1039 (112 bytes each, 116368 total
bytes)
Heap space used for cache = 237641/1204228 bytes
Mapped memory used for medium file contents = 5742797/10485760 bytes
Number of cache lookup hits = 435877/720427 ( 60.50 %)
Number of hits/misses on cached file info = 212125/128556
Number of hits/misses on cached file content = 19426/502284
Number of outdated cache entries deleted = 0
Number of cache entry replacements = 127405
Total number of cache entries deleted = 127407
Number of busy deleted cache entries = 17


Parameter settings


HitOrder: false
CacheFileInfo: true
CacheFileContent: true
```

```
TransmitFile: false
MaxAge: 30 seconds
MaxFiles: 1024 files
SmallFileSizeLimit: 2048 bytes
MediumFileSizeLimit: 537600 bytes

CopyFiles: false
Directory for temporary files: /tmp/netscape/https-axilla.mcom.com
Hash table size: 2049 buckets
```

You can include a query string = when you access the "`/nsfc`" URI. The following values are recognized:

- `?list` - Lists the files in the cache.
- ?`refresh=`*n* - Causes the client to reload the page every *n* seconds.
- `?restart` - Causes the cache to be shut down and then started.
- `?start` - Starts the cache.
- `?stop` - Shuts down the cache.

If you choose the `?list` option, the file listing includes the file name, a set of flags, the current number of references to the cache entry, the size of the file, and an internal file ID value. The flags are as follows:

- C - File contents are cached.
- D - Cache entry is marked for delete.
- E - `PR_GetFileInfo()` returned an error for this file.
- I - File information (size, modify date, etc.) is cached.
- M - File contents are mapped into virtual memory.
- O - File descriptor is cached (when TransmitFile is set to true).
- P - File has associated private data (should appear on `shtml` files).
- T - Cache entry has a temporary file.
- W - Cache entry is locked for write access.

For sites with scheduled updates to content, consider shutting down the cache while the content is being updated, and starting it again after the update is complete. Although performance will slow down, the server operates normally when the cache is off.

Unix Platform-Specific Issues

The various Unix platforms all have limits on the number of files that can be open in a single process at one time. For busy sites, increase that number to 1024.

- Solaris: in `/etc/system`, set `rlim_fd_max`, and `reboot`.
- AIX: run `smit` and check the kernel tuning parameters.
- HP-UX: run `sam` and check the kernel tuning parameters.

These Unix platforms have proprietary sites for additional information about tuning their systems for web servers:

- AIX - `http://www.rs6000.ibm.com/resource/technology/sizing.html`
- IRIX - `http://www.sgi.com/tech/web/`
- Compaq Tru64 Unix - `http://www.unix.digital.com/internet/tuning.htm`
- SUN - `http://www.sun.com/sun-on-net/performance/book2ref.html`
- anything for HP?

Tuning Solaris for Performance Benchmarking

The following table shows the operating system tuning for Solaris used when benchmarking. These values are an example of how you might tune your system to achieve the desired result.

Is this a good description of why this info is useful?

Table 1.2 Tuning Solaris for performance benchmarking

Parameter	Scope	Default Value	Tuned Value	Comments
rlim_fd_max	/etc/system	1024	8192	Process open file descriptors limit; should account for the expected load (for the associated sockets, files, pipes if any).
rlim_fd_cur	/etc/system	64	8192	
sq_max_size	/etc/system	2	0	Controls streams driver queue size; setting to 0 makes it infinity so the performance runs wont be hit by lack of buffer space. Set on clients too.
tcp_close_wait_interval	ndd/dev/tcp	240000	60000	Set on clients too.
tcp_time_wait_interval	ndd/dev/tcp	240000	60000	For Solaris 7 only. Set on clients too.
tcp_conn_req_max_q	ndd/dev/tcp	128	1024	
tcp_conn_req_max_q0	ndd/dev/tcp	1024	4096	
tcp_ip_abort_interval	ndd/dev/tcp	480000	60000	
tcp_keepalive_interval	ndd/dev/tcp	7200000	900000	For high traffic web sites lower this value.
tcp_rexmit_interval_initial	ndd/dev/tcp	3000	3000	If retransmission is greater than 30-40%, you should increase this value.
tcp_rexmit_interval_max	ndd/dev/tcp	240000	10000	
tcp_rexmit_interval_min	ndd/dev/tcp	200	3000	
tcp_smallest_anon_port	ndd/dev/tcp	32768	1024	Set on clients too.
tcp_slow_start_initial	ndd/dev/tcp	1	2	Slightly faster transmission of small amounts of data.
tcp_xmit_hiwat	ndd/dev/tcp	8129	32768	To increase the transmit buffer.
tcp_recv_hiwat	ndd/dev/tcp	8129	32768	To increase the receive buffer.

Tuning HP-UX for Performance Benchmarking

The following table shows the operating system tuning for HP-UX used when benchmarking. These values are an example of how you might tune your system to achieve the desired result.

Table 1.3 Tuning HP-UX for performance benchmarking

Parameter	Scope	Default Value	Tuned Value	Comments
maxfiles	/stand/ system	2048	4096	Must edit file by hand to increase beyond 2048 limit allowed by sam
maxfiles_lim	/stand/ system	2048	4096	Must edit file by hand to increase beyond 2048 limit allowed by sam
tcp_time_wait_interval	ndd/dev/tcp	60000	60000	
tcp_conn_req_max	ndd/dev/tcp	20	1024	
tcp_ip_abort_interval	ndd/dev/tcp	600000	60000	
tcp_keepalive_interval	ndd/dev/tcp	72000000	900000	
tcp_rexmit_interval_initial	ndd/dev/tcp	1500	1500	
tcp_rexmit_interval_max	ndd/dev/tcp	60000	60000	
tcp_rexmit_interval_min	ndd/dev/tcp	500	500	
tcp_xmit_hiwater_def	ndd/dev/tcp	32768	32768	
tcp_recv_hiwater_def	ndd/dev/tcp	32768	32768	

Miscellaneous magnus.conf Directives

You can use the following `magnus.conf` directives to configure your server to function more effectively:

- `RqThrottle` (See About RqThrottle)
- `PostThredsEarly` (See PostThreadsEarly)
- `MaxProcs` (See Multi-process Mode)

- `MinAcceptThreadPerSocket` and `MaxAcceptThreadPerSocket` (SeeAccept Thread Information)
- `MinCGIStubs`, `MaxCGIStubs`, and `CGIStubIdleTimeout` (See CGIStub Processes (Unix))
- `SndBufSize` and `RcvBufSize` (See Buffer Size)
- `NativePoolStackSize`/`NativePoolQueueSize`/ `NativePoolMaxThreads`/`NativePoolMinThreads` (See Native Thread Pool Size)

Multi-process Mode

You can configure the server to handle requests using multiple processes and multiple threads in each process. This flexibility provides optimal performance for sites using threads and also provides backward compatibility to sites running legacy applications that are not ready to run in a threaded environment. Because applications on Windows NT generally already take advantage of multi-process considerations, this feature mostly applies to Unix platforms.

The advantage of multiple processes is that legacy applications which are not thread-aware or thread safe can be run more effectively in iPlanet Web Server. However, because all the Netscape extensions are built to support a single-process, threaded environment, they cannot run in the multi-process mode. WAI, LiveWire, Java, Server-side JavaScript, LiveConnect and the Web Publishing and Search plug-ins fail on startup if the server is in multi-process mode.

There are two approaches to multi-thread design:

- iPlanet Web Server with a single process
- iPlanet Web Server with multiple processes

In the single-process design, the server receives requests from web clients to a single process. Inside the single server process, many threads are running which are waiting for new requests to arrive. When a request arrives, it is handled by the thread receiving the request. Because the server is multi-threaded, all extensions written to the server (NSAPI) must be thread-safe. This means that if the NSAPI extension uses a global resource (like a shared reference to a file or global variable) then the use of that resource must be synchronized so that only one thread accesses it at a time. All plug-ins provided

by Netscape are thread-safe and thread-aware, providing good scalability and concurrency. However, your legacy applications may be single-threaded. When the server runs the application, it can only execute one at a time. This leads to severe performance problems when put under load. Unfortunately, in the single-process design, there is no real workaround.

In the multi-process design, the server spawns multiple server processes at startup. Each process contains one or more threads (depending on the configuration) which receive incoming requests. Since each process is completely independent, each one has its own copies of global variables, shared libraries, caches, and other resources. Using multiple processes requires more resources from your system. Also, if you try to install an application which requires shared state, it has to synchronize that state across multiple processes. NSAPI provides no helper functions for implementing cross-process synchronization.

If you are not running any NSAPI in your server, you should use the default settings: one process and many threads. If you are running an application which is not scalable in a threaded environment, you should use a few processes and many threads, for example, 4 or 8 processes and 256 or 512 threads per process.

`MaxProcs` (Unix)

Use this directive to set your Unix server in multi-process mode, which allows for higher scalability on multi-processor machines. If, for example, you are running on a four-processor CPU, setting `MaxProcs` to `4` improves performance: one process per processor.

If you are running iPlanet Web Server in multi-process mode, you cannot run LiveWire, Web Publisher, and WAI.

This directive results in one primordial process and four active processes:

```
MaxProcs 4
```

Note This value is not tunable from the Server Manager. You must use magnus.conf.

Accept Thread Information

`MinAcceptThreadsPerSocket` / `MaxAcceptThreadsPerSocket`

Use this directive to specify how many threads you want in accept mode on a listen socket at any time. It's a good practice to set this to equal the number of processes. You can set this to twice (`2x`) the number of processes, but setting it to a number that is too great (such as ten (`10x`) or fifty (50x)) allows too many threads to be created and slows the server down.

CGIStub Processes (Unix)

You can adjust the `CGIStub` parameters on Unix systems. In the iPlanet Web Server, the CGI engine creates `CGIStub` processes as needed to handle CGI processes. On systems that serve a large load and rely heavily on CGI-generated content, it is possible for the `CGIStub` processes spawned to consume all system resources. If this is happening on your server, the `CGIStub` processes can be tuned to restrict how many new `CGIStub` processes can be spawned, their timeout value, and the minimum number of `CGIStub` processes that will be running at any given moment.

Note If you have an `init-cgi` function in the `obj.conf` file and you are running in multi-process mode, you must add `LateInit = yes` to the `init-cgi` line.

`MinCGIStubs/MaxCGIStubs/CGIStubIdleTimeout`

The three directives (and their defaults) that can be placed in the `magnus.conf` file to control `Cgistub` are:

```
MinCGIStubs             2
MaxCGIStubs            10
CGIStubIdleTimeout     45
```

`MinCGIStubs` controls the number of processes that are started by default. The first `CGIStub` process is not started until a CGI program has been accessed. The default value is 2. Note that if you have a `init-cgi` directive in the `obj.conf` file, the minimum number of `CGIStub` processes are spawned at startup.

`MaxCGIStubs` controls the maximum number of `CGIStub` processes the server can spawn. This is the maximum *concurrent* `CGIStub` processes in execution, not the maximum number of pending requests. The default value shown should be adequate for most systems. Setting this too high may actually reduce throughput. The default value is 10.

`CGIStubIdleTimeout` causes the server to kill any `CGIStub` processes that have been idle for the number of seconds set by this directive. Once the number of processes is at `MinCGIStubs` it does not kill any more processes.

Buffer Size

SndBufSize/RcvBufSize

You can specify the size of the send buffer (`SndBufSize`) and the receiving buffer (`RcvBufSize`) at the server's sockets. For more information regarding these buffers, see your Unix documentation.

Native Thread Pool Size

NativePoolStackSize/NativePoolQueueSize/ NativePoolMaxThreads/NativePoolMinThreads

These magnus.conf directives control the native kernel thread pool. You can override them In previous versions of the server, you could control the native thread pool by setting the system environment variables NSCP_POOL_STACKSIZE, NSCP_POOL_THREADMAX, and NSCP_POOL_WORKQUEUEMAX. In iPlanet Web Server, Enterprise Edition 4.0, you can use the directives in `magnus.conf` to control the size of the native kernel thread pool.

`NativePoolStackSize` determines the stack size of each thread in the native (kernel) thread pool.

`NativePoolQueueSize` determines the number of threads that can wait in the queue for the thread pool. If all threads in the pool are busy, then the next request-handling thread that needs to use a thread in the native pool must wait in the queue. If the queue is full, the next request-handling thread that tries to

get in the queue is rejected, with the result that it returns a busy response to the client. It is then free to handle another incoming request instead of being tied up waiting in the queue.

`NativePoolMaxThreads` determines the maximum number of threads in the native (kernel) thread pool.

`NativePoolMinThreads` determines the minimum number of threads in the native (kernel) thread pool.

About RqThrottle

The `RqThrottle` parameter in the `magnus.conf` file specifies the maximum number of simultaneous transactions the web server can handle. The default value is 512. Changes to this value can be used to throttle the server, minimizing latencies for the transactions that are performed. The `RqThrottle` value acts across multiple virtual servers, but does not attempt to load-balance.

To compute the number of simultaneous requests, the server counts the number of active requests, adding one to the number when a new request arrives, subtracting one when it finishes the request. When a new request arrives, the server checks to see if it is already processing the maximum number of requests. If it has reached the limit, it defers processing new requests until the number of active requests drops below the maximum amount.

In theory, you could set the maximum simultaneous requests to 1 and still have a functional server. Setting this value to 1 would mean that the server could only handle one request at a time, but since HTTP requests generally have a very short duration (response time can be as low as 5 milliseconds), processing one request at a time would still allow you to process up to 200 requests per second.

However, in actuality, Internet clients frequently connect to the server and then do not complete their requests. In these cases, the server waits 30 seconds or more for the data before timing out. (You can define this timeout period in `obj.conf`. It has a default of 5 minutes.) Also, some sites do heavyweight transactions that take minutes to complete. Both of these factors add to the maximum simultaneous requests that are required. If your site is processing many requests that take many seconds, you may need to increase the number of maximum simultaneous requests.

The defaults are 48/512. If your site is experiencing slowness and the `ActiveThreads` count remains close to the limit, consider increasing the maximum threads limit. To find out the active thread count, use The perfdump Utility.

A suitable `RqThrottle` value ranges from 200-2000 depending on the load. If you want your server to use all the available resources on the system (that is, you don't run other server software on the same machine), then you can increase `RqThrottle` to a larger value than necessary without negative consequences.

Note If you are using older NSAPI plug-ins that are not reentrant, they will not work with the multithreading model described in this document. To continue using them, you should revise them so that they are reentrant. If this is not possible, you can configure your server to work with them by setting `RqThrottle` to 1 and then using a high value for `MaxProcs`, such as 48 or greater, but this will adversely impact your server's performance.

Tuning

There are two ways to tune the thread limit: through editing the `magnus.conf` file and through the Server Manager.

If you edit the `magnus.conf` file, `RqThrottleMinPerSocket` is the minimum value and `RqThrottle` is the maximum value.

The minimum limit is a goal for how many threads the server attempts to keep in the `WaitingThreads` state. This number is just a goal. The number of actual threads in this state may go slightly above or below this value. The default value is 48. The maximum threads represents a hard limit for the maximum number of active threads that can run simultaneously, which can become a bottleneck for performance. The default value is 512.

If you use the Server Manager, follow these steps:

1. Go to the Preferences tab.
2. Click the Performance Tuning link.
3. Enter the desired value in the Maximum simultaneous requests field.

For additional information, see the online help for the Performance Tuning page.

Tuning the ACL Cache

Because of the default size of the cache (200 entries), the ACL cache can be a bottleneck or can simply not serve its purpose on a heavily trafficked site. On a heavily trafficked site well more than 200 users can hit ACL-protected resources in less time than the lifetime of the cache entries. When this situation occurs, the iPlanet Web Server has to query the LDAP server more often to validate users, which impacts performance.

This bottleneck can be avoided by increasing the size of the ACL cache with the `ACLUserCacheSize` directive in `magnus.conf`. Note that increasing the cache size will use more resources; the larger you make the cache the more RAM you'll need to hold it.

There can also be a potential (but much harder to hit) bottleneck with the number of groups stored in a cache entry (by default four). If a user belongs to five groups and hits five ACLs that check for these different groups within the ACL cache lifetime, an additional cache entry is created to hold the additional group entry. When there are two cache entries, the entry with the original group information is ignored.

While it would be extremely unusual to hit this possible performance problem, the number of groups cached in a single ACL cache entry can be tuned with the `ACLGroupCacheSize` directive.

Using magnus.conf Directives

In order to adjust the cache values you will need to manually add these directives to your `magnus.conf` file.

ACLCacheLifetime

Set this directive to a number that determines the number of seconds before the cache entries expire. Each time an entry in the cache is referenced, its age is calculated and checked against ACLCacheLifetime. The entry is not used if its age is greater than or equal to the ACLCacheLifetime. The default value is 120 seconds. If this value is set to 0, the cache is turned off. If you use a large number for this value, you may need to restart Enterprise Server when you make changes to the LDAP entries. For example, if this value is set to 120

seconds, Enterprise Server might be out of sync with the LDAP server for as long as two minutes. If your LDAP is not likely to change often, use a large number.

ACLUserCacheSize

Set this directive to a number that determines the size of the User Cache (default is 200).

ACLGroupCacheSize

Set this directive to a number that determines how many group IDs can be cached for a single UID/cache entry (default is 4).

Setting LogVerbose

If you set LogVerbose to on, you can verify that the ACL cache settings are being used. When LogVerbose is running you should expect to see these messages in your errors log when the server starts:

```
User authentication cache entries expire in ### seconds.
User authentication cache holds ### users.
Up to ### groups are cached for each cached user.
```

Improving Servlet Performance

The use of NSAPI cache will improve servlet performance in cases where the `obj.conf` configuration file has many directives. To enable NSAPI cache include the following line in `obj.conf`:

```
Init fn="nsapi-cache-init" enable=true
```

It's advisable to have the servlet engine `NameTrans` (`NameTrans fn="NSServletNameTrans" name="servlet"`) to be the first in the list.

This directive uses highly-optimized URI cache for loaded servlets and will return `REQ_PROCEED` if the match is found, thus eliminating the need of other `NameTrans` directives to be executed.

`jvm.conf`/`jvm12.conf` has a configuration parameter, called `jvm.stickyAttach`. Setting the value of this parameter to 1 will cause threads to remember that they are attached to the JVM, thus speeding up request processing by eliminating `AttachCurrentThread` and `DetachCurrentThread` calls. It can however have a side-effect as recycled threads which may be doing other processing can be suspended by the garbage collector arbitrarily. Thread pools can be used to eliminate this side effect for other subsystems.

Thread Pools

You can specify a number of configurable native thread pools, by adding the following directives to the `obj.conf`:

```
Init fn="thread-pool-init" name=name_of_the_pool MaxThreads=n MinThreads=n
QueueSize=n StackSize=n
```

Pool must be declared before it's used. To use the pool add `pool=`*`name_of_the_pool`* parameter to load-modules directive of the appropriate subsystem. The older parameter `NativeThread=yes` will always engage one default native pool, called NativePool.

In addition to configuring the native pool parameters on Windows NT using the environmental variables beginning with "NSCP_POOL," the following parameters can be added to `magnus.conf` for convenience:

`NativePoolMinThreads.` Default value is 1.

`NativePoolMaxThreads.` Default value is 128.

`NativePoolQueueSize.` Default value is unlimited.

`NativePoolStackSize.` Default value is the same as the default value for the OS.

Any of the parameters can be omitted to reflect the default behavior.

Native pool on Unix is normally not engaged, as all threads are OS-level threads. Using native pools on Unix may introduce a small performance overhead as they'll require an additional context switch; however they can be used to localize `jvm.stickyAttach` effect or for other purposes, such as resource control/management or to emulate single-threaded behavior of plug-ins (by setting `maxThreads=1`).

On Windows NT, at least the default native pool is always being used and iPlanet Web Server uses fibers (user-scheduled threads) for initial request processing. Using custom/additional pools on Windows NT will introduce no additional overhead.

Common Performance Problems

This section discusses a few common performance problems to check for on your web site:

- Low-Memory Situations
- Under-Throttled Server
- Cache Not Utilized
- KeepAlive Connections Flushed
- Log File Modes
- Using Local Variables

Low-Memory Situations

If you need iPlanet Web Server to run in low-memory situations, try reducing the thread limit to a bare minimum by lowering the value of `RqThrottle` in your `magnus.conf` file. Also you may want to reduce the maximum number of processes that the iPlanet Web Server will spawn by lowering the value of the `MaxProcs` value in the `magnus.conf` file.

Under-Throttled Server

The server does not allow the number of active threads to exceed the Thread Limit value. If the number of simultaneous requests reaches that limit, the server stops servicing new connections until the old connections are freed up. This can lead to increased response time.

In iPlanet Web Server, the server's default `RqThrottle` value is 512. If you want your server to accept more connections, you need to increase the `RqThrottle` value.

Checking

The symptom of an under-throttled server is a server with a long response time. Making a request from a browser establishes a connection fairly quickly to the server, but on under-throttled servers it may take a long time before the response comes back to the client.

The best way to tell if your server is being throttled is to look at the `WaitingThreads` count. If this number is getting close to 0 or is 0, then the server is not accepting new connections right now. Also check to see if the number of `ActiveThreads` and `BusyThreads` are close to their limits. If so, the server is probably limiting itself.

Tuning

See About RqThrottle.

Cache Not Utilized

If the cache is not utilized, your server is not performing optimally. Since most sites have lots of GIF or JPEG files (which should always be cacheable), you need to use your cache effectively.

Some sites, however, do almost everything through CGIs, SHTML, or other dynamic sources. Dynamic content is generally not cacheable and inherently yields a low cache hit rate. Don't be too alarmed if your site has a low cache hit rate. The most important thing is that your response time is low. You can have a very low cache hit rate and still have very good response time. As long as your response time is good, you may not care that the cache hit rate is low.

Checking

Begin by checking your Hit Ratio. This is the percentage of times the cache was used with all hits to your server. A good cache hit rate is anything above 50%. Some sites may even achieve 98% or higher.

In addition, if you are doing a lot of CGI or NSAPI calls, you may have a low cache hit rate.

Tuning

If you have custom NSAPI functions (nametrans, pathcheck, etc), you may have a low cache hit rate. If you are writing your own NSAPI functions, be sure to see the programmer's guide for information on making your NSAPI code cacheable as well.

KeepAlive Connections Flushed

A web site that might be able to service 75 requests per second without keepalives may be able be able to do 200-300 requests per second when keepalives are enabled. Therefore, as a client requests various items from a single page, it is important that keepalives are being used effectively. If the `KeepAliveCount` exceeds the `KeepAliveMaxCount`, subsequent KeepAlive connections will be closed (or "flushed") instead of being honored and kept alive.

Checking

Check the `KeepAliveFlushes` and `KeepAliveHits` values. On a site where KeepAlives are running well, the ratio of `KeepAliveFlushes` to `KeepAliveHits` is very low. If the ratio is high (greater than 1:1), your site is probably not utilizing the HTTP KeepAlives as well as it could.

Tuning

To reduce KeepAlive flushes, increase the `MaxKeepAliveConnections` value in the magnus.conf file. The default value is 200. By raising the value, you keep more waiting keepalive connections open.

Warning On Unix systems, if you increase the `MaxKeepAliveConnections` value too high, the server can run out of open file descriptors. Typically 1024 is the limit for open files on Unix, so increasing this value above 500 is not recommended.

Log File Modes

Keeping the log files on verbose mode can have a significant affect of performance.

Client-Host, Full-Request, Method, Protocol, Query-String, URI, Referer, User-Agent, Authorization and Auth-User: Because the "obscure" variable cannot be provided by the internal "accelerated" path, the accelerated path will not be used at all. Therefore performance numbers will decrease significantly for requests that would typically benefit from the accelerator, for example static files and images.

iPlanet Web Server, Enterprise Edition 4.0 has a relaxed logging mode that eases the requirements of the log subsystem. Adding "`relaxed.`*`logname=anything`*" to the "`flex-init`" line in `obj.conf` changes the behavior of the server in the following way: Logging variables other than the "blessed few" does not prevent the accelerated path from being used. If the accelerator is used, the "non-blessed" variable (which is then not available internally) will be logged as "`-`". The server does not use the accelerator for dynamic content like CGIs or SHTML, so all the variables would be logged correctly for these requests.

Using Local Variables

The JavaScript virtual machine in iPlanet Web Server, Enterprise Edition 4.0 implements significant improvements in processing local variables (variables declared inside a function). Therefore, you should minimize the use of global variables (variables declared between the <server> and </server> tags), and write applications to use functions as much as possible. This can improve the application performance significantly.

Sizing Issues

This section examines subsystems of your server and makes some recommendations for optimal performance:

- Processors
- Memory
- Drive Space
- Networking

For more information on scalability, see the studies in Scalability Studies.

Processors

On Solaris and Windows NT, iPlanet Web Server transparently takes advantage of multiple CPUs. In general, the effectiveness of multiple CPUs varies with the operating system and the workload. Dynamic content performance improves the most as more processors are added to the system. Because static content involves mostly IO and more primary memory means more caching of the content (assuming the server is tuned to take advantage of the memory) more time is spent in IO rather than any busy CPU activity. Our study of dynamic content performance on a four-CPU machine indicate a 40-60% increase for NSAPI and about 50-80% increase for servlets.

See the Scalability Studies for more information.

Memory

As a baseline, iPlanet Web Server requires 64MB RAM. If you have multiple CPUs, get at least 64MB per CPU. For example, if you have four CPUs, you should install at least 256MB RAM for optimal performance. At high numbers of peak concurrent users, also allow extra RAM for the additional threads. After the first 50 concurrent users, add an extra 512KB per peak concurrent user.

Drive Space

You need to have enough drive space for your OS, document tree, and log files. In most cases 2GB total is sufficient.

Put the OS, swap/paging file, iPlanet Web Server logs, and document tree each on separate hard drives. Thus, if your log files fill up the log drive, your OS will not suffer. Also, you'll be able to tell whether, for example, the OS paging file is causing drive activity.

Your OS vendor may have specific recommendations for how much swap or paging space you should allocate. Based on our testing, iPlanet Web Server performs best with swap space equal to RAM, plus enough to map the document tree.

Networking

For an Internet site, decide how many peak concurrent users you need the server to handle, and multiply that number of users by the average request size on your site. Your average request may include multiple documents. If you're not sure, try using your home page and all its associated subframes and graphics.

Next decide how long the average user will be willing to wait for a document, at peak utilization. Divide by that number of seconds. That's the WAN bandwidth your server needs.

For example, to support a peak of 50 users with an average document size of 24kB, and transferring each document in an average of 5 seconds, we need 240 KBytes/s - or 1920 kbit/s. So our site needs two T1 lines (each 1544 kbit/s). This allows some overhead for growth, too.

Your server's network interface card should support more than the WAN it's connected to. For example, if you have up to 3 T1 lines, you can get by with a 10BaseT interface. Up to a T3 line (45 Mbit/s) you can use 100BaseT. But if you have more than 50 Mbit/s of WAN bandwidth, consider configuring multiple 100BaseT interfaces, or look at Gigabit Ethernet technology.

For an intranet site, your network is unlikely to be a bottleneck. However, you can use the same calculations as above to decide.

Scalability Studies

This scalability section contains the results of two studies covering the following topics:

- Scalability of Dynamic and Static Content
- Connection Scalability Study

You can refer to these studies for a sample of how the server performs, and how you might configure your system to best take advantage of the iPlanet Web Server's strengths.

Is this a good description of why this info is valuable?

For additional performance information, see the white paper "iPlanet Web Server, Enterprise Edition 4.0 and Stronghold 2.4.2 Performance Comparison Analysis and Details" at:

http://www.mindcraft.com/whitepapers/iws/iwsee4-sh242-p2.html

Scalability of Dynamic and Static Content

Scalability for the server varies for different content types, but all types of content scale well. This section describes a study that tests the scalability of various types of content: 100% static, 100% dynamic, and mixed load (30% static + 70% dynamic). Please note that this study was not done using the optimal equipment or configuration.

need description of conditions that WERE used?

Perl-CGI and C-CGI scale the most by a factor of 0.88, followed by SHTML and mixed load, with a scaling factor of 0.79. Java servlets scale moderately by a factor of 0.68. NSAPI's scaling factor is 0.57. Finally 100% static content does not scale. Its scaling factor is only 0.44, which is expected. The poor scalability of static content is most likely due to the fact that the system only has a single disk to store content, and system performance is bottlenecked on disk I/O. Performance will improve is you spread the data out on more than one disk, or if you use a faster disk or faster file system.

Study Goals

This study shows how well iPlanet Web Server, Enterprise Edition scales against one CPU, two CPUs and four CPUs. This study also helps in determining what kind of configuration (CPU and memory) is required for different types of content. The studies were conducted against the following content:

- 100% Static

- 100% SHTML
- 100% C-CGI
- 100% Perl-CGI
- 100% NSAPI
- 100% Java Servlets
- Mixed loads; 30% Static + 10% SHTML + 20% Perl- CGI + 20% NSAPI + 20% Java servlets

Study Assumptions

The following assumptions were made to make the studies more realistic:

- A 1 CPU machine has 256 MB of memory.
- A 2 CPU machine has 512 MB of memory.
- A 4 CPU machine has 1 GB of memory
- A normal web site would have mixed load (static + dynamic) content; 30% Static,10% SHTML, 20% Perl- CGI, 20% NSAPI, and20% Java servlets
- The expected average response time is no more than 20 seconds

Setting up the Study

After modifying the `/etc/system` appropriately (`physmem` =256MB for one CPU or 512MB for two CPUs or 1GB for four CPUs), the server was rebooted. Using the `psradm` command, the desired number of CPUs are disabled. Following this the server is started. After making a note of the memory (using `top` command) and CPU utilization (using `vmstat` command), WebBench clients are started. First with one client, then with two clients, and so on, until we see the server CPU utilization close to 100%.

The result with the highest requests/second and response time no more than 20ms, is considered a good reading. This is repeated three times to check for consistency.

Application. The default configuration (`obj.conf` and `magnus.conf`) of iPlanet Web Server, Enterprise Edition 4.0 was used.

Study Tool. WebBench 3.0

Server. The server under test was an E450 with 4 CPUs (168MHz) and 1.6 GB of memory. The server parameters were tuned appropriately.

Clients. The clients were WIntel (running Windows NT 4.0) machines running 1 or more clients (depending on the size of the machine). In all 7 to 8 machines were used.

Each WebBench 3.0 client was configured to run HTTP 1.0, with 24 threads.

Network. All systems are connected through a single 100baseT switch.

CPU. The number of CPUs used was controlled by the `psradm` command (and `-f` option).

Memory. The amount of physical memory used was controlled by the adding the line `set physmem=x` in the `/etc/system` file; where `x` was equal to 0x8000 for 256 MB, 0x10000 for 512 MB and 0x20000 for 1 GB.

Content. The static content was a 64 MB tree (provided by WebBench 3.0), containing 6000 files. The files varied in size from 1K to 500K. The document root (in obj.conf) was pointed to this tree, which is on a separate disk. Except NSAPI executables, all other content--such as SHTMl, c-cgi, Perl-cgi and Java servlets--were on the same disk as the document root.

Study Results

The following sections show the results of the study.

100% Static

The study used Web Bench 3.0 standard static content tree comprising files of different sizes totalling about 64 MB. Each file belongs to a particular class depending on its size. The workload characteristics ensure small and medium sized files be accessed more than the large files, reflecting a more realistic stress on the server. The study was first run with defaults (without tuning the file cache with `nsfc.conf`). The server scales moderately with a scaling factor of 0.40.

The study was run for the second time after tuning the file cache. The scaling factor was still about 0.40. The `nsfc.conf` was configured to cache or mmap all the content, hence guaranteeing better performance. Figure 1.1 and Figure

1.2 show the average requests per second and average throughput for 100% static content against one CPU, two CPUs and four CPUs, for both unconfigured and configured `nsfc.conf` setup.

Figure 1.1 Requests per second for 100% static content

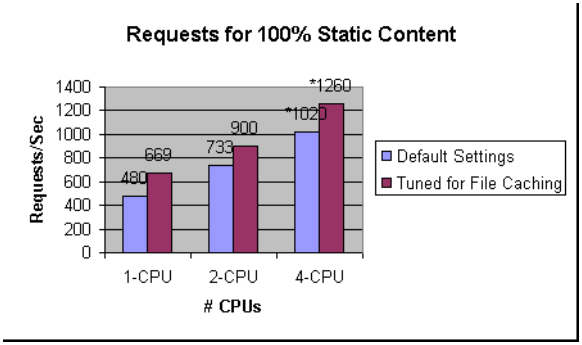
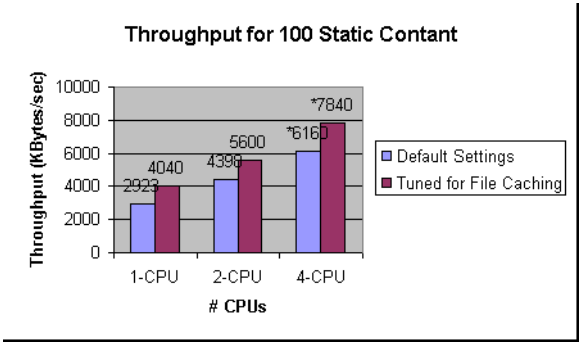


Figure 1.2 Throughput for 100% static content



Notes The numbers with an asterisk (*) in the graphs are estimated. These numbers are estimated due to the small number of client machines and plenty of available CPU idle time. When all the four CPUs were enabled, and all available 18 clients were used, the server (CPU) was still idle for approximately 30% of the time, with default file cache (no `nsfc.conf` present), and about 50% with a relatively tuned `nsfc.conf`. The maximum numbers obtained were 853 req/sec and 5134 KB per second throughput, for default configuration and 955 requests/sec and 5900 KB per second throughput when `nsfc.conf` was tuned.

Also note that the Cache-hit ratio typically never reaches 100% unless the benchmark is run a number of times (this is due to statistical nature of the benchmark where by not all files in the workload are necessarily accessed during any run).

100% SHTML

This study was conducted by running it against the file `mixed-dirs.shtml`. This file has a number of `echo` statements, an include of 8 KB, and displays the last modification time stamp of a file. Figure 1.3 and Figure 1.4 represent average requests per second and average throughput for 100% SHTML content against one CPU, two CPUs and four CPUs. From the graphs it is clear that the server scales well above average, with a scaling factor of 0.79.

Figure 1.3 Requests per second for 100% SHTML content

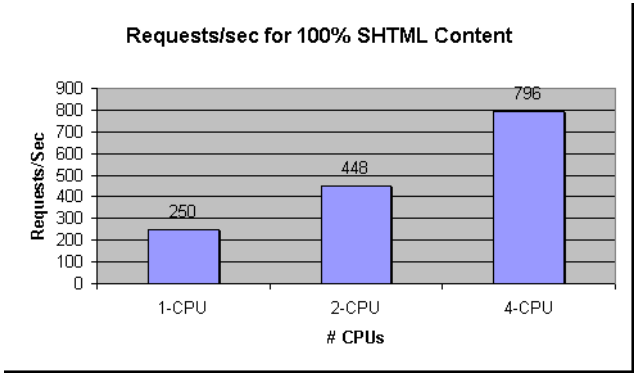
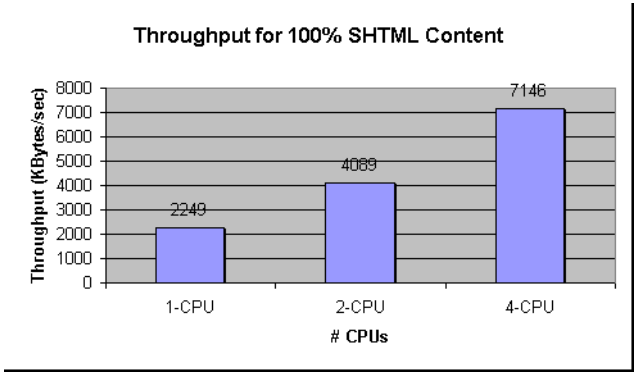


Figure 1.4 Throughput for 100% SHTML content



100% C-CGI

100% C-CGI was tested by accessing a `C` executable called `printenv`. This executable prints the CGI environment. Figure 1.5 and Figure 1.6 represent average requests per second and average throughput for 100% C-CGI content against one CPU, two CPUs and four CPUs. From the graphs it is clear that the server scales very well for C-CGI content. It scales with a factor of 0.88.

Figure 1.5 Requests per second for 100% C-CGI content

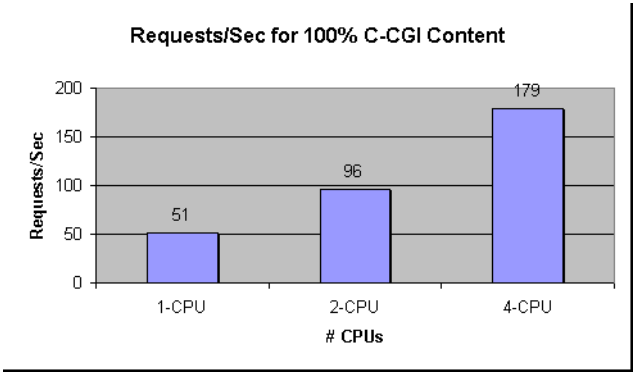
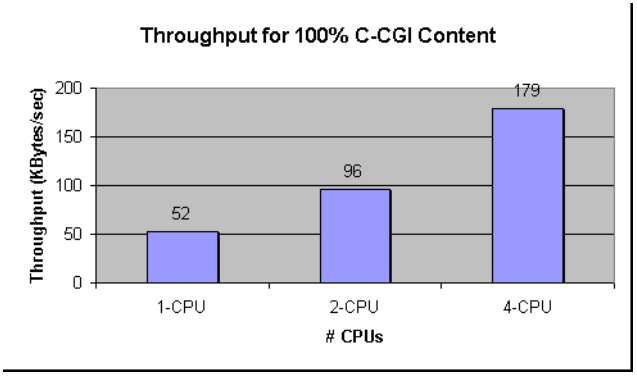


Figure 1.6 Throughput of 100% C-CGI content



100% Perl-CGI

This study runs against a Perl script called `printenv.pl`. This script prints the CGI environment, just like the C executable `printenv` does. Figure 1.7 and Figure 1.8 represent average requests per second and average throughput for

100% Perl-CGI content against one CPU, two CPUs, and four CPUs. From the graphs it is clear that the server scales very well similar to C-CGI. The scaling factor is 0.88.

Figure 1.7 Requests per second for 100% Perl-CGI content

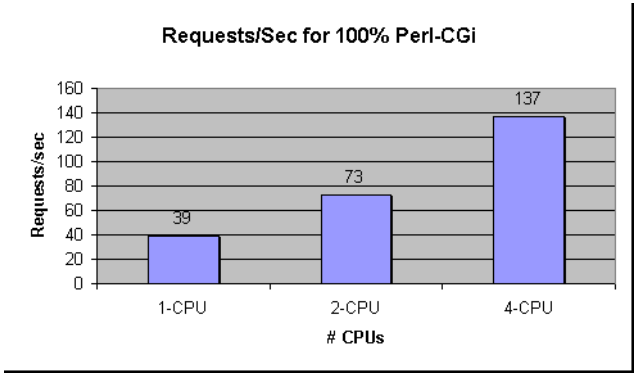
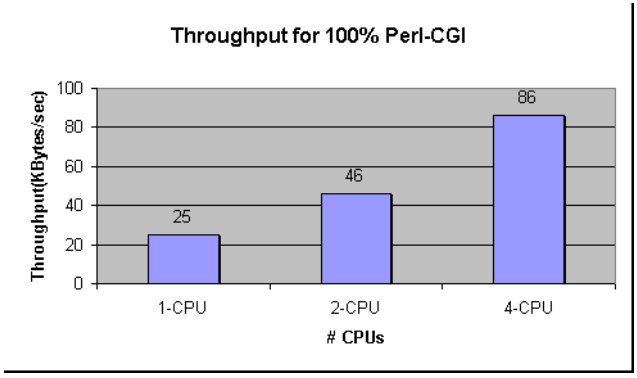


Figure 1.8 Throughput for 100% Perl-CGI content



100% NSAPI

The NSAPI module used to study this was `printenv2.so`. This module prints the NSAPI environment variables along with some text to make the entire response over 1 KB. Figure 1.9 and Figure 1.10 represent average requests per second and average throughput for 100% NSAPI content against one CPU, two CPUs, and four CPUs.

Figure 1.9 Requests per second for 100% NSAPI content

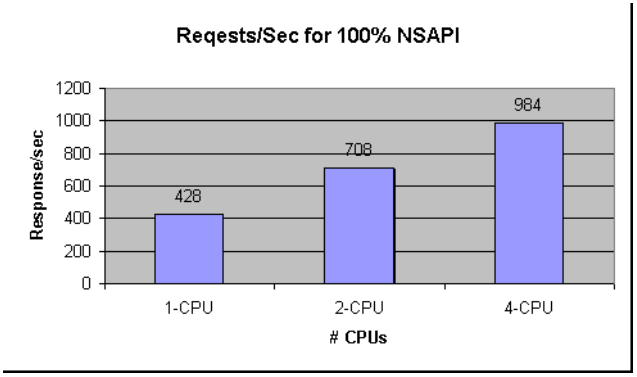
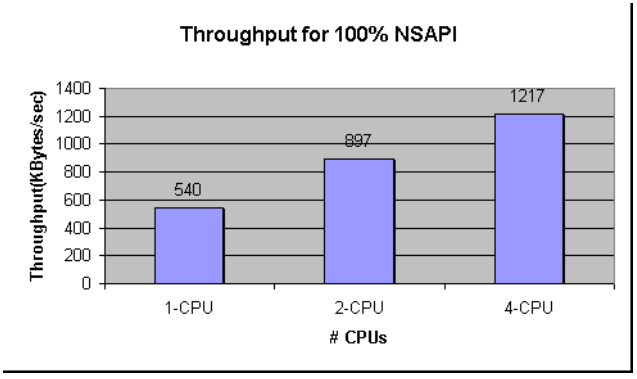


Figure 1.10 Throughput for 100% NSAPI content



100% Java Servlets

This study was conducted using the WASP servlet. It prints out the servlet's initialization arguments, environments, request headers, connection/client info, URL information, as well as remote user information. Figure 1.11 and Figure 1.12 represent average requests per second and average throughput for 100% Java Servlets content against one CPU, two CPUs, and four CPUs. From the graphs it is clear that the server scales moderately well for Java Servlets content. The scaling factor is 0.68.

Figure 1.11 Response per seconds for 100% Java servlets

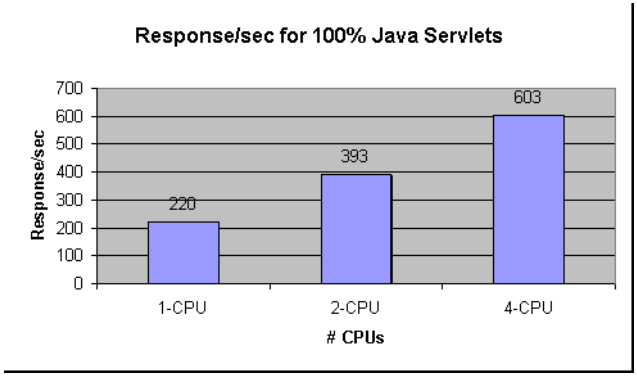
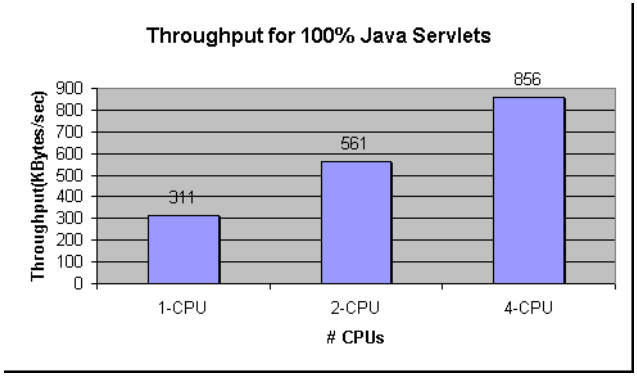


Figure 1.12 Throughput for 100% Java servlets



Mixed Load

The Mixed load study was conducted using the 64MB static content tree, for static content, and all the dynamic scripts/executables for the dynamic content. The workload was configured so that 30% of the requests would access files from the static tree, 10% of the requests would access the `mix-dir.shtml` file, 20% `printenv.pl`, 20% `printenv`, 20% the `NSAPI.so` and the remaining 20% of the requests would access the WASP servlet. Figure 1.13 and Figure 1.14 represent average requests per second and average throughput for content with mixed load against one CPU, two CPUs and four CPUs. From the graphs it is clear that the server scales well for content with mixed load. The scaling factor for such a mixed load is 0.79.

Figure 1.13 Requests per second for mixed content

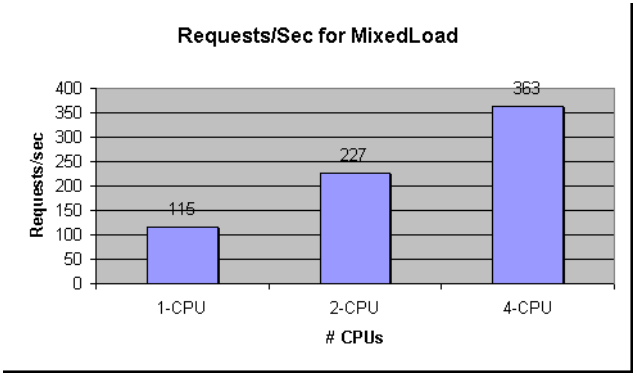
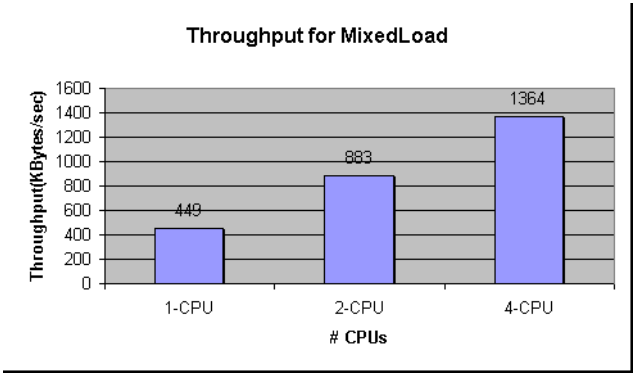


Figure 1.14 Throughput for mixed content



Connection Scalability Study

This study shows how many connections you can have for a given number of CPUs and the memory needed as the number of connections increases.

In terms of the number of requests that the server can handle, it scales quite nicely from one CPU to four CPUs. With a load of 5500 concurrent users, the server on a four CPUs system handles close to 2136 requests per second with a reasonable response time.

Each iPlanet Web Server process seems capable of handling up to 1500 requests with a reasonable response time; however, it is recommended that each process handle up to 1000 requests per second. You can increase the number of processes for the optimal performance. Usually, when you increase of number of processes you reduce response time.

In terms of memory footprint, it seems to grow 1 MB for each 350 incremental requests. This is true only for the single process. When the number of processes is increased, the memory footprint becomes 60 MB, with 40 MB of this 60 MB an mmaped file to share data between processes.

Configuration and Study Details

The goal of this exercise is to study the cost of connections on a four CPU system. This study deliberately uses a bare minimum size of `index.html`. All the load generators are set up to GET this `index.html` file.

Analysis

From Table 1.4, Figure 1.15, and Figure 1.16, we see the number of requests served and throughput scale almost linearly from one CPU to four CPUs, with reasonable response time.

Table 1.4 Throughput vs. number of CPUs

Number of CPUs	Number of Requests	Throughput (MB)	Response time (ms)
1 CPU	885	2.8	29.5
2 CPUs	1571	4.9	5.6
4 CPUs	2136	7.9	5.0

Figure 1.15 : Throughput in Number of Requests

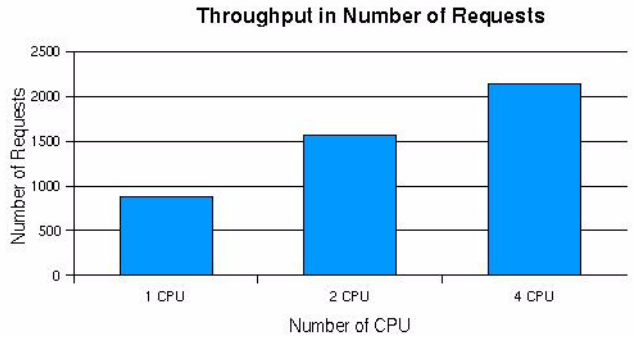
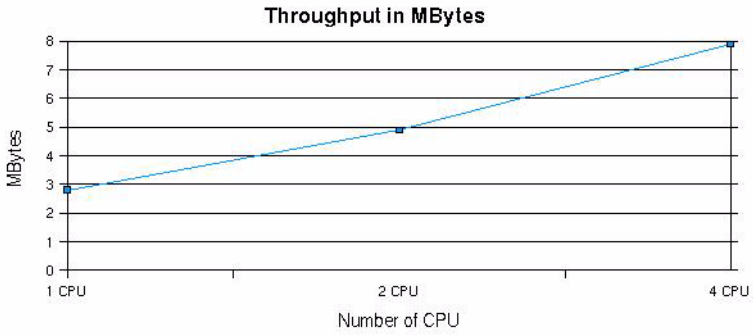


Figure 1.16 Throughput in MB



From Table 1.5, Figure 1.17, Figure 1.18, and Figure 1.19 we see the throughput and requests handled scale quite well with increasing load on the system from 500 concurrent users all the way up to 5500 clients. Note that we had to start more than one iPlanet Web Server process when it reached 1500 requests per second, otherwise there are long delays for all the requests.

Table 1.5 Statistics on a 4 CPU system

Load	Throughput	Number of Requests	Response Time	Notes
500	0.73	19	4.15	
1000	1.46	393	4.15	
1500	2.16	589	4.15	
2000	2.80	785	4.70	

Table 1.5 Statistics on a 4 CPU system

Load	Throughput	Number of Requests	Response Time	Notes
2500	3.65	982	5.00	
3000	4.38	1177	6.00	
3500	4.90	1374	8.30	
4000	5.60	1548	10.00	
4500	6.30	1769	5.00	MaxProc=3
5000	7.00	1908	5.00	MaxProc=3
5500	7.70	2136	5.00	MaxProc=3

Figure 1.17 Throughput in MB vs. requested load

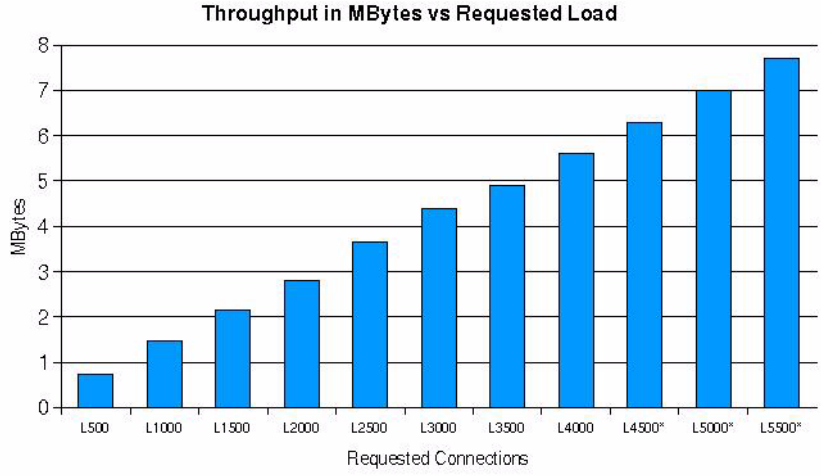


Figure 1.18 Throughput in number of requests vs. requested load

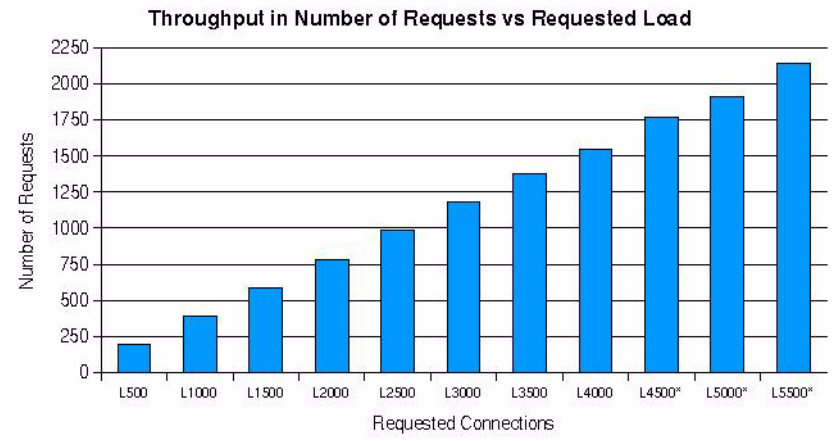
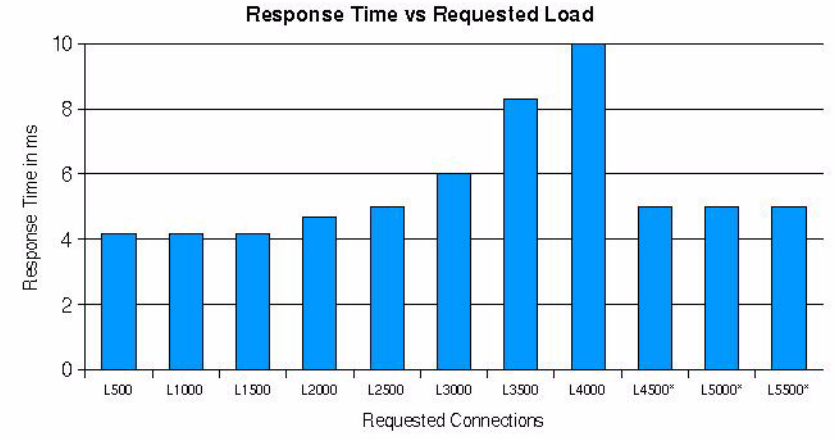


Figure 1.19 Response time vs. requested load

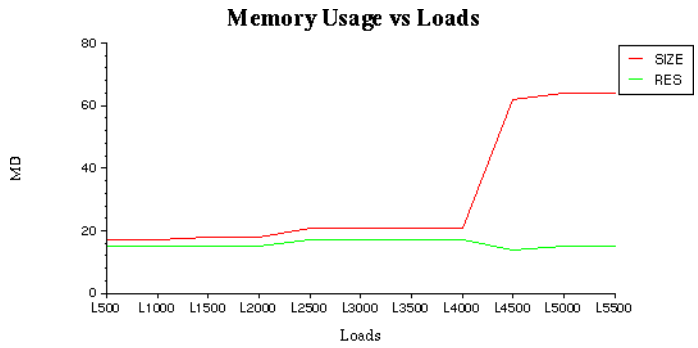


From Table 1.6 and Figure 1.20, we see memory footprint grew about 1M for each additional 1000 load imposed on the system (or each 400 requests). The last three rows of Table 3 show MaxProc has been tuned to 3 to increase the performance, since a single iPlanet Web Server process could not handle the number of requests at the load of 4500.

Table 1.6 Memory usage vs. load imposed

Load	Size	Res	Note
500	17	15	
1000	17	15	
1500	18	15	
2000	18	15	
2500	21	17	
3000	21	17	
3500	21	17	
4000	21	17	
4500	62	14	MaxProc=3
5000	65	15	MaxProc=3
5500	64	15	MaxProc=3

Figure 1.20 Memory usage vs. load imposed



magnus.conf Directive Settings Used in Study

- RqThrottle 1024
- RqThrottleMaxAcceptThreads 8

- SingleAccept Off
- KeepAliveTimeout 100000
- MaxKeepAliveConnections 512
- ListenQ 1024
- BlockingListenSocket On