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Oracle Business Intelligence Suite Enterprise Edition: 50,000-User Benchmark on Sun SPARC Enterprise T5440 Server Running Oracle Solaris 10

ORACLE

Executive Overview

Business intelligence (BI) is no longer the domain of a few power analysts or a point application used by a small target audience of middle and upper management. BI has evolved into a mission-critical application that is being used by many thousands of users across the broad expanse of the enterprise, ranging from customer touchpoints such as bank tellers and call center agents all the way up to the executive offices that drive strategy down through an organization. The requirements therefore have changed dramatically. While evaluating a BI foundation, companies should now consider how it can support thousands of concurrent active users, and then be able to elegantly scale for future increases in the user base. This benchmark was designed to showcase how the Oracle Business Intelligence Suite Enterprise Edition 10.1.3.4 performs under high user loads, and how well it scales vertically and horizontally on two Sun SPARC Enterprise T5440 servers from Oracle running the Oracle Solaris 10 operating system.

The benchmark test results proved the following:

- Oracle Business Intelligence Suite Enterprise Edition can support a named user population of half a million with the benchmark configuration. This assumes a 10 percent concurrency rate for the 50,000 active concurrent users in the benchmark.

- Oracle Business Intelligence Suite Enterprise Edition running as a 64-bit application deployed on UltraSPARC T2 Plus–powered Sun SPARC Enterprise T5440 servers running Oracle Solaris 10 will scale to meet the needs of any demanding business enterprise.

Benchmark Objectives

The objective of this benchmark is to highlight how Oracle Business Intelligence Suite Enterprise Edition can support pervasive deployments in large enterprises, using minimal hardware, by simulating an organization that needs to support 50,000 active concurrent users, each operating in mixed mode: ad hoc reporting, application development, and report viewing. Oracle Business Intelligence Suite Enterprise Edition was tested on two Sun SPARC Enterprise T5440 servers running Oracle Solaris 10. Two Sun SPARC Enterprise T5440 servers—each with four isolated virtual servers—were configured to run eight instances of BI and presentation servers, clustered using a 64-bit version of Oracle Business Intelligence Suite Enterprise Edition 10.1.3.4. Eight processor cores and 32 GB memory resources were allocated for each virtual server running in the BI cluster. In addition, one Sun SPARC Enterprise T5220 server was configured to run the NFS server and the Oracle 11*g* Release 1 database server.

Product Overview

Oracle Business Intelligence Suite Enterprise Edition is a comprehensive suite of enterprise BI products that delivers a full range of capabilities. It features a unified and highly scalable architecture centered on a sophisticated BI server that provides semantic integration of data, spanning operational and analytical enterprise datasources. It empowers the largest communities with a full range of information access and delivery methods, including live interactive dashboards, full ad hoc analysis over the Web, proactive detection and alerts, advanced pixel-perfect reporting, mobile analytics, Microsoft Office integration, and Web services and business process integration.

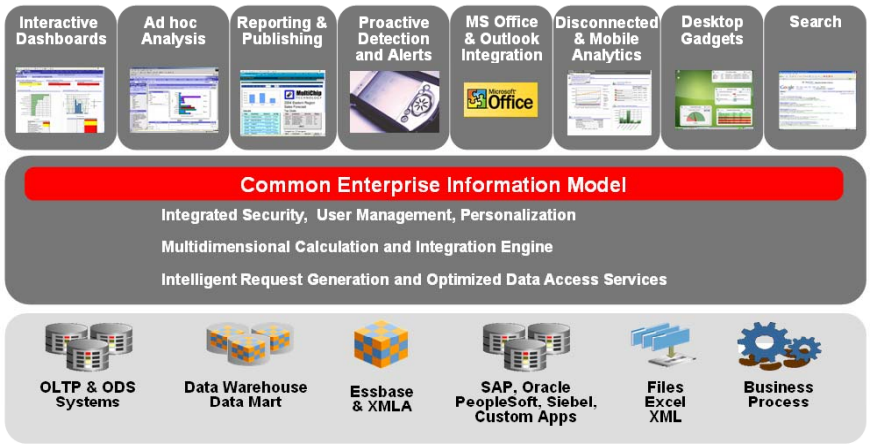

Figure 1. Oracle Business Intelligence Suite Enterprise Edition Plus

To enable true enterprise scaling, Oracle Business Intelligence Suite Enterprise Edition can be run in both single and clustered node configurations. Clustering can occur at the Oracle Business Intelligence Presentation Server layer, which supports all end-user tools, such as Oracle Interactive Dashboard and Answers. Clustering can also occur at the Oracle Business Intelligence Server layer, which drives all of

the data access, data federation, calculations, and computations within the Oracle Business Intelligence Suite Enterprise Edition environment. This clustering flexibility, combined with sophisticated access and performance-enhancing mechanisms, such as BI server caching, allows for the necessary scalability for today's pervasive BI deployments.

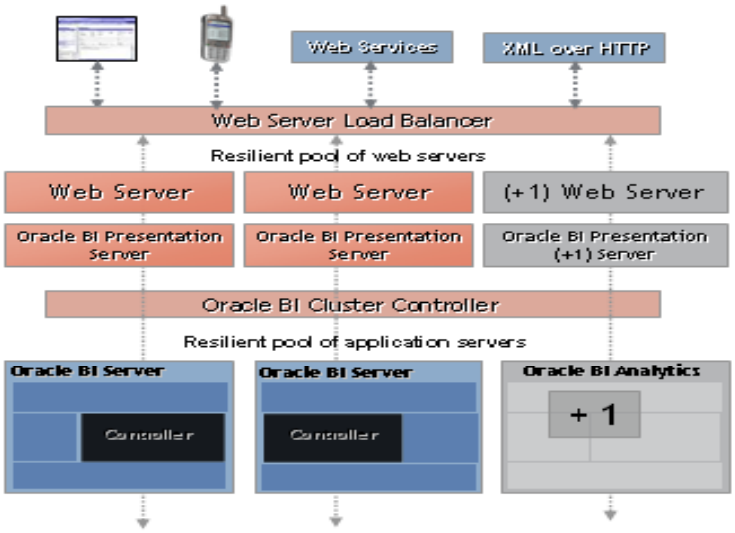

Figure 2. Clustered configuration options

The Sun SPARC Enterprise T5440 server is the industry's first quad-socket chip multithreading (CMT) server that packs a massive 256 threads into a four rack unit (4U) form factor. The Sun SPARC Enterprise T5440 server is equipped with up to four multicore (eight cores per chip) and multithread (eight threads per core) 1.2 GHz, 1.4 GHz, or 1.6 GHz UltraSPARC T2 Plus processors, and supports up to half a terabyte of memory, to provide reliable and scalable performance across all 32 cores. The Sun SPARC Enterprise T5440 server leverages hardware and Oracle Solaris features such as domains and Oracle Solaris Containers virtualization technologies to provide server and resource virtualization for the consolidation of Oracle Business Intelligence Suite Enterprise Edition deployments.

The benchmark results discussed in this report were captured with an eight-node Oracle Business Intelligence Suite Enterprise Edition cluster configuration. This demonstrates impressive vertical and horizontal scalability, which can be achieved by Oracle Business Intelligence Suite Enterprise Edition running on Oracle Solaris, when supported by two Sun SPARC Enterprise T5440 servers.

Benchmark Scenario Summary

It is important to note that this benchmark did not use a synthetic database schema. On the contrary, the benchmark tests were run on a full production version of the Oracle Business Intelligence applications, with a fully populated underlying database schema. The Oracle Business Intelligence applications are a set of complete, prebuilt BI solutions that include a prebuilt database schema; merchant extract, transform, and load adapters; and prebuilt dashboards and subject areas. These

applications deliver intuitive, role-based intelligence for everyone in an organization—from front-line employees to senior management—enabling better decisions, actions, and business processes.

This scenario more-closely represents a true customer scenario, because these are commercially available BI applications that are in production in some of the largest organizations worldwide.

The user population was divided into a mix of administrative users and business users. A maximum of 50,000 concurrent users were actively interacting and working in the system during the steady-state period. The tests executed 1,031 transactions per second, with random think times of between 9 and 111 seconds per user, between requests.

In the test scenario, 95 percent of the workload consisted of business users viewing reports and navigating within dashboards. The remaining 5 percent of the concurrent users, categorized as administrative users, were doing application development.

Business User Scenario

The benchmark scenario used a typical business user sequence of dashboard navigation, report viewing, and drill-down. For example, a service manager logs in to the system and navigates to his own set of dashboards, such as Service Manager. The user then selects the Service Effectiveness dashboard, which shows him four distinct reports: "Service Request Trend," "First Time Fix Rate," "Activity Problem Areas," and "Cost Per completed Service Call – 2002 till 2005."

The user proceeds to view the Customer Satisfaction dashboard, which also contains a set of four related reports. The user drills down on some of the reports to see the detail data. Then the user proceeds to more dashboards, for example, Customer Satisfaction and Service Request Overview. After navigating through these dashboards, the BI user logs out of the application.

Benchmark Details

The benchmark tests used five different business user roles: marketing executive, sales representative, sales manager, sales vice president, and service manager. These constituted 95 percent of all user roles and included a maximum of five different prebuilt dashboards. Each dashboard page had an average of five reports (a mix of charts, tables, and pivot tables), returning anywhere from 50 to approximately 500 rows of aggregated data. The scenario also included drill-down into multiple levels from a table or chart within a dashboard.

The remaining 5 percent of users were doing concurrent application development and ad hoc reporting, that is, navigating catalogs, creating new reports, modifying existing reports, and saving reports. The concurrent user load was generated using HP's Mercury LoadRunner, a scalability automation test tool.

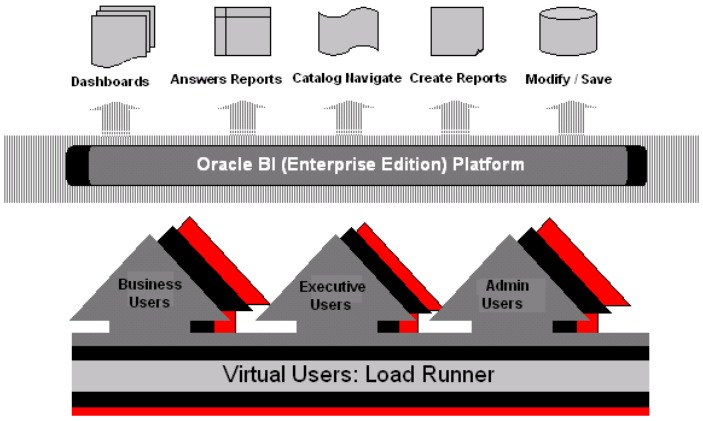

Figure 3. Logical testing

To eliminate any network delays and latencies, the client and server machines were located in the same subnet, using a 1000 Mp/sec network.

All tests were based on a one-hour steady-state period. A *steady-state period* is the time during which concurrent users are logged on to the system performing some type of work.

Benchmark Setup

The Platform Sizing and Performance Program benchmark test was run using an eight-node Oracle Business Intelligence Suite Enterprise Edition cluster configuration.

Eight sparse root Oracle Solaris Containers—each with one 1.6 GHz eight-core UltraSPARC T2 Plus processor and 32 GB memory—were configured on two identical Sun SPARC Enterprise T5440 servers to run eight BI nodes inside the virtual servers. All eight BI nodes were clustered using the BI cluster software. Each BI node was configured to run clustered Oracle Business Intelligence Presentation Server and Oracle Containers for Java 2 Platform, Enterprise Edition (OC4J) servers.

One Sun SPARC Enterprise T5220 server with 1x 1.2 GHz eight-core UltraSPARC T2 processor and 64 GB memory was configured to run the Oracle 11*g* Release 1 database server and the NFS server, to facilitate the sharing of the Oracle Business Intelligence Presentation Catalog among eight BI nodes in the cluster.

Oracle Solaris 10 5/09 was the operating system on all nodes in the benchmark configuration.

The eight-node cluster configuration was able to handle 50,000 concurrent users at an overall average CPU usage of 63 percent on each Sun SPARC Enterprise T5440 server.

Summary of Benchmark Results

Horizontal and vertical scaling across multiple nodes in clustered setup with subsecond average response times.

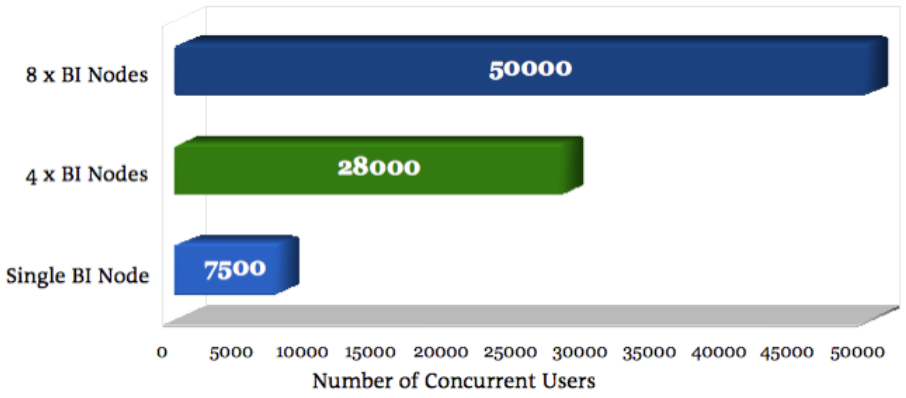

Figure 4. Scalability across multiple BI nodes

Figure 4 shows 80 percent scaling from one node in a standalone BI setup to eight nodes in a clustered Oracle Business Intelligence Enterprise Edition 10.1.3.4 setup. The Oracle Business Intelligence Server and the Oracle Business Intelligence Presentation Server were colocated on the same BI node in both of the setups. In the clustered setup, all BI components were configured to work together in a many-to-many fashion.

TABLE 1. THE HARDWARE SPECIFICATIONS AND THE SOFTWARE INSTALLED IN EACH NODE

INSTALLATION	SERVER MODEL	# CPU	# CORES PER CPU	CPU TYPE/ SPEED (GHZ)	RAM (GB)	OS	# SYSTEMS
EIGHT-NODE BUSINESS INTELLIGENCE CLUSTER SETUP - 50,000 USERS							
Oracle BI EE 10.1.3.4 64-bit: Oracle BI Server, Oracle BI Presentation Server, OC4J Web server, Oracle BI Cluster Controller	Sun SPARC Enterprise T5440	4	8	UltraSPARC T2 Plus 1.6	128	Oracle Solaris 10 5/09	2
Oracle 11*g* R1 11.1.0.6 64-bit, NFS server	Sun SPARC Enterprise T5220	1	8	UltraSPARC T2 1.2	64	Oracle Solaris 10 5/09	1
Mercury LoadRunner: Agent/Generator 8.1 FP4	Sun Fire x4170	2	4	Intel Xeon E5520 2.26	8	Microsoft Windows 2003 32-bit	16

50,000-User Cluster Benchmark Topology

The Oracle Business Intelligence Server and the Oracle Business Intelligence Presentation Server were colocated on each of the BI application server nodes in the BI cluster.

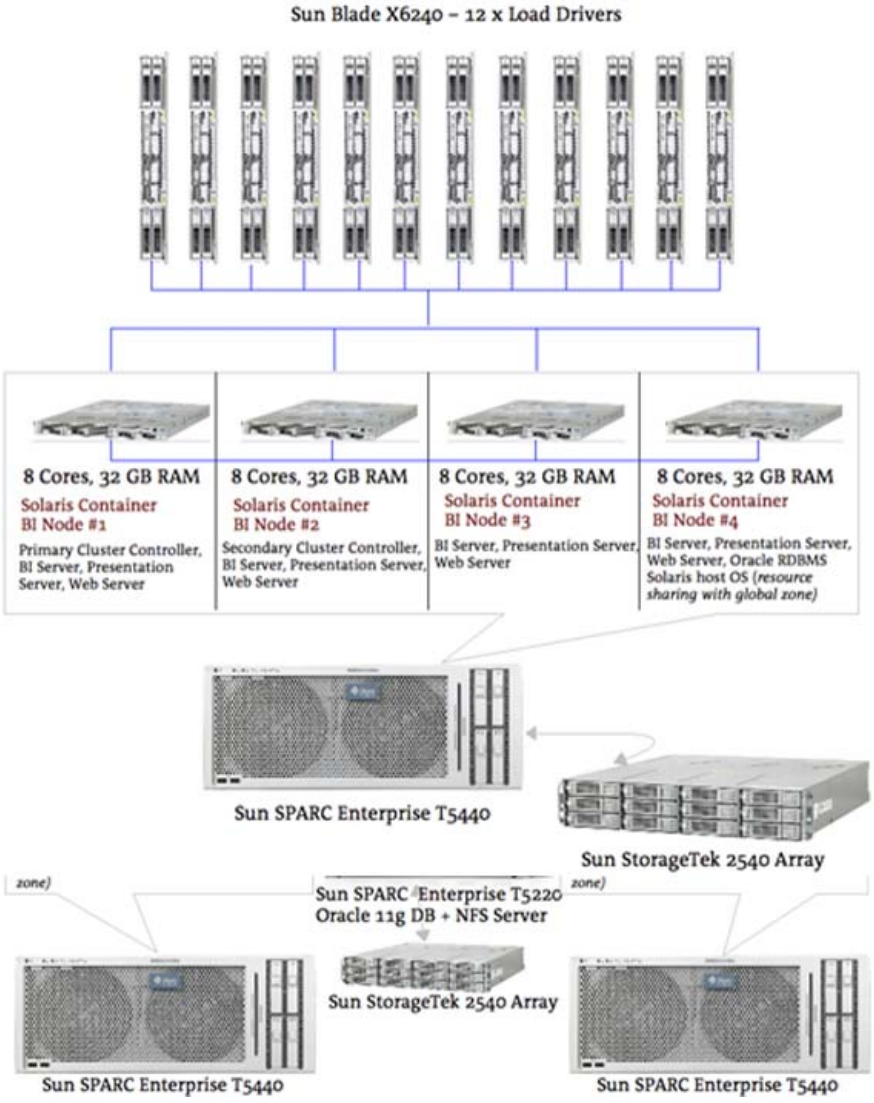

Figure 7. Four-node BI cluster topology

Benchmark Results

Table 2 shows the average CPU usage for the overall application server and the memory usage by individual Oracle Business Intelligence Server and Oracle Business Intelligence Presentation Server processes in the BI cluster. The table also shows the CPU and memory usage of the NFS server and Oracle 11*g* R1 database server. The benchmark tests were executed with the Oracle Business Intelligence Server cache set to "On."

TABLE 2. AVERAGE CPU USAGE WITH 28,000-USER CLUSTER

RESOURCE	DATA
Number of Users	50000
Transactions per Second	1031
Average Response Time for all Transactions (sec)	0.28
Percentage CPU Usage of the BI Application Server - Node 1 (Primary Controller)	58.53
Percentage CPU Usage of the BI Application Server - Node 2	60.78
Percentage CPU Usage of the BI Application Server - Node 3	62.87
Percentage CPU Usage of the BI Application Server - Node 4	69.61
Percentage CPU Usage of the BI Application Server - Node 5 (Secondary Controller)	60.79
Percentage CPU Usage of the BI Application Server - Node 6	61.64
Percentage CPU Usage of the BI Application Server - Node 7	63.78
Percentage CPU Usage of the BI Application Server - Node 8	68.67
Percentage CPU Usage of the Oracle 11*g* R1 RDBMS & NFS Server	19.06
Oracle BI Presentation Server Process Virtual Memory (GB) - Node 1	16
Oracle BI Presentation Server Process Virtual Memory (GB) - Node 2	16
Oracle BI Presentation Server Process Virtual Memory (GB) - Node 3	16
Oracle BI Presentation Server Process Virtual Memory (GB) - Node 4	16
Oracle BI Presentation Server Process Virtual Memory (GB) - Node 5	16
Oracle BI Presentation Server Process Virtual Memory (GB) - Node 6	16
Oracle BI Presentation Server Process Virtual Memory (GB) - Node 7	16
Oracle BI Presentation Server Process Virtual Memory (GB) - Node 8	16
Oracle BI Server Virtual Memory (MB) - Node 1	1900
Oracle BI Server Virtual Memory (MB) - Node 2	1882
Oracle BI Server Virtual Memory (MB) - Node 3	1901
Oracle BI Server Virtual Memory (MB) - Node 4	1915
Oracle BI Server Virtual Memory (MB) - Node 5	1899
Oracle BI Server Virtual Memory (MB) - Node 6	1902
Oracle BI Server Virtual Memory (MB) - Node 7	1891
Oracle BI Server Virtual Memory (MB) - Node 8	1922
Oracle 11*g* R1 RDBMS Virtual Memory (MB)	2280
NFS Server Virtual Memory (MB)	5.44

Figure 8 shows the total percentage of CPU usage in all eight application server nodes with 50,000 active concurrent users, over a one-hour steady-state period. Notice the high system CPU usage on nodes 4 and 8 relative to the rest of the nodes in the BI cluster. Nodes 4 and 8 are sharing the CPU and memory resources with the host operating system.

The green lines in the middle of the graph represent the CPU usage of the NFS server on the Sun SPARC Enterprise T5220 server and the host operating system. The NFS server spent almost all its time in the system CPU.

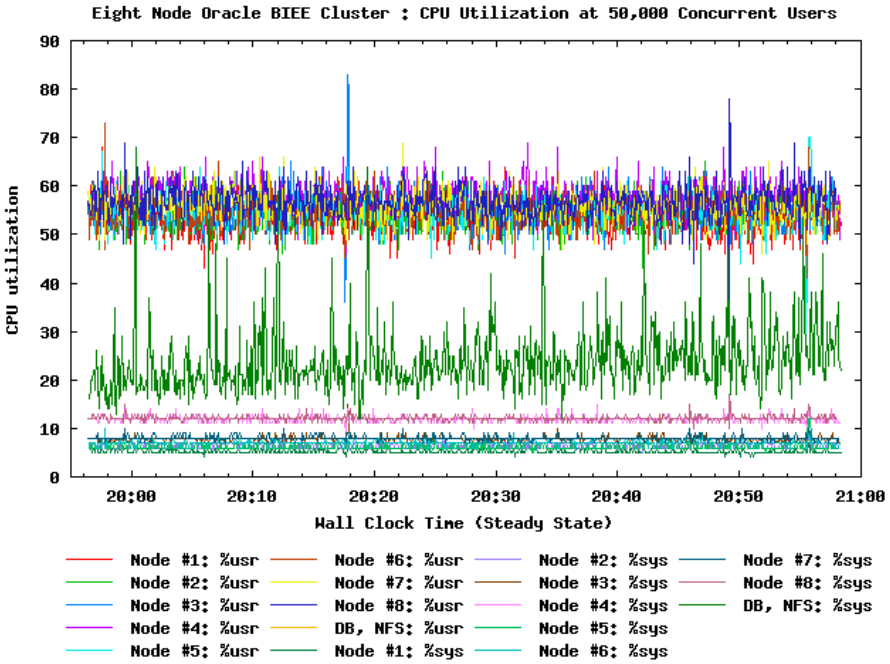

Figure 8. CPU usage in four-node 50,000-user benchmark

Conclusion

The tested eight-node clustered configuration demonstrates that the powerful combination of Oracle Business Intelligence Suite Enterprise Edition and the UltraSPARC T2 Plus processor–powered Sun SPARC Enterprise T5440 servers provide extremely cost-effective per-core performance with impressive horizontal and vertical scalability.

Two Sun SPARC Enterprise T5440 servers—each with eight-core 1.6 GHz UltraSPARC T2 Plus processors—delivered the best performance of 50,000 concurrent Oracle Business Intelligence Enterprise Edition users, at around 63 percent CPU usage.

The Oracle Business Intelligence Enterprise Edition cluster was deployed on two Sun SPARC Enterprise T5440 servers running the Oracle Solaris 10 5/09 operating system. All the nodes in the BI cluster were consolidated on the same Sun SPARC Enterprise T5440 server using the free and efficient Oracle Solaris Containers virtualization technology.

The Oracle Business Intelligence Presentation Catalog was hosted on the ZFS file system, which was created on top of four internal solid-state drive (SSD) disks. The Oracle Business Intelligence Presentation Catalog was shared among all eight BI nodes in the cluster as an NFS share. One eight-core 1.2 GHz UltraSPARC T2 processor–powered Sun SPARC Enterprise T5220 server was used to

run the NFS server. Due to the minimal activity of the database, the Oracle 11*g* database was also hosted on the same server. Oracle Solaris 10 is the operating system.

The low-end CoolThreads CMT Server T5220 and the midrange Sun SPARC Enterprise T5440 server once again proved to be ideal candidates to deploy and run multithread workloads by exhibiting resilient performance when handling a large number of simultaneous requests from 50,000 virtual users. The CoolThreads CMT Server T5220 handled a large number of concurrent asynchronous read/write requests from eight different NFS clients.

SSD disks with a ZFS file system showed significant I/O performance improvement over traditional disks for the Oracle Business Intelligence Presentation Catalog activity. In addition, ZFS helped get past the UFS limitation of 32,767 subdirectories in an Oracle Business Intelligence Presentation Catalog directory.

While supporting 50,000 concurrent BI users, the entire Oracle solution—based on two Sun SPARC Enterprise T5440 servers and one Sun SPARC Enterprise T5220 server running Oracle Business Intelligence Enterprise Edition 10.1.3.4, Oracle 11*g* database server, and NFS server on top of Oracle Solaris 10—consumed 3283 watts in a 10U rack space. As a result, the Sun SPARC Enterprise T5440 server supports 15.2 users per watt of energy consumed and supports 5,000 users per rack unit.

The data presented in this document clearly shows that the underlying hardware—Sun SPARC Enterprise T5440 server—and the Oracle Business Intelligence Enterprise Edition 10.1.3.4 64-bit platform scale linearly across multiple CMT processors, processor cores, and servers. This implies that Oracle Business Intelligence Enterprise Edition can cater to the growing user base by simply adding more Sun SPARC Enterprise T5440 servers and BI nodes to an Oracle Business Intelligence Enterprise Edition cluster deployment.

The excellent vertical and horizontal scalability of Oracle's Sun SPARC Enterprise T5440 server gives clients the option to scale up as well as scale out growth, to support large Oracle Business Intelligence Enterprise Edition installations, with minimal hardware investment.

Appendix A: Server Configuration

The Oracle Business Intelligence Presentation Server configuration is as follows:

- This benchmark used one chart server process in each BI application server node in the BI cluster. It is the default setting.
- The file descriptor limit has been increased to 2048 by overriding the default value of 1024 in the SAROOTDIR/setup/systunesrv.sh script. Also, the following line has been appended to the shell profile:

  ulimit-n 2048
- On each BI application server node running in an Oracle Solaris Container, the following Java Virtual Machine (JVM) options were configured in the SAROOTDIR/web/javahost/bin/run.sh script for the chart server Java process.

  -Xms1024M-Xmx1024M-XX:LargePageSizeInBytes=256M-XX:+UseParallelGC-XX:ParallelGCThreads=8
- The Oracle Business Intelligence Presentation Server keeps the access information of all the users in the Web catalog. Because this benchmark had 50,000 unique BI users, it can take a significant amount of time to look up a user if all the users reside in one single directory. To avoid this, the user directories were hashed. This was achieved by having the following entry in instanceconfig.xml:

  <Catalog>

  <HashUserHomeDirectories>2</HashUserHomeDirectories>

  </Catalog>
- The CacheMaxEntries setting for Oracle Business Intelligence Presentation Server was set to 20,000 in instanceconfig.xml. Be advised that the Oracle Business Intelligence Presentation Server process consumes more virtual memory when this parameter is set to a high value.

  <CacheMaxEntries>20000</CacheMaxEntries>
- The Oracle Business Intelligence Presentation Server asynchronous job queue has been increased to 200 in instanceconfig.xml. 50 is the default value.

  <ThreadPoolDefaults>

  <AsyncLogon>

  <MaxQueue>200</MaxQueue>

  </AsyncLogon>

  </ThreadPoolDefaults>

The general recommendation is to increase the queue size only when errors, such as "The queue for the thread pool AsyncLogon is at its maximum capacity of 50 jobs," started to show up in presentation services log files.

- Due to the high concurrency, the query cache expiry time has been increased to 600 minutes. The default is 60 minutes. However, under very high loads, a cache entry can be removed before one hour if many queries are being run. Hence, it is necessary to tune the parameter CacheMaxExpireMinutes in Oracle Business Intelligence Presentation Server instanceconfig.xml.

  <CacheMaxExpireMinutes>600</CacheMaxExpireMinutes>

- The Oracle Business Intelligence Presentation Server cache timeout values have been increased to larger values to keep the cached data intact during the course of the long benchmark test.

  The following parameters have been set in the Oracle Business Intelligence Presentation Server instanceconfig.xml configuration file.

  <AccountIndexRefreshSecs>36000</AccountIndexRefreshSecs>

  <AccountCacheTimeoutSecs>36000</AccountCacheTimeoutSecs>

  <CacheTimeoutSecs>36000</CacheTimeoutSecs>

  <CacheCleanupSecs>36000</CacheCleanupSecs>

  <PrivilegeCacheTimeoutSecs>36000</PrivilegeCacheTimeoutSecs>

- The Oracle Business Intelligence Server and Oracle Business Intelligence Presentation Server processes create many temporary files while rendering reports and dashboards for a user. This can result in significant I/O activity on the system. The I/O waits can be minimized by pointing the temporary directories to a memory resident file system such as /tmp on Oracle Solaris.

- To achieve this, the following line was added to the instanceconfig.xml configuration file.

  <TempDir>/tmp/OracleBISAW</TempDir>

Similarly, the temporary directory (SATEMPDIR) can be pointed to a memory resident file system such as /tmp to minimize the I/O waits.

Oracle Business Intelligence Server Configuration

The following values were set in the 'NQSConfig,.INI' file:

[CACHE]

ENABLE = YES;

DATA_STORAGE_PATHS = "/export/oracle/OracleBIData/cache" 500 MB;

MAX_ROWS_PER_CACHE_ENTRY = 0;

MAX_CACHE_ENTRY_SIZE = 10 MB;

MAX_CACHE_ENTRIES = 5000;

```
POPULATE_AGGREGATE_ROLLUP_HITS = NO;
USE_ADVANCED_HIT_DETECTION = NO;

// Cluster-aware cache
GLOBAL_CACHE_STORAGE_PATH =
"/export/oracle/OracleBIsharedRepository/GlobalCacheDirectory" 2048 MB;
MAX_GLOBAL_CACHE_ENTRIES = 10000;
CACHE_POLL_SECONDS = 300;
CLUSTER_AWARE_CACHE_LOGGING = NO;

[ SERVER ]
READ_ONLY_MODE = YES;
MAX_SESSION_LIMIT = 20000 ;
MAX_REQUEST_PER_SESSION_LIMIT = 1500 ;
SERVER_THREAD_RANGE = 512-2048;
SERVER_THREAD_STACK_SIZE = 0;
DB_GATEWAY_THREAD_RANGE = 512-512;

#SERVER_HOSTNAME_OR_IP_ADDRESSES = "ALLNICS";
CLUSTER_PARTICIPANT = YES;

REPOSITORY_PUBLISHING_DIRECTORY = "/export/oracle/OracleBIsharedRepository";
REQUIRE_PUBLISHING_DIRECTORY = YES;
```

Oracle Business Intelligence Cluster Configuration

The following parameters were configured in the NQClusterConfig.INI configuration file on the primary and secondary cluster controller nodes.

```
[ CLUSTER ]
ENABLE_CONTROLLER = YES;

PRIMARY_CONTROLLER = "bizone1";
```

SECONDARY_CONTROLLER = "bizone5";

SERVERS = "bizone1", "bizone2", "bizone3", "bizone4", "bizone5", "bizone6", "bizone7", "bizone8";

MASTER_SERVER = "bizone1";

Oracle Containers for Java 2 Platform, Enterprise Edition Web Server Configuration

On each BI node running in an Oracle Solaris Container, the following JVM options were configured for the OC4J Web server in the SAROOTDIR/setup/oc4j script.

-XX:MaxPermSize=128m -Xmx1024m -XX:LargePageSizeInBytes=256M -XX:+UseParallelGC -XX:ParallelGCThreads=8

Load balancing among the eight Oracle Business Intelligence Presentation Servers was achieved by configuring the following parameter on all eight BI application server nodes in the BI cluster in the SAROOTDIR/oc4j_bi/j2ee/home/applications/analytics/analytics/WEB-INF/web.xml configuration file.

<init-param>

<param-name>

oracle.bi.presentation.Sawservers

</param-name>

<param-value>

binode1:9710; binode2:9710; binode3:9710; binode4:9710; binode5:9710 ; binode6:9710; binode7:9710; binode8:9710

</param-value>

</init-param>

Appendix B: Oracle Solaris Tunable Parameters

/etc/system Tunable Parameters

The following /etc/system parameters were set in all containers/zones, including the global zone:

* enable 256M large pages

set max_uheap_lpsize=0x10000000

* file descriptor limits

set rlim_fd_cur=65536

set rlim_fd_max=65536

The NFS server has the following /etc/system tunable in addition to the parameters mentioned above.

* number of directory name look-up cache (DNLC) entries

set ncsize=5242880

NFS Tuning

NFS v3 was used to run the NFS server and the NFS clients in this benchmark. Tuned values for NFS parameters at the NFS server and the NFS clients are shown below.

- NFS server

Configuration file location: /etc/default/nfs

NFSD_SERVERS=512

NFS_SERVER_VERSMIN=3

NFS_SERVER_VERSMAX=3

NFSMAPID_DOMAIN=etc.sfbay.sun.com

- NFS client(s)

Configuration file location: /etc/default/nfs

NFS_CLIENT_VERSMIN=3

NFS_CLIENT_VERSMAX=3

NFSMAPID_DOMAIN=etc.sfbay.sun.com

Mounting NFS Share

Mount NFS share that contains the Oracle Business Intelligence Presentation Catalog on all the NFS clients (BI nodes in this context) using the following mount options:

rw, forcedirectio, nocto

ZFS Tuning

- Even though disabling the ZFS Intent Log (ZIL) can improve the performance of synchronous write operations, it is not a recommended practice to disable the ZIL. Doing so might compromise the data integrity.

  Disabling the ZIL on an NFS server can lead to client-side corruption.

- When running CPU intensive workloads, consider disabling the ZFS metadata compression to provide more CPU cycles to the application.

  Starting with Oracle Solaris 10 11/06, metadata compression can be disabled and enabled dynamically as shown below.

  - To disable metadata compression:

    echo zfs_mdcomp_disable/W0t1 | mdb -kw

  - To enable metadata compression:

    echo zfs_mdcomp_disable/W0t0 | mdb -kw

  - To permanently disable the metadata compression, set the following /etc/system tunable.

    set zfs:zfs_mdcomp_disable = 1

TCP/IP Tunable Parameters

Proactively tune the TCP/IP stack to avoid running into undesirable network related issues.

ndd -set /dev/tcp tcp_time_wait_interval 60000

ndd -set /dev/tcp tcp_conn_req_max_q 1024

ndd -set /dev/tcp tcp_conn_req_max_q0 4096

ndd -set /dev/tcp tcp_ip_abort_interval 60000

ndd -set /dev/tcp tcp_keepalive_interval 900000

ndd -set /dev/tcp tcp_rexmit_interval_initial 3000

ndd -set /dev/tcp tcp_rexmit_interval_max 10000

ndd -set /dev/tcp tcp_rexmit_interval_min 3000

ndd -set /dev/tcp tcp_smallest_anon_port 1024

ndd -set /dev/tcp tcp_slow_start_initial 2

```
ndd -set /dev/tcp tcp_xmit_hiwat 400000
ndd -set /dev/tcp tcp_recv_hiwat 400000
ndd -set /dev/tcp tcp_max_buf  4194304
ndd -set /dev/tcp tcp_cwnd_max 2097152
ndd -set /dev/tcp tcp_fin_wait_2_flush_interval 67500
ndd -set /dev/udp udp_xmit_hiwat 400000
ndd -set /dev/udp udp_recv_hiwat 400000
ndd -set /dev/udp udp_max_buf  4194304
```

Sample Configuration for One of the Oracle Solaris Containers in a Business Intelligence Cluster

```
zonename: binode1
zonepath: /zones/binode1
brand: native
autoboot: false
bootargs:
pool:
limitpriv:
all,!sys_suser_compat,!sys_res_config,!sys_net_config,!sys_linkdir,!sys_devices,!sys_config,!proc_zone,!
dtrace_kernel,!sys_ip_config
scheduling-class:
ip-type: shared
inherit-pkg-dir:
    dir: /lib
inherit-pkg-dir:
    dir: /platform
inherit-pkg-dir:
    dir: /sbin
inherit-pkg-dir:
    dir: /usr
fs:
```

```
    dir: /export/oracle/OracleBIsharedRepository
    special: /export/oracle/OracleBIsharedRepository
    raw not specified
    type: lofs
    options: [rw]
fs:
    dir: /export/oracle/WebCat/SiebelAnalytics_newscenario_mshahi
    special: /WebCat/WebCat/SiebelAnalytics_newscenario_mshahi
    raw not specified
    type: lofs
    options: [rw]
net:
    address: 10.8.xx.xx
    physical: nxge0
    defrouter not specified
net:
    address: 192.168.1.202
    physical: e1000g1
    defrouter not specified
dedicated-cpu:
    ncpus: 64
capped-memory:
    physical: 32G
```

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