E-BUSINESS SUITE APPLICATIONS R12 (RUP 4) PAYROLL (BATCH) BENCHMARK - USING ORACLE10*g* 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			
10,000 Employees	**Threads**	**Time (Min)**	**Hourly Employee Throughput**
Payroll Processing	12	0.32	1,875,000
PrePayments	12	0.10	6,000,000
External Archive	12	0.97	618,556
NACHA	12	0.02	30,000,000
Checkwriter	12	0.17	3,529,411
Costing	12	0.05	12,000,000
Totals:		1.63	368,098
Parent Proc. Total		3.13	191,693
Wall Clock Duration*		3.17	189,274

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 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 Oracle10*g*™ 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 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 a Cisco UCS server running Oracle Enterprise Linux or Red Hat Enterprise Linux 5.5.**
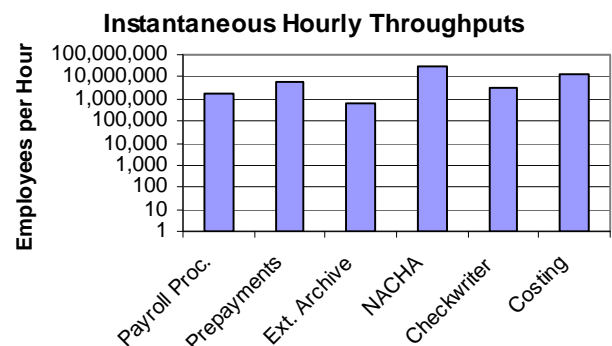

Instantaneous Hourly Throughputs

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.

	UCS B200 M2
	DB Server/ App Server
	12-core
	48 GB Memory
	22% Utilized
	CX4 240 Disk Array
	System Storage
	75 Disks Drives (Data and Logs)
	1% Utilized

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

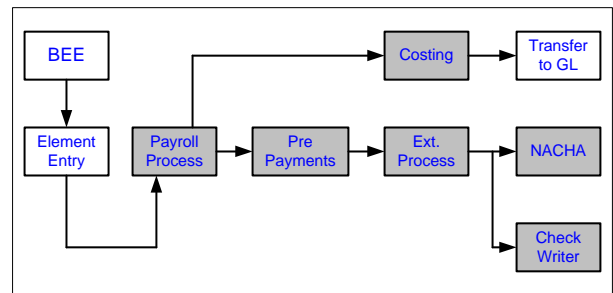| Business Process	Number of Threads Used	Process Type
Payroll Process	12	Pro-C
PrePayments	12	Pro-C
External Archive Process	12	Pro-C & PL/SQL
NACHA	12	Pro-C
Check Writer	12	Pro-C & Oracle Report Writer
Costing	12	Pro-C

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

10,000 employees were processed in this test. Table 2 shows the processing time in minutes.

Batch Workload			
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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).
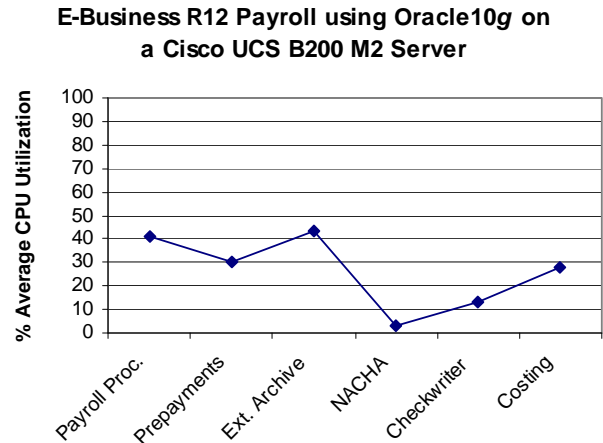

E-Business R12 Payroll using Oracle10*g* on a Cisco UCS B200 M2 Server

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	37.72	2.93	0.31	59.05
PrePayments	18.65	1.50	0.31	79.54
External Archive	42.12	1.15	0.15	56.58
NACHA	2.72	0.18	0.38	96.73
Checkwriter	12.06	0.79	0.18	86.97
Costing	23.18	4.35	0.61	71.86
Wall Clock Avg.	20.82	1.02	0.15	78.00

Table 3: Average Server CPU Utilization

Average GB Used	DB Server
12-Threads	17.98 GB

Table 4: 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		12-Thread
Transfers/Sec	Avg	4.82
	Peak	601.6
Writes/Sec	Avg	4.81
	Peak	601.6
Reads/Sec	Avg	0.01
	Peak	2.0
Avg Service Time (ms)	Avg	0.24
	Peak	30.0

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
Items		
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).

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 = 327679
  kernel.core_uses_pid = 1
  kernel.sem = 250 32000 100 128
  kernel.shmall = 8388608
  kernel.shmmax = 34359738368
  kernel.shmmni = 4096
  kernel.msgmax = 65536
  kernel.msgmnb = 65535
  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=8192
```

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

```
  * hard nofile 131072
  * soft nofile 131072
  * hard nproc 131072
  * soft nproc 131072
  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 (~18.4 GB 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 393 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   **R**eal **A**pplications **C**lusters

ORACLE®

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