

E-BUSINESS SUITE APPLICATIONS R12 (R12.1.3) (OLTP) BENCHMARK - USING ORACLE DATABASE 11g ON ORACLE'S M7 SERVER RUNNING SOLARIS 11

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 OLTP benchmark test was run on a 128-core server.

Online Workload		
Number of Users	Average Response (Sec)	90 th Percentile Response Time (Sec)
2,500 Users Order Man.	0.77	1.12
2,700 Users iProcure.	0.97	1.33
(Search)	(0.71)	(1.21)
7,000 Users Cust. Service	0.83	0.95
5,000 Users HR Self-Serv.	0.58	1.72
(Search)	(0.54)	(1.18)
2,800 Users Financials	0.11	0.13
(Search)	(0.30)	(0.34)
Net Weighted Averages	0.70	1.13
(Search)	(0.51)	(0.87)

Many factors can influence performance and your results may differ. Notes times are Save/Update or (Search).

BENCHMARK PROFILE

In September 2015 Oracle conducted a benchmark in Burlington MA to measure the online (OLTP) performance of five Oracle E-Business business flows in an environment running Oracle E-Business Suite R12 (12.1.3) using the Oracle Database 11g with Oracle Solaris 11.3 operating system (OS) on an Oracle's SPARC M7 server, configured as four environments. Moreover, four of Oracle's ZFS Storage ZS3-2 appliances with Flash were used for data storage (~1800 GB).

The benchmark measured the Order to Cash, iProcurement, Customer Service, HR Self-Service and Financials OLTP business process response times for an 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 online response times for the Oracle E-Business Suite R12 Benchmark, using Oracle's SPARC servers running Oracle Solaris 11 OS in a server-virtualization configuration.**

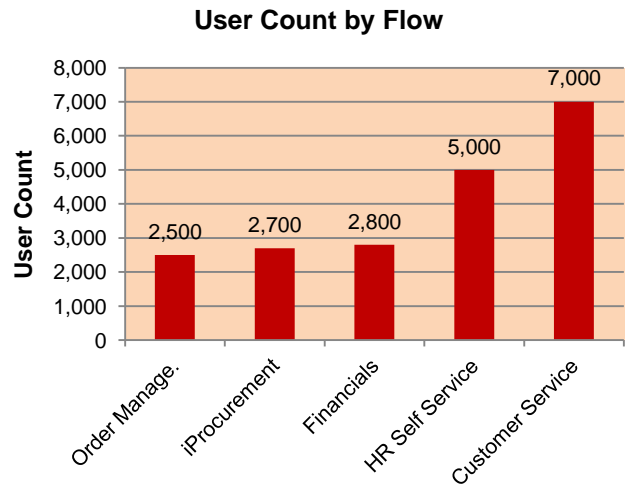


Figure 1: Oracle E-Business Suite Benchmark Concurrent User Distribution

BENCHMARK METHODOLOGY

E-Business Suite 12 Benchmark 12.1.3 online processes can be initiated from a browser. For this benchmark, all runs used a browser to initiate the on-line user transactions.

Oracle® OATS® was used as the load driver, simulating concurrent users. It submitted transactions at an average rate of one every 75 to 800 seconds for each concurrent user.

Measurements were recorded on all of the servers when the user load was attained and the environment reached a steady state. Note that the measured response times may be shorter than a live user would experience as client and browser latency is not simulated by this load test system.

Figure 2 shows the configuration used for this benchmark run. Figure 3 shows the logical domains and E-Business Suite environments.



	<p>½ SPARC M7-8</p> <p>4 App/Web Servers 4 DB Servers 4-CPU, 128-core (1024 Processors) ~28% Avg. CPU</p> <p>2 TB Memory ~90.9% Utilized</p>
	<p>4 x Oracle ZFS Storage ZS3-2 Appliances with Flash Arrays and RAID-0 Arrays for Storage</p> <p>2 x Sun Server X4-2L Servers with Flash Arrays and RAID-0 Arrays for Redo</p>

Figure 2: 3-Tier Configuration

This benchmark was run as a “Physical” 3-Tier configuration with discrete machine zones hosting the Database and Application/Web server instances on their respective OS images.

The complete E-Business Suite benchmark consists of a mix of on-line transactions and batch processes running in parallel. This test utilized five flows of OLTP transactions. The following table describes the on-line transactions included in the benchmark run.

Oracle Application Product Flow	Users	Pacing in Sec
Order to Cash	(2,500)	
Create & Book Order	800	135
Pick Release	375	75
Ship Confirm / ITS	350	90
Receivables - Invoice	325	95
AR Customer Summary	325	360
OM Order Summary Report	325	720
iProcurement	(2,700)	
SS Create & Query Req.	540	135
Create Approve PO	486	160
View Purchase Order	432	170
Create Payables Invoice	432	170
View Payables Invoice	405	180
PO Report	405	720
Customer Service	(7,000)	
Create Service Request	3,010	200
Update Service Request	2,800	230
Close Service Request	1,190	235
HR Self-Service	(5,000)	
Cash Expenses	1,000	330
Credit Expenses	1,000	330
Submit Time Card	1,500	330
View Payslip	1,500	330
Financials	(2,800)	
AR View Cust. Transaction	400	420
FA Create & Query Asset	400	420
GL Journal Entry	400	420
INV View Item Attributes	400	420
INV Insert Misc. Transactions	400	420
AR Aging Report	400	800
Min/Max Inventory Report	400	800
	20,000	

Table 1: Online Transaction Mix

Note that the user counts and pacing intervals have been tuned to maximize the **achieved hourly transaction rate**.

Order to Cash OLTP Processes

Create & Book Order: The user navigates to the “Orders” page, enters customer information and creates a 5-line order. Finally, the user clicks on “Book Order” to enter the completed order. The response time is to ‘save’ the entry.

Pick Release: The user navigates to the “Shipping/Release Sales Orders” page and enters the order number and clicks on “Execute Now.” Finally, the user clicks on “OK” to acknowledge that “Pick Release Only” has completed. The response time is to ‘save’ the entry.

Ship Confirm: The user navigates to the “Shipping/Transactions” page and enters “From Order Number” and “To Order Number” before clicking on “Find.” Finally, the user clicks through the confirmation steps and then clicks on “OK” to acknowledge that “ship Confirm” has completed. The response time is to ‘save’ the entry.

Receivables – Insert Invoice: The user navigates to the “Transactions/Transactions” page and enters Source, Reference Number, and Line Item information. After entering 5 items, the user save the form. The response time is to ‘save’ the entry.

iProcurement OLTP Processes

Create & Query Requisition: The user navigates to the “iProcurement” page, enters an Item Name to search for. The item is added to the Shopping Cart along with four more. The user clicks on “Checkout.” The user steps through the approval details and submits the requisition for Auto Approval. Finally, the user clicks on “Requisitions” to search for the requisition. The response time is to ‘search’ for the requisition.

Create & Approve Purchase Order: The user navigates to the “AutoCreate” page and clicks through the AutoCreate process. The user enters a supplier and clicks on “Create.” Finally, the user clicks on “Approve” to complete the PO creation. The response time is to ‘save’ the entry.

View Purchase Order: The user navigates to the “Purchase Order/Purchase Order Summary” page and enters a PO number to search for. Finally, the user clicks through the Order Header and Order Lines forms. The response time is to ‘search’ each category.

Create Payables Invoice: The user navigates to the “Invoices/Entry/Invoices” page and enters the PO Number, Invoice Number, and Invoice Amount information. After saving that form, the user proceeds through the Distributions steps and saves the form. The response time is to ‘save’ the form.

View Payables Invoice: The user navigates to the “Invoices/Inquiry/Invoice Overview” page and enters the Invoice Number, then clicks on “Find.” Proceed through the “Invoice Overview” and “Invoices” forms. The response time is to ‘search’ each category.

Customer Service OLTP Processes

Create Service Request: The user navigates to the “Customer Management” page, enters customer information and the issue owner’s name. The user selects an Instance number and enters the Problem Code. Then they enter the Tracking Summary and Notes. Finally, the user clicks on “SAVE” to enter the completed request. The response time is to ‘save’ the entry.

Update Service Request: The user navigates to the “Service Requests” page and searches open requests for the specified customer. They enter a Note and change the status of the request. Finally, the user clicks on “SAVE” to enter the updated request. The response time is to ‘save’ the entry.

Close Service Request: The user navigates to the “Service Requests” page and clicks on the first request listed. Finally, the user clicks on “Close Request” to close out this request. The response time is to ‘save’ the entry.

HR Self-Service OLTP Processes

Cash Expenses: The user navigates to the “Expenses Home” and enters various travel and lodging expenses including airfare, car rental, hotel, entertainment, meals, etc. Finally, the user clicks on “Submit” to enter the completed expense report. The response time is to ‘save’ the entry.

Credit Card Expenses: The user navigates to the “Expenses Home” and enters various travel and lodging expenses including airfare, car rental, hotel, entertainment, meals, etc. Finally, the user clicks on “Submit” to enter the completed expense report. The response time is to ‘save’ the entry.

Create Timecard: The user navigates to the “Create Timecard” button and enters information about their project, the type(s) of tasks undertaken and the hours spent. Finally, the user clicks on “Submit” to enter the completed time card. The response time is to ‘save’ the entry.

View Payslip: The user navigates to the “Employee Self-Service” page and clicks on ‘Payslip.’ The response time is for the ‘retrieval’ of the search.

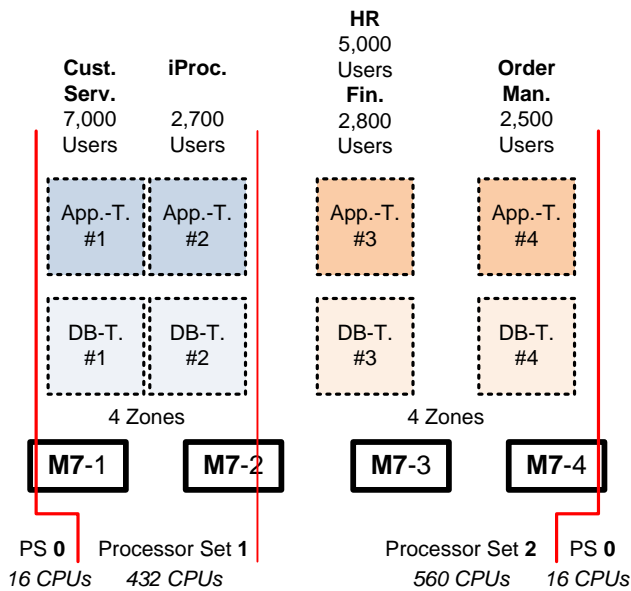


Figure 3: Benchmark Configuration (Logical Domain with 2 'Processor Sets' Providing 8 'Zones' & 1 'Processor Set' Handling Network Interrupts)

BENCHMARK RESULTS

Online Business Metrics	Achieved Output
Number of Order Lines Created	73,700
Number of Invoice Lines Created	217,000
Number of Order Summary Reports	725
Fixed Assets Created	3,200
GL Journal Entries	31,000
Inventory Transactions	15,400
Number of Requisitions Created	7,300
Number of Purchase Orders Created	35,900
Number of PO Invoices Created	6,500
Number of Service Requests Created	40,600
Number of Service Requests Closed	18,500
Number of Cash Expenses Created	6,800
Number of Credit Expenses Created	6,800
Number of Timecards Created	11,500

Table 2: Online Transactions Completed (20,000 Users)

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.

	20,000 Users	
	Avg. (Sec)	90 th (Sec)
Order to Cash		
Insert Order	1.993	2.654
Pick Release	0.069	0.076
Ship Confirm	0.126	0.138
Insert Manual Invoice	1.621	2.696
OM Order Summary Report	0.049	0.051
iProcurement		
SS_Req_Submit_Data_SAVE	1.37	1.959
CREATE_APPROVE_PO-SAVE	1.009	1.084
Create_Payables_invoice_Submit	0.531	0.949
VIEW_PAYABLES_INVOICE_Find	0.286	0.754
VIEW_PAYABLES_INVOICE_Details	0.364	0.845
VIEW_PURCHASE_ORDER_Find	0.818	1.531
VIEW_PURCHASE_ORDER_Schedule_Search	1.354	1.721
Customer Service		
Create Service Request	0.646	0.733
Update Service Request	0.653	0.734
Close Service Request	1.2	1.374
HR Self-Service		
Submit Cash Exp.	0.639	1
Submit Credit Card Expense	0.641	1.164
Submit Project Timecard	0.472	2.9862
View Emp. Payslip Search	0.544	1.182
Financials		
AR View Cust. Transaction Tab	0.019	0.02
AR View Cust. Trans. Credit	1.292	1.425
FA Create Assets Save	0.14	0.162
FA Create Assets Inquiry	0.112	0.124
GL Journal Entry Save	0.217	0.246
GL Journal Entry Find	0.002	0.002
Inv. View Item Attributes Find	0.098	0.11
Inv. View Item Attributes Save	0.036	0.043
Inventory Insert Misc.	0.05	0.06
Weighted Average Saves	0.701	1.133
Weighted Avg. Searches	0.508	0.869
Transactions/min	~4,470	

Table 3: Detailed Online Transaction Response Times

The transaction rate is estimated by summing the transaction rates from each business flow's Application Test Suite (ATS) report for the steady-state period.

SERVER PERFORMANCE

Figure 4 shows the Steady-State CPU for each logical processor set.

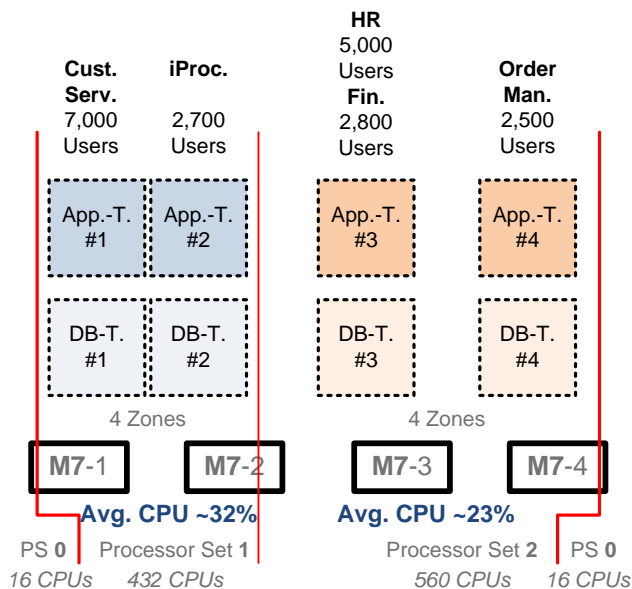


Figure 4: Average CPU Utilization by Processor Set

Each server scaled smoothly as users were added, keeping the load fairly constant over the steady state period.

Processor Sets	% User	% System	% Idle
Processor Set 1 (Customer Service & iProcurement)	26.48	5.48	68.24
Processor Set 2 (HR, Financials & Order Management)	19.57	3.00	77.48
Processor Set 0 (Network Interrupts)	0	25.57	74.14

Table 4: Average CPU Utilization Breakout

Total Memory Used By:	20,000 Users
LDOM1	90.9% of 2 TB (~1848 GB)

Table 5: Average Memory Utilization Breakout

I/O PERFORMANCE

Four Oracle ZFS Storage ZS3-2 Appliances were used for data storage. Two X4-2L storage arrays were used for redo logs. The workload requires optimal I/O performance.

I/O Performance		CS	iProc	HR Fin	OM
Writes/Sec	Avg	405	227	227	801
	Peak	1,142	549	758	1,157
Reads/Sec	Avg	75	53	4	27
	Peak	237	207	154	179
KB Written/Sec	Avg	5,815	3,432	3,480	10,010
	Peak	14,757	7,439	10,874	13,892
KB Read/Sec	Avg	619	559	48	330
	Peak	2,920	2,802	2,107	2,549
Avg Service Time (ms)	Avg	2.3	5.6	4.6	4.3
	Peak	3.2	7.6	6.8	6

Table 6: I/O Utilization (Data)

I/O Performance		CS	iProc	HR Fin	OM
Writes/Sec	Avg	947	992	1,270	766
	Peak	1,140	1,483	1,584	1,162
KB Written/Sec	Avg	8,178	5,508	5,188	11,235
	Peak	10,296	8,293	7,127	14,254
Avg Service Time (ms)	Avg	0.2	0.2	0.2	0.4
	Peak	0.3	0.4	0.3	3.4

Table 7: I/O Utilization (Redo)

DATA COMPOSITION DESCRIPTION

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

Application	Business Objects	Extra-Large Model
TCA	Organizations	1,100,000
	Contacts	4,900,000
	Contact Points	3,700,000
	Accounts	1,100,000
	Account Sites	1,090,000
	Account Site Uses	2,180,000
	Contracts	Contracts
Install Base	Instances	1,300,000
	Trackable Items	5
HR	Managers	800
	Employees	250,000
	Payroll Users	250,000
	Users	20,000
	Credit Card Entries	4,000,000
	Supplier(s)	10,000
Assets	Asset Categories	984
General Ledger	GL Code Combos	93,417

Table 8: Data Composition

PATCHES

The following patches were applied to the benchmark environment on top of Oracle E-Business Applications R12 (12.1.2 and 12.1.3).

DB-tier patches:

Patch 13366268 : ID: 14394336
 Patch 13258936 : ID: 14465000
 Patch 13004894 : ID: 14182829
 Patch 13001379 : ID: 14706905.1
 Patch 12985184 : ID: 14321186
 Patch 12960302 : ID: 14254252
 Patch 12942119 : ID: 14210496
 Patch 9858539 : ID: 14308099
 Patch 4247037 : ID: 14211388

Mid-tier patches:

Installed Patch List:

- 1) Patch 8300196
- 2) Patch 5651245
- 3) Patch 7329300
- 4) Patch 7580744
- 5) Patch 7379122
- 6) Patch 7121788
- 7) Patch 6400501
- 8) Patch 5394728
- 9) Patch 3559326
- 10) Patch 7140405
- 11) Patch 7281456
- 12) Patch 7195389
- 13) Patch 7016961
- 14) Patch 4526825
- 15) Patch 4407272
- 16) Patch 6857221
- 17) Patch 7229760
- 18) Patch 12647406
- 19) Patch 13487351

TUNING

```
Drop index applsys.wf_notifications_n1;
create index applsys.wf_notifications_n1 on applsys.wf_notifications
(recipient_role, status, message_type);
```

```
exec dbms_utility.analyze_schema('APPLSYS','ESTIMATE',
estimate_percent=> 25);
exec fnd_stats.gather_table_stats('APPLSYS','WF_ITEMS',
PERCENT=>100);
exec fnd_stats.gather_table_stats('APPLSYS','WF_NOTIFICATIONS',
PERCENT=>35);
```

```
Delete aso.aso_order_feedback_t;
alter table aso.aso_order_feedback_t move;
exec
fnd_stats.gather_table_stats('ASO','ASO_ORDER_FEEDBACK_T');
```

```
Drop index hr.pay_element_entry_values_f_n50;
create index hr.pay_element_entry_values_f_n50 on
hr.pay_element_entry_values_f
(element_entry_id,effective_start_date,effective_end_date,screen_entry
_value);
```

```
update pay_action_parameter_values
set parameter_value = 30
where parameter_name = 'CHUNK_SIZE' ;
```

```
exec fnd_stats.gather_table_stats
('APPLSYS','FND_CURRENCIES',100,cascade=>TRUE);
exec fnd_stats.gather_schema_stats (schemaname =>
'HR',estimate_percent => 100,degree => 32);
```

```
update fnd_concurrent_programs
set enable_trace = 'N'
where enable_trace = 'Y' ;
```

```
alter table hr.pay_recorded_requests cache;
alter table hr.per_all_assignments_f cache;
```

```
select * from per_all_assignments_f where job_post_source_name =
'xxx';
select * from pay_recorded_requests where attribute20 = 'xxx';
```

```
update ap_credit_card_trxns_all
set report_header_id = null,
expensed_amount=10,
transaction_amount=10,
billed_amount=10,
billed_date = sysdate,
posted_date = sysdate,
transaction_date = sysdate;
```

```
update pa_projects set completion_date = completion_date+365;
update pa_tasks set completion_date = completion_date + 365;
commit;
```

```
update pa_projects_all
set completion_date = completion_date+365;
select project_id, name, segment1, completion_date from
pa_projects_all
where project_id = 2779;
commit;
update pa_tasks set completion_date = '30-DEC-12' where task_id in (
select task_id from pa_tasks a,pa_projects_all b where
a.project_id=b.project_id and b.completion_date = '30-DEC-12');
commit;
```

TUNING CONTINUED

```
Drop index inv.mtl_system_items_b_tn3;
create index inv.mtl_system_items_b_tn3 on inv.mtl_system_items_b
(organization_id, upper(segment1), customer_order_enabled_flag );
```

```
exec fnd_stats.gather_table_stats('APPLSYS','WF_ITEMS',
PERCENT=>100);
```

```
Delete po.po_requisition_headers_all where requisition_header_id
in (select h.requisition_header_id from
po.po_requisition_headers_all h, fnd_user u where h.preparer_id =
u.employee_id and h.active_shopping_cart_flag = 'Y');
delete po.po_req_distributions_all where requisition_line_id in
(select requisition_line_id from po.po_requisition_lines_all where
requisition_header_id in
(select h.requisition_header_id from
po.po_requisition_headers_all h, fnd_user u where
h.preparer_id = u.employee_id and h.active_shopping_cart_flag = 'Y'));
delete po.po_requisition_lines_all where
requisition_header_id in
(select h.requisition_header_id from
po.po_requisition_headers_all h, fnd_user u where
h.preparer_id = u.employee_id and
h.active_shopping_cart_flag = 'Y');
commit;
```

```
Drop index hr.pay_action_information_N2 ;
create index hr.pay_action_information_n2 on
hr.pay_action_information(action_context_id, action_context_type,
action_information_category) parallel nologging ;
alter index hr.pay_action_information_n2 noparallel logging ;
```

```
Drop index hr.pay_action_information_n5 ;
create index hr.pay_action_information_n5 on
hr.pay_action_information (assignment_id,effective_date,
action_information_category,action_context_id,action_information16)
parallel nologging;
alter index hr.pay_action_information_n5 noparallel logging ;
```

```
Drop index hr.pay_legislative_field_info_n1 ;
create index hr.pay_legislative_field_info_n1 on
hr.pay_legislative_field_info ( field_name,legislation_code,rule_type) ;
```

```
exec
fnd_STATS.load_histogram_cols('INSERT',801,'PAY_ACTION_INF
ORMATION','EFFECTIVE_DATE');
exec
fnd_STATS.load_histogram_cols('INSERT',801,'PAY_ACTION_INF
ORMATION','ACTION_CONTEXT_TYPE');
exec
fnd_STATS.load_histogram_cols('INSERT',801,'PAY_ACTION_INF
ORMATION','ACTION_INFORMATION_CATEGORY');
exec
fnd_stats.gather_table_stats('HR','PAY_ACTION_INFORMATION',P
ERCENT=>35);
```

```
analyze index hr.pay_action_information_n2 compute statistics;
analyze index hr.pay_action_information_n5 compute statistics;
analyze index hr.pay_legislative_field_info_n1 compute statistics;
```

BENCHMARK ENVIRONMENT

HARDWARE CONFIGURATION

DATABASE/APPLICATION SERVERS

A single SPARC M7-8 server was divided into two logical domains. One domain was utilized for this test. The domain was divided into 3 processor sets, two of which hosted four E-Business Suite environments, each with a database server and mid-tier server. It was equipped with the following:

- 4 × 4.13 GHz SPARC™ M7 Thirty-Two Core processors each with 16 Kilobytes of Instruction and 16 Kilobytes of Data Level-1 on core cache, 128 Kilobytes of shared Instruction and Data Level-2 cache per core, and 48 Megabytes of Level-3 on-chip cache (128 cores total – 1024 vcpus/threads)
- 2048 Gigabytes of Memory (~1850 GB used at peak load) for E-Business Suite LDom
- 2 × Sun Storage Dual 16Gbps FC PCIe HBA
- 2 × Sun Dual 10GBase-T Gen2 PCIe Adapters
- 2 × Oracle Flash Accelerator F160 PCIe Card [1.6 TB NVMe] Mirrored

Four Oracle ZFS Storage ZS3-2 Appliances were used for storage. The storage servers were equipped with the following:

- 2 × 900 GB SAS-2 HDD
- 2 × Read Flash Accelerator SSD 1.6 TB SAS
- 2 × DE2-24P Storage Drive Enclosures with Write Flash Accelerators 68.4 GB SSD + 20 × 900 GB 10K RPM SAS-2 HDD

Two Sun Server X4-2L 2RU were used for redo log files.

- 2 × 2.6 GHz Intel Xeon E5-2650 v2 Eight-Core processors
- 128 Gigabytes of Memory
- 4 × 400 GB SSDs
- 14 × 600 GB HDDs

LOAD DRIVER SERVER(S)

Four of Oracle's X3-2 servers were used as OATS controllers. They were equipped with the following:

- 2 × 2.9 GHz Intel Xeon E5-2690 Eight-Core processors, each with 2 × 6 Megabytes of Level-2 on-chip cache (16 cores total)
- 128 Gigabytes of Memory

Two of Oracle's X4-2 server modules were used as load drivers (OATS 'Agents'). They were equipped with the following:

- 2 × 3.0 GHz Intel Xeon E5-2630 Eight-Core processors, each with 6 Megabytes of Level-3 cache (16 cores total)
- 128 Gigabytes of Memory

Two of Oracle's X5-2L server modules were used as load drivers (OATS 'Agents'). They were equipped with the following:

- 2 × 2.4 GHz Intel Xeon E5-2630 v3 Eight-Core processors, each with 30 Megabytes of Level-3 cache (16 cores total)
- 512 Gigabytes of Memory

SOFTWARE VERSIONS

Oracle's E-Business Suite (E-Business Suite Kit) R12.1.3

Oracle11g 11.2.0.3.0 (64-bit)

Oracle Solaris 11.3 on the database servers

Oracle Solaris 11.3 on the app/web servers

Oracle Enterprise Linux 6.4 (64-bit) on the OATS controller and drivers

Oracle® Application Test Suite 12.4.0.2 Build 129 (OATS)

Glossary and Acronyms:

ATP	Available to Promise
BEE	Batch Element Entries
HVOP	High Volume Order Processing
LDom	Logical Domain
OASB	Oracle Applications Standard Benchmark
OATS	Oracle Application Test Suite
OLTP	On Line Transaction Processing
RAC	Real Applications Clusters

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>

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

E-Business R12 OLTP Five Flows
September 2015
Audit Approved October 20, 2015

Oracle Corporation
World Headquarters
500 Oracle Parkway
Redwood Shores, CA 94065
U.S.A.

Worldwide Inquiries:
Phone: +1.650.506.7000
Fax: +1.650.506.7200

oracle.com



Oracle is committed to developing practices and products that help protect the environment

Copyright © 2015, Oracle and/or its affiliates. All rights reserved. This document is provided for information purposes only and the contents hereof are subject to change without notice. This document is not warranted to be error-free, nor subject to any other warranties or conditions, whether expressed orally or implied in law, including implied warranties and conditions of merchantability or fitness for a particular purpose. We specifically disclaim any liability with respect to this document and no contractual obligations are formed either directly or indirectly by this document. This document may not be reproduced or transmitted in any form or by any means, electronic or mechanical, for any purpose, without our prior written permission.

Oracle and Java are registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners.

AMD, Opteron, the AMD logo, and the AMD Opteron logo are trademarks or registered trademarks of Advanced Micro Devices. Intel and Intel Xeon are trademarks or registered trademarks of Intel Corporation. All SPARC trademarks are used under license and are trademarks or registered trademarks of SPARC International, Inc. UNIX is a registered trademark licensed through X/Open Company, Ltd. 1010

Hardware and Software, Engineered to Work Together