ORACLE E-BUSINESS SUITE 12

Sun ORACLE

ORACLE E-BUSINESS BENCHMARK REV. 1.1

E-BUSINESS SUITE APPLICATIONS R12 (12.1.3) EXTRA-LARGE PAYROLL (BATCH) BENCHMARK - USING ORACLE11*g* ON ORACLE'S SUN SERVER X3-2L 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	2.9	5,172,413
PrePayments	32	1.13	13,239,187
External Archive	32	12.93	1,159,823
NACHA	16	0.27	56,179,775
Checkwriter	20	0.93	16,077,170
Costing	32	0.83	18,007,202
Totals:		19.0	789,515
Parent Proc. Total		28.07	534,378
Wall Clock Duration*		28.07	534,378

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 April 2012, Oracle conducted a benchmark in Burlington, MA 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 Oracle11*g*™ database (11.2.0.3.0) for the Linux® operating system on an Oracle's Sun Server X3-2L (formerly known as the Sun Fire X4270 M3) server configured with two eight-core processors (16 cores total) and eight 100GB SSD for data and one 300GB SSD for log, running Oracle® Enterprise Linux® 5.7 (64-bit) OS

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 an Oracle's Sun Server X3-2L server running Oracle Enterprise Linux Linux 5.7.**

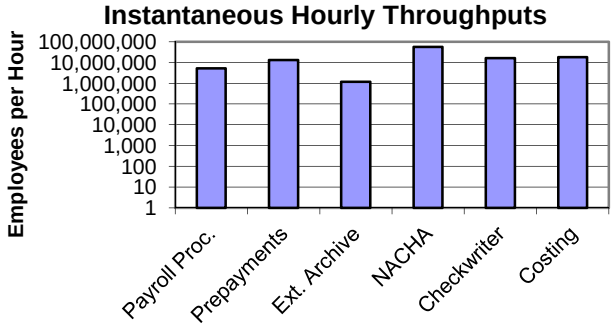

Figure 1: Oracle E-Business Payroll Batch Throughputs

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.

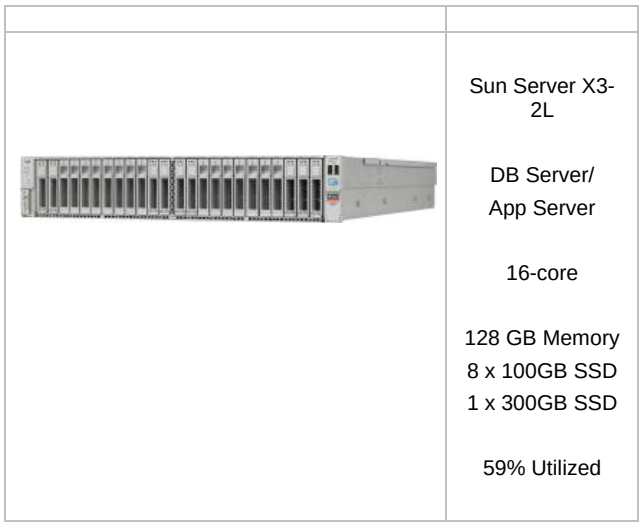

Figure 2: 2-Tier Configuration

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

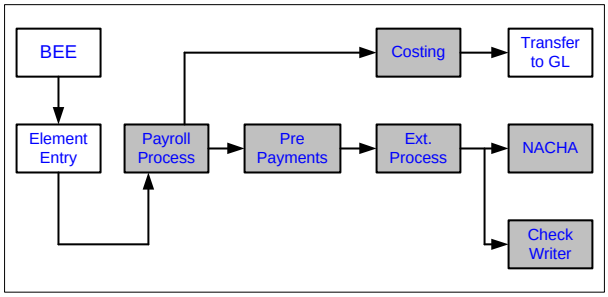

Figure 3: Payroll Process Flow

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
Payroll		
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 12.1.2, 12.0.4, 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).

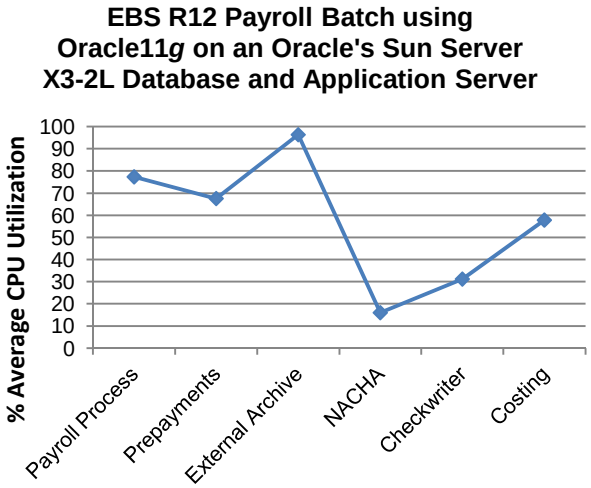

Figure 4: Average DB/App/Web CPU Utilization

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

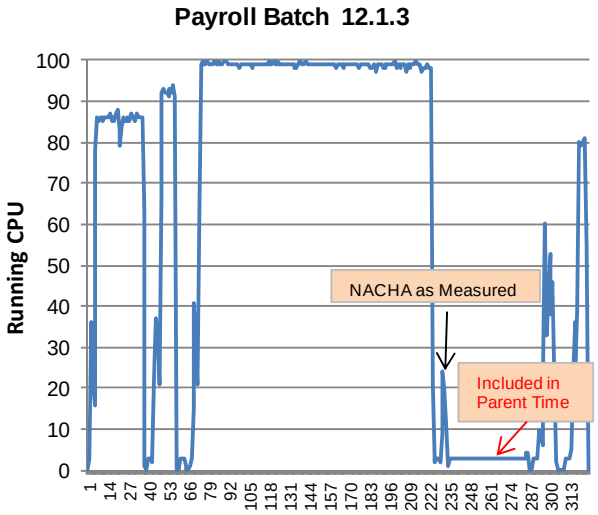

Figure 5: Running CPU Utilization

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	% Idle	% I/O Wait
Payroll Processing		70.19	7.14	22.67	0.06
PrePayments		61.40	5.87	32.47	0.33
External Archive		93.12	3.00	3.64	0.05
NACHA		13.50	1.50	84.00	1.00
Checkwriter		23.82	1.82	68.82	5.27
Costing		47.9	9.1	42.2	0.4
Wall Clock Avg.		58.65	2.88	37.95	0.40

Table 3: Average Server CPU Utilization

Average GB Used	DB Server
32-Threads	99.59 GB

Table 5: Average Memory Utilization

I/O PERFORMANCE

Sun Server X3-2L internal storage with 8 × 100GB SSD and 1 × 300GB SSD. The batch workload requires optimal I/O performance.

I/O Performance		Data	Redo Log
Writes/Sec	Avg.	938.79	273.6
	Peak	14,772.26	3,641.0
Reads/Sec	Avg.	150.84	0
	Peak	1,859.48	0.40
Writes KB/s	Avg.	11,415	13,434
	Peak	139,957	79,057
Reads KB/S	Avg.	2,242	0.003
	Peak	29,752	0.75
Avg Service Time (ms)	Avg.	0.33	0.48
	Peak	61.21	1.95

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).

1. Patch 13656236 Unique Patch ID: 14561258
Created on 9 Feb 2012, 07:34:17 hrs PST8PDT
Bugs fixed:
13370330, 13004894

Patch 13588248 Unique Patch ID: 14543914
Created on 3 Feb 2012, 13:13:09 hrs PST8PDT
Bugs fixed:
13588248

The following patches were included in the Oracle E-Business Suite R12 (12.1.3) benchmark kit.

2. Patch 12960302 Unique Patch ID: 14254250
Created on 10 Nov 2011, 02:40:18 hrs PST8PDT
Bugs fixed:
12960302

Patch 12942119 Unique Patch ID: 14210475
Created on 25 Oct 2011, 10:44:34 hrs PST8PDT
Bugs fixed:
12942119

Patch 9858539 Unique Patch ID: 14308099
Created on 28 Nov 2011, 01:07:44 hrs PST8PDT
Bugs fixed:
9858539

APPLICATION TUNING

Database:

1. Gather stats as follows:

```
  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_N3',
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_PK',
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_N50',
estimate_percent => 100);
  dbms_stats.gather_index_stats(ownname => 'HR',
indname => 'PAY_ASSIGNMENT_ACTIONS_FK2',
estimate_percent => 100);
  dbms_stats.gather_table_stats(ownname => 'HR', tabname
=> 'PAY_ASSIGNMENT_ACTIONS', 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');
```

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 = 1
  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 single Oracle's Sun Server X3-2L server was used for the database server and middle-tier 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 (~100.5 peak)
- 8 × 100 GB internal SSD and 1 × 300GB internal SSD attached to an embedded LSI MegaRAID SAS 2004 3-Gbps SAS Controller.

SOFTWARE VERSIONS

Oracle's E-Business Suite R12 (12.1.3)

Oracle11*g*™ 11.2.0.3.0 (64-bit)

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

Glossary and Acronyms:

ATP	Available to Promise
BEE	Batch Element Entries
HVOP	High Volume Order Processing
OASB	Oracle Applications Standard Benchmark
RAC	**R**eal **A**pplications **C**lusters

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

INFO SIZING

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