

# E-BUSINESS SUITE APPLICATIONS R12 (12.1.3) EXTRA-LARGE PAYROLL (BATCH) BENCHMARK - USING ORACLE11g ON A CISCO UCS B200 M3 SERVER

As a global leader in e-business applications, Oracle is committed to delivering high performance solutions that meet our customers' expectations. Business software must deliver rich functionality with robust performance. This performance must be maintained at volumes that are representative of customer environments.

Oracle benchmarks demonstrate our software's performance characteristics for a range of processing volumes in a specific configuration. Customers and prospects can use this information to determine the software, hardware, and network configurations necessary to support their processing volumes.

The primary objective of our benchmarking effort is to provide as many data points as possible to support this important decision.

## SUMMARY OF RESULTS

This batch benchmark test was run on a 16-core server.

Batch Workload			
250,000 Employees	Threads	Time (Min)	Hourly Employee Throughput
Payroll Processing	32	2.82	5,319,148
PrePayments	32	1.05	14,285,714
External Archive	32	12.57	1,193,317
NACHA	16	0.22	68,181,818
Checkwriter	20	0.43	34,883,720
Costing	32	0.77	19,480,519
Totals:		17.86	839,865
Parent Proc. Total		26.12	574,272
Wall Clock Duration*		27.0	555,555

Note that the hourly throughput numbers mentioned above are linear extrapolations. Many factors can influence performance and your results may differ.

\* The "Wall Clock Duration" includes all of the job scheduling and management activity (parent process) as well as some idle intervals due to polling or waiting for all workers in a particular process to complete prior to kicking off the subsequent process. These intervals would not increase substantially, if at all, as the workload size is increased. Consequently, the throughput for larger workloads would converge toward the "Totals:" value.

## BENCHMARK PROFILE

In September 2012, Oracle and Cisco conducted a benchmark in San Jose, CA to measure the batch performance of the Oracle E-Business Standard Benchmark processes in an environment running Oracle E-Business Suite R12 (12.1.3) with Oracle11g™ database (11.2.0.3.0) for the Linux® operating system on a Cisco® UCS™ B200 M3 server configured with two eight-core processors (16-cores total), running Oracle® Enterprise Linux® 5.7 (64-bit) OS. A single EMC® VNX5300 Storage System was used for storage.

The benchmark measured the Payroll batch business process hourly throughputs for an extra-large database model. Testing was conducted in a controlled environment with no other applications running. **The goal of this Benchmark was to obtain reference batch throughputs for Oracle E-Business Suite R12 Benchmark on a Cisco UCS server running Oracle Enterprise Linux 5.7.**

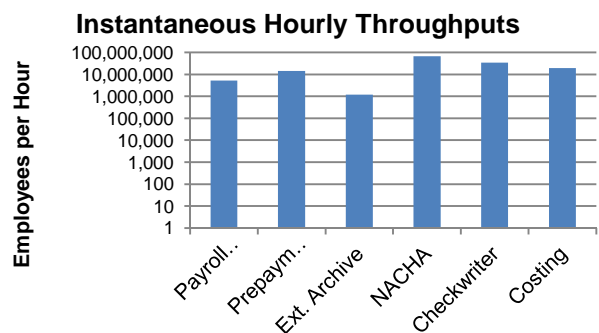




Figure 1: Oracle E-Business Payroll Batch Throughputs

## BENCHMARK METHODOLOGY

E-Business Suite R12 Benchmark batch processes are initiated from a benchmark-provided SQL script.

The batch workloads were run as standard concurrent processes via the concurrent manager.

Figure 2 shows the configuration used for this benchmark run.

	<p>UCS B200 M3</p> <p>DB Server/ App Server</p> <p>16-core</p> <p>128 GB Memory</p> <p>61% Utilized</p>
	<p>VNX5300 Storage System</p> <p>75 Disks Drives (Data and Logs)</p> <p>1% Utilized</p>

**Figure 2: 2-Tier Configuration**

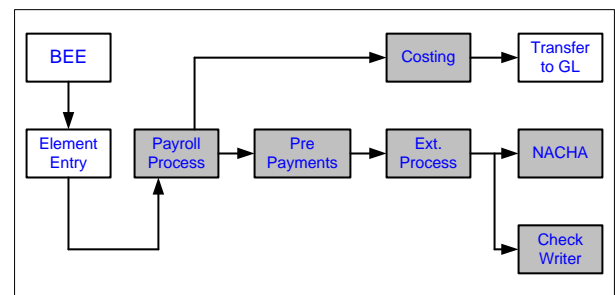
This benchmark was run as a “Physical” 2-Tier configuration with a single machine hosting both the Database and Application server instances on a single OS image.

## BENCHMARK BUSINESS PROCESSES

This E-Business Suite benchmark consists of a batch flow with six metered processes.

### Batch Payroll Processes

Business Process	Number of Threads Used	Process Type
Payroll Process	32	Pro-C
PrePayments	32	Pro-C
External Archive Process	32	Pro-C & PL/SQL
NACHA	16	Pro-C
Check Writer	20	Pro-C & Oracle Report Writer
Costing	32	Pro-C



**Figure 3: Payroll Process Flow**

The Oracle E-Business Suite R12 Payroll processes tested are as follows:

**Payroll Process:** Identifies all employees to be processed and performs calculations required to complete the gross-to-net calculation, including earnings, deductions, and taxes. The specific groups of employees processed can be controlled by multiple parameters to the payroll process, including the ability for a user to define a rules-based set of employees.

**PrePayments:** Distributes the net pay for each employee across the various payment methods (Direct Deposit, Check, or Cash). This can be run for a single payroll process or across multiple payroll processes.

**External Archiving Process:** (Pro-C, PL/SQL) Replicates the results of the Payroll run into a separate archive for audit purposes. This data is primarily used for Payslips (Both printed and on line), as a source for check and direct deposit printing, third party interfaces, and tax remittance reporting.

**NACHA:** This is the US version of the Global Direct Deposit process, which creates the bank interface file as per NACHA rules, based on the rules in the Pre Payment process.

**Check Writer:** (Oracle Report Writer) This process allocates check numbers and creates/prints the payroll check and associated paper payslip.

**Costing:** This process associates the payroll transaction data with the General Ledger (GL) accounts in preparation for transfer of the data to GL. This process uses a sophisticated hierarchical rules-based engine to determine the mapping of the HRMS data and payroll results to the GL accounts.

## BENCHMARK RESULTS

Batch Business Metrics	Achieved Output
<b>Payroll</b>	
Payroll Process	500,000
PrePayment	250,000
NACHA + Check	250,000
Costing	250,000

**Table 1: Batch Transactions Completed**

In this test, 250,000 employees were processed. One checkpoint was completed during the measurement interval. Table 2 shows the processing time in minutes.

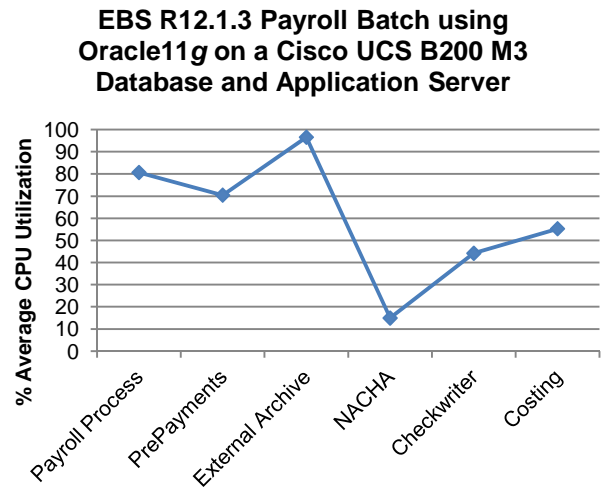
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**Table 2: Payroll Batch Performance**

R12 Application changes, data model additions and test methodology improvements render direct comparison to previous Oracle E-Business release 11.5.10 and 11.5.9 results invalid.

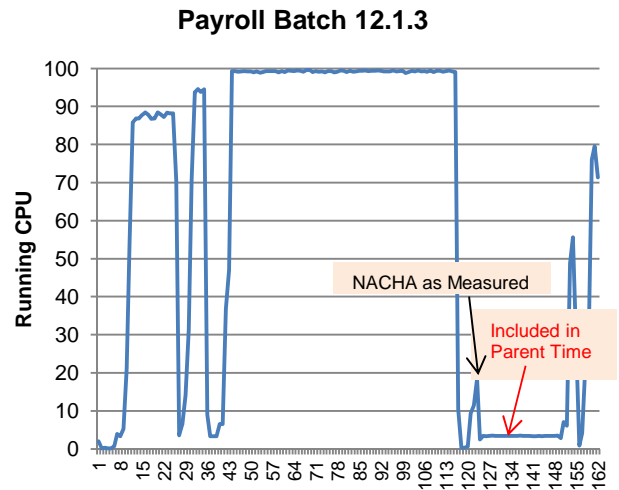
## SERVER PERFORMANCE

Figure 4 shows the average CPU utilization on the Database server. The value shown is the average across the processors (16 cores total).



**Figure 4: Average DB/App/Web CPU Utilization**

Note that the high processing power applied to the briefest business processes resulted in sparse CPU data sampling.



**Figure 5: Running CPU Utilization**

Figure 5 shows the CPU activity for the entire sequence of processes. Processing after the reported NACHA 'child' threads appears to account for much of the discrepancy between the overall sum of the 'child' threads and the overall sum of the 'parent' threads.

## SERVER PERFORMANCE CONTINUED

Online Workload	% User	% System	% I/O Wait	% Idle
Payroll Processing	72.90	7.07	0.68	19.35
PrePayments	63.77	5.33	1.33	29.58
External Archive	93.28	3.19	0.09	3.44
NACHA	10.97	0.97	2.99	85.08
Checkwriter	40.25	3.15	0.78	55.82
Costing	45.79	8.42	1.06	44.74
Wall Clock Avg.	57.27	2.87	0.48	39.38

**Table 3: Average Server CPU Utilization**

Average GB Used	DB Server
32-Threads	98.95 GB

**Table 5: Average Memory Utilization**

## I/O PERFORMANCE

An EMC VNX5300 Storage System equipped with 5 Disk Array Enclosures (75 disk drives total) was used for storage. The batch workload requires optimal I/O performance.

I/O Performance		32-Thread
Transfers/Sec	Avg	62.35
	Peak	1925.10
Writes/Sec	Avg	52.06
	Peak	1868.50
Reads/Sec	Avg	10.29
	Peak	1925.10
Avg Service Time (ms)	Avg	1.04
	Peak	18.00

**Table 6: Average I/O Utilization Breakout**

## DATA COMPOSITION DESCRIPTION

Major data components for the model under test are summarized in the following table.

Application	Business Objects	Large/Extra-Large Model
HR	Employees	250,000

**Table 7: Data Composition**

## PATCHES

The following patches were applied to the benchmark environment on top of Oracle E-Business Suite R12 (12.1.3).

- 9858539: DATA PUMP IMPORT FAILS for LOGON TRIGGER ORA-04072: INVALID TRIGGER TYPE
- 12942119: APPSPERF: CBO using EMPTY INDEX STATS VS DYNAMIC SAMPLING for TAB W/NO STATS
- 12960302: TST&PERF: QUERY REPORT CORRUPT METADATA of CONTEXT INDEX after database upgrade
- 13588248: COREDUMP in RAC env with SESSION POOLING, DRCP, FLASH CACHE, SERVER CACHE, AC
- 13656236: MERGE REQUEST on top of 11.2.0.3.0 for bugs 13004894 13370330

## APPLICATION TUNING

### Database:

1. Gather stats as follows:

```
dbms_stats.gather_index_stats(ownname => 'HR',
indname => 'PAY_ACTION_INFORMATION_N1',
estimate_percent => 100);
dbms_stats.gather_index_stats(ownname => 'HR',
indname => 'PAY_ACTION_INFORMATION_N4',
estimate_percent => 100);
dbms_stats.gather_index_stats(ownname => 'HR',
indname => 'PAY_ACTION_INFORMATION_N5',
estimate_percent => 100);
dbms_stats.gather_index_stats(ownname => 'HR',
indname => 'PAY_ACTION_INFORMATION_PK',
estimate_percent => 100);
dbms_stats.gather_table_stats(ownname => 'HR', tabname
=> 'PAY_ACTION_INFORMATION', estimate_percent =>
100, method_opt => 'FOR ALL COLUMNS SIZE AUTO');
dbms_stats.gather_index_stats(ownname => 'HR',
indname => 'PAY_ACTION_INTERLOCKS_PK',
estimate_percent => 100);
dbms_stats.gather_table_stats(ownname => 'HR', tabname
=> 'PAY_ACTION_INTERLOCKS', estimate_percent =>
100, method_opt => 'FOR ALL COLUMNS SIZE AUTO');
dbms_stats.gather_index_stats(ownname => 'HR',
indname => 'PAY_ASSIGNMENT_ACTIONS_FK2',
estimate_percent => 100);
dbms_stats.gather_index_stats(ownname => 'HR',
indname => 'PAY_ASSIGNMENT_ACTIONS_N2',
estimate_percent => 100);
dbms_stats.gather_index_stats(ownname => 'HR',
indname => 'PAY_ASSIGNMENT_ACTIONS_N3',
estimate_percent => 100);
dbms_stats.gather_index_stats(ownname => 'HR',
indname => 'PAY_ASSIGNMENT_ACTIONS_N4',
estimate_percent => 100);
dbms_stats.gather_index_stats(ownname => 'HR',
indname => 'PAY_ASSIGNMENT_ACTIONS_N51',
estimate_percent => 100);
dbms_stats.gather_index_stats(ownname => 'HR',
indname => 'PAY_ASSIGNMENT_ACTIONS_PK',
estimate_percent => 100);
dbms_stats.gather_table_stats(ownname => 'HR', tabname
=> 'PAY_ASSIGNMENT_ACTIONS', estimate_percent =>
100, method_opt => 'FOR ALL COLUMNS SIZE AUTO');
```

## OPERATING SYSTEM TUNING

### DATABASE OPERATING SYSTEM TUNING

1. The following additional Kernel parameters were automatically setup during boot via the /etc/sysctl.conf file:

```
fs.aio-max-nr = 3145728
fs.file-max = 6815744
kernel.core_uses_pid = 0
kernel.sem = 20010 2561280 20010 256
kernel.shmall = 4294967296
kernel.shmmax = 4398046511104
kernel.shmmni = 4096
kernel.msgmax = 65536
kernel.msgmnb = 65536
kernel.msgmni = 2878
kernel.sysrq = 0
net.ipv4.conf.default.rp_filter = 1
net.ipv4.conf.default.accept_source_route = 0
net.ipv4.ip_forward = 0
net.ipv4.ip_local_port_range = 9000 65500
net.ipv4.tcp_syncookies = 1
net.core.rmem_default = 262144
net.core.rmem_max = 4194304
net.core.wmem_default = 262144
net.core.wmem_max = 4194304
vm.min_free_kbytes = 51200
vm.nr_hugepages = 48000
```

2. The following limits were modified via the /etc/security/limits.conf file:

```
* soft nofile 131072
* hard nofile 131072
* soft nproc unlimited
* hard nproc unlimited
* soft core unlimited
* hard core unlimited
* soft memlock unlimited
* hard memlock unlimited
```

3. Hugepages were enabled for the database instance

# BENCHMARK ENVIRONMENT

## HARDWARE CONFIGURATION

A Cisco® UCS™ B200 M3 server was used for the database server. It was equipped with the following:

- 2 × 2.90 GHz Intel® Xeon™ Eight-Core E5 2690 processors with Hyper-Threading enabled (2-processors, 16-cores, 32-threads total), each with 20 MB of Level 3 cache
- 128 Gigabytes of Memory (~99.8 peak)
- 2 × 300 GB internal disk drives attached to an embedded LSI MegaRAID SAS 2004 3-Gbps SAS Controller
- 1 × EMC VNX5300 Storage System attached to a Cisco UCSB-MLOM-40G-01 Virtual Interface Card for data and logs
- ~39 TB raw disk space available for allocation (75 × 536 GB)
- Database storage configured using Oracle Automatic Storage Management (ASM) with 1024 GB RAID 5 storage for data and 256 GB RAID 1/0 storage for logs

## SOFTWARE VERSIONS

Oracle E-Business Suite R12 (12.1.3)

Oracle11g™ 11.2.0.3.0 (64-bit)

Oracle Enterprise Linux® 5 update 7 (64-bit) on the database/application/web server.

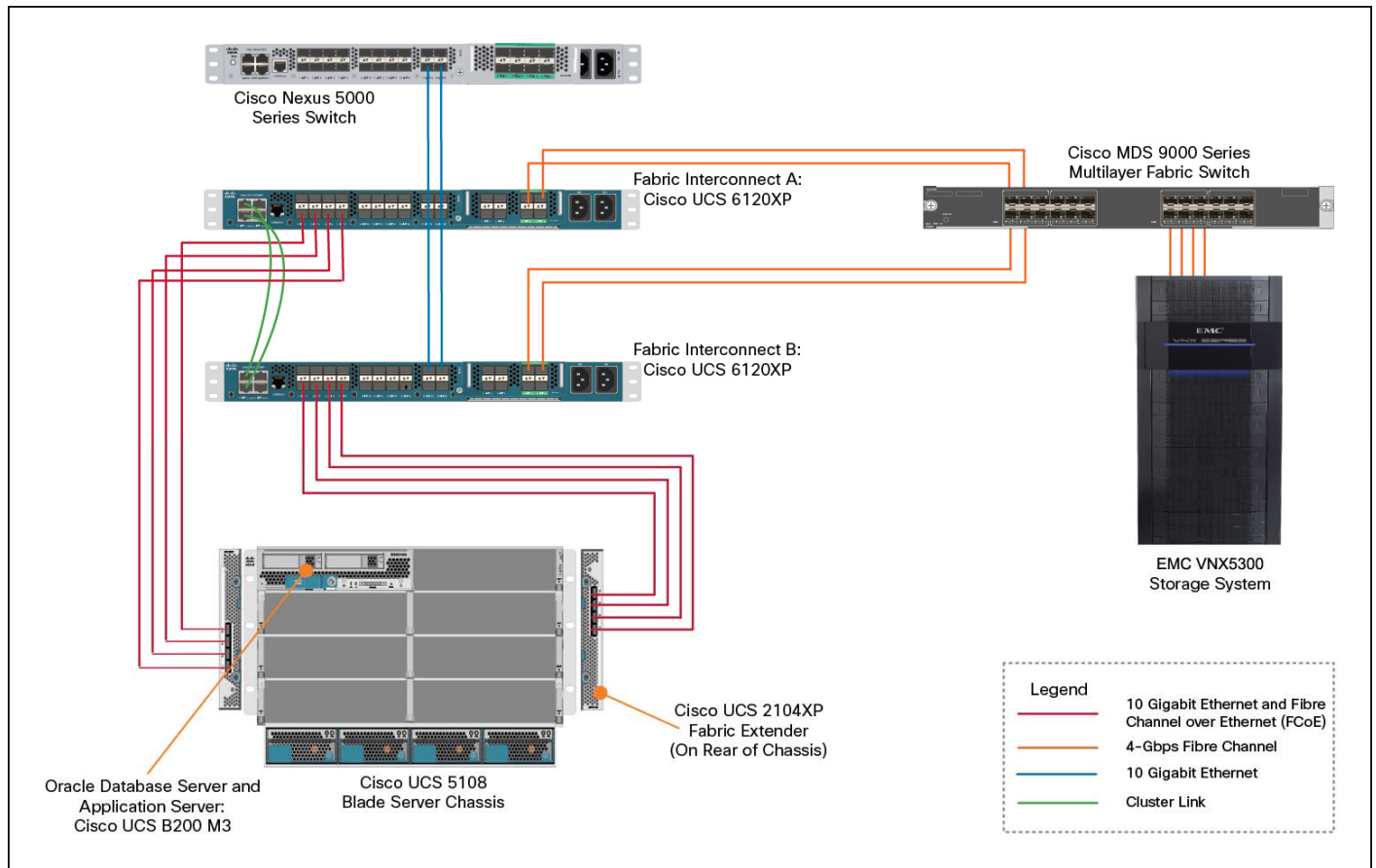
The following Java versions have all been used in the Oracle Apps environment:

- Java 1.4.1\_04-b05
- Java 1.4.2\_08-b03
- Java 1.4.2\_10-b03
- Java 1.5.0\_07-b03
- Java 1.5.0\_08-b03
- Java 1.5.0\_18-b02
- Java 1.5.0\_30-b03
- Java 1.6.0\_17-b04

Glossary and Acronyms:

OASB Oracle Applications Standard Benchmark

RAC Real Applications Clusters





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The results published in this report have been independently reviewed and audited by:



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