

E-BUSINESS SUITE APPLICATIONS R12 (RUP 4) LARGE/EXTRA-LARGE PAYROLL (BATCH) BENCHMARK - USING ORACLE10g ON A CISCO UCS B200 M2 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 12-core server.

Batch Workload			
250,000 Employees	Threads	Time (Min)	Hourly Employee Throughput
Payroll Processing	24	4.57	3,282,275
PrePayments	24	1.72	8,720,930
External Archive	24	16.82	891,795
NACHA	24	0.22	68,181,818
Checkwriter	24	1.22	12,295,081
Costing	24	1.23	12,195,121
Totals:		25.78	581,846
Parent Proc. Total		36.60	409,836
Wall Clock Duration*		36.73	408,385

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 July 2010, 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 (RUP 4) with Oracle10g™ database (10.2.0.3) for the Linux® operating system on a Cisco® UCS™ B200 M2 server configured with two six-core processors (12-cores total), running Red Hat® Enterprise Linux® 5.5 (64-bit) OS. A single EMC® CLARiiON® CX4 Model 240 disk array was used for storage.

The benchmark measured the Payroll batch business process hourly throughputs for a large/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 or Red Hat Enterprise Linux 5.5.**

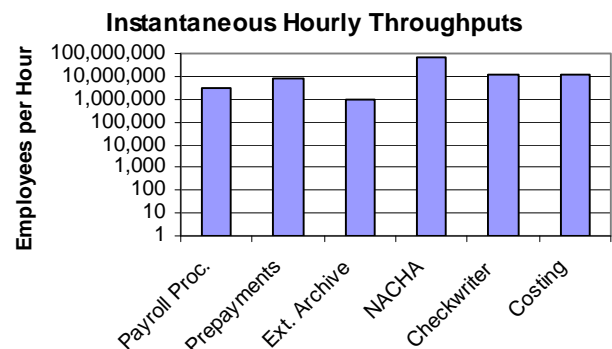


Figure 1: Oracle E-Business Payroll Batch Throughputs

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 M2</p> <p>DB Server/ App Server</p> <p>12-core</p> <p>48 GB Memory</p> <p>61% Utilized</p>
	<p>CX4 240 Disk Array</p> <p>System Storage</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	24	Pro-C
PrePayments	24	Pro-C
External Archive Process	24	Pro-C & PL/SQL
NACHA	24	Pro-C
Check Writer	24	Pro-C & Oracle Report Writer
Costing	24	Pro-C

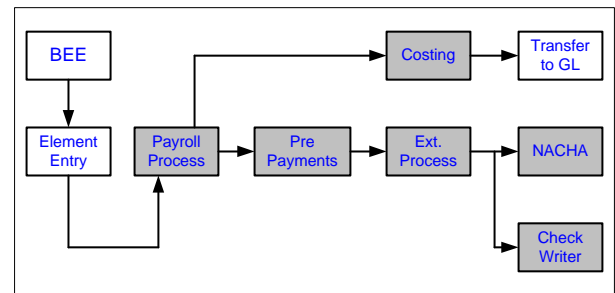


Figure 3: Payroll Process Flow

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 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 (12 cores total).

E-Business R12 Payroll using Oracle10g on a Cisco UCS B200 M2 Server

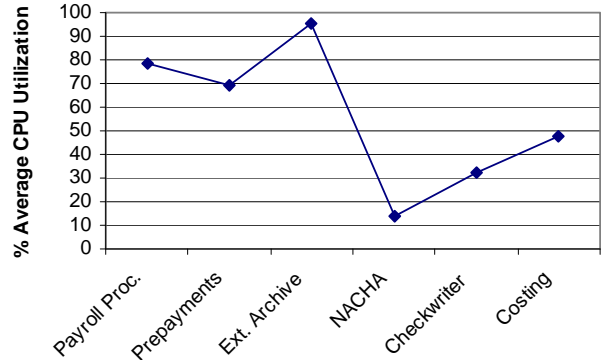


Figure 4: Average Server CPU Utilization

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

Online Workload	% User	% System	% I/O Wait	% Idle
Payroll Processing	72.38	5.92	0.39	21.31
PrePayments	63.85	4.75	1.01	30.39
External Archive	89.94	2.65	2.72	4.70
NACHA	12.05	1.07	0.93	85.95
Checkwriter	27.69	1.92	2.91	67.48
Costing	39.15	6.60	2.12	52.14
Wall Clock Avg.	58.25	2.63	1.60	37.52

Table 3: Average Server CPU Utilization

Average GB Used	DB Server
24-Threads	28.02 GB

Table 5: Average Memory Utilization

I/O PERFORMANCE

An EMC CLARiiON CX4 Model 240 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		24-Thread
Transfers/Sec	Avg	16.97
	Peak	1660.21
Writes/Sec	Avg	12.67
	Peak	1660.21
Reads/Sec	Avg	4.30
	Peak	275.90
Avg Service Time (ms)	Avg	1.05
	Peak	30.00

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 (RUP 4).

1. Oracle E-Business Applications R12 (RUP 4)

Per note 386434 (patches)

6778401

6610000

7346620

7461822

7260001

2. Oracle 10g 10.2.0.3

RDBMS patch 5455880

APPLICATION TUNING

Database:

1. R12 tuning through RUP4 and handover of benchmark kit.

2. Drop index HR.PAY_RUN_BALANCES_N3

3. Create index

```
HR.PER_TIME_PERIODS(TIME_DEFINITION_ID)
```

4. Gather stats as follows:

```
  fnd_stats.gather_table_stats
('HR','PAY_RUN_BALANCES',100,cascade=>TRUE);
  fnd_stats.gather_table_stats
('HR','PAY_DEFINED_BALANCES',100,cascade=>TRUE)
;
  fnd_stats.gather_table_stats
('HR','PAY_ACTION_INFORMATION',100,cascade=>TR
UE);
  fnd_stats.gather_table_stats
('HR','PAY_ASSIGNMENT_ACTIONS',100,cascade=>TR
UE);
  fnd_stats.gather_table_stats
('HR','PAY_PAYROLL_ACTIONS',100,cascade=>TRUE);
  fnd_stats.gather_table_stats
('HR','PAY_POPULATION_RANGES',100,cascade=>TRU
E);
  fnd_stats.gather_table_stats
('HR','PER_ALL_ASSIGNMENTS_F',100,cascade=>TRUE
);
  fnd_stats.gather_table_stats
('HR','PER_TIME_PERIODS',100,cascade=>TRUE);
  fnd_stats.gather_table_stats
('APPLSYS','FND_CURRENCIES',100,cascade=>TRUE);
  fnd_stats.gather_table_stats
('HR','PAY_RUN_RESULTS',100,cascade=>TRUE);
  fnd_stats.gather_table_stats
('HR','PAY_RUN_RESULT_VALUES',100,cascade=>TRU
E);
  fnd_stats.gather_table_stats
('HR','PAY_BALANCE_FEEDS_F',100,cascade=>TRUE);
  fnd_stats.gather_table_stats
('HR','PAY_ELEMENT_TYPES_F',100,cascade=>TRUE);
  fnd_stats.gather_schema_statistics (schemaname =>
'HR',estimate_percent => 100, degree => 12);
```

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.file-max = 6553600
kernel.core_uses_pid = 1
kernel.sem = 250 32000 100 128
kernel.shmall = 4294967296
kernel.shmmax = 68719476736
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 = 1024 65000
net.ipv4.tcp_syncookies = 0
net.core.rmem_default = 4194304
net.core.rmem_max = 4194304
net.core.wmem_default = 262144
net.core.wmem_max = 262144
vm.nr_hugepages=12300
```

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

```
* hard nofile 130000
* soft nofile 130000
* hard nproc 20000
* soft nproc 20000
oracle - memlock 100000000
```

3. Hugepages were enabled for the database instance

BENCHMARK ENVIRONMENT

HARDWARE CONFIGURATION

A Cisco® UCS™ B200 M2 server was used for the database server. It was equipped with the following:

- 2 × 3.33 GHz Intel® Xeon™ Six-Core X5680 processors with Hyper-Threading enabled (2-processors, 12-cores, 24-threads total), each with 12 MB of Level 3 cache
- 48 Gigabytes of Memory (~29.11 peak)
- 2 × 73 GB internal disk drives attached to an embedded LSI SAS1064E PCI Express 3-Gbps SAS Controller
- 1 × EMC CLARiiON CX4 Model 240 disk array attached to a Cisco UCS M71KR-Q CAN 4-Gbps Fibre Channel Controller for data and logs
- ~33 TB raw disk space available for allocation (75 × 450 GB)
- Approximately 318 GB of RAID 0 storage configured for this benchmark (data and logs)

SOFTWARE VERSIONS

Oracle E-Business Suite R12 (RUP 4)

Oracle10g™ 10.2.0.3 (64-bit)

Red Hat® Enterprise Linux® 5 update 5 (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 Real Applications Clusters



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



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