Tuning Oracle WebCenter 11g on Oracle Solaris 10
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Executive Overview

The combination of Oracle WebCenter Suite, Oracle Solaris and Oracle’s Sun SPARC Enterprise servers is shown to provide excellent performance and scaling, starting from a set of basic performance tuning Best Practices.

Introduction

Oracle’s WebCenter Suite 11g provides enterprise-class portal platform and collaboration functionality for business users (internet) and corporate IT staff (intranet). Built with best-of-breed Java EE-based components, and based upon industry standards, WebCenter Suite allows for comprehensive integration with business applications, Enterprise 2.0 services, and a variety of social networking tools and communities.

With the addition this year of the Sun product and technology portfolio, Oracle can now offer powerful servers, storage products and Operating Systems. The combination of Oracle WebCenter Suite atop Oracle Solaris 10, Sun SPARC servers and Sun Storage yields a complete, scalable and robust portal solution for a wide range of business users.

This document will introduce the reader to this integrated set of software and hardware offerings, and will highlight:

- Advantages of developing and deploying WebCenter applications on Oracle Solaris, Sun SPARC servers and Sun Storage.

- Recommended best practices for deployment, configuration, administration and tuning of this integrated hardware/software stack.

- The results of initial performance and scaling testing, including details of setup and tuning.
This white paper is intended for developers and administrators of WebCenter, as well as IT professionals tasked with configuring and maintaining WebCenter instances within their Enterprise.
Oracle WebCenter 11g Architecture

Part of Oracle’s Fusion Middleware stack, WebCenter Suite 11g combines the standards-based, declarative development of Java Server Faces (JSF), the flexibility and power of portals and social networks, and a holistic set of integrated Web 2.0 services to boost end-user productivity. Together, these services provide a unique ability to build applications that eliminate context shifts and maximize productivity. For example, using Oracle WebCenter capabilities, you can build applications that allow the user to interact directly with instant messengers and other collaborative services directly within the application. Users don’t merely pass through the application to get to the services they need; the services are integrated into the very fabric of the application.

Oracle WebCenter is targeted at enterprise developers as well as business users. Its key built-in application are: WebCenter Framework, WebCenter Social Computing Services, WebCenter Composer and WebCenter Spaces. In addition, WebCenter Anywhere provides capabilities to mobile-enable your WebCenter application so users can access it from various different mobile devices.

For the purposes of this white paper, we will focus on the most recent release of Oracle WebCenter Suite; 11g Release 1 was released in July 2009, and the most recent Release 1 Patchset 2 (denoted “PS2”) was made available earlier in 2010.

The following figure shows the basic product architecture.
WebCenter On Sun

Designed to run best on Oracle WebLogic Application Server, Oracle Database System and Java Runtime Environments, WebCenter Suite 11g runs on a variety of platforms, including Oracle's own Oracle Solaris 10. The Solaris 10 and Sun SPARC Enterprise Server platforms are a natural fit for WebCenter Suite, and form the basis for the testing at the heart of this document.

Solaris 10

Solaris 10 is the Enterprise Operating Environment for the Sun SPARC Enterprise server line. In addition to being the reference platform for many Java SE and Java EE implementations, it provides a number of unique applicable features not found elsewhere:

- ZFS Filesystems, providing 128-bit volumes, double-bit parity, and extreme ease of administration
- Solaris Containers, providing lightweight Solaris instance virtualization for developers, administrators and end-users. As shown later in this document, some of the testing done with WebCenter Suite was performed using Solaris Containers.
- DTrace Observability Framework, providing non-intrusive debugging and observability down into Solaris itself

Sun SPARC Enterprise T-Series Servers

The T-Series servers utilize the massively-threaded UltraSPARC T-Series CPUs to provide the ideal price-performant environment for Web Tier Applications.

Sun SPARC Enterprise M-Series Servers

M-Series servers, powered by Fujitsu SPARC64 VII CPUs, are well-suited for running Oracle Databases for application back-ends.

Goals of This Paper

As shown earlier, WebCenter Suite 11g is comprised of numerous components and layers, and can be used in a variety of ways in a wide range of usage scenarios. This white paper, and the testing behind it, is envisioned as the first steps in a comprehensive set of Best Practices, Tuning Recommendations and Performance and Scaling Studies on Solaris and SPARC. In order to establish an initial testing baseline, a modest set of operations against WebCenter Spaces was developed.

This initial testing and results detailed herein are designed to show:

1. How to best deploy and configure on Solaris 10 and SPARC servers
2. Performance and scaling characteristics of a small representative set of operations using the WebCenter Spaces application

3. Performance and scaling behavior of a single WebCenter Spaces instance

Application Test Driver Used

For these initial tests, the WebCenter Spaces built-in application was chosen. WebCenter Spaces is a ready-to-use WebCenter Application which provides a framework for team collaboration.

A basic HTTP-based driver was developed using the open-source Faban workload generation framework. This driver is comprised of a Faban-based HTTP client which runs some number of users simultaneously against the WebCenter Spaces instance – with a built-in ‘think time’ per operation – for some amount of steady-state time (after at least a 10 minute ramp-up period). This client rotates through the following set of basic WebCenter Spaces operations:

- Home: access the standard ‘front page’ of WebCenter Spaces
- Login: log into WebCenter Spaces
- Visit PS (Personal Space): access the user’s Personal Space landing page
- Visit GS (Group Space): access a Group Space landing page (assumes user is a member of that group); do this twice for two different Groups
- Logout: log out of WebCenter Spaces

At any time during a test run, no WebCenter Spaces user is logged in more than once.

Test Configuration

As stated above, all testing described in this document was done on Oracle Solaris and SPARC-based Sun Servers (Sun SPARC Enterprise T-Series servers for the Application Tier and Sun SPARC Enterprise M-Series servers for the Database Tier.) The intention of the configuration was to be able to drive the maximum amount of load on WebCenter in order to characterize performance and scalability. N.B.: This setup should not be taken as a recommendation for an actual deployment configuration.

The sections below provide more detailed information on both the hardware and software setup along with guidance on how to most effectively utilize the system resources.

Hardware Configuration

The following diagram shows the hardware setup for the test. Each box represents a physical system and is labeled with server model number, operating system, and test software. All systems are currently shipping from Oracle at this writing.
All servers are placed in the same subnet, with dedicated Gigabit Ethernet. The table below lists the specifications for each system.

<table>
<thead>
<tr>
<th>Model</th>
<th>Used For</th>
<th>CPUs</th>
<th>Cores per CPU</th>
<th>HW Threads per Core</th>
<th>Total HW Threads</th>
<th>Total Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>T5240</td>
<td>App Tier</td>
<td>2 x 1.582GHz UltraSPARC T2+</td>
<td>8</td>
<td>8</td>
<td>128</td>
<td>96GB</td>
</tr>
<tr>
<td>M4000</td>
<td>Database Tier</td>
<td>4 x 2.53GHz SPARC64 VII</td>
<td>2</td>
<td>2</td>
<td>32</td>
<td>32GB</td>
</tr>
<tr>
<td>X2270 M2</td>
<td>Load Generation</td>
<td>2 x 2.93GHz Xeon 5670</td>
<td>6</td>
<td>1</td>
<td>12</td>
<td>96GB</td>
</tr>
</tbody>
</table>

TABLE 1: TESTING HARDWARE

The Figure below shows the test configuration topography, and shows that a second T-Series server is being used for secondary WebCenter Spaces services.

FIGURE 2: TESTING SOFTWARE CONFIGURATION
Software Configuration

All the systems are configured with Solaris 10 Update 8. The Load Generation is run from Faban on one or more X64-based servers; the Fusion Middleware components are installed on T-Series systems as shown in the Figure above; the Oracle Database is installed on the M-Series server, with direct-attach disk array. The table below lists the software components used in these tests.

<table>
<thead>
<tr>
<th>Component</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>WebLogic</td>
<td>10.3.3</td>
</tr>
<tr>
<td>WebCenter</td>
<td>11.1.1.3.0</td>
</tr>
<tr>
<td>HotSpot JVM</td>
<td>16.0.b13 (mixed mode)</td>
</tr>
<tr>
<td>Oracle Internet Directory</td>
<td>11.1.1.3.0</td>
</tr>
<tr>
<td>Oracle Content Server</td>
<td>10.1.3.5.1</td>
</tr>
<tr>
<td>Oracle HTTP Server</td>
<td>11.1.1.3.0</td>
</tr>
<tr>
<td>Oracle Database Server</td>
<td>11.2.0.1.0</td>
</tr>
<tr>
<td>Faban Testing Tool</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**Table 2: Testing Software Versions**

**NOTES:**
- Tests performed on a single WebLogic instance
- Discussion server runs on same machine as WebCenter
- All servers (WC, OID, OCS, Discussion Server) share the same Oracle Database instance

The test WebCenter instance was pre-configured with WebCenter users and groups.

Response times were measured during testing, and the 90th percentile value was used (rather than average value, to discount spurious values.) For these tests, the following values were determined to be permissible for the tested operations:
### TABLE 3: ACCEPTABLE RESPONSE TIME LIMITS

<table>
<thead>
<tr>
<th>Operation</th>
<th>Max Permissible 90&lt;sup&gt;th&lt;/sup&gt; Percentile response time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Page</td>
<td>3.0 seconds</td>
</tr>
<tr>
<td>Login</td>
<td>5.0 seconds</td>
</tr>
<tr>
<td>Access First Group Space</td>
<td>3.0 seconds</td>
</tr>
<tr>
<td>Access Second Group Space</td>
<td>3.0 seconds</td>
</tr>
<tr>
<td>Access User's Personal Space</td>
<td>3.0 seconds</td>
</tr>
<tr>
<td>Logout</td>
<td>3.0 seconds</td>
</tr>
</tbody>
</table>

### Using Solaris Containers for Added Deployment Flexibility

As mentioned above, the Sun SPARC T5240 server has a large number of CPU hardware threads. To effectively use this system, Oracle Solaris Containers (aka Zones) were used to “slice” the system into multiple virtual environments. This not only isolates the environment but also makes it easy to allocate resources such as CPU & Memory to each Zone. Additionally, when a Zone becomes fully utilized, an additional Zone can be provisioned and made available to the application, analogous to adding another physical system.

In the testing done for this paper, WebCenter and WebLogic share the same Zone on a T5240; Oracle Internet Directory (OID) and Oracle Content Server (OCS) are deployed to separate T5240 Zones; lastly, the Oracle Database is also deployed into its own Zone.

The following table details the Solaris Zones used for this testing cycle:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Software Deployed</th>
<th>CPU Threads Assigned</th>
<th>Memory Assigned</th>
</tr>
</thead>
<tbody>
<tr>
<td>wczone</td>
<td>WebCenter, WebLogic</td>
<td>8 UltraSPARC T2+ HW threads</td>
<td>32GB</td>
</tr>
<tr>
<td>ldapzone</td>
<td>OID</td>
<td>8 UltraSPARC T2+ HW threads</td>
<td>16GB</td>
</tr>
<tr>
<td>ocszone</td>
<td>OCS, OHS</td>
<td>8 UltraSPARC T2+ HW threads</td>
<td>16GB</td>
</tr>
<tr>
<td>dbzone</td>
<td>Oracle DB</td>
<td>8 SPARC64 VII HW threads</td>
<td>32GB</td>
</tr>
</tbody>
</table>

### TABLE 4: SOLARIS CONTAINERS/ZONES USED IN TESTING

It should be noted that Solaris Zones/Containers are a very appropriate options in more than just testing environments, and are used extensively in large Enterprise Production environments today.
Performance/Scalability Testing and Recommendations

N.B.: The hardware configuration used for this testing is not to be construed as a Reference Architecture for Oracle WebCenter on Solaris.

Using the driver described above, the scalability tests were performed by injecting load from the Faban test driver into WebCenter, started with 10 concurrent users. The user load was then increased in multiples of 10 concurrent users until the CPU cycles were saturated, or until the observed response times were above acceptable limits (as described above.)

First, tests were done using the default ‘Out of the Box’ settings for WebCenter and WebLogic. After obtaining baselines values, tunings were applied and tests were re-run.

Recommended Tunings

With any complex Java application, tuning of each layer helps achieve optimal application performance and scaling. The following sections show the tunings done, across each layer, for these tests.

1) The Java Virtual Machine

Through profiling and experimentation, the following JVM options have been found to provide good performance improvement:

- -Xms3g
- -Xmx3g
- -XX:PermSize=512m
- -XX:MaxPermSize=512m
- -XX:+UseParallelGC
- -XX:ParallelGCThreads=8
- -verbose:gc
- -XX:+PrintGCDetails
- -XX:+PrintGCTimeStamps
- -XX:NewRatio=3
- -XX:+UseAdaptiveSizePolicy
- -XX:+AggressiveHeap
- -XX:+DisableExplicitGC
- -Xnoclassgc
- -Xloggc:<file_name>

2) WebCenter and WebLogic

- It is important that WebLogic runs in Production Mode to avoid unnecessary class recompilation and loading. This option is selected during installation, but can also be changed after this time. To ensure WebLogic runs in Production Mode, perform the following steps from the WebLogic Admin Console:

  Admin Console-> domain -> <domain_name> -> check Production Mode
This option can also be enabled by adding the following option to the startup script:

-Dweblogic.ProductionModeEnabled=true

- The following options have some impact on performance:
  -Dweblogic.SocketReaders=4
  -Djps.auth.debug=false

- With a large number of concurrent users, WebCenter's JDBC connection pool size needs to be increased. In our tests, the default value of 50 was increased to 200.

- To reduce the volume of data written to the log files (which can slow down the application), all occurrences of loglevel in $MW_HOME/user_projects/domains/<domain_name>/config/fmwconfig/servers/WLS_Spaces/logging.xml should be changed to ERROR:1

3) Oracle Database 11g

No additional tuning was done on the database for these tests.

4) Solaris 10

No additional tuning was done on the operating system for these tests.

Observed Performance and Scaling After Tuning

Initial testing using Application Tier Solaris Zones with varying numbers of T-Series CPU hardware threads produced different amount of work, but exhibited similar behaviors. For the purposes of this document, we will concentrate on those behaviors, as opposed to specific results.

For any amount of hardware resources used in an Application Tier Solaris Zone (and, by extension, a T-Series server configured similarly), throughput, as measured in operations per second, initially increases linearly. At a particular point, the CPU hardware threads become saturated with work, response times increase significantly, throughput drops, and the overall system grows less and less productive as load increases.

Throughput, as seen in these relative performance graphs, peaks then falls off. The value of our basic system tunings is clear, however, when the two data sets are overlaid:
A comparison of CPU utilization tendencies reveals that the tuned Application Tier performs more work with less overhead and does not fall off as quickly after peak efficiency is reached:
Response times also benefit significantly from these tunings. For a more 'lightweight' operation such as accessing the WebCenter Spaces home page, the tunings allow acceptable response to a much higher simultaneous user load:

![Response Time - Home Page](image)

Figure 5: Home Page Response Time Comparison

Operations which require more work be done within WebCenter, WebLogic and Oracle Database, such as login, show an even stronger affinity to the tunings:

![Response Time - Login](image)

Figure 6: Login Response Time Comparison
Conclusions

Significant performance and scaling improvement was observed on Oracle Solaris and SPARC-based servers by the use of several basic system and product settings. The extreme parallelism afforded by Oracle's Sun SPARC Enterprise servers is well suited to the Application Tier – in this case WebCenter plus the WebLogic Application Server.

In our limited testing, a few tunings applied to an 'out of the box' WebCenter/ WebLogic configuration resulted in a scalability improvement on the order of 100%. Further performance improvements are expected in larger Application Tier environments, with these and other tunings applied.

Solaris Zones have proven to be a very useful mechanism for both testing and actual deployment of pieces of large software stacks. This testing has demonstrated the use of Zones on T-Series servers for WebCenter, WebLogic, OID, UCM, etc. Similarly, Zones on M-Series servers can be used for individual instances of the underlying Oracle database system. Both Tiers can be scaled to multiple instances, without the need to necessarily add additional hardware.

The testing performed to date covers only a small fraction of WebCenter's functionality, and the performance and scaling tuning done only scratched the surface. Future testing and tuning is planned to understand how to best use Solaris and Sun SPARC-based servers to maximize Oracle WebCenter performance and scaling.
References

- Faban testing framework: [http://faban.sunsource.net](http://faban.sunsource.net)