BEA WebLogic Portal™®

Capacity Planning Guide

Version 10.0
Document Revised: June 2007

Copyright

Restricted Rights Legend

Trademarks and Service Marks

Contents

Capacity Planning for WebLogic Portal

Capacity Planning for WebLogic Portal

BEA WebLogic Portal is an enterprise class portal infrastructure built on a flexible framework designed to meet the highest performance expectations of our customers. Deployments of this product range from smaller departmental applications with a few machines to very large deployments comprising of many machines in a clustered configuration. The architecture and physical deployment of any given application will depend upon several factors which will be explained later in the document. The process of determining what type of hardware and software configuration is required to meet application needs adequately is called capacity planning.

This document covers the steps involved with capacity planning for WebLogic Portal 10.0 and will serve as a baseline set of measurements so that more accurate estimates can be made for capacity planning by our customers.

Capacity planning is not an exact science. Every application is different and every user behavior is different. This document is meant only as a guide for developing capacity planning numbers and will encourage you to err on the side of caution. Before deploying any application into a production environment the application should be put through a rigorous performance testing cycle. For more information on performance testing see "Approaches to Performance Testing".

Note: Any and all recommendations provided in this guide should be adequately verified before a given system is moved into production. As stated above, the data published in this document is meant to represent the specific configuration that was tested. There are a number of factors that come into play when determining how much capacity a system can support and thus there is no substitute for adequately testing a prototype to obtain your own capacity planning numbers.

Capacity Planning Factors to Consider

A number of factors influence how much capacity a given hardware configuration will need in order to support a WebLogic Portal and a given application. The hardware capacity required to support your application depends on the specifics of the application and configuration. You should consider how each of these factors applies to your configuration and application.

Table 1 provides a checklist for capacity planning. The following sections discuss each item in the checklist. Understanding these factors and considering the requirements of your application will aid you in generating server hardware requirements for your configuration.

Table 1 Capacity Planning Factors and Information Reference

Capacity Planning Questions	For Information, See:
Have you performance tested your application?	"Performance Testing Suggestions" on page 3
Does the hardware meet the configuration requirements?	"Hardware Configuration and Performance Requirements" on page 3
Is WebLogic Portal configured for clustering?	"Clustered Configurations" on page 4
Is the simulated workload adequate?	"Simulated Workload" on page 4
How many users need to run simultaneously?	"Concurrent Sessions" on page 5
Is WebLogic Portal well-tuned?	"Tuning WebLogic Server" on page 6
How well-designed is the user application?	"Application Design" on page 6
Do clients use SSL to connect to WebLogic Portal?	"SSL Connections and Performance" on page 7
What is running on the machine in additional to WebLogic Portal?	"WebLogic Server Process Load" on page 7
Is the database a limiting factor?	"Database Server Capacity" on page 8
Is there enough network bandwidth?	"Network Load" on page 9
What JVM is used and with what parameters?	"Selecting Your JVM" on page 9

Performance Testing Suggestions

Capacity planning is the last step in the performance testing process. Before an application is ready to be sized for a production deployment it must go through an iterative performance testing process to ensure that all of the bottlenecks are out of the system and the application is running as fast as possible.

Running benchmarks against the application will set a baseline set of measurements so that as features are added and removed from the application the impact of those changes can be objectively measured.

Profiling the application during development will help flush out performance problems or performance hotspots that could turn into major issues down the road. Catching these kinds of problems early will significantly reduce the overhead in trying to fix them later.

Recommendation

Read Approaches to Performance Testing on BEA's dev2dev site.

Hardware Configuration and Performance Requirements

The operating systems and hardware configurations that BEA supports for WebLogic Portal 10.0 are documented in WebLogic Platform 10.0 Supported Configurations.

Often performance goals for a given WebLogic Portal application are not met because of either slow response time, not enough concurrent users are running, or the application's throughput is too low. The first question that has to be asked in this situation is: What hardware is running the Portal? This is the single most important factor when determining how well the system will scale. During BEA's internal performance testing, WebLogic Portal was CPU bound, so the performance of the system will depend on how fast each CPU is and how many total CPUs there are.

BEA's internal performance testing indicated a direct relationship between the performance of the system and the overall clock-speed of the CPU(s). By adding more CPUs, or faster CPUs the capacity of the system will increase. Additionally, by clustering machines WebLogic Portal will gain additional scalability due to the addition of CPUs to the overall application deployment. Newer processor technology is also a big factor in determining how a system will perform. For instance, in the results section there is a series of data on Sun's UltraSPARC IIIi processors and although the machines have 4 CPUs, their performance is not nearly as good as the results on Intel Xeon processors.

Recommendation

Get the fastest CPUs possible and grow the size of the cluster as needed.

Clustered Configurations

Is the WebLogic Portal Server deployment configured to support clusters? Clusters provide session protection and fail over via state replication in addition to spreading out the load across several systems. Customers using clustering should not see any noticeable performance degradation unless their application stores large amounts of data in the session and that session is replicated across the cluster.

If you are using a web server to forward requests to a WebLogic Server cluster, sometimes the bottleneck can be the web server. This can happen when using the supplied HttpClusterServlet and a proxy server, or one of the supported plug-ins. If the response time does not improve after adding servers to the cluster and the web server machine shows a high CPU utilization, consider clustering the web server or running the web server on more powerful hardware. The web server should be largely I/O bound (including disk utilization and network utilization) rather than CPU bound.

Recommendation

Based on capacity tests with tuned applications, WebLogic Portal is typically CPU-bound. When deciding how much hardware to buy for a production environment, the speed of the processor(s) should be the top priority.

In most cases, WebLogic Server clusters scale best when deployed with one WebLogic Server instance for every two CPUs. However, as with all capacity planning, you should test the actual deployment with your target portal applications to determine the optimal number and distribution of server instances.

Simulated Workload

When trying to determine the performance requirements of your system you will need to take into account the expected workload on the application. For example, a typical banking application experiences heavy traffic (a high number of concurrent sessions) during the “peak hours” of 9 AM and 5 PM. So when doing capacity estimates it is best to test with workloads that will closely mimic the anticipated workload.

Several workload factors can influence the overall performance of the system and depending on how these factors are tested, very different results will be produced. The first is the anticipated

"think-time" of the users on the system. Think-time is defined as the pause between requests by a user who is active on the system. For example, if a user clicks to see their bank account balance, they may not click again for 30 seconds, thus the think-time is 30 seconds. This think-time should be averaged across all users (because "expert" users will have shorter think-times and "novice" users will have much longer times) and then that value should be used to test the system. Decreasing the think-time will put a higher load on the system and thus require additional hardware resources.

When testing the system the rate at which users are added to the system also can have a dramatic impact on the performance characteristics of the system. For example, if all of the users are added to the system at once, a "wave" effect will occur where the response times will be very high during the initial steps and improve dramatically as users pause, then increase rapidly as users continue to navigate through the system. Adding users in a staggered fashion will prevent this from happening and provide more consistent performance form the system. Putting some degree of randomization in the think-time will also help to decrease the "wavy" behavior and produce more consistent results.

Recommendation

When testing the system to determine capacity requirements, make sure that the workload of the simulated users accurately reflects what the system would experience in the production environment. Pay close attention to excessive simulated workload that is put simultaneously on the system.

Concurrent Sessions

Determine the maximum number of concurrent user sessions for your WebLogic Portal. To handle more users, you will need to have adequate CPU capacity and RAM for scalability. For most supported configurations 1GB of RAM is the minimum configuration and 2GB is recommended in production for each WebLogic Portal instance.

Next, research the maximum number of clients that will make requests at the same time and how frequently each client will be making a request. The number of user interactions per second with WebLogic Portal represents the total number of interactions that should be handled per second by a given Portal deployment.

Consider also the maximum number of transactions in a given period to handle spikes in demand. Ensure that there is enough excess capacity on the system to handle these spikes. If the demand is close to the maximum capacity for the system, then additional hardware should be added to

increase the overall system performance and capacity. For capacity information about concurrent users see "Portal Framework Concurrent User Results" on page 18.

Tuning WebLogic Server

WebLogic Server should be tuned using the available tuning guide.

Recommendation

For more information about tuning Server, see

- WebLogic Server Performance and Tuning
- Top Tuning Recommendations for WebLogic Server

Application Design

How well-designed is the application? Badly designed or non-optimized user applications can drastically slow down the performance of a given configuration. The best course is to assume that every application that is developed for WebLogic Portal will have features that will add overhead and will thus not perform as well as benchmark applications. As a precaution, you should take into account these features of the application and add additional capacity to your system.

It is important to note that the size of the portal (based on the taxonomy of the portal which is calculated by adding up the number of distinct books, pages, and portlets) may have a significant impact on the performance and capacity of the system. As the portal size increases so does the control tree that must be rendered and thus the system will not perform as well as a smaller portal.

The use of multi-level menus negates many of the benefits of the Portal Control Tree Optimizations because the tree must be navigated in order to build the menu structure. This is fine with smaller portals, but for larger portals this will have a significant impact on the performance and scalability of the system and will thus require more hardware resources in the deployment.

Recommendation

Breaking large portals into several smaller Desktops is recommended to optimize the performance of the system. Additionally, profiling with either a "heavy-weight" profiler or a run-time "light-weight" profiler is strongly recommended to find non-optimized areas of code in your application. The use of multi-level menus is discouraged for large portals.

For more information about designing portals, see Designing Portals for Optimal Performance.

SSL Connections and Performance

Secure Sockets Layer (SSL) is a standard for secure Internet communications. WebLogic Server security services support X.509 digital certificates and access control lists (ACLs) to authenticate participants and manage access to network services. For example, SSL can protect JSP pages listing employee salaries, blocking access to confidential information.

SSL involves intensive computing operations. When supporting the cryptography operations in the SSL protocol, WebLogic Server cannot handle as many simultaneous connections.

You should note the number of SSL connections required out of the total number of clients required. Typically, for every SSL connection that the server can handle, it can handle three non-SSL connections. SSL reduces the capacity of the server by about 33-50% depending upon the strength of encryption used in the SSL connections. Also, the amount of overhead SSL imposes is related to how many client interactions have SSL enabled.

Recommendation

Implement SSL using hardware accelerators or disable SSL if it is not required by the application.

WebLogic Server Process Load

What is running on the machine in addition to a WebLogic Portal? The machine where a WebLogic Portal is running may be processing much more than presentation and business logic. For example, it could be running a web server or maintaining a remote information feed, such as a stock information feed from a quote service; however, this configuration is not recommended.

Consider how much of your WebLogic Portal machine's processing power is consumed by processes unrelated to WebLogic Portal. In the case in which the WebLogic Portal (or the machine on which it resides) is doing substantial additional work, you need to determine how much processing power will be drained by other processes.

BEA recommends that the average CPU utilization on the WebLogic Portal server when executing benchmark tests be in the range of 85 to 95% as a cumulative statistic for that machine. For example, if the machine has multiple processors then the average for both processors should be between the above percentages. This allows the machine to operate at near peak capacity, but also allows for other system processes to run and not drive the CPU to 100%. During production additional CPU overhead should be given to the system to accommodate spikes in traffic so that SLAs around response times are maintained.

Additionally, if any third party applications, services, or processes are deployed in addition to WebLogic Portal, BEA recommends deploying those applications, services, or processes on separate hardware machines.

When dealing with a clustered WebLogic Portal deployment a load balancing solution must be considered. With load balancing in a cluster, the user sessions across the nodes should be about even. If the distribution is not even then that points to a problem with either the WebLogic Portal configuration or the load balancer configuration.

Recommendation

If a cluster of servers is required to meet the capacity demands of the system then a load balancer should be implemented to distribute load across the machines.

All third party applications and services should be off-loaded onto separate hardware.

Database Server Capacity

Is the database a bottleneck? Are there additional user storage requirements? Many installations find that their database server runs out of capacity much sooner that the WebLogic Portal does. You must plan for a database that is sufficiently robust to handle the application. Typically, a good application will require a database that is three to four times more powerful than the application server hardware. It is good practice to use a separate machine for your database server.

Generally, you can tell if your database is the bottleneck if you are unable to maintain a high CPU utilization for WebLogic Portal CPU. This is a good indication that your WebLogic Portal is spending much of its time idle and waiting for the database to return.

Some database vendors are beginning to provide capacity planning information for application servers. Frequently this is a response to the 3-tier model for applications. An application might require user storage for operations that do not interact with a database. For example, in a secure system, disk and memory are required to store security information for each user. You should calculate the size required to store one user's information, and multiply by the maximum number of expected users.

There are additional ways to prevent the database from being the bottleneck in the system and one of those ways is by implementing caching at the database layer. WebLogic Portal uses many different caches to avoid hitting the database. If during performance testing the database is determined to be a bottleneck then it might be useful to tune the WebLogic Portal caches to take some of the load off the database.

Recommendation

See the WebLogic Portal Database Administration Guide: Performance Considerations and Sizing Considerations documentation for sizing and other performance related considerations.

Review the WebLogic Portal Cache Reference for more information about database caches.

Network Load

Is the bandwidth sufficient? Network performance is affected when the supply of resources is unable to keep up with the demand. WebLogic Server requires a large enough bandwidth to handle all of the connections from clients it is required to handle. If you are handling only HTTP clients, expect a similar bandwidth requirement to a web server serving static pages.

In a cluster, by default, in-memory replication of session information shares the same network as the HTTP clients. An alternative to the standard network topology would be to change the physical network with a different channel for internal cluster communication and a second channel for external traffic. See Configuring Network Resources for details. Although the WebLogic Portal framework does not create large amounts of session data it is possible for a custom application to add significant overhead in this area. Additionally, a high load of concurrent users with frequent requests will also lead to network saturation. Consider whether your application and business needs require the replication of session information. Finally, the combination of lots of concurrent users and frequent requests to the server should be estimated to determine if the network can handle the anticipated load.

To determine if you have enough bandwidth in a given deployment, you should look at the network tools provided by your network operating system vendor. There are plenty of free and commercial tools available including build-in applications for Windows and Solaris to help measure this. Additionally, most hardware load balancing solutions provide network statistics. If only one load balancer is used, it too may become a bottleneck on the system if the load is very high.

Recommendation

BEA recommends running a gigabit LAN and implementing one or more server load balancers to optimize network traffic.

Selecting Your JVM

What JVM will be used? What parameters will be used? How much heap is required to get the best performance out of the application? Different applications may perform better on one JVM

or another. WebLogic Portal supports BEA's JRockit and Sun's HotSpot JVMs. In general, BEA's JRockit JVM performed better during "Benchmark" tests on Intel processors with Linux as the OS, however HotSpot performed slightly better as the cluster size increased during "Concurrent User" tests.

The JVM parameters can have a dramatic impact on the performance of the system. Please see the BEA JRockit Reference Manual for a list of all of the parameters and where they may be used.

The size of the heap will also impact the performance of the system. Larger applications may need larger heap sizes. Additionally, a high number of concurrent users will require a larger heap size to prevent the system from running out of memory.

Recommendation

In all cases with JRockit it is recommended that `-Xgc:parallel` be used and with HotSpot `-XX:MaxPermSize` with a minimum of 128m be used. Depending on your application the memory requirements may be quite high. In all cases a set of benchmark tests should be run with the different settings to determine what is best for your application.

Performance Results

There are two types of performance test results in the following sections; one test to assess throughput and another to determine the maximum number of concurrent users supported by the system. The differences between these tests are numerous and thus comparing a data-point from one type of test to another is not recommended.

The first set of data is referred to as "Benchmark Results." This set of tests were run to determine a baseline for the throughput of system measured in pages returned per second. The goal of these tests is to determine the maximum throughput of the system in various configurations where the portal size, portlet type, and JVM are varied.

The second set of data is referred to as "Concurrent User Results" because it is more closely related to the sort of tests run in production-like systems. The goal of this type of test is to determine the maximum number of concurrent users (actively clicking through the Portal) for a given response time (often referred to as a Service Level Agreement.)

Each test is driven by a LoadRunner script that allows each user to log-in once and then click through the pages (for all but the Very Small portal, there were 50 page/book clicks) and then repeat at the first page when the last page is reached. The very small portal has 8 pages, so there were 8 clicks. This continues until the test duration is complete.

Test Applications

The following sections discuss the applications used in the performance testing. The applications include:

- Portal Framework Application
- WSRP Application
- Content Management Application

Portal Framework Application

The portal framework test application is deployed to the cluster as an EAR that contains `.portal` and `.portlet` files. Form-based authentication is used for each Portal so that a user is registered. The portals themselves vary in size and portlet type. Each portal tested includes portlets of only one type, including JSP, page flow, and JSR168. The portlets used are considered simple portlets such as "Hello World"-type portlets. Tree optimization is enabled for all of the portals. Entitlements and user customizations are disabled. Session replication using the flag "replicated_if_clustered" is configured for all tests. Because all of the users are required to log-in and then did not log-out, a session was maintained for each user for the duration of the test.

The portal sizes vary with the following parameters:

Table 2 Tested WebLogic Portal Sizes

Portal Size	Number of Books	Number of Pages	Number of Portlets
Very Small	1	8	64
Small	5	50	500
Very Large	40	400	4000

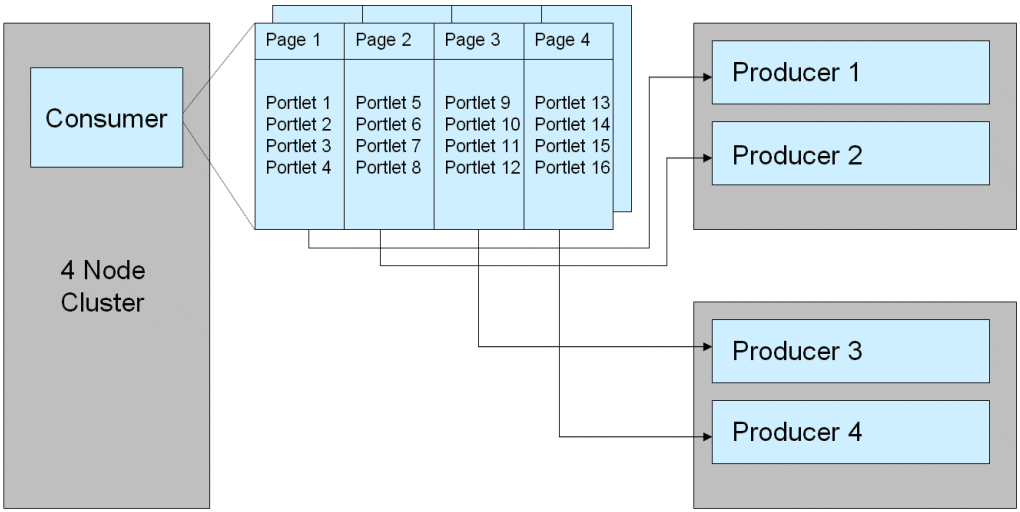
With the exception of the Very Small portal (which has 8 portlets per page) each portal has 10 portlets per page.

WSRP Application

The WSRP test application is deployed to federated clusters as an EAR that contains `.portal` and `.portlet` files. Form-based authentication is used for each Portal so that a user is registered. Each portal has one book containing eight pages; each page has from 1 to 4 remote portlets.

Multiple instances of the same remote portlet are used for each page (i.e., page 1, portlet 1 shares the same remote portlet definition as portlets 2, 3, and 4 on that same page). Each remote portlet accesses a portal Producer located on a remote machine on the same network subnet. The portlets located on pages 1 and 5 are configured to point at the same Producer. The same pattern of configuration was applied for portlets on pages 2 and 6, 3 and 7, and 4 and 8. Graphically this is represented in Figure 1.

Figure 1 WSRP Cluster Configuration



All portlets are page flow portlets. The remote portals are designed to provide approximately 40KB of HTML content to the consumer portlets. Tree optimization is enabled for all portals, while entitlements and user customizations are disabled. Session replication using the flag "replicated_if_clustered" is turned on for all tests. Because all of the users are required to log-in and then do not log-out, a session is maintained for each user for the duration of the test. The WSRP SSO feature using the WSRP SAML identity asserter is not used to propagate user identity between the Consumer and Producer.

The tests application varies over various portlet sizes and features as follows:

- Eight, 16, 32, total portlets on eight portal pages
- Caching on and off

When caching is enabled, the cache TTL is set to a time period longer than the duration of the test.

The F5 Networks Big-IP load balancer is used to balance load on the consumer cluster only. The producers are not clustered or load balanced in any way.

Content Management Application

The content management test application is deployed to a cluster as an EAR that contains JSP files which hit the content APIs directly. These JSPs are designed to test the performance of node creation, node access, paginating over nodes in a result set, the security overhead of reading a node, and the concurrent reading and writing of nodes in a BEA content repository. There are 2 types of node content that are used, simple and complex. Simple content is comprised of five string properties and one binary property. Complex content has two string, two calendar, one boolean, one long, one binary and one nested properties. The nested property is itself made up of three string, two long and two calendar properties. Repository management is disabled as are repository events. The repository is not read only and search is disabled. These tests vary over features as follows:

- Number of users creating nodes
- Number of users reading nodes
- Binary (0 or 10KB) size added to the content
- Number of total nodes in the repository
- Simple and Complex node types
- Reading the node by node Id or node name
- Number of results in a paginated list
- Number of entitled nodes in the database
- Administrator/Non-admin user

In general the nodes are created one level below the repository root. The exception to this is the nested node in the complex type, this is created as a grandchild of the root.

HP Linux Hardware and Server Configurations

The HP Linux tests varied over several different cluster configurations in which there were two, four, and eight physical machines in a cluster. Additionally, a single server configuration with no managed servers was used for each test as well. For the cluster configurations, each machine had

one running managed server, which translated into one portal and one JVM on each physical machine. Each WLP server had two CPUs where the data is presented in the table by CPU count.

- Administration and Managed Servers: HP ProLiant DL360 G4 – Dual 3.6 GHz Xeon, 4 GB RAM, 15K RPM SCSI Disks, HyperThreading enabled, RedHat Enterprise Linux AS 3.0 Update 6, Gigabit NIC
- Database Server: HP ProLiant DL380 G4 – Dual 3.4 GHz Xeon, 4 GB RAM,15K RPM SCSI Disks, HyperThreading enabled, Windows 2003 Server Enterprise Edition SP1, Oracle 9.2.0.6, Oracle 10G, Gigabit NIC
- Load Balancer: F5 Networks Big-IP 1500 and 3500
- LoadRunner Controller: HP ProLiant DL320 G3 – 3.6 GHz Pentium 4, 2 GB RAM, 15K RPM SCSI Disk, HyperThreading enabled, Windows 2003 Server Enterprise Edition SP1, LoadRunner 7.8, Gigabit NIC
- BEA JRockit JVM with `-Xms1536m -Xmx1536m -Xgc:parallel` setting.
- Sun HotSpot JVM with `-server -Xms1536m -Xmx1536m -XX:MaxPermSize=128m` setting.

Sun Solaris Hardware and Server Configurations

The Sun Solaris tests used four and eight CPU configurations in which there were one and two physical machines. Each machine had two running managed servers, which translates into two portals and two JVMs on each physical machine, for a total of two and four managed servers in the cluster. Each server has four CPUs and the data is presented in the table by CPU count.

- Administration Server: Sun Fire v240, 2 x 1.02GHz, 4GB RAM, 10K RPM SCSI Disks, Sun Solaris 10
- Managed Servers: Sun Fire v440, 4 x 1.02GHz, 8GB RAM, 10K RPM SCSI Disks, Sun Solaris 10, Gigabit NIC
- Database Server: HP ProLiant DL380 G4 – Dual 3.4 GHz Xeon, 4 GB RAM, 15K PRM SCSI Disks, HyperThreading enabled, Windows 2003 Server Enterprise Edition SP1, Oracle 9.2.0.6, Gigabit NIC
- Load Balancer: F5 Networks Big-IP 1500
- LoadRunner Controller: HP ProLiant DL320 G3 – 3.6 GHz Pentium 4, 2 GB RAM, 15K RPM SCSI Disk, HyperThreading enabled, Windows 2003 Server Enterprise Edition SP1, LoadRunner 7.8, Gigabit NIC

- JVM: Hotspot with `-server -Xms1536m -Xmx1536m -XX:MaxPermSize=128m` setting.

Portal Framework Benchmark Results

"Benchmark" tests are designed to show the maximum throughput of the system under different conditions. We varied over the type of portlets in the portal and the size of the portal as well as the JVM. For each configuration the goal is to saturate the server to achieve maximum throughput. The WebLogic Portal servers reached between 85 and 95 percent CPU utilization which is the optimal range for maximum throughput.

To achieve maximum throughput, zero seconds of "think-time" was used, which is to say that the time between a response from the server and the subsequent request was zero seconds. With this type of workload it is very easy to saturate the server and achieve maximum throughput in a short period of time with relatively few users.

For the Benchmark tests a ratio of 10 virtual users (VUsers in LoadRunner) were used per CPU. The Benchmarks were run on two hardware configurations, HP Linux and Sun Solaris. Since all of the Linux machines tested were configured with two CPUs, for each node in the WebLogic Portal cluster, 20 virtual users were used per machine. The Sun Solaris machines tested had 4 CPUs and thus 40 virtual users were used per machine. These users were "ramped-up" (added to the system) over 25 minutes followed by a steady-state (where no additional users were added but the existing users continued to access the system) that lasted an additional 10 minutes.

Note: The baseline numbers produced by the Benchmarks used in this study should not be used to compare WebLogic Portal with other portals or hardware running similar Benchmarks. The Benchmark methodology and tuning used in this study are unique.

This section includes results from the following configurations:

- HP Linux Hardware and Server Configurations
- Sun Solaris Hardware and Server Configurations

HP Linux Results

The servers were set to auto-tune which has been a new feature since WebLogic Server 9.0. The JDBC connection pools were set to start at five connections with the ability to grow to 25. These tests were run with zero seconds of think time so that the servers would become saturated quickly.

Table 3 JSP - JRockit JVM - Throughput in Pages Per Second

Portal Size	2 CPUs	4 CPUs	16 CPUs
Very Small	303	484	1972
Small	225	308	1474
Very Large	194	307	1323

Table 4 JSP - HotSpot JVM - Throughput in Pages Per Second

Portal Size	2 CPUs	4 CPUs	16 CPUs
Very Small	340	515	2254
Small	255	410	1753
Very Large	217	360	1462

Table 5 PageFlow - JRockit JVM - Throughput in Pages Per Second

Portal Size	2 CPUs	4 CPUs	16 CPUs
Very Small	278	377	1645
Small	204	188	856
Very Large	174	172	786

Table 6 PageFlow - HotSpot JVM - Throughput in Pages Per Second

Portal Size	2 CPUs	4 CPUs	16 CPUs
Very Small	273	342	1489

Table 6 PageFlow - HotSpot JVM - Throughput in Pages Per Second

Portal Size	2 CPUs	4 CPUs	16 CPUs
Small	197	163	708
Very Large	177	154	677

Table 7 JSR168 - JRockit JVM - Throughput in Pages Per Second

Portal Size	2 CPUs	4 CPUs	16 CPUs
Very Small	198	313	1329
Small	148	240	1049
Very Large	131	218	908

Table 8 JSR168 - HotSpot JVM - Throughput in Pages Per Second

Portal Size	2 CPUs	4 CPUs	16 CPUs
Very Small	209	315	1477
Small	152	260	1153
Very Large	134	232	995

Sun Solaris Results

The servers were set to auto-tune which has been a new feature since WebLogic Server 9.0. The JDBC connection pools were set to start at five connections with the ability to grow to 25. These tests were run with zero seconds of think time so that the servers would become saturated quickly.

Table 9 JSP - HotSpot JVM - Throughput in Pages Per Second

Portal Size	4 CPUs	8 CPUs
Very Small	170	334
Small	124	247
Very Large	110	218

Table 10 PageFlow - HotSpot JVM - Throughput in Pages Per Second

Portal Size	4 CPUs	8 CPUs
Very Small	114	221
Small	57	110
Very Large	53	103

Table 11 JSR168 - HotSpot JVM - Throughput in Pages Per Second

Portal Size	4 CPUs	8 CPUs
Very Small	59	232
Small	42	169
Very Large	41	155

Portal Framework Concurrent User Results

This set of performance test results are also known as “Capacity Planning” results because they are best suited for determining what the overall capacity of the system is by measuring how many concurrent users can run on a given set of hardware. These tests are designed to mimic real-world user loads and thus show a more accurate representation of the system than the standard “Benchmark” tests.

Based on feedback from our customers the most common SLAs are 2 second and 5 second response times. Our goal was to determine how many users WebLogic Portal could support across various configurations with those SLAs. If your given SLA is higher, then the number of supported users will also be higher, although estimating that number would be difficult to do without actually running additional tests.

For Capacity Planning tests the think-time is also meant to mimic real-world production systems being accessed by so-called "expert users." This should be considered a very high workload for the system and in many other configurations the request times by the end users will not be "expert" like. The think-time for these tests was randomized at 5 seconds +/- 25% (between 3.75 and 6.25 seconds.) Whereas a non-export like system might state that the think-time is closer to 30 seconds averaged across all users. The think-time for the system has a dramatic impact on the overall capacity of the Portal. A higher think-time will allow many more users on the system. You can see in the "Benchmark" configuration there was only 10 users per CPU required to saturate the system, but with think-time it could take hundreds if not thousands of users per CPU to have the same impact.

The workload for Capacity Planning tests is vastly different than that of the above "Benchmark" tests. Because the number of users required to meet the minimum SLAs is much higher (due to think-time) the duration of the tests must be extended. The number of users for each configuration was ramped-up over the course of one hour and for each configuration a different number of users was added at a constant rate every 30 seconds. We chose one hour because the system responded better and thus supported more users than with shorter ramp-up schedules. A high number of users was added to the system until they were all running at roughly the one hour mark.

This test established how many concurrent users the test portal could support with a given response time. Goal response times of two seconds and five seconds were used. The number of concurrent users listed in the table represent the maximum number of running concurrent users under 2 or 5 seconds. This test used the HP Linux configuration, see "HP Linux Hardware and Server Configurations" on page 13. Each server has two CPUs and the data is presented in the table by CPU count.

This section reports the following results:

- JSP Portlet Results
- PageFlow Portlet Results
- JSR168 Portlet Results

JSP Portlet Results

Table 12 JSP - JRockit JVM - Two-Second Response Time

Portal Size	4 CPUs	8 CPUs	16 CPUs
Very Small	2862	5245	10650
Small	1912	3780	7340
Very Large	1176	3369	6400

Table 13 JSP - JRockit JVM - Five-Second Response Time

Portal Size	4 CPUs	8 CPUs	16 CPUs
Very Small	3996	7600	15086
Small	2738	5076	10423
Very Large	2424	4750	8800

Table 14 JSP - HotSpot JVM - Two-Second Response Time

Portal Size	4 CPUs	8 CPUs	16 CPUs
Very Small	2862	5640	11250
Small	2162	5117	7900
Very Large	1908	3400	6672

Table 15 JSP - HotSpot JVM - Five-Second Response Time

Portal Size	4 CPUs	8 CPUs	16 CPUs
Very Small	4212	7840	15225
Small	2812	5710	11907
Very Large	2568	5275	9003

PageFlow Portlet Results

PageFlow portlets can have additional memory requirements which may affect performance. This is documented in more detail in the Tuning for PageFlow Portlets section of The Performance Tuning Guide and in the Portal Development Guide. The numbers in this section are subject to these limitations.

Table 16 PageFlow - JRockit JVM - Two-Second Response Time

Portal Size	4 CPUs	8 CPUs	16 CPUs
Very Small	1200	2580	5104
Small	460	930	1854
Very Large	470	931	1813

Table 17 PageFlow - JRockit JVM - Five-Second Response Time

Portal Size	4 CPUs	8 CPUs	16 CPUs
Very Small	1625	3784	7179
Small	525	1110	2074
Very Large	515	1026	2082

Table 18 PageFlow - HotSpot JVM - Two-Second Response Time

Portal Size	4 CPUs	8 CPUs	16 CPUs
Very Small	1387	2840	8165
Small	594	1139	2222
Very Large	582	1086	2184

Table 19 PageFlow - HotSpot JVM - Five-Second Response Time

Portal Size	4 CPUs	8 CPUs	16 CPUs
Very Small	1875	4550	8732
Small	612	1224	2520
Very Large	648	1290	2373

JSR168 Portlet Results

Table 20 JSR168 - JRockit JVM - Two-Second Response Time

Portal Size	4 CPUs	8 CPUs	16 CPUs
Very Small	900	3520	4650
Small	1375	2592	5160
Very Large	1272	2430	4770

Table 21 JSR168 - JRockit JVM - Five-Second Response Time

Portal Size	4 CPUs	8 CPUs	16 CPUs
Very Small	2664	5040	10050
Small	1975	3780	7543
Very Large	1764	3428	6785

Table 22 JSR168 - HotSpot JVM - Two-Second Response Time

Portal Size	4 CPUs	8 CPUs	16 CPUs
Very Small	1458	3040	7035
Small	1225	2214	4305
Very Large	1164	2038	4860

Table 23 JSR168 - HotSpot JVM - Five-Second Response Time

Portal Size	4 CPUs	8 CPUs	16 CPUs
Very Small	2448	5520	10312
Small	1975	3888	7680
Very Large	1776	3350	6750

WSRP Benchmark Results

WSRP Benchmark tests are designed to show the maximum throughput of a federated system under different conditions. The number of portlets in the portal, caching, as well as the JVM are all varied over during these tests.

For each configuration the goal is to saturate the infrastructure to achieve maximum throughput. The WebLogic Portal servers reach between 85 and 95 percent CPU utilization which is the

optimal range for maximum throughput. The number of producers is fixed for these tests at two. As additional managed servers are added to the consumer cluster, the producers are not able to keep in step, and eventually become the system bottleneck. The CPUs of the producer clusters increase beyond the optimal range and affect the overall performance of the consumer cluster. In the case of these tests, the optimal configuration is two producer machines to three managed servers in the consumer cluster.

To achieve maximum throughput, zero seconds of "think-time" is used, which is to say that the time between a response from the server and the subsequent request is zero seconds. With this type of workload it is very easy to saturate the server and achieve maximum throughput in a short period of time with relatively few users. For these tests a ratio of 50 virtual users (VUsers in LoadRunner) are used per CPU to produce maximum load.

These users are "ramped-up" (added to the system) over 40 minutes followed by a steady-state (where no additional users were added but the existing users continued to access the system) that lasts an additional 20 minutes.

There are a myriad of configuration parameters on various JVMs. Each of these can have a specific effect on the overall performance of an application. For JRockit JVM and Sun's HotSpot JVM we run with the following JVM parameters:

- JRockit: -Xms1536m -Xmx1536m -Xgc:parallel
- HotSpot: -Xms1536m -Xmx1536m -XX:MaxPermSize=128m

For information on performance tuning WSRP application see the "Tuning for WSRP" section of the Performance Tuning Guide.

Table 24 WSRP - JRockit JVM - Throughput in Pages Per Second

Number of Portlets	Caching	4 CPUs	6 CPUs	8 CPUs
8	OFF	557	799	1074
8	ON	610	877	1167
16	OFF	380	540	728
16	ON	420	613	821

Table 24 WSRP - JRockit JVM - Throughput in Pages Per Second

Number of Portlets	Caching	4 CPUs	6 CPUs	8 CPUs
32	OFF	231	343	456
32	ON	275	399	530

This data is represented graphically in Figure 1. Across the X-axis, the data is partitioned according to the configuration that was run. The lowest set of numbers corresponds to the left-most block “PORTAL_SIZE” - this is the number of portlets in the test configuration. The middle set of numbers corresponds to the “NUM_CPUS” block on the bottom and is the number of CPUs that were contained in the cluster. The upper-most configuration is related to whether of not caching is on. This corresponds to the right-most block on the bottom of the graph “CACHE”.

Figure 2 Graphical View of JRockit JVM Data

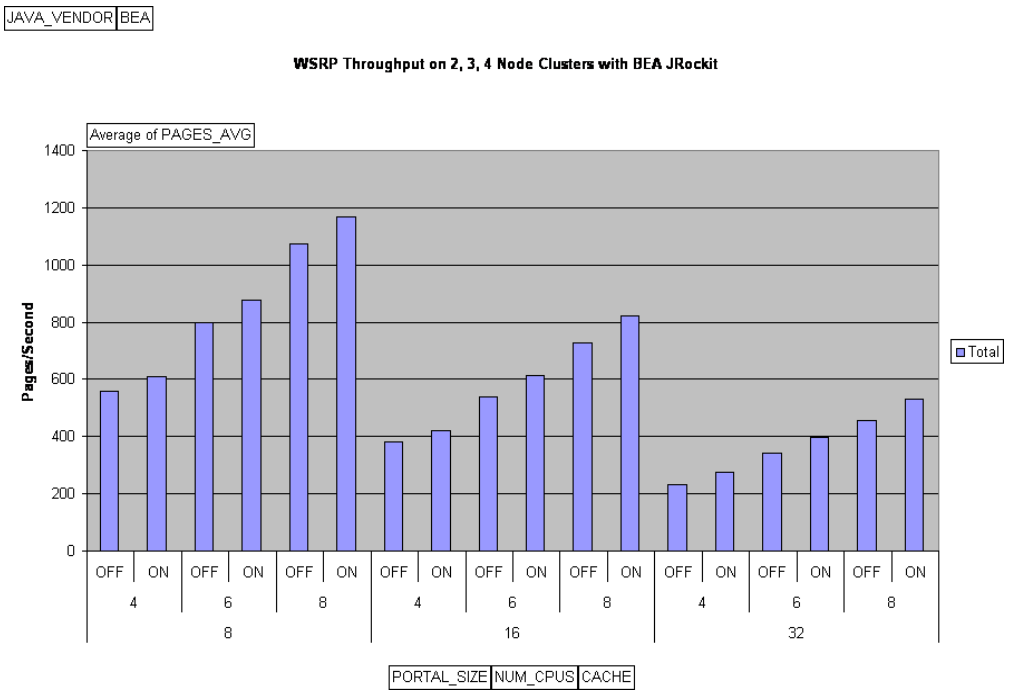
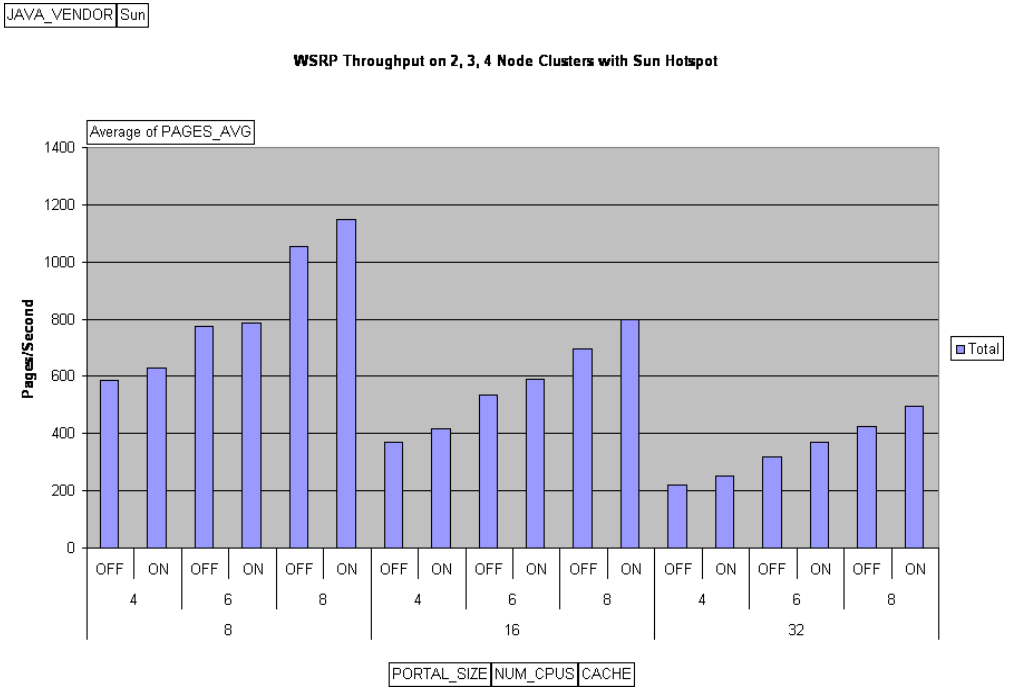


Table 25 WSRP - HotSpot JVM - Throughput in Pages Per Second

Number of Portlets	Caching	4 CPUs	6 CPUs	8 CPUs
8	OFF	585	775	1055
8	ON	631	785	1148
16	OFF	368	533	696
16	ON	417	588	798
32	OFF	221	319	424
32	ON	253	371	497

This data is represented graphically in Figure 2. Across the X-axis, the data is partitioned according to the configuration that was run. The lowest set of numbers corresponds to the left-most block “PORTAL_SIZE” - this is the number of portlets in the test configuration. The middle set of numbers corresponds to the “NUM_CPUS” block on the bottom and is the number of CPUs that were contained in the cluster. The upper-most configuration is related to whether of not caching is on. This corresponds to the right-most block on the bottom of the graph “CACHE”.

Figure 3 Graphical View of HotSpot JVM Data



Content Management Benchmark Results

Content Management Benchmark tests are designed to show the effects that different types of load have on the Content Management API and infrastructure. These are "Benchmark" style tests that seek to load the system up to maximum capacity and test under various configurations. Where as other test results in this document use a throughput calculation to determine performance statistics, the content tests use response time as a measure. The response time is the amount of time that it takes for a single request from the client to be processed by the server and the response handed back to the client. Other tests use rendered HTML as part of the performance measure. Since the content tests are primarily for driving native APIs (rather than rendering HTML) the measure isn't on how much HTML can be rendered, but rather, how fast the API responds.

Content Management Benchmark tests run on a single machine in a standalone, non-clustered configuration. While the database schema for content can be located in any location, for these tests, the content schema was co-located with the WebLogic Portal schema.

These tests do not follow the LoadRunner ramp-up/duration model that the rest of the tests in this document follow. Instead, these tests have all users running concurrently from the start of the test, and they repeat API requests for a fixed number of iterations. These iterations roughly correspond to the number of nodes in the database. The duration of a test is controlled by periodically flushing all the caches when all content from the database has been viewed once, and then repeating the cycle. In all cases, zero "think time" seconds is used between requests. This creates the maximum amount of load on the server in the shortest period of time.

All Content tests were run with the JRockit JVM.

For information on improving Content Management performance, see the "Tuning for Content Management" section of the Performance Tuning Guide.

Content Creation Results

These tests measure the response time required to create a node within the content management system, via the content API. These tests include numbers for importing binary data into a binary property. This binary data is located in a file inside the webapp. The first time it is requested, it is loaded into a binary object in memory and then read out of memory for each successive request.

Two different types of content were used, simple and complex. These are defined in the section: "Content Management Application" on page 13.

Table 26 Simple Node Type - Content Creation Results

Nodes	Users	Binary Size (KB)	Average Response Time (Milliseconds)
1000	1	0	18
1000	1	10	53
1000	10	0	56
1000	10	10	259
10000	1	0	17
10000	1	10	53
10000	10	0	61
10000	10	10	280

Table 26 Simple Node Type - Content Creation Results

Nodes	Users	Binary Size (KB)	Average Response Time (Milliseconds)
100000	1	0	18
100000	1	10	54
100000	10	0	76
100000	10	10	359

Table 27 Complex Node Type - Content Creation Results

Nodes	Users	Binary Size (KB)	Average Response Time (Milliseconds)
1000	1	0	59
1000	1	10	112
1000	10	0	230
1000	10	10	572
10000	1	0	68
10000	1	10	139
10000	10	0	330
10000	10	10	686
100000	1	0	66
100000	1	10	134
100000	10	0	565
100000	10	10	939

Content Read Results

These tests are designed to measure how much time it takes to retrieve a random node from the content repository. Each test uses one of the following methods to retrieve random nodes from the content repository:

- By node "ID" (calling INodeManager.getNodeByUUID(ContentContext, ID).
- By node "PATH" (calling INodeManager.getNode(ContentContext, String).

Each node is retrieved only once to make sure that caching is defeated.

Two different types of content were used, simple and complex. These are defined in the section: "Content Management Application" on page 13.

Table 28 Simple NodeType - Content Read Results

Users	Read Method	Average Response Time (Milliseconds)
10	ID	4
10	PATH	569
100	ID	27
100	PATH	4709

Table 29 Complex Node Type - Content Read Results

Users	Read Method	Average Response Time (Milliseconds)
10	ID	17
10	PATH	1146
100	ID	85
100	PATH	6097

Content Pagination Results

These tests are used to determine how different pagination methods affect performance. The tests vary over different levels of concurrency and pagination batch size (the number of content nodes returned per page). These tests replicate how a "real world" application might read data from the repository and then display it with pagination. These tests compare the following pagination methods available in the Content API:

- IPagedList (referred to as "LIST").
- ICMPagedResult (referred to as "RESULT").

Two different types of content were used, simple and complex. These are defined in the section: "Content Management Application" on page 13.

Table 30 Simple Node Type - Content Pagination Results

Nodes	Users	Pagination Method	Pagination Batch Size	Average Response Time (Milliseconds)
1000	1	LIST	10	72
1000	1	LIST	100	430
1000	1	RESULT	10	428
1000	1	RESULT	100	426
1000	10	LIST	10	951
1000	10	LIST	100	923
1000	10	RESULT	10	970
1000	10	RESULT	100	877
5000	1	LIST	10	2120
5000	1	LIST	100	2105
5000	1	RESULT	10	2130
5000	1	RESULT	100	2112
5000	10	LIST	10	5987
5000	10	LIST	100	5631

Table 30 Simple Node Type - Content Pagination Results

Nodes	Users	Pagination Method	Pagination Batch Size	Average Response Time (Milliseconds)
5000	10	RESULT	10	5969
5000	10	RESULT	100	5633

Table 31 Complex Node Type - Content Pagination Results

Nodes	Users	Pagination Method	Pagination Batch Size	Average Response Time (Milliseconds)
1000	1	LIST	10	531
1000	1	LIST	100	513
1000	1	RESULT	10	530
1000	1	RESULT	100	528
1000	10	LIST	10	1402
1000	10	LIST	100	1359
1000	10	RESULT	10	1388
1000	10	RESULT	100	1373
5000	1	LIST	10	2564
5000	1	LIST	100	2530
5000	1	RESULT	10	2544
5000	1	RESULT	100	2541
5000	10	LIST	10	29132
5000	10	LIST	100	28983
5000	10	RESULT	10	32182
5000	10	RESULT	100	31500

Content Security Results

Content Security tests are designed to measure overhead implicit in the security mechanisms in the Content Management System. These tests are run with a user who does not have administrator permissions and who views paginated content. Depending on the test configuration, different overall percentages of content repository nodes will be visible to the user. This is managed via node entitlement, and varied over at 50% and 100% node entitlement. The "Content Pagination Results" on page 31 demonstrate that increasing the pagination batch size will lessen the average response time slightly. A ten-fold increase in batch size translates to a small reduction in the average response time. These tests take that into account, and fix the pagination batch size at 100.

Two different types of content were used, simple and complex. These are defined in the section: "Content Management Application" on page 13.

Table 32 Simple Node Type - Content Security Results

Nodes	% Entitled	Pagination Method	Average Response Time (Milliseconds)
1000	50	LIST	479
1000	50	RESULT	740
1000	100	LIST	537
1000	100	RESULT	488
5000	50	LIST	3133
5000	50	RESULT	3099
5000	100	LIST	2955
5000	100	RESULT	2929

Table 33 Complex Node Type - Content Security Results

Nodes	% Entitled	Pagination Method	Average Response Time (Milliseconds)
1000	50	LIST	648
1000	50	RESULT	551
1000	100	LIST	970
1000	100	RESULT	539
5000	50	LIST	3247
5000	50	RESULT	3173
5000	100	LIST	3293
5000	100	RESULT	3330

Content Concurrent Read/Write Results

Content Concurrent tests measure the impact of multiple users concurrently creating and reading data from the content repository. These tests are modelled on a realistic use case of the Content Management System. The tests are run against a repository that already contains 100,000 nodes. The tests then add an additional 5000 or 10000 nodes while simultaneously reading nodes out of the database. The users that are performing the read operations do so by calling into the content API method: INodeManager.getNodeByUUID(ContentContext, ID).

Two different types of content were used, simple and complex. These are defined in the section: "Content Management Application" on page 13.

Table 34 Simple Node Type - Content Concurrent Read/Write Results

Nodes	Create Users	Read Users	Average Create Response Time (Milliseconds)	Average Read Response Time (Milliseconds)
5000	5	10	135	22
5000	5	15	164	30
10000	10	10	173	30
10000	10	15	205	38

Table 35 Complex Node Type - Content Concurrent Read/Write Results

Nodes	Create Users	Read Users	Average Create Response Time (Milliseconds)	Average Read Response Time (Milliseconds)
5000	5	10	340	33
5000	5	15	363	49
10000	10	10	568	35
10000	10	15	568	50

Other Resources

Remember that WebLogic Portal uses many components from WebLogic Platform. See the following documentation for more information about tuning WebLogic Portal.

- Designing Portals for Optimal Performance
- WebLogic Server Performance and Tuning Guide
- WebLogic Server Capacity Planning Guide
- Tuning WebLogic JRockit JVM

- BEA's dev2dev Website