JD EDWARDS ENTERPRISEONE APPLICATIONS 9.1 UPDATE 2 AND TOOLS 9.1.4.4 DAY-IN-THE-LIFE BENCHMARK - USING ORACLE DATABASE 11G CONSOLIDATED ON AN IBM POWER SYSTEMS S824 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.

This version of the JD Edwards EnterpriseOne "Day-in-the-Life" (DIL) benchmark kit is based on JD Edwards EnterpriseOne Applications 9.1 Update 2 and Tools release 9.1.4.4 and these results are not comparable with previous versions of JD Edwards EnterpriseOne, their respective Tools releases, or previous "Day-in-the-Life" benchmark kits.

SUMMARY OF RESULTS

This OLTP benchmark test was run on an IBM® Power System™ S824 with web, application and database tiers consolidated onto a single three-core logical partition (LPAR). This benchmark achieved 750 users per core based on the 2250 user run.

The IBM Power System S824 with a single 6 core chip was enabled with three 4.2 GHz POWER8™ cores (configured using Maximum Frequency Mode on standard 3.89 GHz cores) and used the following software: Oracle Database 11*g* R2 Standard Edition, JD Edwards EnterpriseOne Applications 9.1 Update 2 and Tools 9.1.4.4, and Oracle WebLogic Server 10.3.6. A series of JD Edwards EnterpriseOne software business processes were executed concurrently.

Number of Users	Response Time (Seconds)
100	0.066
500	0.098
1000	0.101
1000 With Mixed Batch	0.218
2000	0.167
2250	0.279

Table 1: Weighted Average Response Times

Many factors can influence performance and your results may differ.

BENCHMARK PROFILE

The goal of this benchmark was to obtain reference online response time and batch transaction rate for interactive users running concurrently. Additionally, the mixed batch workload measurement of UBE's (Universal Business Engine) per minute are recorded. Testing was conducted in a controlled environment with no other applications running. Finally, nine serially-executed batch UBE's are initiated and execution times were taken for understanding the performance of single batch results.
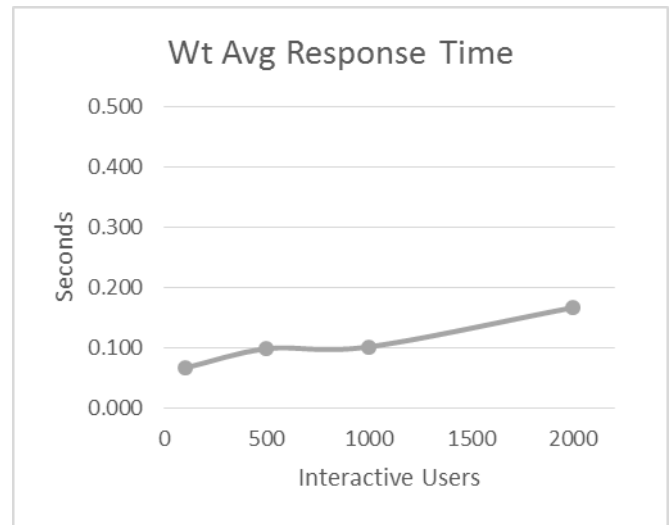
Figure 1: Weighted Average Response Times

The weighted average response time is based on a business mix of interactive test scripts (see Table 4 and Table 5) running concurrently as reflected in Table 1.

The CPU busy percentage for the Interactive Users runs are shown in Figure 2.
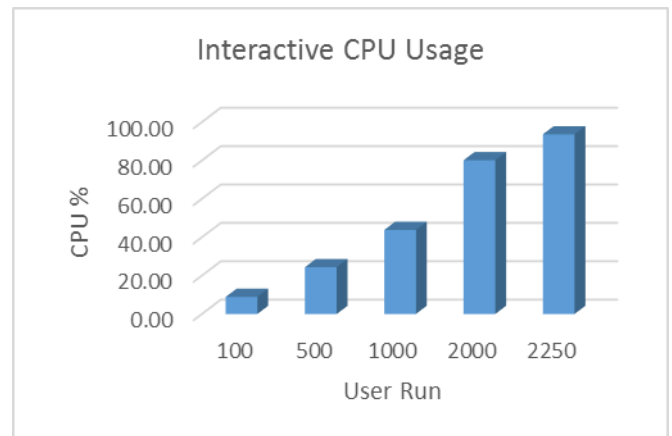
Figure 2: Average CPU Percentage per Interactive Run

BENCHMARK METHODOLOGY

The test machine topology consists of a Windows Server 2008 R2 system running Oracle Application Test Suite (OATS) delivering interactive user loads to the system under test — an IBM Power System S824 with the AIX Operating System. Disk storage is provided by the IBM FlashSystem® 840. A pre-defined mixture of OATS scripts brought users online, driving a sustaining load. A one-hour window of sustained load was captured as in Figure 3. OATS scheduled Ramp-up and Ramp-down actions are not considered in the statistics presented in this document.
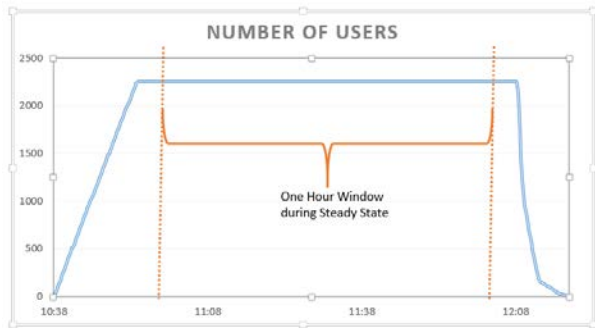
Figure 3: User Load over Time: One Hour Steady State

Figure 4 shows the hardware configuration used for the benchmark.

	IBM System x3690 X5 Xeon 8-Core 2.67 GHz 64GB Memory Oracle Application Test Suite (OATS)

	IBM Power System S824 POWER8 6-Core 3.89 GHz 256 GB Memory Oracle DB Server, JDE App Server, WebLogic Server
	IBM FlashSystem 840 Firmware Release 1.4.0.10 12 disk enclosure 9.37 TB Physical Flash Memory

Figure 4: Hardware Topology

This benchmark ran as a logical three-tier configuration with a single machine hosting the database, web server and application server instances on a three-core IBM AIX operating system LPAR.

The complete JD Edwards EnterpriseOne "Day-in-the-Life" (DIL) benchmark consists of a mix of on-line transactions and batch processes running in parallel. This test utilized a single flow of transactions. Table 2 describes the on-line transactions included in the benchmark, they are listed by JD Edwards EnterpriseOne application area.

Transaction Mix by Product Area	% Mix
Customer Relationship Management	5%
Financial Management Systems	20%
Human Capital Management	2%
Supplier Relationship Management	24%
Supply Chain Management	49%
	100%

Table 2: Online Transaction Mix

The complete JD Edwards EnterpriseOne "Day in the Life" Benchmark Kit contains 17 interactive scripts and 23 of the most commonly used batch processes. A listing of the EnterpriseOne interactive and batch processes used in this test are found in Table 4 and Table 5.

The 17 interactive scripts were executed by an Oracle Application Testing Suite (OATS) controller. Each of the

OATS scripts simulates a series of web interface actions including:
- Logging into JD Edwards EnterpriseOne application
- Performing a series of steps within the JD Edwards EnterpriseOne module
- Repeating these steps for a number of iterations
- Logging out of the JD Edwards EnterpriseOne application

The series of steps within the interactive scripts include data entry, inquiry, update, and confirmation operations similar to that of a typical customer.

The batch processes generate consistent load on the enterprise and database servers and can run from few minutes to hours. The characteristics of short and long running JD Edwards EnterpriseOne batch processes are different. The short-run batch processes generate PDF files of a few kilobytes and the database requests consist primarily of fetches. The long running UBEs tend to generate substantial load on the database server since they typically involve more complex SQL queries including inserts and updates. They generate PDF files of sizes ranging from kilobytes to gigabytes. The test runs typically last for one hour and some long running UBEs run for more than one hour before completion, representing further continuous load on database server.

Script Name	Description	Use Case (mm:ss)	Mix (%)
Customer Relationship Management			**5%**
H17500E	Case Management Add	10:32	5%
Financial Management Systems			**20%**
H03B102E	Apply Accounts Receivable Receipt	03:55	10%
H0411I	Supplier Ledger Inquiry	04:24	10%
Human Capital Management			2%
H051141E	Employee Daily Time Entry	10:32	2%
Supplier Relationship Management			**24%**
H4310E	Purchase Order Entry	05:13	20%
H4312U	Purchase Order Receipt	07:06	2%
H4314U	Voucher Match	08:34	2%
Supply Chain Management			**49%**
H42101E	Sales Order Entry	02:03	25%
H42101U	Sales Order Update	04:21	5%
H4915AU	Shipment Approval	04:29	3%
H4915CE	Shipment Confirmation	04:10	1%
H4915CU	Shipment Change and Confirmation	04:31	1%

Script Name	Description	Use Case (mm:ss)	Mix (%)
H4113E	Inventory Transfer	08:57	5%
H31114U	Work Order Completion	04:34	3%
H3411AE	MRP Messages for Work Orders	00:43	2%
H3411BE	MRP Messages for Purchase Orders	01:28	2%
H3411CE	MRP Messages for Transfer Orders	00:43	2%

Table 3: Interactive Processes

Table 3 lists the 17 interactive processes with several columns of interest. The use case column describes the average time the use case runs, prior to the next invocation of the same use case. For example, the use case column represents the typical time a call center worker would take to handle that use case. The Mix column describes what percentage of the total number of users were running during the workload simulation. For example, the H0411I script takes an average of 4 minutes and 24 seconds to execute and is 10% of the workload mix.

Batch Process	Description
R09801	General Ledger Post
R31410	Work Order Processing
R31802A	Manufacturing Accounting
R3483	MRP Processing
R42520	Print Pick Slips
R42565	Sales Order Invoicing
R42800	Sales Order Update
R43500	Purchase Order Print
R4981	Freight Update

Table 4: Long Running Batch Processes

Batch Process	Description
R0004P	UDC Record Types Report
R00067	Business Unit Translation Report
R0006P	Business Unit Report
R0008P	Date Patterns Report
R0010P	Company Constants Report
R0012P1	AAI Report
R0014	Payment Terms Report
R0018P	Tax Detail Report
R00425	Organization Structure Report
R01402W	Who's Who Report
R03B155	Open A/R Summary Analysis
R03B31	Activity Log Report
R41411	Select Items for Count
R42072	Price Categories Print

Table 5: Short Running Batch Processes

BENCHMARK RESULTS

Each interactive test case followed the same procedure; the database was restored, the system rebooted, the database, application and web services were started, the user load initiated, the system reached steady state and finally an hour of statistics were captured.

The average CPU usage and memory usage for the interactive runs along with the mixed interactive-batch runs are shown in Figure 5 and Figure 6. The figures also include the 1000 user with mixed batch load as well. The mixed batch load averaged *60 UBE's per minute* during the one hour workload.

In Figure 5 and Figure 6 the metrics are broken down by tier usage. For example, from Figure 5, during the 2000 user run the Oracle Database Tier consumed 4%, the Weblogic Tier consumed 27% and the JD Edwards EnterpriseOne Tier consumed 49% of CPU Usage.
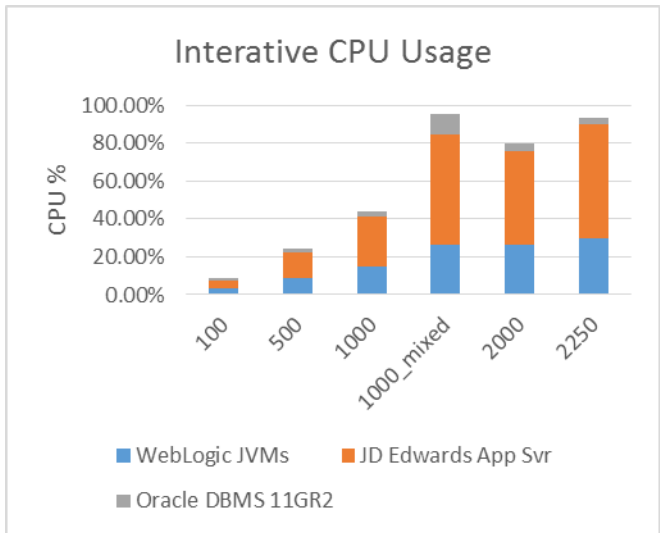

Figure 5: Average CPU Usage

From Figure 5, when comparing the 1000 run (43%) with the 1000_mixed batch run (80%), we see that the batch workload consumed roughly half of the CPU usage observed. The system configuration was identical for the two runs.
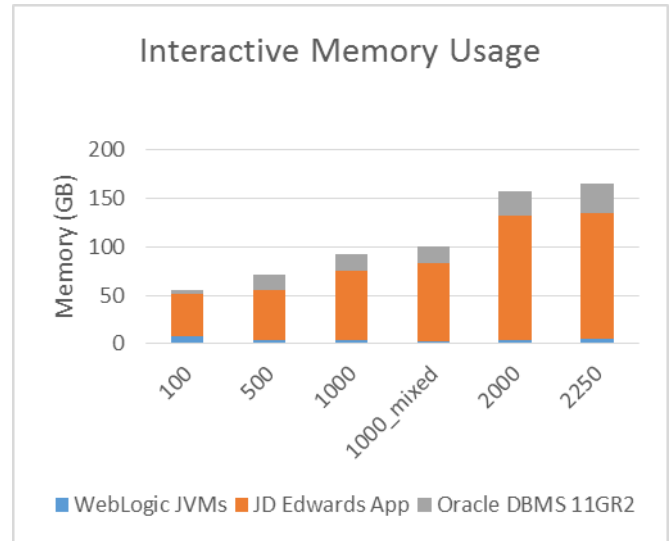

Figure 6: Average Memory Usage

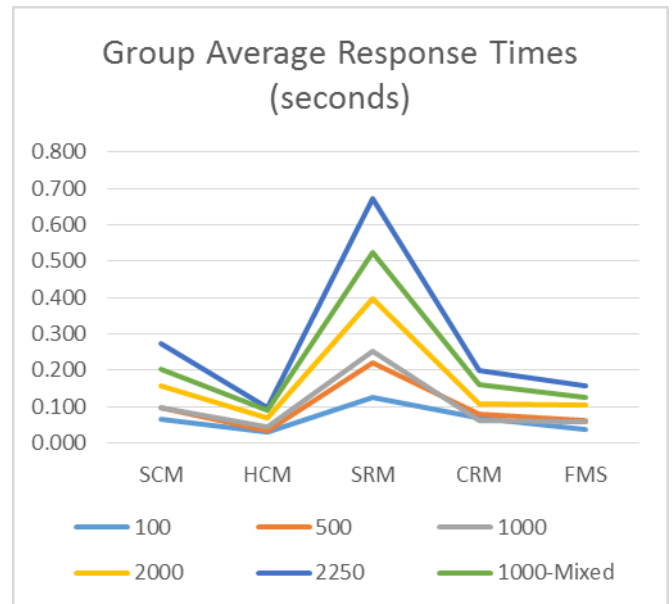Memory usage for the 1000_mixed batch run was slightly more than the 1000 user run as seen in Figure 6.

Figure 7: Detailed Online Transaction Response Times

A detailed weighted average response time for the five different application types, (HCM – Human Capital Management being one of them) can be seen in Figure 7. The *combined* weighted average response time, (where the five groups are combined into one number) is reported in Table 1.

Nine batch scripts were run in serial order to judge the ability of the hardware to handle single execution jobs. Some UBE batch scripts were run up to 10 times and the average taken. Others were run just once. The reported run times can be seen in Table 6. The total time of the averages listed in Table 6 is one hour 20 minutes and 57 seconds.

UBE Single Batch Runs	Average Time(s)
UBE R09801 (GL Post)	212
UBE R31410 (W.O. Processing)	1,028
UBE R31802A (MFG Acct Journal)	500
UBE R3483 (MRP Processing)	309
UBE R42520 (Print Pick Slips)	262
UBE R42565 (S.O. Invoicing)	428
UBE R42800 (S.O. Update)	492
UBE R43500 (P.O. Print)	1,337
UBE R4981 (Freight Update)	290

Table 6: Single Batch UBE Average Completion Times

I/O PERFORMANCE

The IBM FlashSystem 840 is data center-optimized to strategically harness the value of stored data. By providing extreme performance for the most demanding applications, including online-transaction processing and analytics databases, virtual desktop infrastructures, technical computing applications, and cloud environments, The IBM FlashSystem 840 delivers a competitive advantage for today's organizations. The FlashSystem 840 reduces response times with MicroLatency — that is, less than 135-microsecond access times. It is this consistent low latency that enables the FlashSystem 840 to deliver application performance improvements.

The database, redo-logs and rootvg volume groups for the entire set of machines consumed 1.5 TB of flash storage on the IBM FlashSystem 840. The database contained 30 tablespaces (See Table 7) and consumed 1170 GB of flash disk space.

TableSpace	USED(GB)	TableSpace	USED(GB)
DD910I	0.1	PRODDTAI	256.0
DD910T	0.4	PRODDTAT	921.6
OL910I	0.1	SVM910I	0.0
OL910T	0.3	SVM910T	0.0
PD910I	2.0	SY910I	0.2
PD910T	5.0	SY910T	0.3
PRODCTLI	1.0	SYSTEM	1.1
PRODCTLT	1.0	USERS	0.1

TableSpace	USED(GB)	TableSpace	USED(GB)
DD910I	0.1	PRODDTAI	256.0
DD910T	0.4	PRODDTAT	921.6
OL910I	0.1	SVM910I	0.0
OL910T	0.3	SVM910T	0.0
PD910I	2.0	SY910I	0.2
PD910T	5.0	SY910T	0.3
PRODCTLI	1.0	SYSTEM	1.1
PRODCTLT	1.0	USERS	0.1

Table 7: Tablespace Usage

The Oracle Database 11*g* R2 I/O statistics can be seen in Table 8, and is a 30-minute snapshot captured during the 2250 Interactive user run.

Filetype Name	Reads		Writes	
	Reqs per sec	Data per sec	Reqs per sec	Data per sec
Data File	72.73	.571M	86.36	2.51M
Log File	0	0M	229.54	1.946M
Control File	4.13	.065M	2.15	.033M
Temp File	1.3	.01M	1.63	.015M
Other	0	0M	0.01	0M
TOTAL:	78.17	.645M	319.68	4.505M

Table 8: AWR Breakout of I/O Statistics

PATCHES

The following patches were applied to the benchmark environment.

JD Edwards EnterpriseOne Application Release: 9.1
ESUs applied: Update 2

JD Edwards EnterpriseOne Tools Release: 9.1.4.4

Additional Patches:
- Oracle Database Client 11.2.0.4: Doc ID 2117443.1
- Weblogic V10.3.6: Doc ID 1616726.1

OPERATING SYSTEM TUNING

The following AIX commands with options configured the AIX system for best performance:

```
dscrctl -n -b -s 1
vmo -p -o vmm_default_pspa=100
no -p -o  tcp_nagle_limit=1
ctctrl -P -c all memtraceoff
skeyctl -k off
schedo -p -o proc_disk_stats=0
schedo -p -o n_idle_loop_vlopri=0
schedo -p -o smt_snooze_delay=1
```

DATABASE SERVER OPERATING SYSTEM TUNING

The Oracle Database 11*g* R2 configuration options are listed below:

```
filesystemio_options  = "SETALL"
sga_target = 20G
session_cached_cursors  = 1000
job_queue_processes = 1000
commit_wait  = "WAIT"
commit_logging  = "BATCH"
open_cursors   = 30000
parallel_adaptive_multi_user= FALSE
pga_aggregate_target  = 50G
_ash_size   = 300M
```

HTML SERVER OPERATING SYSTEM TUNING

The following java options were used within the Weblogic HTML servers:

```
-Xms4096m -Xmx4096m -Xgcthreads7 -Xdisableexplicitgc
-Xconcurrentlevel0 -Xjit:disableProfiling -Xlp -
DcloneId=VC01
```

BENCHMARK ENVIRONMENT

HARDWARE CONFIGURATION

ENTERPRISE SERVER

IBM Power System Model S824 8286-42A
- One 6-core 3.89 GHz POWER8 Processor Card
- Enabled Fixed Maximum Frequency mode enabled to get to 4.223 GHz core frequency
- 3 Active Cores. 3 Cores offline.
- Memory: 256GB
- Disk: See IBM FlashSystem 840
- Network: 2 - 100/1000 Base-TX PCIe2 Converged Network Adapter

FLASH MEMORY SERVER FOR STORAGE

IBM FlashSystem Model 840:

- Memory: 2 Canisters 8GB each
- 12 Disk Enclosures
- Disk: 9.37 TB of usable Flash Storage

LOAD DRIVER SERVER(S)

Model IBM System x3690 X5 – [7147AC1]
- CPU: Intel Xeon CPU E7-8837 @ 2.67 GHz
- Memory: 64 GB
- Disk: See IBM FlashSystem 840
- Network: 2 - 100/1000 Base-TX PCIe2 Converged Network Adapter
- Other: Windows Server 2008 R2 Enterprise

SOFTWARE VERSIONS

- AIX Operating System: 7100-03-03-1415 TL3.
- JD Edwards EnterpriseOne Applications [9.1] Update 2
- JD Edwards Tools [9.1.4.4]
- Oracle Weblogic Server 10.3.6
- Oracle Application Test Suite (OATS): 12.3.0.1.0 build 376
- Windows Server 2008 R2 Enterprise

GLOSSARY AND ACRONYMS:

DIL - Day in the Life (Refers to pre-build E1 database for load/stress testing)
E1 - JD Edwards EnterpriseOne (ERP Software)
JAS – Java Application Server
DB – Database
UBE – Universal Batch Engine.

LPAR - Logical partitions are equivalent to separate machine running its own AIX operating system.

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