

E-BUSINESS SUITE APPLICATIONS R12 (RUP 4) PAYROLL (BATCH) BENCHMARK - USING ORACLE10g ON AN IBM SYSTEM x3550 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 an 8-core server.

Batch Workload			
10,000 Employees	Threads	Time (Min)	Hourly Employee Throughput
Payroll Processing	10	0.75	800,000
PrePayments	10	0.45	1,333,333
External Archive	10	1.18	508,475
NACHA	10	0.02	30,000,000
Checkwriter	10	0.22	2,727,273
Costing	10	0.27	2,222,222
Totals:		2.89	207,612
Parent Proc. Total		3.85	155,844
Wall Clock Duration*		~5.92	101,351

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 August 2009, Oracle and IBM conducted a benchmark in San Mateo, 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 an IBM® System x3550 M2 server configured with two 4-core Intel® Xeon® 5500 processors (8-cores total), running Red Hat® Enterprise Linux® 5 (64-bit) OS. A single IBM Storage System™ DS4700 disk array was used for storage.

The benchmark measured the Payroll batch business process hourly throughputs for a medium 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 IBM System x™ server running Linux.**

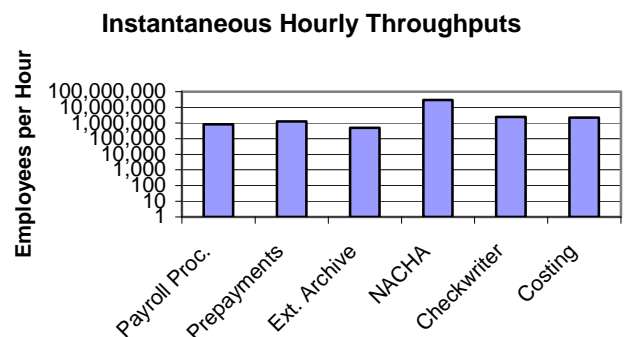


Figure 1: Oracle E-Business Payroll Batch Throughputs

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>System x3550 M2 DB Server 8-core 64 GB</p> <p>20% Utilized</p>
	<p>DS4700 System Storage 5 Drawers – Data 1 Drawer – 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 all of the Database and Application server instances.

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	8, 10	Pro-C
PrePayments	8, 10	Pro-C
External Archive Process	8, 10	Pro-C & PL/SQL
NACHA	8, 10	Pro-C
Check Writer	8, 10	Pro-C & Oracle Report Writer
Costing	8, 10	Pro-C

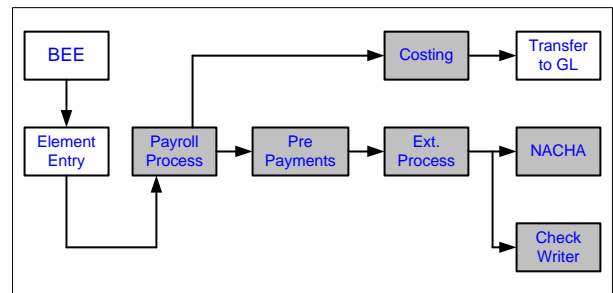


Figure 3: Payroll Process Flow

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	20,000
PrePayment	10,000
NACHA + Check	10,000
Costing	10,000

Table 1: Batch Transactions Completed

In this test, 10,000 employees were processed. Tables 2 and 3 show the processing time in minutes.

Batch Workload			
10,000 Employees	Threads	Time (Min)	Hourly Employee Throughput
Payroll Processing	8	0.73	821,918
PrePayments	8	0.47	1,276,596
External Archive	8	1.22	491,803
NACHA	8	0.02	30,000,000
Checkwriter	8	0.25	2,400,000
Costing	8	0.27	2,222,222
Totals:		2.96	202,703
Parent Proc. Total		3.85	155,844
Wall Clock Duration*		~5.75	104,348

Table 2: Payroll Batch Performance (8 Threads)

Batch Workload			
10,000 Employees	Threads	Time (Min)	Hourly Employee Throughput
Payroll Processing	10	0.75	800,000
PrePayments	10	0.45	1,333,333
External Archive	10	1.18	508,475
NACHA	10	0.02	30,000,000
Checkwriter	10	0.22	2,727,273
Costing	10	0.27	2,222,222
Totals:		2.89	207,612
Parent Proc. Total		3.85	155,844
Wall Clock Duration*		~5.92	101,351

Table 3: Payroll Batch Performance (10 Threads)

Table 2 shows the results for 8 threads (workers) and table 3 shows the results for 10 threads. There was little difference between 8 and 10 threads for this workload.

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/Application/Web server. The value shown is the average across the processors (8 cores total).

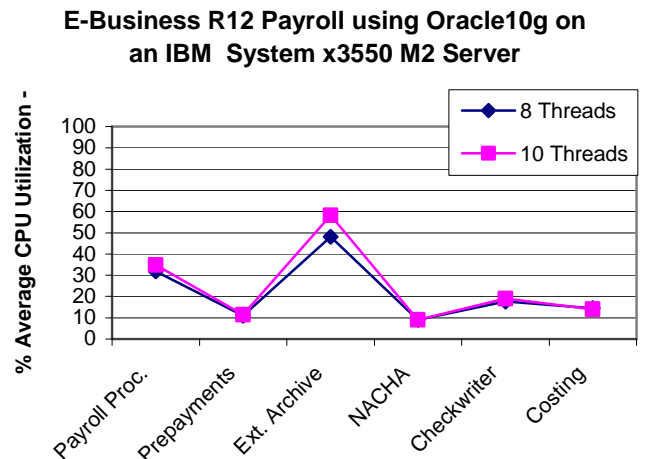


Figure 4: Average DB Server CPU Utilization

SERVER PERFORMANCE CONTINUED

Online Workload	% User	% System	% Idle	% I/O Wait
Payroll Processing	30.00	3.67	65.22	0.89
PrePayments	9.33	0.83	88.50	0.50
External Archive	52.60	4.73	41.80	0.93
NACHA	6	2	91	2
Checkwriter	17.33	1.33	81.00	0.33
Costing	10.00	3.00	86.00	1.50
Wall Clock Avg.	17.79	1.83	79.81	0.51

Table 4: Average Server CPU Utilization (10 Threads)

Online Workload	% User	% System	% Idle	% I/O Wait
Payroll Processing	27.00	3.89	68.22	0.89
PrePayments	9.50	1.00	89.00	0.33
External Archive	44.00	3.80	51.87	0.20
NACHA	6	1	91	1
Checkwriter	15.67	1.33	82.33	0.00
Costing	11.00	2.75	85.50	0.75
Wall Clock Avg.	15.81	1.68	82.10	0.28

Table 5: Average Server CPU Utilization (8 Threads)

Average GB Used	DB/Mid-Tier Server
10 Threads	~8.7 GB
8 Threads	~8.7 GB

Table 6: Average Memory Utilization

DATA COMPOSITION DESCRIPTION

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

Application	Business Objects	Medium Model	
TCA	Organizations	616,207	
	Contacts	2,630,672	
	Contact Points	2,073,332	
	Accounts	609,422	
	Account Sites	610,152	
	Account Site Uses	1,065,726	
	Contracts	Contracts	0
	Install Base	Instances	278,494
		Trackable Items	5
HR	Managers	400	
	Employees	10,000	
	Payroll Users	10,000	
	Users	10,000	
		Credit Card Entries	2,500,055
		Supplier(s)	5,000
	Assets	Asset Categories	984
	General Ledger	GL Code Combinations	93,417
	Sales & Marketing	Resources	9,021
Resource Groups		820	
		Sales Leads	1,217,062
		Campaigns	1
	Sales Territories	8,200	

Table 6: Data Composition

PATCHES

The following patches were applied to the benchmark environment on top of Oracle E-Business Applications R12 (RUP 4).

APPLICATION TUNING

Database:

1. R12 tuning through RUP 4 and handover of benchmark kit.

2. An index was added to per_time_periods as hr.per_time_periods(time_definition_id)

Gather 100% table stats for the following tables:

```
exec
fnd_stats.gather_table_stats('HR','PAY_ACTION_INFORMATION',100);
exec
fnd_stats.gather_table_stats('HR','PAY_ASSIGNMENT_ACTIONS',100);
exec
fnd_stats.gather_table_stats('HR','PAY_PAYROLL_ACTIONS',100);
exec
fnd_stats.gather_table_stats('HR','PAY_POPULATION_RANGES',100);
exec
fnd_stats.gather_table_stats('HR','PER_ALL_ASSIGNMENTS_F',100);
exec
fnd_stats.gather_table_stats('HR','PER_TIME_PERIODS',100);
exec
fnd_stats.gather_table_stats('APPLSYS','FND_CURRENCIES',100);
exec
fnd_stats.gather_table_stats('HR','PAY_RUN_RESULTS',100);
exec
fnd_stats.gather_table_stats('HR','PAY_RUN_RESULT_VALUES',100);
```

Gather 100% index stats for the following indexes:

```
exec dbms_stats.gather_index_stats(ownname =>
'HR',indname => 'PAY_ACTION_INFORMATION_N2',
estimate_percent => 100);
exec dbms_stats.gather_index_stats(ownname =>
'HR',indname => 'PAY_ACTION_INTERLOCKS_PK',
estimate_percent => 100);
exec dbms_stats.gather_index_stats(ownname =>
'HR',indname => 'PAY_ACTION_INTERLOCKS_FK2',
estimate_percent => 100);
exec dbms_stats.gather_index_stats(ownname =>
'HR',indname => 'PAY_ASSIGNMENT_ACTIONS_PK',
estimate_percent => 100);
exec dbms_stats.gather_index_stats(ownname =>
'HR',indname => 'PAY_ASSIGNMENT_ACTIONS_N50',
estimate_percent => 100);
exec dbms_stats.gather_index_stats(ownname =>
'HR',indname => 'PAY_ASSIGNMENT_ACTIONS_N51',
estimate_percent => 100);
```

```
exec dbms_stats.gather_index_stats(ownname =>
'HR',indname => 'PAY_ELEMENT_ENTRIES_F_PK',
estimate_percent => 100);
exec dbms_stats.gather_index_stats(ownname =>
'HR',indname => 'PAY_ELEMENT_LINKS_F_PK',
estimate_percent => 100);
exec dbms_stats.gather_index_stats(ownname =>
'HR',indname => 'PAY_ELEMENT_TYPES_F_PK',
estimate_percent => 100);
exec dbms_stats.gather_index_stats(ownname =>
'HR',indname => 'PAY_PAYROLL_ACTIONS_PK',
estimate_percent => 100);
exec dbms_stats.gather_index_stats(ownname =>
'HR',indname => 'PAY_RUN_RESULTS_N50',
estimate_percent => 100);
```

Pinning the following parameters may also help in Payroll:

```
exec dbms_shared_pool.keep('APPS.FFP51704_01010001');
exec dbms_shared_pool.keep('APPS.FFP1893_01010001');
exec dbms_shared_pool.keep('APPS.FND_DATE');
exec dbms_shared_pool.keep('APPS.FND_NUMBER');
exec dbms_shared_pool.keep('APPS.HR_COST');
exec
dbms_shared_pool.keep('APPS.HR_NONRUN_ASACT');
exec dbms_shared_pool.keep('APPS.HR_PRE_PAY');
exec dbms_shared_pool.keep('APPS.PAY_ARCHIVE');
exec dbms_shared_pool.keep('APPS.PAY_CORE_UTILS');
exec
dbms_shared_pool.keep('APPS.PAY_CC_PROCESS_UTILIS');
exec
dbms_shared_pool.keep('APPS.PAY_INTERPRETER_PKG');
exec dbms_shared_pool.keep('APPS.PAY_RETRO_PKG');
exec
dbms_shared_pool.keep('APPS.PAY_US_ACTION_ARCH');
exec
dbms_shared_pool.keep('APPS.PAY_US_NACHA_TAPE');
```

OPERATING SYSTEM TUNING

DATABASE OPERATING SYSTEM TUNING

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

```
kernel.shmmni = 4096
kernel.sem = 250 32000 100 128
fs.file-max = 327679
net.ipv4.ip_local_port_range = 1024 65500
net.core.rmem_default = 419304
net.core.rmem_max = 4194304
net.core.wmem_default = 262144
net.core.wmem_max = 262144
net.ipv4.tcp_wmem = 262144 262144 262144
net.ipv4.tcp_rmem = 4194304 4194304 4194304
kernel.msgmax = 65536
kernel.msgmnb = 65535
kernel.msgmni = 2878
```

```
vm.nr_hugepages=8192
```

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

```
oracle soft nproc 131072
oracle hard nproc 131072
oracle soft nofile 131072
oracle hard nofile 131072
```

```
oracle hard memlock 16777216
oracle soft memlock 16777216
```

3. Hugepages was enabled for the database instance

BENCHMARK ENVIRONMENT

HARDWARE CONFIGURATION

An IBM System x3550 M2 (7946-AC1) server was used for the Database server and Application/Web server. It was equipped with the following:

- 2 × 2.93 GHz Intel Xeon Four-Core 5500 processors (8 cores total), each with 32 KB of Level 1 cache, 256 KB of Level 2 cache and 8 MB of Level 3 cache
- Total Memory: 64 GB
- Network: Gigabit full duplex.
- Operating system: Red Hat Enterprise Linux 5
- For more details on the IBM x3550 M2, please visit <http://www-03.ibm.com/systems/x/hardware/rack/x3550m2/index.html>
- Storage: Storage: DS4700 with a total of 48 × 145 GB 15K RPM fibre-channel disks.
- For more details on DS4700, please visit <http://www.ibm.com/servers/storage/disk/ds4000/ds4700/index.html>

SOFTWARE VERSIONS

Oracle's E-Business Suite (E-Business Suite Kit) R12 (RUP 4)

Oracle 10g™ 10.2.0.3 (64-bit)

Red Hat Enterprise Linux 5 update 3 (64-bit) (on the server)

Note: Oracle accepts that the results obtained using Redhat Enterprise Linux 5 very closely approximates results that may be obtained if Oracle Enterprise Linux 5 update 3 were used in this test.

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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