

Oracle Business Intelligence Suite  
Enterprise Edition  
5,800 User Benchmark on HP DL380 G4

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Suite Enterprise Edition  
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# Oracle Business Intelligence Suite Enterprise Edition 5,800 User Benchmark on HP DL380 G4

## **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 touch points 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 (Oracle BI EE) Release 10.1.3.2.1 performs under very high user-loads, and how it can be scaled transparently across multiple nodes in a clustered configuration.

The benchmark test results proved that:

- Oracle BI EE can support a named user population of 50,000 users with the benchmark configuration. This assumes more than 10% concurrency rate for the 5,800 active concurrent users in the benchmark.
- That Oracle BI EE shows near linear scalability across multiple nodes enabling transparent scaling of an environment to match increased user load over time.

## INTRODUCTION

### Benchmark Objectives

The objective of this benchmark is to showcase how Oracle BI EE can support pervasive deployments in large enterprises by simulating an organization that needs to support 5,800 active concurrent users, each operating in mixed mode: ad-hoc reporting; application development; and report viewing.

### Product Overview

Oracle Business Intelligence Suite Enterprise Edition is a comprehensive suite of enterprise business intelligence 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 data sources. 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, Web Services and business process integration, and more.

**Oracle Business Intelligence Suite Enterprise Edition Plus is a comprehensive suite of enterprise business intelligence (BI) products that delivers a full range of capabilities.**

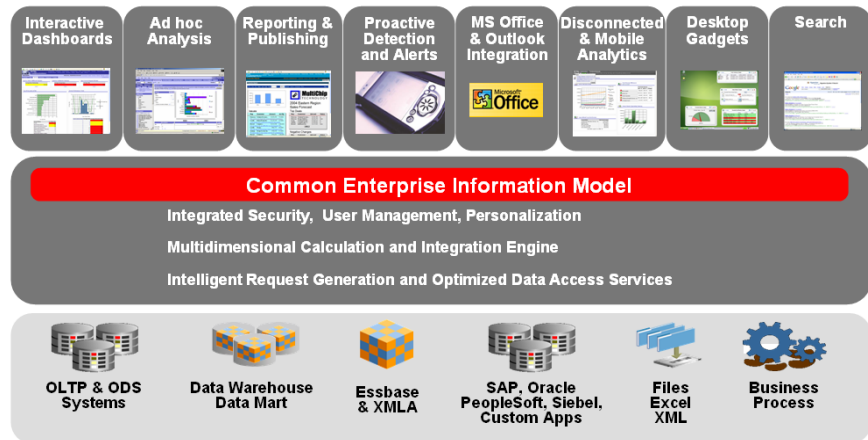


Figure 1. Oracle Business Intelligence Suite Enterprise Edition Plus

To enable true enterprise scaling, Oracle BI EE can be run in both single and clustered node configurations. Clustering can occur at the Presentation Server layer, which supports all end-user tools, such as Oracle Interactive Dashboards and Oracle Answers. Clustering can also occur at the Oracle BI Server layer, which drives all of the data access, data federation, calculations, and computations within the Oracle BI EE environment. This clustering flexibility, combined with sophisticated access and performance enhancing mechanisms, such as BI Server caching, enable the necessary scalability for today's pervasive BI deployments.

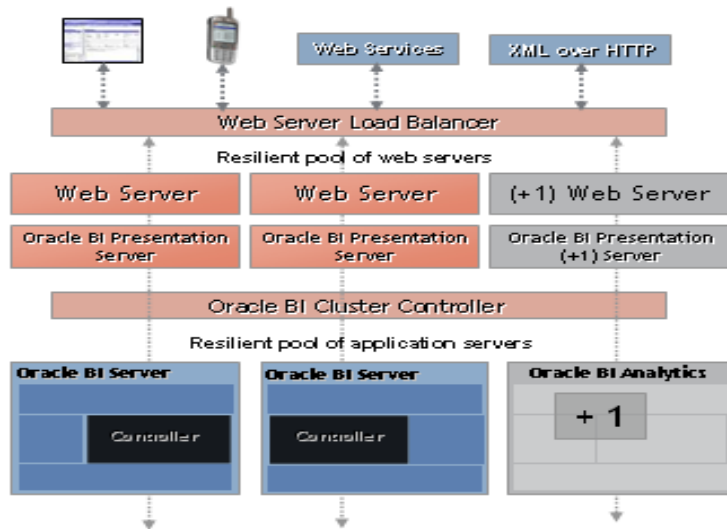


Figure 2. Clustered Configuration Options

### 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 BI Applications are a set of complete, pre-built BI solutions that include a pre-built database schema, merchant ETL adapters, and pre-built 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, as 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 5,800 concurrent users were actively interacting and working in the system during the steady-state period. The tests executed 113 transactions per second, with think times of 60 seconds per user, between requests.

In the test scenario 95% of the workload consisted of business users viewing reports and navigating within dashboards. The remaining 5% 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 into the system and navigates to his own set of dashboards viz. “Service Manager.” The user then selects the “Service Effectiveness” dashboard, which shows him four

**The benchmark tests executed 113 transactions per second with think times of 60 seconds per user between requests.**

distinct reports, “Service Request Trend”, “First Time Fix Rate”, “Activity Problem Areas”, and “Cost Per completed Service Call – 2002 till 2005” .

The user then proceeds to view the “Customer Satisfaction” dashboard, which also contains a set of 4 related reports. He then proceeds to drill-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, he logs out of the application.

### Results Summary

A clustered setup of Oracle BI EE shows linear scaling across multiple nodes, with sub-second average response times.

The following chart shows the near linear scalability from a 1-node non-clustered to 3-node clustered BI EE 10.1.3.2.1 setup. Both, the Oracle BI Server (OBIS) and Oracle BI Presentation Server (OBIP) were collocated on the same computer.

The benchmark results showed linear scaling across nodes with sub-second average response times

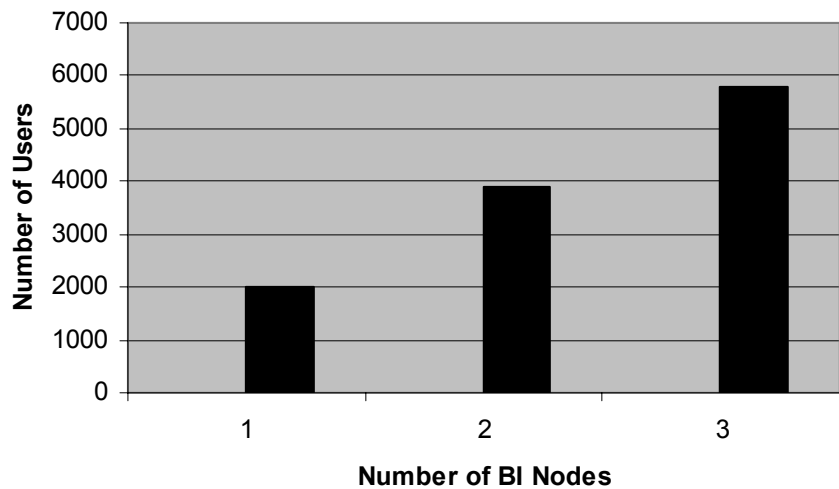


Figure 3. Scalability improvements with clustering

### BENCHMARK DETAILS

The benchmark tests used five different business user roles. These constituted 95% of all user roles, and were Marketing Executive, Sales Representative, Sales Manager, Sales Vice-president, and Service Manager. These roles included a maximum of 5 different pre-built dashboards. Each dashboard page had an average of 5 reports (a mix of charts, tables and pivot tables), returning anywhere from 50 rows 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% of users were doing concurrent application development and ad-hoc reporting; i.e. navigating catalogs, creating new reports, modifying existing reports, and saving reports.

The concurrent user load was randomly distributed across all the nodes and generated using HP's Mercury LoadRunner®, a scalability automation test tool. The 5,800 unique concurrent users were spread across all three nodes in the cluster using a round-robin load balancing algorithm.

The benchmark tests simulated different types of users performing multiple tasks, according to their respective roles.

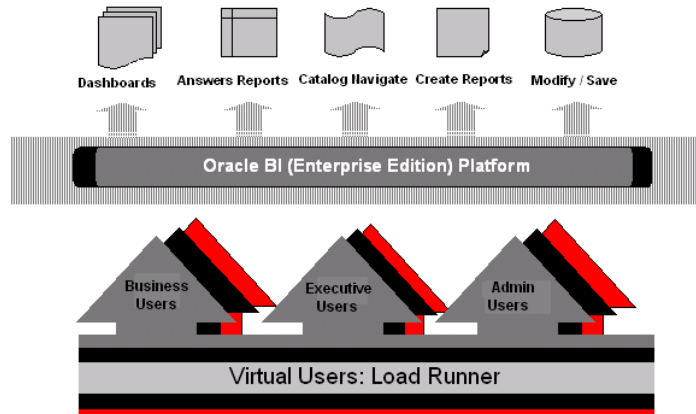


Figure 4. Logical Testing Diagram

To eliminate any network delays and latencies, all the client and server machines were located in the same sub-net, using a 1 Gbps network.

All tests were based on a 2-hour steady-state period. A steady-state period is the time during which concurrent users are logged onto the system performing some type of work.

### Benchmark Setup

The benchmark tests were run on a 3-node cluster setup of Oracle BI EE 10.1.3.2.1 using three HP DL380 G4 computers. As a comparative against a clustered setup a single node implementation was also created with the same hardware.

The Web server used for the Oracle BI Presentation Server was Oracle Containers for J2EE 10.1.3.1.0 which was running on a separate HP DL380 G4. The metadata files (OBIP web catalog files) were setup on a Network Attached Storage (NAS) device and OCFS2 1.2.2 was used to make the EVA 6000 storage available to all the nodes in an Active-Active cluster configuration.

The table below provides the hardware specifications and the software that was installed on each computer.

| Installation  | Computer            | # CPU | # Cores /CPU | CPU Speed | Memory | OS                      | # M/C |
|---|---------------------|-------|--------------|-----------|--------|-------------------------|-------|
| HP's Mercury LoadRunner®: LoadRunner Agent/Generator 8.0                                | DL380 G4 Intel Xeon | 2     | 1            | 2.8 GHz   | 4 GB   | Win 2003                | 2     |
| Oracle HTTP Server 10.1.3.1.0: HTTP Server, OC4J  | DL380 G4 Intel Xeon | 2     | 2            | 2.8 GHz   | 4 GB   | Oracle Enterprise Linux | 1     |
| Oracle BI EE 10.1.3.2.1: Oracle BI Presentation Server, Oracle BI Server, OCFS2 (1.2.2) | DL380 G4 Intel Xeon | 2     | 2            | 2.8 GHz   | 8 GB   | Oracle Enterprise Linux | 3     |
| Database: Oracle 10g 64 Bit (10.1.0.3.0)  | Rx4640              | 4     | 1            | 900 MHz   | 4 GB   | HP-UX 11v2              | 1     |

### 5,800 User Benchmark Topology

Oracle BI Server and Oracle BI Presentation Server collocated on the same computer across three nodes and OC4J on different system.

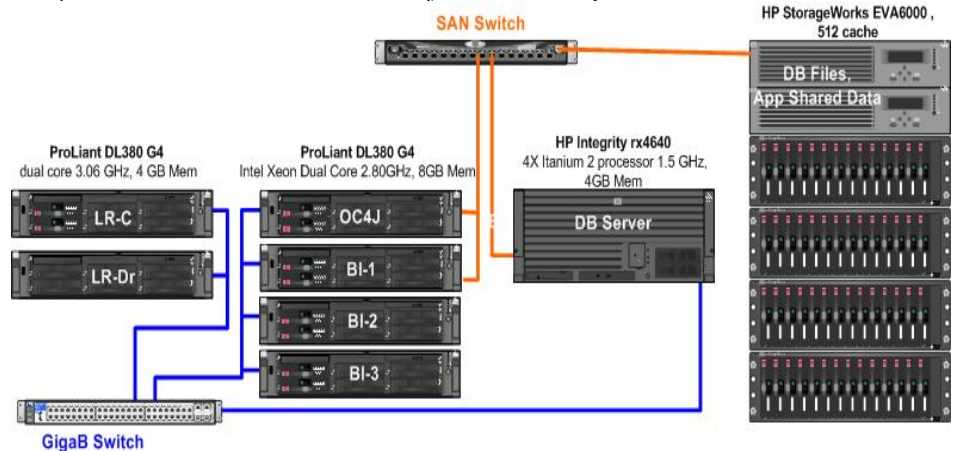


Figure 5. Three-node Topology

## Single Instance Benchmark Topology

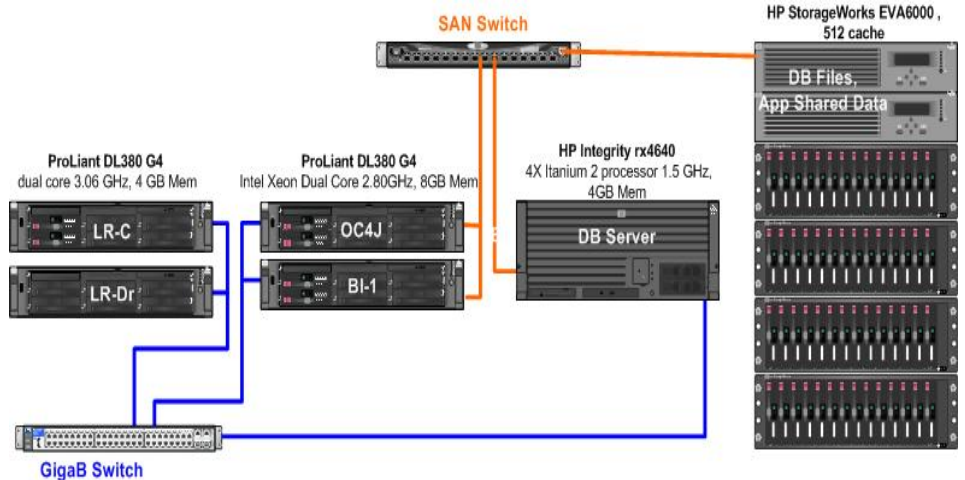


Figure 6. Single node Topology

## BENCHMARK RESULTS

### CPU and Memory Usage

The following table shows the individual CPU and memory usage for all three nodes during the 5,800 user benchmark. The data shows the high levels of throughput

—as measured in transactions per second— across each node.

The benchmark results proved that Oracle BI EE can deliver an average response time of less than half a second, with 5,800 concurrent users running 113 transactions per second.

| Resource  | Data       |
|---|------------|
| Transactions per Second   | 113        |
| Average Response Time For Transactions  | 0.497 sec. |
| Oracle BI Presentation and Oracle BI Server CPU – Node 1 (Primary Controller)   | 77% Usage  |
| Oracle BI Presentation and Oracle BI Server CPU – Node 2 (Secondary Controller) | 81% Usage  |
| Oracle BI Presentation and Oracle BI Server CPU – Node 3                        | 77% Usage  |
| Oracle BI Presentation Server Process Virtual Memory – Node 1                   | 2345 Mb    |
| Oracle BI Presentation Server Process Virtual Memory – Node 2                   | 2525 Mb    |
| Oracle BI Presentation Server Process Virtual Memory – Node 3                   | 2393 Mb    |
| Oracle BI Server Process Virtual Memory – Node 1                                | 483 Mb     |
| Oracle BI Server Process Virtual Memory – Node 2                                | 505 Mb     |
| Oracle BI Server Process Virtual Memory – Node 3                                | 478 Mb     |

### Comparison of Cluster vs. Non-Cluster Setup

The following table compares a non-cluster setup with a multiple-node cluster setup. The data shows near linear scalability of concurrent user counts when we increase from a 2-node cluster to 3-node cluster. This enables an organization to correctly anticipate additional capacity when adding nodes to a cluster.

| Resource   | Non-Cluster Setup<br>2000<br>Users | 2-Node<br>Cluster<br>3900 Users | 3-Node<br>Cluster<br>5800 Users |
|--|------------------------------------|---------------------------------|---------------------------------|
| Transactions per Second                                      | 39                                 | 76                              | 113                             |
| Average Response Time For All Transactions                   | 0.39 sec.                          | 0.434 sec.                      | 0.497 sec.                      |
| Oracle BI Presentation and Oracle BI Server CPU – Node 1     | 77% Usage                          | 77% Usage                       | 77% Usage                       |
| Oracle BI Presentation and Oracle BI Server CPU – Node 2     | -                                  | 78% Usage                       | 81% Usage                       |
| Oracle BI Presentation and Oracle BI Server CPU – Node 3     | -                                  | -                               | 77% Usage                       |
| Oracle BI Presentation Server Process Virtual Memory -Node 1 | 1582 Mb                            | 1913 Mb                         | 2345 Mb                         |
| Oracle BI Presentation Server Process Virtual Memory -Node 2 | -                                  | 1904 Mb                         | 2525 Mb                         |
| Oracle BI Presentation Server Process Virtual Memory -Node 3 | -                                  | -                               | 2393 Mb                         |
| Oracle BI Server Process Virtual Memory – Node 1             | 365 MB                             | 363 MB                          | 483 Mb                          |
| Oracle BI Server Process Virtual Memory - Node 2             | -                                  | 370 MB                          | 505 Mb                          |
| Oracle BI Server Process Virtual Memory - Node 3             | -                                  | -                               | 478 Mb                          |

## CONCLUSION

This 5,800 concurrent user benchmark demonstrates that Oracle BI EE 10.1.3.2.1 (Linux 32-bit) on HP DL380 G4 servers can meet or exceed the demands of large, pervasive enterprise-wide deployments. This scenario modeled an organization with 50,000 named users, assuming more than 10% concurrency rate for active users.

This benchmark also proves that Oracle BI EE 10.1.3.2.1 (32-bit) on HP DL380 G4 scales linearly across multiple nodes. This means that it can respond to the needs of a growing user base by adding more nodes into a cluster.

## APPENDIX A – SERVER CONFIGURATIONS

### Oracle BI Presentation Server Configuration

- 1) This benchmark used one chart-server processes in each HP DL380 G4 computer (the default setting of a single chart server).
- 2) Set Java Heap Size for the chart-server java process to 512 Mb (in `$$SAROOTDIR/web/javahost/bin/run.sh`).
- 3) The Oracle BI Presentation Server keeps users' access information in the Web Catalog. Since this benchmark had 5,800 unique users, it could take a significant amount of time to lookup a user if all the users reside in a single directory. To prevent this from skewing results, we had hashed the user-directories. This was achieved by having the following entry in `$$SADATADIR/web/config/instanceconfig.xml`.

```
<Catalog>
```

```
  <HashUserHomeDirectories>3</HashUserHomeDirectories>
```

```
</Catalog>
```

- 4) CacheMaxEntries settings for the Oracle BI Presentation Server were set to 10,000 in `$$SADATADIR/web/config/instanceconfig.xml`. Note that the OBIP process consumes more virtual memory when this parameter is set to a higher value.

```
<CacheMaxEntries>5000</CacheMaxEntries>
```

- 5) Both the Oracle BI Server and Oracle BI Presentation server create many temporary files while rendering reports/dashboards for a user. This can result in significant I/O waits in the system. You can minimize the I/O waits by pointing the temporary directories to a memory resident disk space, e.g., in Oracle Enterprise Linux we can point to `/dev/shm`. The following settings need to be present in `instanceconfig.xml`

```
.<TempDir>/dev/shm/saw</TempDir>.
```

Similarly the Temporary directory (`$$ATEMPDIR`) can be pointed to a memory resident disk, e.g., `/dev/shm`, to minimize the I/O waits.

### Oracle BI Server Configuration

The following parameters were set in `NQSCfg.INI` file:

```
[ CACHE ]
```

```
ENABLE = YES;
```

```
DATA_STORAGE_PATHS = "/vol1/121906/OracleBIData/cache" 500 Mb;
```

```
MAX_ROWS_PER_CACHE_ENTRY = 100000; // 0 is unlimited size
```

```
MAX_CACHE_ENTRY_SIZE = 10 MB;
```

```
MAX_CACHE_ENTRIES = 10000;
```

```
POPULATE_AGGREGATE_ROLLUP_HITS = NO;  
USE_ADVANCED_HIT_DETECTION = NO;
```

```
[ SERVER ]
```

```
MAX_SESSION_LIMIT = 5000 ;  
MAX_REQUEST_PER_SESSION_LIMIT = 5000 ;  
SERVER_THREAD_RANGE = 40-2000;  
SERVER_THREAD_STACK_SIZE = 0;  
DB_GATEWAY_THREAD_RANGE = 40-1000;
```

### **Apache Web Server Configuration**

The following configuration was used for Apache (httpd.conf)

```
Timeout 120  
KeepAlive Off  
MaxKeepAliveRequests 100  
ConnQueueSize 8192  
KeepAlive Timeout 15
```

### **Oracle Enterprise Linux Kernel Configuration**

All the Kernel parameters are default values except for the following:

```
fs.file-max = 65536
```



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