E-BUSINESS SUITE APPLICATIONS R12 (RUP 4) PAYROLL (BATCH) BENCHMARK - USING ORACLE10*g* ON AN IBM BladeCenter JS22 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 4-core server.

Batch Workload			
10,000 Employees	**Threads**	**Time (Min)**	**Hourly Employee Throughput**
Payroll Processing	8	0.82	734,694
Prepayments	8	0.30	2,000,000
External Archive	8	2.37	253,521
NACHA	8	0.05	12,000,000
Checkwriter	8	0.30	2,000,000
Costing	8	0.18	3,272,727
Totals:		4.02	149,378
Parent Proc. Total		4.98	120,401
Wall Clock Duration*		~5.8	102,857

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 towards the "Totals:" value.

BENCHMARK PROFILE

In August 2008, Oracle and IBM conducted a benchmark in Beaverton, OR 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 Oracle10*g*™ database (10.2.0.3) for the AIX® operating system on an IBM® BladeCenter® JS22 (POWER6™) server configured with two dual-core processors (4-cores total), running AIX® 6.1 TL01 (64-bit) OS. A single IBM System Storage™ DS4800 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 IBM BladeCenter servers running AIX.**

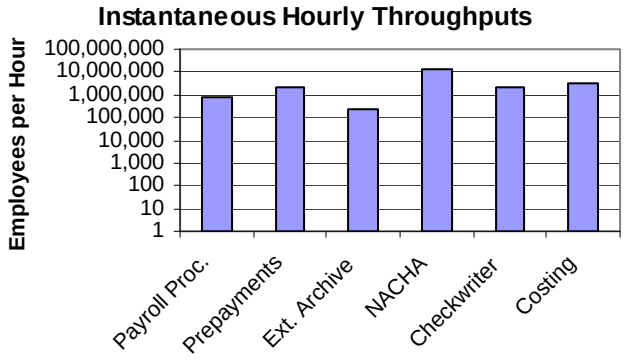

Figure 1: Oracle E-Business Payroll Batch Throughputs

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.

	BladeCenter JS22 App Server 4-core 32 GB 13% Utilized
	BladeCenter JS22 DB Server 4-core 32 GB 62% Utilized
	DS4800 System Storage 5 Drawers – Data 1 Drawer – Logs 1% Utilized

Figure 2: 3-Tier Configuration

This benchmark was run as a "Physical" 3-Tier configuration with discrete machines 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	Pro-C
PrePayments	8	Pro-C
External Archive Process	8	Pro-C & PL/SQL
NACHA	8	Pro-C
Check Writer	8	Pro-C & Oracle Report Writer
Costing	8	Pro-C

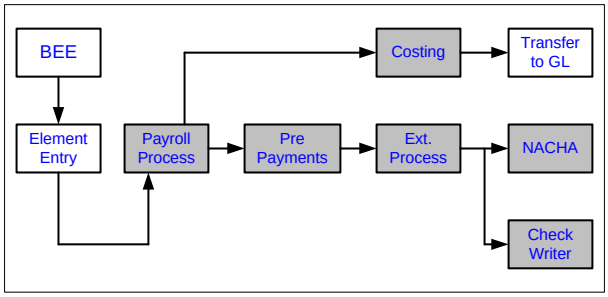

Figure 3: Payroll Process Flow

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. 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 (4 cores total).

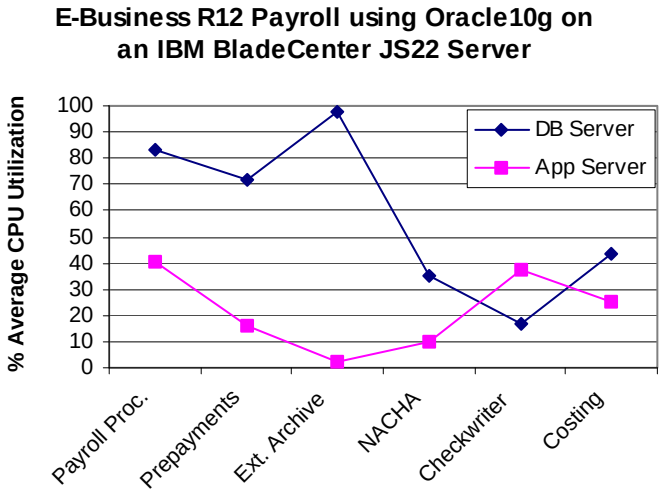

Figure 4: Average DB Server CPU Utilization

Online Workload		% User	% System	% Idle	% I/O Wait
Payroll Processing		73.60	9.80	16.60	0.30
Prepayments		66.25	5.75	28.00	0.00
External Archive		93.89	3.96	2.14	0.00
NACHA		33.00	2.00	65.00	0.00
Checkwriter		15.25	1.00	83.50	0.00
Costing		33.33	9.67	56.67	0.00
Wall Clock Avg.		58.07	4.30	37.49	0.00

Table 3: Average DB Server CPU Utilization Breakout

Utilization in the Application/Web server was low in this batch benchmark and is omitted from this report.

Average GB Used	App Server	DB Server
	4.9 GB	15.4 GB

Table 4: Average Memory Utilization

I/O PERFORMANCE

A DS4800 storage system equipped with six disk drawers was used for storage. The batch workload requires optimal I/O performance.

I/O Performance		Payroll
preads/Sec	Avg	0.74
	Peak	2
pwrites/Sec	Avg	57.2
	Peak	269
R+W/Sec	Avg	56.8
	Peak	268
Kbs/Sec	Avg	2,055.8
	Peak	5,326
Avg Service Time (ms)	Avg	0.89
	Peak	2.7

Table 5: 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	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.

Gather 100% table stats for the following tables:

```
exec
fnd_stats.gather_table_stats('HR','PAY_ACTION_INFORM
ATION',100);
exec
fnd_stats.gather_table_stats('HR','PAY_ASSIGNMENT_AC
TIONS',100);
exec
fnd_stats.gather_table_stats('HR','PAY_PAYROLL_ACTIO
NS',100);
exec
fnd_stats.gather_table_stats('HR','PAY_POPULATION_RA
NGES',100);
exec
fnd_stats.gather_table_stats('HR','PER_ALL_ASSIGNMEN
TS_F',100);
exec
fnd_stats.gather_table_stats('HR','PER_TIME_PERIODS',10
0);
exec
fnd_stats.gather_table_stats('APPLSYS','FND_CURRENCI
ES',100);
exec
fnd_stats.gather_table_stats('HR','PAY_RUN_RESULTS',10
0);
exec
fnd_stats.gather_table_stats('HR','PAY_RUN_RESULT_VA
LUES',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_UTIL
S');
exec
dbms_shared_pool.keep('APPS.PAY_INTERPRETER_PK
G');
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

AIX TUNING

AIX 6.1 Operating System Tuning in Network:
no -p -o tcp_sendspace=262144
no -p -o tcp_recvspace=262144
no -p -o udp_sendspace=65536
no -p -o udp_recvspace=262144
no -p -o rfc1323=1
no -r -o ipqmaxlen=512
no -p -o tcp_nagle_limit=1
no -p -o tcp_nodelayack=1

Sendmail:
Disable sendmail:
chrctcp -d sendmail

Time Zone:
chtz PST8PDT

AIX TUNING CONTINUED

RAS disable:
ctctrl -P memtraceoff
errctrl -P errcheckoff
raso -r -o mtrc_enabled=0
bosboot -ad /dev/ipdevice

Storage Key disable:
skeyctl -k off
bosboot -ad /dev/ipdevice

Large Page enable for 6GB:
vmo -p -o v_pinshm=1
vmo -p -o maxpin%=90
vmo -p -o lgpg_regions=384 -o lgpg_size=16777216
bosboot -ad /dev/ipldevice
Oracle init.ora: lock_sga=true

Multipage enable:
cd $ORACLE_HOME/bin
export
LDR_CNTRL=DATAPSIZE=64K@TEXTPSIZE=64K@S
TACKPSIZE=64K oracle

Daemons comment out in /etc/inittab:
eg. mkatmpvc, atmsvcd, rcnfs, nimsh, cron, nimclient,
qdaemon, writesrv, uprintfd, naudio2, naudio,
rcwpars, logsymp, diagd, xmdaily, ctrmc, pconsole

Default hard values adjustment in /etc/security/limits for DB, APP users:
eg. fsize = -1
data = -1
rss = -1
stack = -1
nofiles = -1
stack_hard = -1
data_hard = -1

Maximum number of processes adjustment:
eg. smitty
System Environments
Change/Show Characteristics of Operating System:
update Maximum number of PROCESSES allowed
per_user [99999]

BENCHMARK ENVIRONMENT

HARDWARE CONFIGURATION

An IBM BladeCenter JS22 server was used for the database server. It was equipped with the following:

- 4-Core 4.0 GHz with IBM POWER6 two dual-core processor chips (SMT-enabled), each with L2 Cache of 4 MB per core.
- Total Memory: 32 GB
- Network: Gigabit full duplex.
- Operating system: IBM AIX 6.1 6100-01-02-0834
- For more details on IBM BladeCenter, please visit http://www.ibm.com/systems/bladecenter/hardware/servers/js22e/index.html
- Storage: DS4800 with 6 arrays of 467 GB each (Total 2.6 Terabytes.). Each array has 14 physical disks --- RAID 0, two controllers - one exclusively for redo logs.
- For more details on IBM TotalStorage DS4800, please visit http://www.ibm.com/servers/storage/disk/ds4000/ds4800/index.html

An IBM BladeCenter JS22 server was used for the application/web server. It was equipped with the following:

- 4-Core 4.0 GHz with IBM POWER6 two dual-core processor chips (SMT-disabled), each with L2 Cache of 4 MB per core.
- Total Memory: 32 GB
- Network: Gigabit full duplex.
- Operating system: IBM AIX 6.1 6100-01-02-0834
- For more details on IBM BladeCenter, please visit For more details on IBM BladeCenter, please visit http://www.ibm.com/systems/bladecenter/hardware/servers/js22e/index.html
-

SOFTWARE VERSIONS

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

Oracle10*g*™ 10.2.0.3 (64-bit)

IBM AIX 6.1 with the 6100-01-02-0834 Technology Level (on the database and Application /Web/CM servers)

Java version "1.5.0"
Java™ 2 Runtime Environment, Standard Edition (build pap32devifx-20071025a (SR6b))
IBM J9 VM (build 2.3, J2RE 1.5.0 IBM J9 2.3

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

Oracle
Applications Performance & Benchmarks
500 Oracle Parkway
Redwood Shores, California 94065
Tel 650/506-7000
Fax 650/506-7000
Email eBSkit_us@oracle.com
World Wide Web http://www.oracle.com

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INFO SIZING