

E-BUSINESS SUITE APPLICATIONS R12 (RUP 4) ORDER-TO-CASH (BATCH) BENCHMARK - USING ORACLE10g ON A HEWLETT-PACKARD PROLIANT DL380 G5 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				
50,000 Lines	Order/Inv.	Threads	Time (Min)	Hourly Order Line Throughput
HVOP		8	2.73	1,098,901
Pick Release		8	11.35	264,317
Interface Trip Stop		8	1.32	2,272,727
Inventory		8	3.63	826,446
Auto Invoice		8	4.2	714,286
Revenue Recognition		8	1.35	2,222,222
Accounting		8	3.17	946,372
Totals:			27.75	108,108
Wall Clock Duration*			~41.6	72,115

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 Hewlett-Packard conducted a benchmark in Corona, 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 Hewlett-Packard® ProLiant® DL380 G5 server configured with two quad-core processors (8-cores total), running Oracle® Enterprise Linux® release 4.0 Update 4. A single HP StorageWorks EVA6100 disk array was used for storage.

The benchmark measured the Order Management 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 HP ProLiant servers running Oracle Enterprise Linux.**

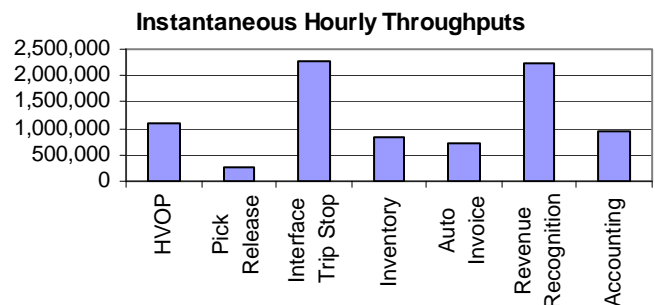


Figure 1: Oracle E-Business Order-to-Cash Batch Throughputs

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.

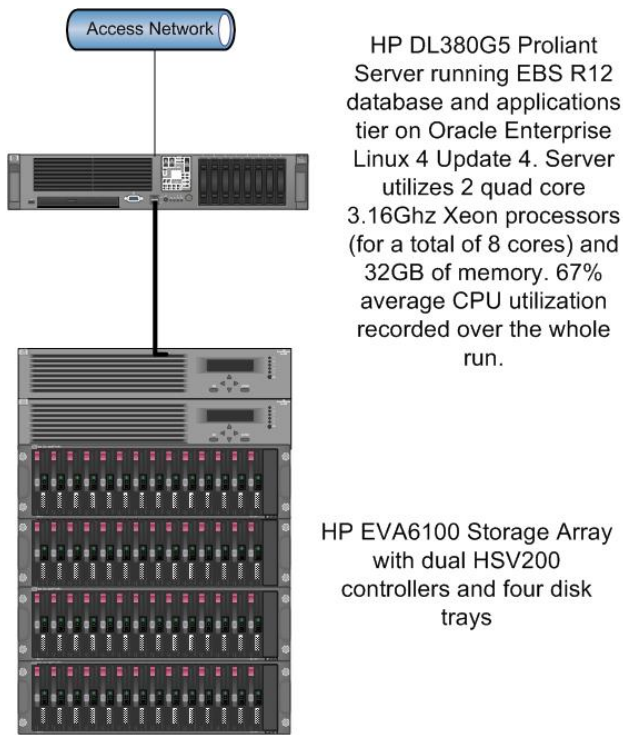


Figure 2: 2-Tier Configuration

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 seven metered processes.

Batch Order-to-Cash Processes

Business Process	Number of Threads Used
HVOP	8
Pick Release	8
Interface Trip Stop	8
Inventory	8
Auto Invoice	8
Revenue Recognition	8
Accounting Processes	8

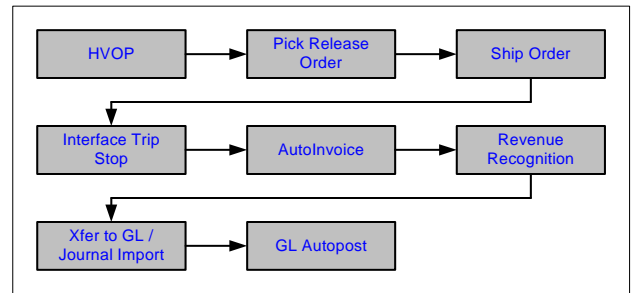


Figure 3: Order-to-Cash Process Flow

High Volume Order Processing (HVOP): The HVOP program processes orders by reading the rows from the Order Management Interface tables and converting the interface records into permanent order headers and their respective order lines. The orders are then booked and advanced to the shipping state.

Pick Release (and Ship Confirm): Pick Release finds and releases the eligible delivery lines that meet the release criteria, and creates move orders. The process of transacting move orders creates a reservation and determines the inventory source sub-inventory.

Ship Confirm is the process of confirming that items have shipped. When a delivery is ship-confirmed, Shipping Execution confirms that the delivery lines associated with the delivery have shipped.

Batch Order-to-Cash Processes Continued

Interface Trip Stop: The deliveries created in the previous step are then assigned to trips, which may involve multiple stops depending upon the shipping addresses of the deliveries. SRS has been modified to accept Organization code as a parameter and process the trip stops for the specified organization. Interface Trip Stop - SRS has also been enhanced to spawn multiple child processes to process trip stops in parallel. The parameter Stops per Batch is used to specify the number of stops to be processed by each thread of the Interface Trip Stop - SRS. Interface Trip Stop - SRS has also been enhanced to defer the Inventory Interface processes. In the E-Business Suite kit, this profile is set to Yes so that the Inventory Interface transactions are processed in the background by the Inventory transaction manager.

INV Material: The material transaction manager is configured to execute material transaction by periodic concurrent request submissions and by direct submission of multiple transaction managers via the benchmark SQL script. The execution interval is set to 5 minutes.

Auto-Invoice: The Auto-Invoice process is used to import invoices, credit memos, debit memos, and on-account credits. 'Receivables' ensures that the data imported is accurate and valid.

Revenue Recognition: Revenue Recognition program generates the revenue distribution records for the invoices and credit memos that use Invoicing and Accounting Rules. Accounting rules were assigned to recognize revenue over a 12-month accounting period. The Revenue Recognition program will create distribution records for the invoices and credit memos that are created in Receivables and imported using Auto-Invoice.

Transfer to General Ledger & Journal Import: The General Ledger Interface program transfers Receivables transaction accounting distributions to the general ledger interface table (GL_INTERFACE) and creates either detailed or summarized journal batches. "Receivables" creates un-posted journal entries in general ledger and executes Journal Import from Oracle General Ledger. It posts journal batches in Oracle General Ledger to update account balances.

General Ledger Auto-post: This posts journal batches to update the account balances of the detail and summary accounts. It can post actual budget or encumbrance journal batches.

BENCHMARK RESULTS

Batch Business Metrics	Achieved Output
Order to Cash	
Number of Order Lines Created/Booked	50,000
Number of Order Lines Picked	50,000
Number of Order Lines Ship Confirmed	50,000
Number of Order lines Interface Trip Stopped	50,000
Number of Invoice Headers Created	50,000
Number of Invoice Lines Created	100,000

Table 1: Batch Transactions Completed

50,000 order lines were processed in this test. Table 2 shows the processing time in minutes.

Batch Workload				
50,000 Lines	Order/Inv.	Threads	Time (Min)	Hourly Order Line Throughput
		8	2.73	1,098,901
		8	11.35	264,317
		8	1.32	2,272,727
		8	3.63	826,446
		8	4.2	714,286
		8	1.35	2,222,222
		8	3.17	946,372
			27.75	108,108
			-41.6	72,115

Table 2: Order-to-Cash 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 combined Database, App/Web and CM server. The value shown is the average across the processors (8 cores total).

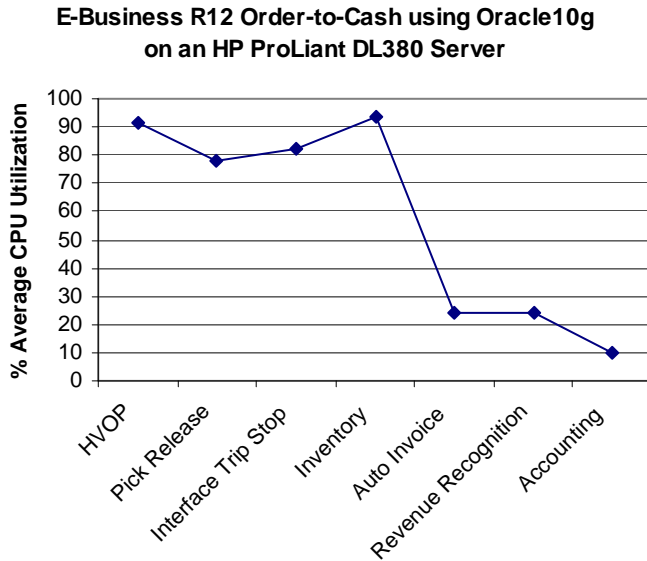


Figure 4: Average CPU Utilization

Online Workload	% User	% System	% I/O Wait	% Idle
HVOP	86.06	4.47	1.19	8.27
Pick Release	75.54	1.73	0.68	22.05
Interface Trip Stop	77.86	3.06	1.56	17.53
Inventory	91.83	1.59	0.47	6.10
Auto Invoice	21.76	0.60	1.72	75.92
Revenue Recognition	21.72	0.88	1.20	76.19
Accounting	7.81	0.46	1.77	89.97
Wall Clock Avg.	63.96	1.54	0.88	33.61

Table 3: Average CPU Utilization Breakout

Average GB Used	O-to-C
DB Server	31.9 GB

Table 4: Average Memory Utilization

The Oracle Enterprise Linux operating system ensured that all of the available memory was used throughout this test for either application memory requirements or system buffering and caching.

I/O PERFORMANCE

An EVA6100 storage system equipped with four disk trays was used for storage. The batch workload requires optimal I/O performance.

I/O Performance		Order-to-Cash
Writes/Sec	Avg	383
	Peak	1,237.1
Reads/Sec	Avg	18.85
	Peak	336.5
Write KB/Sec	Avg	15,244
	Peak	63,929
Read KB/Sec	Avg	515
	Peak	18,973
Avg Service Time (ms)	Avg	0.81
	Peak	7.86

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
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).

Patch for Bug 7142581.

Patch for Bug causing Oracle error 04030

APPLICATION TUNING

Database:

1. R12 tuning through RUP 4 and handover of benchmark kit.
2. The index wsh.wsh_delivery_details_n8 was dropped
3. The index wsh_pr_workers (NVL(INVENTORY_ITEM_ID,-99)) was created
4. SQL Advisor was used to optimize the execution plan for two statements in O2C batch
5. The index GL_PERIOD_STATUSES (application_id , set_of_books_id , adjustment_period_flag) was created
6. Decreased the poll interval and worker wait time for the Revenue Recognition and Accounting job steps
7. The index wsh.wsh_pr_workers(delivery_id) was created

Pick Release:

R12 Pick Release's multi-threading is by default. We no longer submit multiple Pick Release "Master program", however, we submit Pick Release with the number of threads, Parent Pick Release will spawn multiple child Pick Release processes.

In R12, with some setup modifications, Pick Release then spawns multiple Pick Release processes that replaced the Auto-deliveries Process.

Also in R12, Pick Release automatically submits Ship Confirm program.

The following has been done to enable the new behavior of Pick Release:

All Category assignments were linked to one Item Category "IC1" and to one rule EBS_Release_rule1.

Code to submit Auto-deliveries and Ship Confirm was removed from submit_O2C.sql

Apply the following setup changes:

APPLICATION TUNING CONTINUED

Pick Release Continued:

Setup changes:

For the new behavior for O2C for R12, apply the following setup changes:

- 1) Pick the Responsibility: Order Management Super User, Vision Operations (USA).
- 2) Navigate to Shipping > Setup > Shipping Parameters > select "V1"
- 3) go to the Pick Release tab and ensure "Print Pick Slip" is set to "At the End"
- 4) Navigate to Shipping > Setup > Picking > Define Pick Slip Grouping Rules
- 5) Ensure under Rule Name "Order Number", it shows "Group by" set to "Order Number".
- 6) Navigate to Shipping > Setup > Picking > Define Release Rules Form
- 7) Search for Rule "EBS_release_rule1"
 - a) go to the Inventory tab. Under Pick Slip Grouping Rule, select "Order Number".
 - b) go to the Shipping tab. set 'Autocreate Deliveries' to Yes.
 - c) go to the Shipping tab. set 'Auto Pick Confirm' to Yes.
 - d) go to the Shipping tab. set 'Ship Confirm Rule' to 'Auto Ship'.

ITS:

Modifications to enable multi-threading for ITS:

Change Stops per batch to 1 (done in submit_O2C.sql). Set the 'Autocreate Delivery Criteria' value to 'Within Order' for release rule 'EBS_Release_Rule1'.

This will ensure that one delivery is created for each order. Hence, if you run a test case with 50 orders, then 50 deliveries/stops will be created and you can see the effect of running ITS program with multiple threads and also enhance performance considerably.

Process Transactions process:

Process Transactions process is run now with multiple threads, which are submitted from submit_O2C.sql after ITS.

Workflow background process:

Workflow background process is run now with multiple threads, which are submitted from submit_O2C.sql after Process Transactions (Inventory workers) are done processing the lines. This reduced the time spent closing the lines.

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.semmsl = 256 32000 100 142
kernel.shmall = 8388608
kernel.shmmax = 34359738368
kernel.shmmni = 4096
kernel.msgmax = 8192
kernel.msgmnb = 65535
kernel.msgmni = 2878
fs.file-max = 65536
net.ipv4.ip_local_port_range = 1024 65000
net.core.rmem_default = 262144
net.core.rmem_max = 262144
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 65535
* soft nofile 4096
* hard nproc 16384
* soft nproc 2047
* hard memlock 33554432
* soft memlock 33554432
```

3. Hugepages were enabled for the database instance

4. The following options were added to /etc/resolv.conf
options attempts:5
options timeout:15

BENCHMARK ENVIRONMENT

HARDWARE CONFIGURATION

A Hewlett-Packard® ProLiant® DL380 G5 server was used for the database server and application server. It was equipped with the following:

- 2 × 3.16 GHz Intel® Xeon™ Quad-Core X5460 processors (8 cores total), each socket with 12 MB cache
- 32 Gigabytes of Memory
- 8 × 72 GB internal disk drives attached to an embedded HP SmartArray P400i Controller
- 1 × HP StorageWorks EVA6100 disk array was attached to a single Emulex® Zephyr-X LightPulse® Fibre Channel Controller for data and logs
- 3.98 TB raw disk space available for allocation. (56 × 146 GB)
- Approximately 452 GB of VRAID1 storage configured for this benchmark (data and logs)

SOFTWARE VERSIONS

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

Oracle10g™ 10.2.0.3 (64-bit)

Oracle Enterprise Linux release 4.0 Update 4 (on the database 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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