White Paper

Oracle's JD Edwards EnterpriseOne with Microsoft SQL Server and Windows 2008 on the Cisco Unified Computing System

What You Will Learn

This document provides an overview of a performance benchmark of Oracle's JD Edwards EnterpriseOne (JDE E1) Enterprise Resource Planning (ERP) application suite optimized on Cisco Unified Computing System™ (Cisco UCS®). Oracle's JD Edwards suite has been available for many decades and has enabled organizations to streamline their back-end processes and improve management and ROI.

Cisco has invested considerable time and effort in testing, validating, and measuring the performance of Oracle's JDE E1 Release 9.0.2 with Oracle's JDE E1 Day in the Life (DIL) test kit. The benchmark test configuration included a Microsoft SQL Server 2008 R2 database deployed on Cisco UCS® B-Series Blade Servers using EMC® VNX5300™ as the storage platform.

The Cisco® JDE test environment was a three-tier deployment configured with JDE E1 Release 9.0 Update 2 and JDE E1 Tools Release 8.98.4.6 installed on the Microsoft Windows 2008 R2 operating system. The JDE HTML server and JDE E1 server were deployed on two separate Cisco UCS B200 M2 Blade Servers, and the Microsoft SQL Server database was deployed on a Cisco UCS B250 M2 Extended Memory Blade Server. The JDE enterprise batch server can be deployed either on the JDE E1 interactive server or as a separate batch server on the Cisco UCS B200 M2 server; configuring a JDE batch server on a separate server, ensures parallel processing of Universal Batch Engine (UBE) processes with large number of interactive users. All Cisco UCS blade servers were configured using SAN boot from an EMC VNX5300 storage device.

The benchmark test results demonstrated that Cisco UCS servers can easily scale to an impressive 7500 concurrent users, with an average response time of 0.23 seconds. Some of the important observations are listed here:

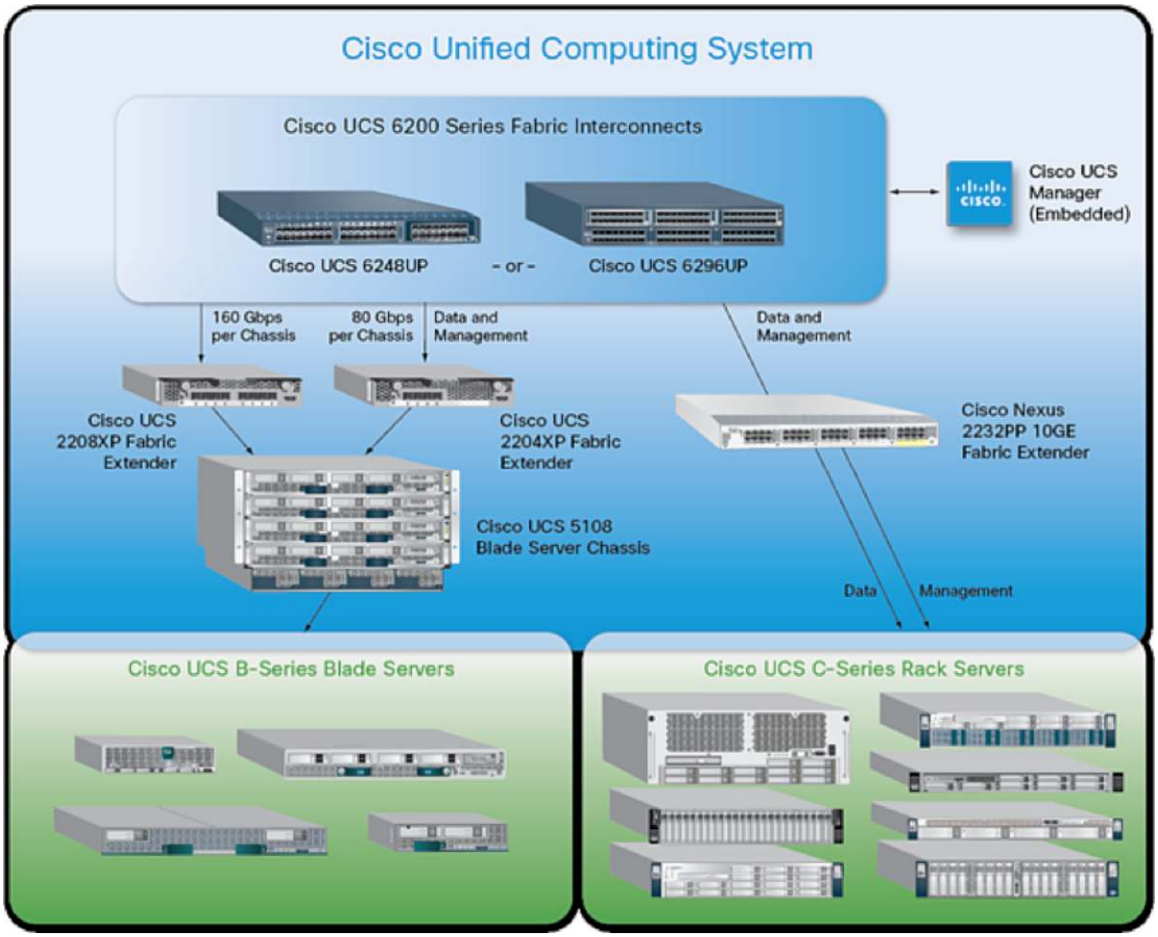
- The weighted average response time for 500 to 5000 concurrent users showed no substantial degradation and was less than 0.18 second.
- A single Cisco UCS server hosting the JD Edwards batch server can process a mix of long and short running UBE processes at a rate of approximately 546 UBE processes per minute with just 25 percent CPU utilization.
- A single JDE enterprise server deployed on Cisco UCS B200 M2 server, running both UBE processes and 1000 interactive users, scaled to 305 UBE processes per minute with an average response time of less than 0.2 second for interactive users.
- With isolation of JDE batch and interactive processes into two separate Cisco UCS B200 M2 servers, 5000 concurrent interactive users can be run along with a mix of short and long running UBE processes with a response time of less than 0.26 second and a batch rate of approximately 361 UBE processes per minute.

Introduction

Cisco UCS is a next-generation data center platform that unites computing, networking, storage access, and virtualization resources into a cohesive system designed to reduce total cost of ownership (TCO) and increase business agility through rapid application deployment. The Cisco UCS server portfolio consists of Cisco UCS B-Series Blade Servers and Cisco UCS C-Series Rack Servers. Cisco UCS B-Series Blade Servers integrate a low-latency; lossless 10 Gigabit Ethernet unified network fabric with enterprise-class x86-based servers. The system is an integrated, scalable, multi-chassis platform in which all resources participate in a unified management domain.

Cisco UCS innovations combine industry-standard, x86-architecture servers with networking and storage access into a single converged system (Figure 1). The system is entirely programmable using unified, model-based management to simplify and accelerate the deployment of enterprise-class applications and services running in bare-metal, virtualized, and cloud-computing environments. Cisco UCS helps organizations gain more than efficiency: it helps them become more effective through technologies that foster simplicity rather than complexity. The result is a flexible, agile, high-performance platform that reduces operating costs with increased uptime through automation and enables more rapid achievement of ROI.

Figure 1. Cisco UCS Is a Single Unified System



Oracle's JDE E1 is the ERP solution of choice for many small and medium-sized businesses (SMBs). JDE E1 offers an attractive combination of a large number of easy-to-deploy and easy-to-use ERP applications across multiple industries. These applications include Supply Chain Management (SCM), Human Capital Management (HCM), Supplier Relationship Management (SRM), Financial Management System (FMS), and Customer Relationship Management (CRM).

In the Cisco Oracle Competency Center, JDE E1 was deployed on Cisco UCS B250 M2 and B200 M2 Blade Servers, which provide exceptional performance for large-data-set workloads along with high memory capacity and throughput. The Cisco UCS B200 M2 is a 2-socket half-width blade server that supports up to 192 GB of physical memory and has a single converged network adapter (CNA) mezzanine slot for up to 20 Gbps of I/O throughput. Similarly designed, the Cisco UCS B250 M2 is a 2-socket full-width blade server that uses Cisco Extended Memory Technology; it supports up to 384 GB of double-data-rate type-3 (DDR3) memory and has two CNA mezzanine slots for up to 40 Gbps of I/O throughput. Each blade server supports two Intel Xeon processors 5600 series and two optional Small-Form-Factor (SFF) serial-attached Small Computer Systems Interface over IP (iSCSI) or solid-state (SAS and SSD) disk drives.

The Cisco Oracle Competency Center chose the EMC VNX5300 as the storage system for testing and validating the performance of Oracle's JDE E1 using the JDE DIL kit. The EMC VNXTM family of storage systems represents EMC's next generation of unified storage designed for high performance for enterprise applications such as JDE E1. The EMC VNX series has been explicitly designed to take advantage of the latest innovation in flash drive technology, increasing the storage system's performance and efficiency while reducing the cost per gigabyte.

The EMC VNX5300 offers support for block and file protocols, is designed for five-nines availability, is based on a fully redundant N+1 hardware design, and includes built-in features for supporting replication and disaster protection, all managed through the simple and intuitive EMC Unisphere™ management interface. EMC software also offers additional benefits that can be derived when using products such as the following:

- **EMC FAST Cache:** Dynamically absorbs unpredicted spikes in system workloads
- **EMC FAST VP:** Tiers data from high-performance to high-capacity drives in 1-GB increments, with fully automated storage tiering for virtual pools, resulting in overall lower costs, regardless of application type or data age
- **EMC FAST Suite:** Automatically optimizes for the highest system performance and the lowest storage cost simultaneously (includes EMC FAST VP and FAST Cache)
- **EMC PowerPath®:** Provides automated data-path management and load-balancing capabilities for heterogeneous server, networking, and storage resources deployed in physical and virtual environments (for additional information, see http://www.emc.com/collateral/software/data-sheet/l751-powerpath-ve-multipathing-ds.pdf)
- **EMC Unisphere™:** Delivers simplified management through a single management framework for all network-attached storage (NAS), SAN, and replication needs (for additional information, see http://www.emc.com/collateral/software/data-sheet/h7303-unisphere-ds.pdf)

The JDE E1 solution architecture is designed to run on multiple platforms and on multiple databases. In the test deployment, the JDE E1 Release 9.0.2 enterprise server was deployed on Microsoft Windows 2008 R2. The JDE E1 database was hosted on Microsoft SQL Server 2008 R2, and the JDE HTML server ran on Oracle WebLogic Server Release 10.3.5.

The JDE E1 DIL kit is a suite of 17 test scripts along with a set of JDE reports (UBE processes) that exercise representative transactions of the most popular JDE E1 applications, including SCM, SRM, HCM, CRM, and FMS. This complex mixture of applications simulates core workloads and closely reflects customer environments.

Test Environment

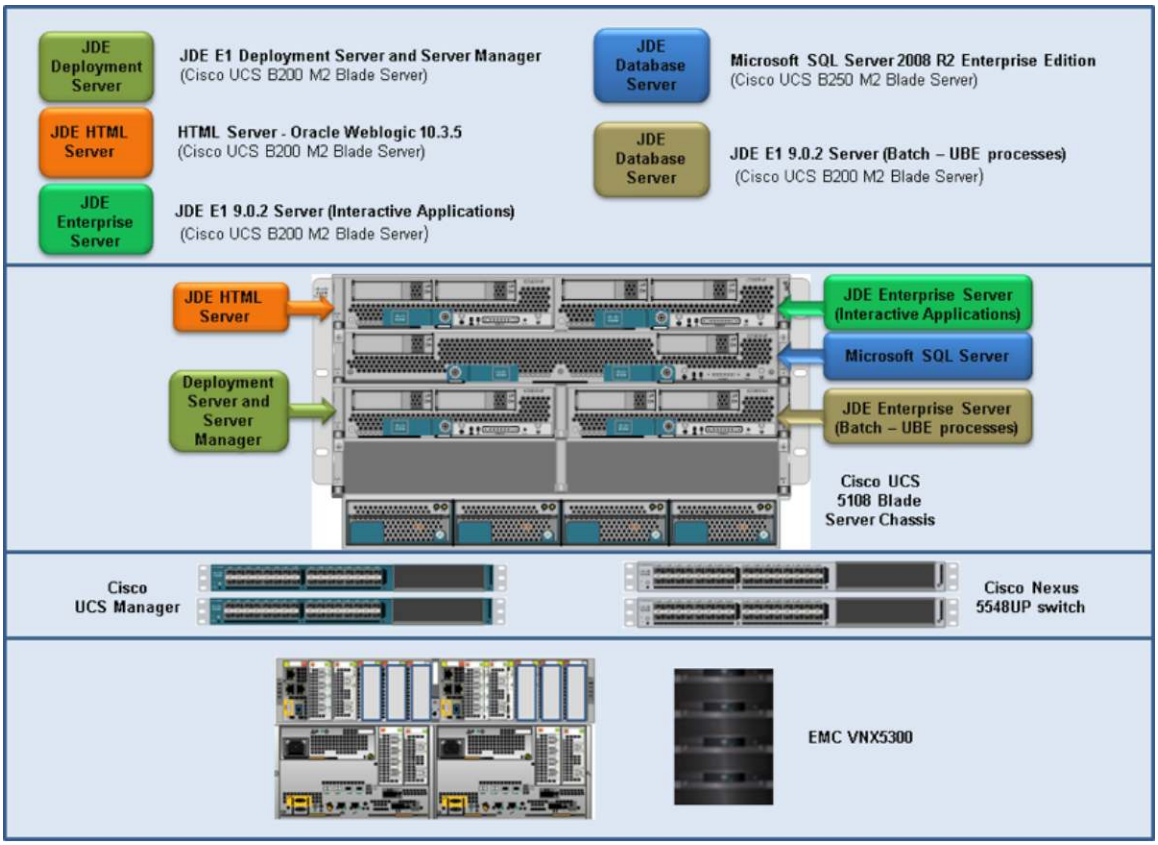
Table 1 summarizes the configuration of JDE E1 on Cisco UCS blade servers with Microsoft Windows 2008 R2 and Microsoft SQL Server.

Table 1. Test Environment for Oracle's JDE E1 on Cisco UCS

JDE E1 HTML server	• Cisco UCS B200 M2 Blade Server equipped with two Intel Xeon X5690 3.46-GHz processors and 96 GB of physical memory. To scale beyond 5000 JDE interactive users, the Cisco UCS B200 M2 was configured with 192 GB of physical memory (12 x 16 GB) • Oracle WebLogic 10.3.5 on Microsoft Windows 2008 R2 Enterprise Edition • Oracle HTTP server (OHS)
JDE E1 enterprise server	• Cisco UCS B200 M2 Blade Server equipped with two Intel Xeon X5690 3.46-GHz processors and 96 GB of physical memory; to scale beyond 5000 JDE E1 interactive users, the Cisco UCS B200 M2 was configured with 192 GB of physical memory (12 x 16 GB) • JDE E1 Release 9.0, Update 2, with Tools Release 8.98.4.6, deployed on Microsoft Windows 2008 R2 Enterprise Edition
JDE E1 enterprise server for batch (UBE processes)	• Cisco UCS B200 M2 Blade Server equipped with two Intel Xeon X5690 3.46-GHz processors and 96 GB of physical memory. • JDE E1 Release 9.0, Update 2, with Tools Release 8.98.4.6, deployed on Microsoft Windows 2008 R2 Enterprise Edition
JDE E1 database server	• Cisco UCS B250 M2 Blade Servers equipped with two 6-core Intel Xeon X5680 3.33-GHz processors and configured with 384 GB of physical memory • Microsoft SQL Server 2008 R2 Enterprise Edition
Deployment server and server manager	• Cisco UCS B200 M2 Blade Server equipped with two 4-core Intel Xeon X5620 2.4-GHz processors and configured with 24 GB of physical memory
Test client	• LoadRunner 9.5 on Microsoft Windows 2003 Server
Storage	• EMC VNX5300
Operating system (64-bit)	• Microsoft Windows 2008 R2 Enterprise Edition

Figure 2 illustrates the essential components of the JDE E1 deployment on Cisco UCS blade servers.

Figure 2. Oracle JDE E1 Essential Components



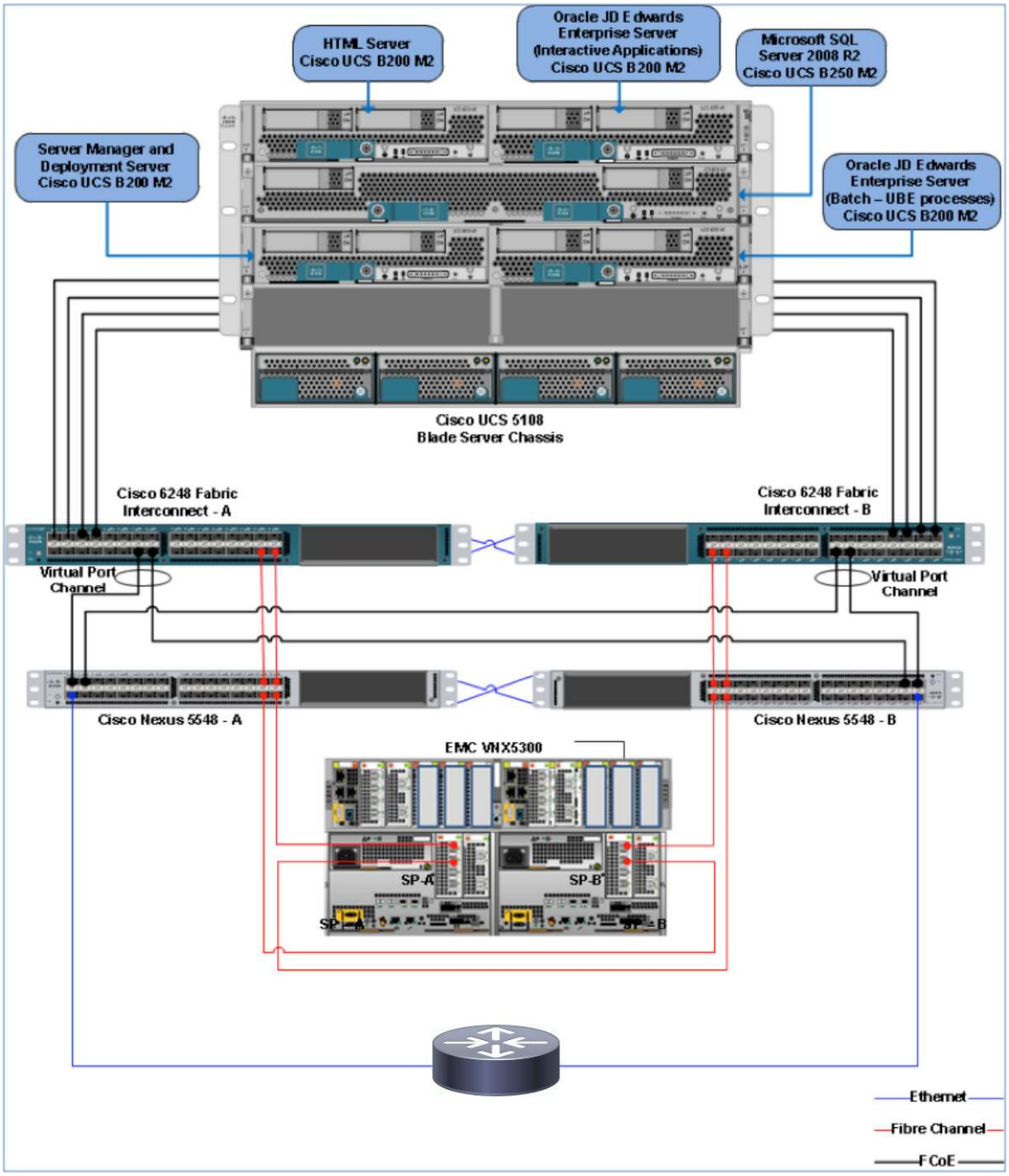
Infrastructure Components

The deployment architecture for the test run is shown in Figure 3 and includes the following components:

- The Cisco UCS 5100 Series Blade Server Chassis delivers a scalable and flexible blade server chassis.
- The Cisco UCS 6248UP 48-Port Fabric Interconnect is a one-rack-unit (1RU) 10 Gigabit Ethernet, Fibre Channel over Ethernet (FCoE), and Fibre Channel switch offering up to 960-Gbps throughput and up to 48 ports. The switch has thirty-two 1/10-Gbps fixed Ethernet, FCoE, and Fibre Channel ports and one expansion slot.
- The Cisco Nexus® 5548UP Switch is a 1RU 10 Gigabit switch offering up to 960-Gbps throughput and up to 48 ports. It offers thirty-two 1/10-Gbps fixed Ethernet Enhanced Small Form-Factor Pluggable (SFP+), FCoE, or 1/2/4/8-Gbps native Fibre Channel unified ports and three expansion slots. These slots have a combination of Ethernet, FCoE, and native Fibre Channel ports
- The EMC VNX5300 consists of a modular architecture that integrates hardware components for block, file, and object with concurrent support for native NAS, iSCSi, Fibre Channel, and FCoE protocols. This storage system is designed to dynamically grow, share, and cost-effectively manage multiprotocol file systems and multiprotocol block storage access. The unified configuration includes the following rack-mounted enclosures:

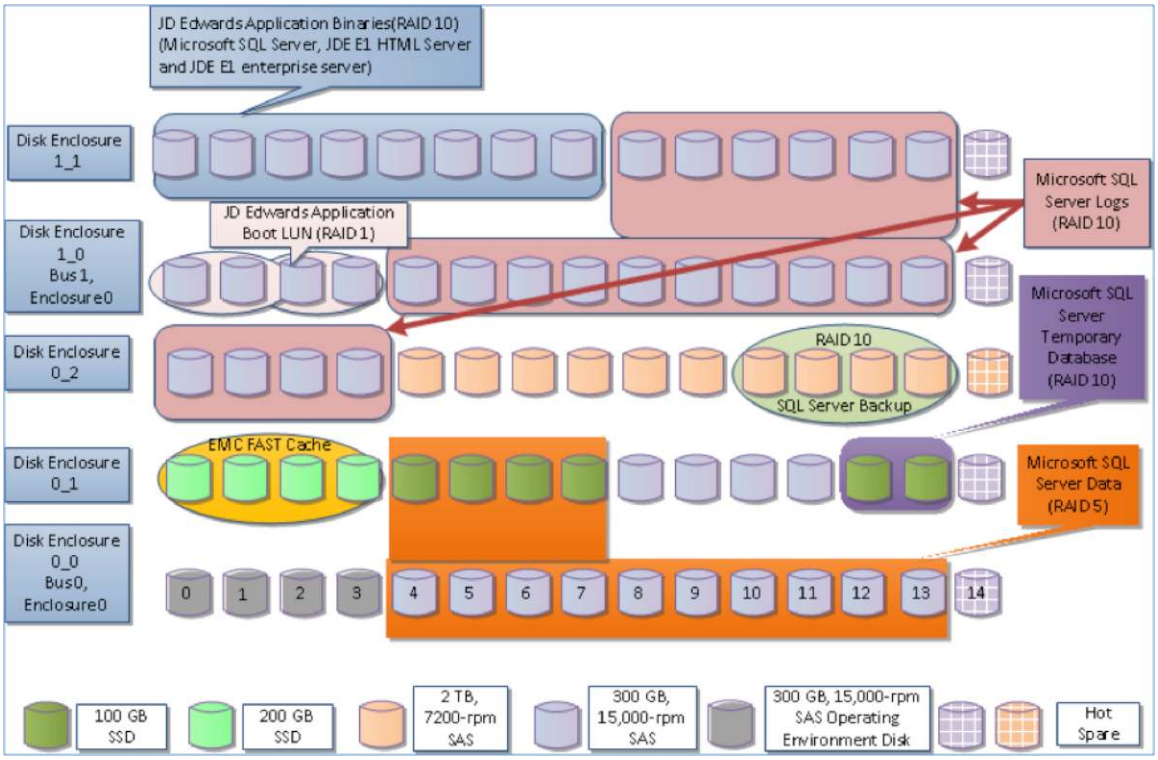
- Disk processor enclosure (holds disk drives) or storage processor enclosure (requires disk drive tray) plus standby power system to deliver block protocols
- One or more data mover enclosures to deliver file protocols (required for file and unified configurations)
- Control Station (required for file and unified configurations)

Figure 3. Deployment Architecture for Oracle's JDE E1 on Cisco UCS



A number of SAS and SSD drive types and classes are supported in the EMC VNX storage system. In this JDE E1 project, the EMC VNX5300 was configured with a combination of SSDs, NL-SAS drives, and 300-GB 15,000-rpm SAS drives. Figure 4 shows the disk layout on the EMC VNX5300 for Oracle's JDE E1 deployment on Cisco UCS.

Figure 4. JDE E1 Disk Layout on EMC VNX5300



Workload

Oracle's JDE DIL kit is an attempt to capture the way that a typical customer interacts with the JDE E1 system during the course of a typical day. The JDE DIL kit accomplishes this with a set of scripts for 17 interactive applications along with a set of JDE reports (UBE processes) that process a specific set of data that is part of the JDE DIL database. Because of the availability of this standard set of scripts and UBE processes, various hardware vendors, including Cisco, have endeavored to benchmark the JDE E1 implementation on their hardware platforms to deliver a value proposition for prospective customers.

The JDE DIL kit interactive application workload emphasizes SRM applications, which are prominent in the application workloads used by the large JDE E1 customer base in the midsize manufacturing industry segment. Similarly, the UBE workload emphasizes the types of reports run by customers in this segment, though it does incorporate reports relevant to a larger audience of customers.

The JDE DIL workload incorporates a mix of applications, including multiple-line-item sales order and purchase order entry and lightweight applications such as supplier ledger enquiries. Similarly, the UBE tasks range from long-running material requirements planning (MRP) and general ledger post reports to short-running company constants and business-unit reports.

The LoadRunner scripts for the JDE E1 interactive applications that the JDE DIL kit incorporates measure the response times for certain representative transactions and these are discussed in this document. UBE performance is described in terms of the total time taken to generate a report, as measured by timings in the JDE E1 logs for those UBE processes.

Test Methodology

The interactive and batch versions of the JDE DIL kit were run to capture the end-user response time variation and batch processing rate with important system characteristics such as CPU, memory, and I/O across the test system. All four components of the JDE E1 deployment—HTML server, enterprise server for interactive users, enterprise server for batch processing, and Microsoft SQL database server—were monitored through Microsoft Windows Performance Monitor (PerfMon), a Microsoft Windows monitoring tool. EMC NAR files were also generated and analyzed to measure the number of I/O operations per second (IOPs) generated on the EMC VNX5300.

Test Scenarios

Cisco invested considerable time and effort in testing and running a broad range of JDE E1 application scenarios to help ensure that when the JDE DIL kit is run against a hardware configuration, the scenarios closely mimic the configurations used by potential customers. The documented response times and the best practices for deploying the JDE E1 server provide customers a good indication of the way they can expect such a configuration to perform when deployed in their own production environments.

Cisco devised several scenarios to test and record the effect that running a batch workload would have on the interactive performance of JDE E1 applications, since batch processes are typically resource intensive, thereby affecting the responsiveness of JDE E1 interactive applications.

The elaborate test scenarios run for JDE E1 deployment on Cisco UCS are as follows:

- **Interactive scaling:** JDE E1 interactive users were scaled from 500 to 7500 concurrent users.
- **Individual UBE processes:** Individual long running UBE processes were run on the JDE E1 server for batch.
- **Only batch processes:** UBE processes were run on the JDE E1 enterprise server without interactive applications.
- **Interactive applications with batch processing on the same physical server:** User interactions and a mix of batch processes were run concurrently on a JDE E1 server for interactive applications. In this scenario, the interactive and batch applications ran on the same server, and the response times for interactive applications were recorded. The number of interactive applications was capped at 1000 users, and batch loads ranging from a low to a high number of UBE processes were run to measure the effect on interactive application response times.
- **Interactive applications with batch processing on separate physical servers:** User interactions were processed on the JDE E1 server for interactive applications, and a mix of batch and UBE processes were run on the JDE E1 server for batch. In this scenario, interactive applications and UBE processes were configured to run on separate servers, and observations on the scaling characteristics of this scenario were recorded. Approximately 5000 concurrent interactive users were run on one enterprise server, and a mix of UBE processes were run on a separate enterprise server.

Interactive Workload Mix

The JDE DIL kit is a set of 17 scripts that include Oracle SCM, SRM, HCM, CRM, and FMS.

Table 2 shows the transaction mix used for the JDE E1 interactive test with the JDE DIL kit.

Table 2. Interactive Workload Mix

Oracle Application	Percentage Weight
Financial Management System (FMS)	20
Supplier Relationship Management (SRM)	24
Supply Chain Management (SCM)	49
Customer Relationship Management (CRM)	5
Human Capital Management (HCM)	2
	100%

Interactive Applications with Batch Processing Test Scenarios

In the batch processing scenario, multiple LoadRunner configurations were created for the processing of various short running UBE processes, as listed in Appendix A: Batch Workload Mix. These scenarios differed in the number of concurrent submissions of these UBE processes as well as the frequency with which they were submitted. The scenarios encompass three different workloads, represented here by the rate of report creation per minute.

For interactive and batch processing on the same server, the first test iteration had a distribution of 67 UBE processes per minute, the second test iteration had a distribution of 161 UBE processes per minute, and in the third iteration it was increased to 305 UBE processes per minute. All the above batch processes were executed concurrently with 1000 interactive users.

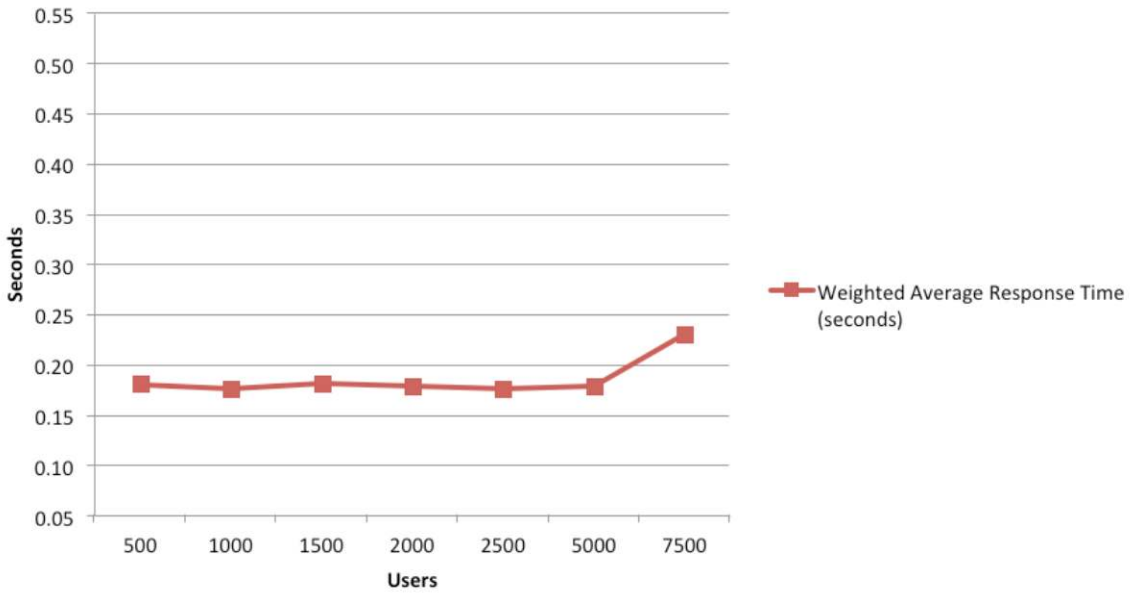
For interactive and batch processing on separate servers, the first scenario had a distribution of 73 UBE processes per minute, the second scenario had a distribution of 151 UBE processes per minute, and in the third iteration it was increased to 361 UBE processes per minute. All the above batch processes were executed concurrently with 5000 interactive users.

In addition to the short running UBE processes, four long running UBE processes were part of each of the three test scenarios. The long running UBE processes chosen to be a part of the scenarios provided a sustained, database intensive load, thereby providing the test scenarios with a reliable means of measuring interactive application performance during a period of high resource utilization.

Interactive Scaling Test Results

The interactive version of the JDE DIL kit was run for a user load of 500 to 7500 concurrent interactive users deployed on Cisco UCS servers. Figure 5 shows the weighted average response time for 500 to 7500 interactive users.

Figure 5. Oracle's JDE DIL Kit Illustrating Weighted Average Response Time for Interactive Users



As illustrated in Figure 5, JDE E1 deployment on a Cisco UCS blade server infrastructure scales exceptionally well, with an almost flat response time of less than 0.2 second while scaling from 500 to 5000 concurrent users. At around 7500 concurrent users, the weighted average response time is about 0.23 second, but is a reasonably below the required threshold of 0.5 second for a JDE DIL kit benchmark.

Test Scenario: Interactive Scaling

The interactive scaling test scenario was run to determine the variation in end-user response times when the number of interactive users increases from 500 to 7500 concurrent users. System resource utilization metrics such as CPU, memory, and disk I/O were captured across all three tiers: HTML server, JDE E1 enterprise server, and Microsoft SQL database server. To successfully scale to 7500 concurrent users, the physical memory of the HTML and JDE E1 enterprise servers installed on the Cisco UCS B200 M2 server was scaled from 96 GB (12 x 8-GB DIMMs) to 192 GB (12 x 16-GB DIMMs).

User Response Time

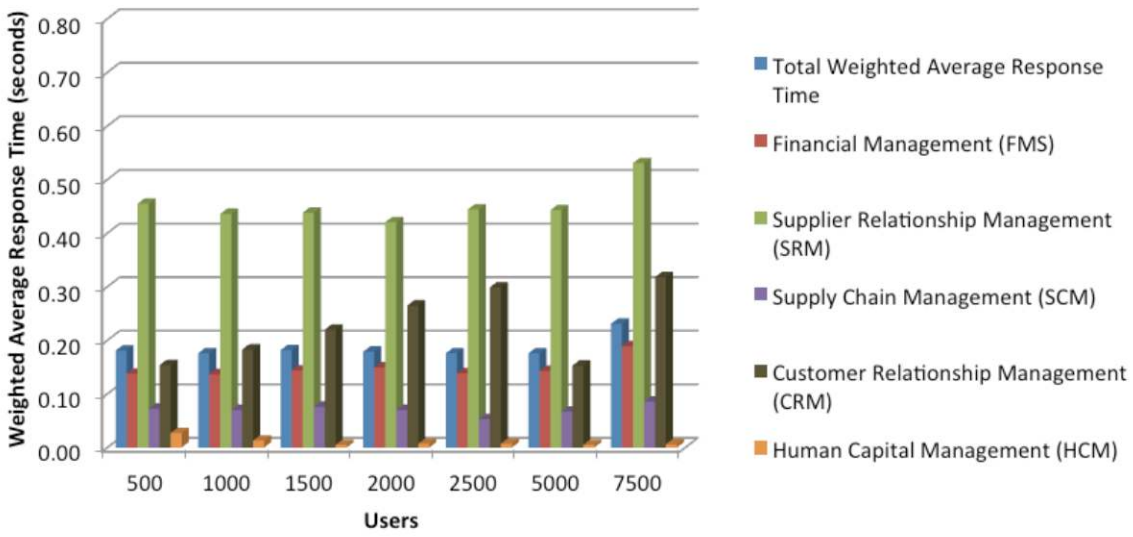
User response time was captured at the LoadRunner controller for all 17 interactive JDE DIL test scripts. The five important JDE E1 applications measured using the JDE DIL kit were:

- Financial Management System (FMS)
- Supplier Relationship Management (SRM)
- Supply Chain Management (SCM)
- Customer Relationship Management (CRM)
- Human Capital Management (HCM)

The transaction mix for these applications is detailed in the Interactive Workload Mix section of this document.

Figure 6 shows the weighted average response times for all 17 JDE DIL kit scripts and for the five JDE E1 applications.

Figure 6. Oracle's JDE DIL Kit Weighted Average Response Times



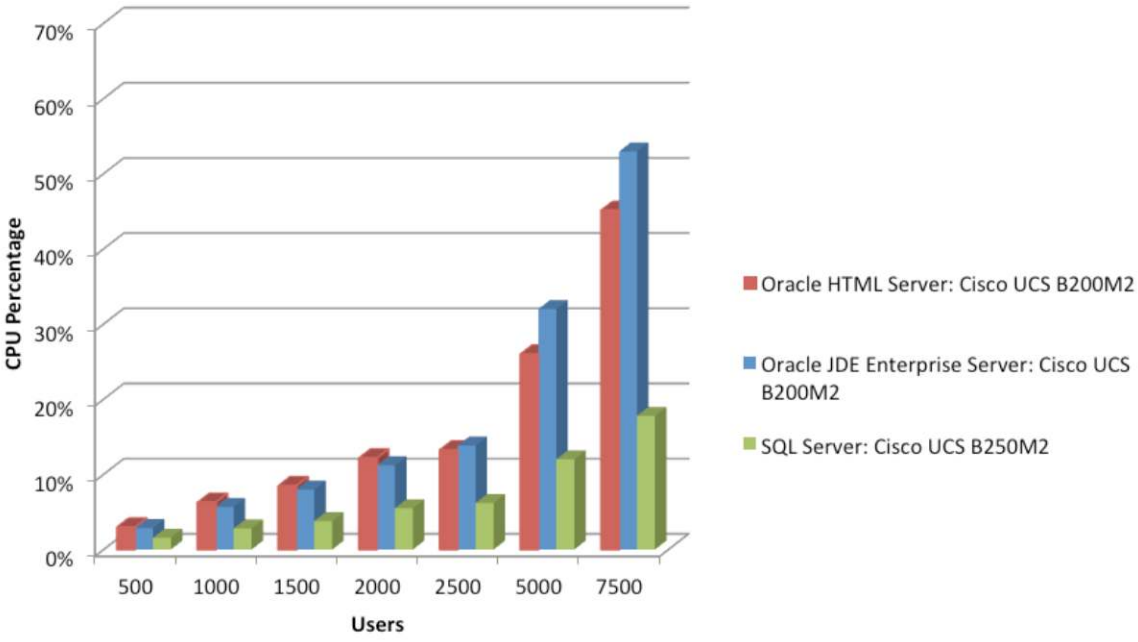
As detailed in Figure 6, the total weighted average response time for interactive user tests was always below 0.25 second during the scalability from 500 to 7500 concurrent users.

CPU Utilization

The HTML server and JDE E1 enterprise server were deployed on two discrete Cisco UCS B200 M2 Blade Servers, and the Microsoft SQL database server was deployed on a Cisco UCS B250 M2 Blade Server.

Figure 7 illustrates the average CPU utilization across the three-tier JD Edwards technology stack.

Figure 7. JDE E1 CPU Utilization



Observations include the following:

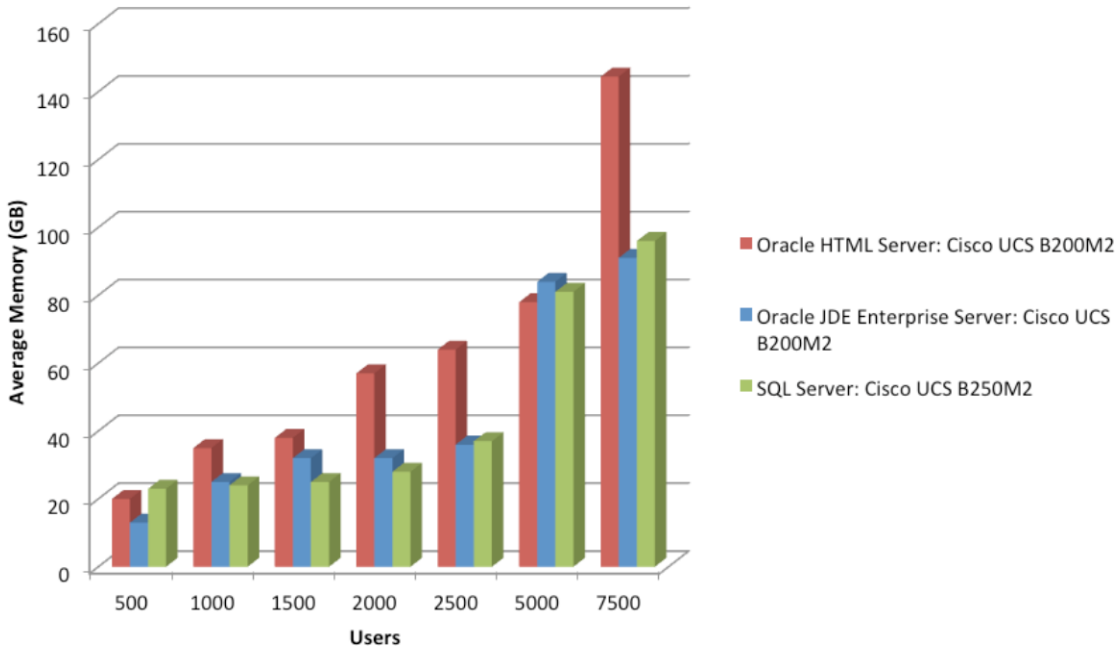
- The maximum CPU utilization for the JDE E1 enterprise server was about 53 percent for 7500 interactive users.
- CPU utilization was observed to be higher on the application tier than on the database tier. The database tier was about 18 percent for 7500 interactive users, which was relatively low compared to the utilization on the HTML and JDE E1 enterprise servers.
- The maximum CPU utilization recorded on the HTML server was about 45 percent. This rate was on the expected line because multiple Java Virtual Machine (JVM) instances configured with the Oracle WebLogic server and clustered through the Oracle HTTP server were running on a single Cisco UCS B200 M2 server.
- CPU utilization across all tiers gradually increased, reflecting the linear scalability of the workload.

Memory Utilization

Memory utilization for the test with 500 to 7500 interactive users across the three-tier JD Edwards technology stack is illustrated in Figure 8.

The physical memory of JDE E1 and HTML servers deployed on the Cisco UCS B200 M2 server was increased from 96 to 192 GB of memory to successfully run 7500 concurrent interactive users. Memory utilization on the JDE E1 enterprise server ranged from 13 to 91 GB, and on the HTML server memory utilization was approximately 12 to 145 GB. Utilization of the Microsoft SQL database server deployed on the Cisco UCS B250 M2 Blade Server with 384 GB of memory ranged from 21 to 96 GB for a user workload of 500 to 7500 concurrent Interactive users.

Figure 8. JDE E1 Memory Utilization



Observations include:

- Memory utilization on the JDE HTML server was relatively high, with a maximum of about 145 GB for 7500 users. This rate was reached because for 7500 concurrent users, about 30 JVM instances with a

heap size of 3 GB each were configured in Oracle WebLogic. These instances were load balanced through the Oracle HTTP server, which was installed on the same HTML server.

- For lower user loads, the enterprise server configuration was set so that memory scaled linearly, but as higher user loads were introduced, the JDE E1 configuration was further optimized through JDE E1 kernel processes to provide ample memory for running additional JDE E1 processes such as UBE processes.

I/O Performance

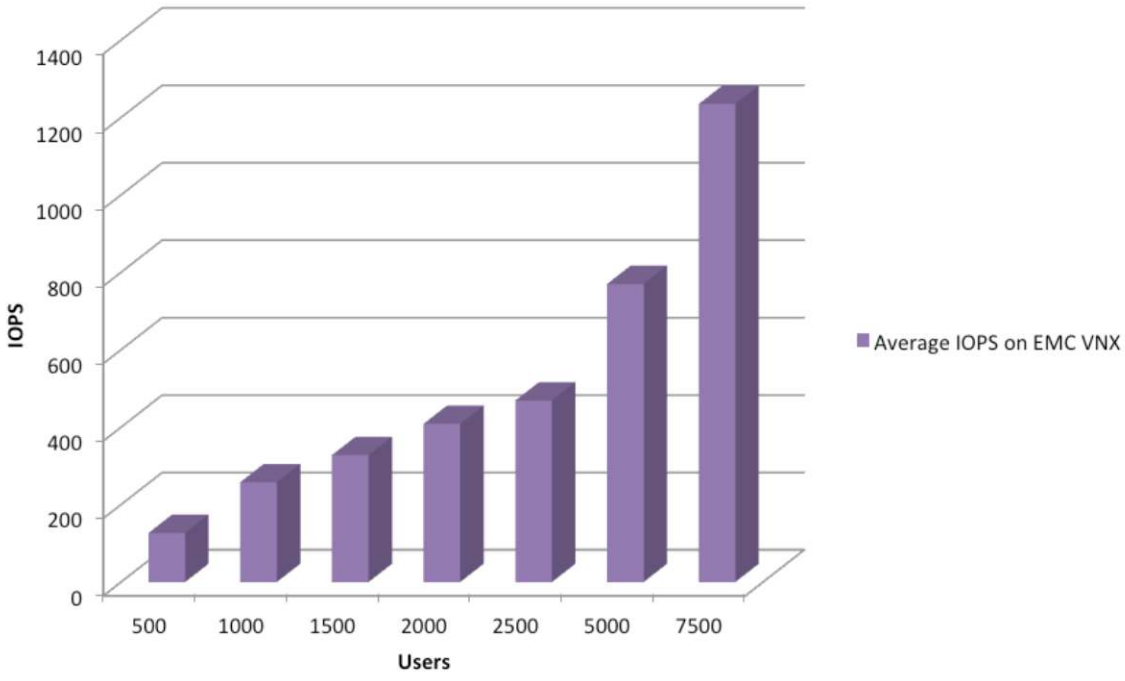
EMC VNX5300 was configured as the storage system for each of the three components of the JDE E1 deployment: HTML server, JDE E1 server, and Microsoft SQL database server. The Cisco UCS servers were booted from the SAN (EMC VNX5300), unleashing the full capabilities of Cisco UCS statelessness. Cisco UCS stateless configuration allows migration of Cisco UCS service profiles from a failed physical server to a standby server.

The Cisco UCS service profiles are logical representations of server configurations and infrastructure policies. Service profiles include all the firmware, firmware settings, and BIOS settings for server deployments (for example, definition of server connectivity, configuration, and server identity). Using service profiles, administrators can automate provisioning and increase business agility, enabling provisioning of server, network, and storage resources in minutes instead of days.

Cisco UCS Manager, with its API, can also be configured for automated service profile migration during physical server hardware failure.

Figure 9 illustrates total disk I/O performance captured with the help of EMC NAR files during the scalability test for 500 to 7500 JDE E1 interactive users.

Figure 9. JDE E1 Average IOPS on EMC VNX5300



Observations include:

- The number of IOPS generated on EMC VNX5300 scaled linearly, reflecting the gradual increase in the user count.
- The IOPS counts on the HTML and enterprise servers were very low.
- The response times observed from the EMC generated NAR files were less than 5 milliseconds (ms) for the duration of the test.
- The EMC VNX5300 is capable of handling a higher number of IOPS than reflected in this graph. The IOPS shown are a result of what was driven by the JDE DIL kit workload

Test Scenario: Individual UBE Processes

Batch processing is another critical activity in Oracle's JD Edwards environment, and it was important to test and determine the processing time for long running UBE processes. In a real-world JDE E1 deployment, several long running UBE processes are run after business hours, and they must complete within a fixed time frame because they are end-of-the-day reports and should not continue running during the day, when they could affect interactive users. The performance characteristics of these UBE processes are summarized in Table 3, with a brief description of what the reports do and the data sets on which they operate. These long-running reports ran on a fixed set of data with a standard set of processing options against the JDE DIL database, as described here.

Table 3. Long-Running UBE Processing Time

UBE	Time Taken (mm:ss)	Description
R43500	33:53	This purchase order print UBE processed records in the F4311 table (purchase order detail file) with a status code of 280 in one business unit; 255,481 records were processed using this data range
R3483	28:02	This MRP UBE processed 50,000 records in F4102 using one business unit. This process is a night-only process.
R31410	25:46	The work order processing UBE acts on the document invoice numbers in the work order master file, F4801, and 28,751 records were processed with the specified data selection.
R42565	15:43	This UBE processes document invoice orders located in the F4211 table, which is the sales order detail file. For the specified data selection, the number of records in F4211 was 150 rows, and in the F42119 table, which is the sales order history table, 47,463 rows were processed.
R42520	12:59	The print pick slips batch process acted on shipment numbers in tables F4201, which is the sales order header file, and F4211, which is the sales order detail file, using a next status code between 520 and 540, thereby processing 37,154 records.
R4981	10:33	The freight update UBE acts on shipment numbers in the shipment header table, F4215, using a next status code of 70, for one business unit; 800 records were processed using this data selection criterion.
R09801	10:18	This general ledger post UBE acts on records located in the batch control records table, F0011. Data selection used a batch status of A and a batch type of G and processed 990,099 records.
R31802a	09:19	The manufacturing account journal UBE acted on document invoice numbers in the work order master file, F4801, with a status code of 95, and processed 1501 records using the data selection criterion.
R42800	08:53	This sales order update report acted on rows with a status code of 620 and in one business unit in the F4211 table. This data selection resulted in the processing of 12,900 rows.

Test Scenario: Only Batch Processes

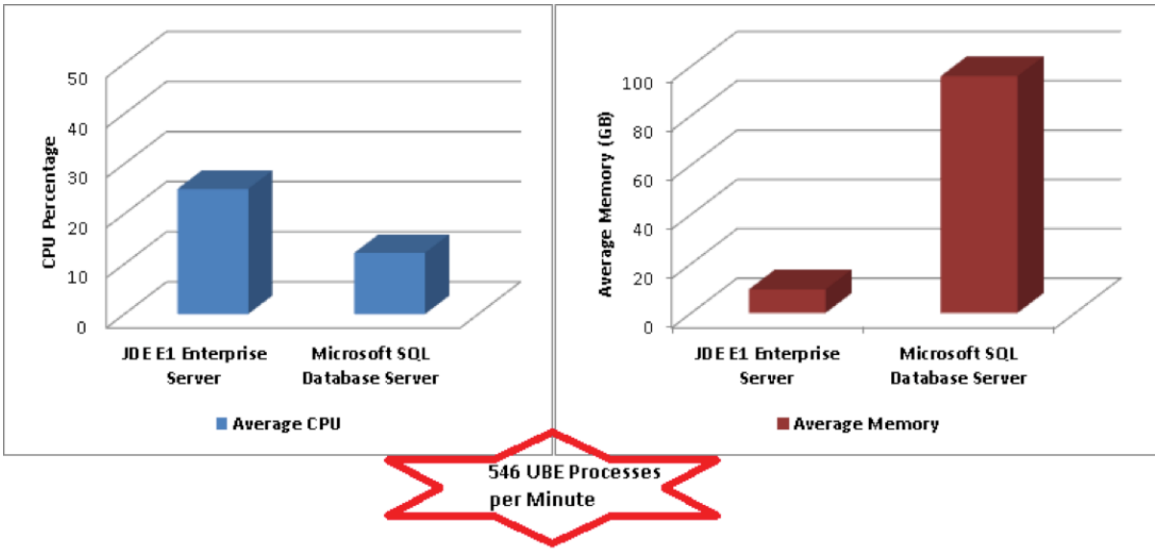
Some customers run only JDE E1 batch processing for many business functions, and it was imperative that Cisco test this scenario and provide enough information for such customers to make informed decisions about a JDE E1 deployment on Cisco UCS. For such customers, a test scenario was configured in which a high volume of short-running UBE processes as well as four long-running UBE processes were run, and the effect of this test scenario

was measured in terms of CPU and memory consumed on the enterprise and database servers. This test scenario revealed that in the absence of a large number of concurrent interactive users, the JDE E1 system can handle a lot more throughput in terms of UBE completions per minute.

The test successfully achieved 546 UBE processes per minute. The average IOPS measure on EMC VNX5300 was about 3800. It would be a good strategy for real-world JDE E1 customers to schedule a very high volume of UBE processes during those nonpeak hours when few interactive users are logged on to the JDE E1 system.

Figure 10 illustrates the CPU and memory utilization on the JDE E1 server and Microsoft SQL database server during the processing of only batch processes.

Figure 10. Resource Utilization for Only Batch Processing



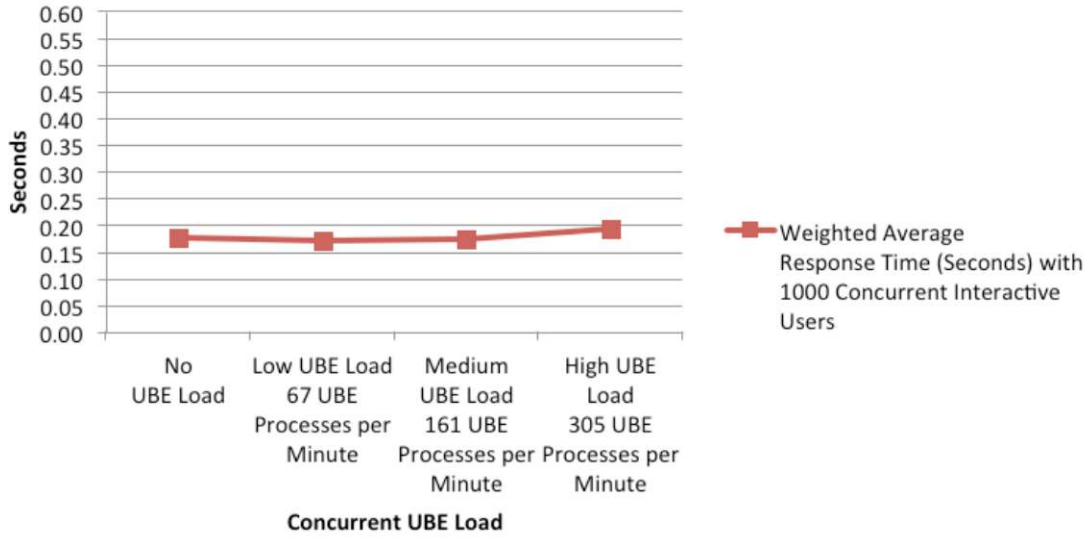
Test Scenario: Interactive Applications with Batch Processing on the Same Physical Server

A scenario was run to determine the effect on interactive user response time when a mix of short-running plus four long-running UBE processes are run in parallel on the same JDE E1 enterprise server. The number of interactive application users was fixed at 1000 users, and various batch loads, ranging from low to medium to high, were processed to measure the effect on interactive application response times. The short- and long-running UBE processes run are listed in Appendix A: Batch Workload Mix.

User Response Time

As shown in Figure 11, the weighted average response time for 1000 concurrent interactive users was below 0.2 second for a batch load ranging from 67 to 161 UBE processes per minute. There was no degradation of response time for UBE concurrent loads of up to 161 UBE processes per minute, and response time increased marginally to 0.193 second for a high UBE load of 305 UBE processes per minute, thus demonstrating the high-performance capability of the Cisco UCS B200 M2 server, which makes it one of the best fits for JDE E1 server deployments.

Figure 11. Weighted Average Response Time for 1000 User Interactive Users and Batch Processes on the Cisco UCS B200 M2 server

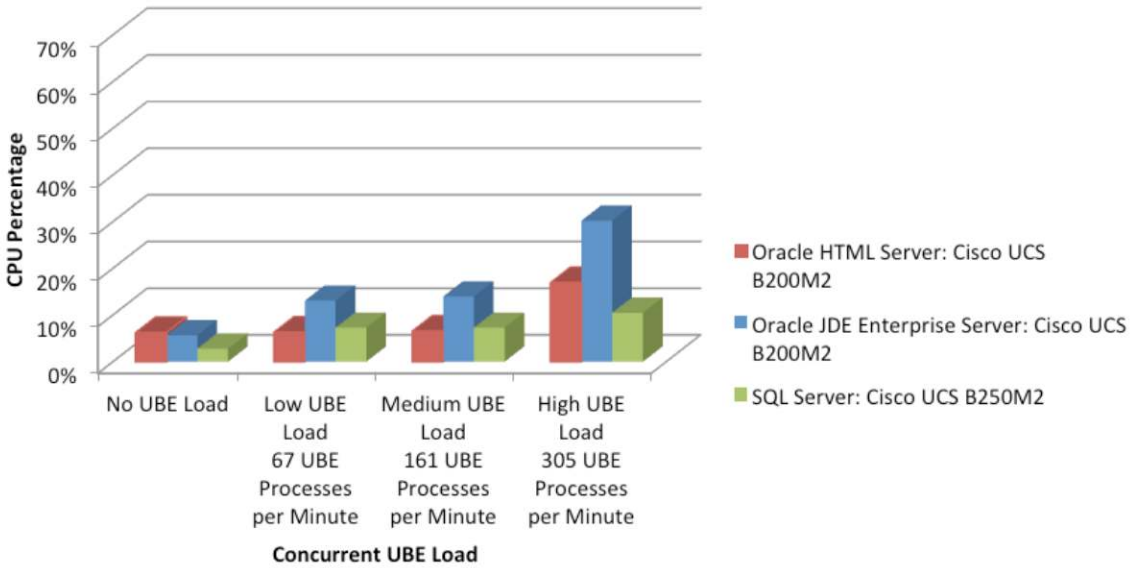


CPU Utilization

As in previous tests, the HTML server and enterprise server were deployed on two discrete Cisco UCS B200 M2 Blade Servers, and the Microsoft SQL database server was deployed on a Cisco UCS B250 M2 Blade Server.

Figure 12 illustrates the average CPU utilization across the three-tier JD Edwards technology stack.

Figure 12. JDE E1 CPU Utilization for Batch and Interactive Processes on the Same Server



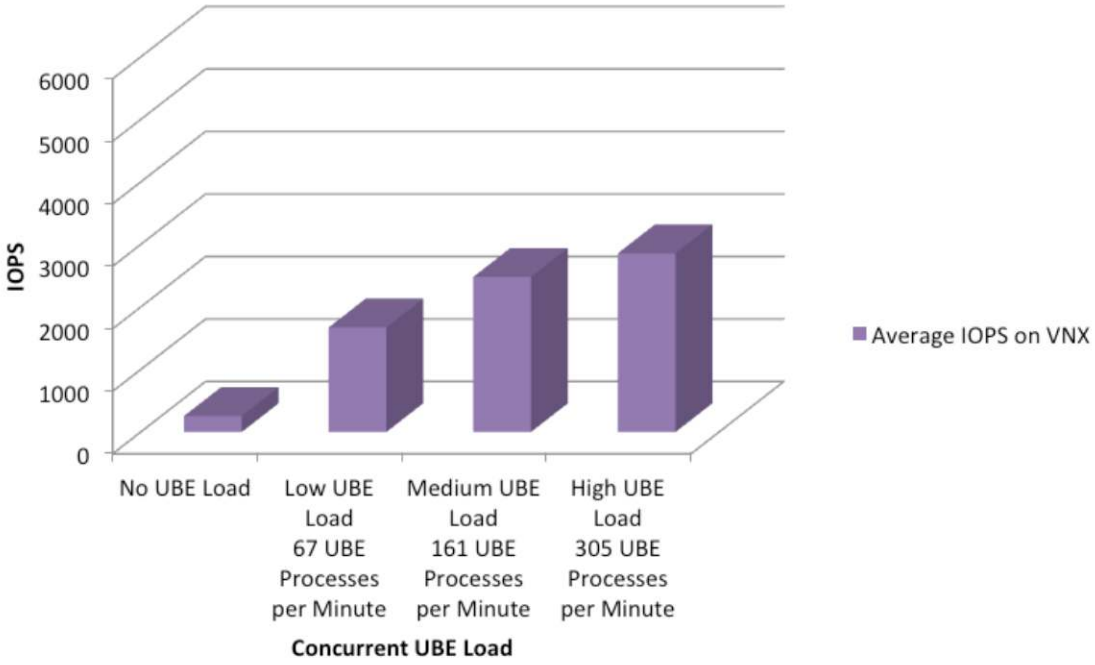
Observations include:

- The maximum average CPU utilization for the JDE E1 enterprise server was about 30 percent for 1000 users, with a high batch processing rate of 305 UBE processes per minute.
- The average CPU utilization on the database tier for low and medium UBE loads was similar to previous test results, at about 7 to 8 percent, though utilization increased marginally to about 10.5 percent for the high batch workload.

I/O Performance

Figure 13 illustrates the average IOPS recorded on EMC VNX5300. As mentioned earlier, EMC NAR files were analyzed to record the average IOPS for JDE E1 deployments. There was little I/O activity for the HTML and enterprise servers. The Microsoft SQL Server log data file (LDF) and master data file (MDF) were the major contributors to the total IOPS.

Figure 13. Average IOPS on EMC VNX5300 for Batch and Interactive Processes on the Same Server



Observations include:

- The average IOPS generated on EMC VNX5300 for 1000 interactive users with no batch load was about 258 IOPS, and this number scaled to a maximum average of 2860 IOPS for 1000 users with a batch load of 305 UBE processes per minute. This metric demonstrates that significant I/O activity was generated during concurrent batch and interactive user processing.
- The response times observed from the EMC-generated NAR files were less than 5 ms for the duration of the test.

Test Scenario: Interactive Applications with Batch Processing on Separate Physical Servers

As a best practice and suggestion from Oracle, Cisco decided to run a test scenario to determine the effect on interactive user response times of running a mix of short-running and four long-running UBE processes with a JDE

E1 interactive server and JDE E1 batch server deployed on two separate Cisco UCS B200 M2 servers. The Microsoft SQL database deployed on the Cisco UCS B250 M2 server was common to both JDE E1 interactive and batch servers, thus maintaining the same database schema for interactive and batch processes.

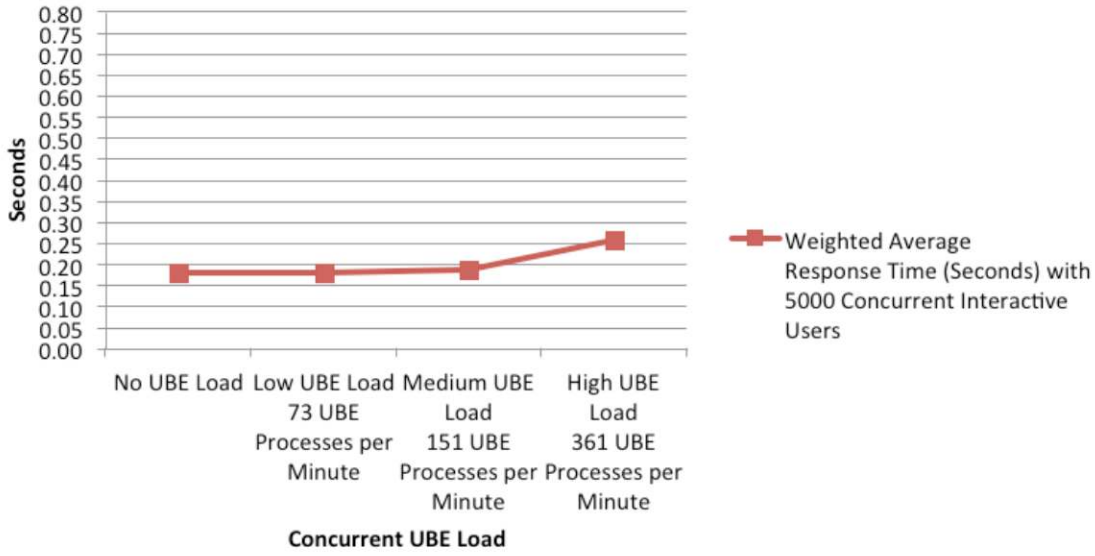
The number of interactive applications users was fixed at 5000 users, and various batch loads, ranging from low to medium to high, were run to measure the effect on interactive application response times.

Details of the workload mix are presented in the section Interactive Applications with Batch Processing Test Scenarios.

User Response Time

As shown in Figure 14, the weighted average response time for 5000 concurrent interactive users was below 0.2 second for a batch load ranging from 73 to 151 UBE processes per minute. Little degradation was observed in the response time for UBE concurrent loads of up to 151 UBE processes per minute. The high UBE load of 361 UBE processes per minute did have some effect on the response time for 5000 interactive users, with the time increasing to 0.257 second. This increase is attributed to the fact that a common database server was used for the JDE E1 interactive and batch servers.

Figure 14. Response Time for 5000 Users with Batch Processing on Separate Cisco UCS B200 M2 server

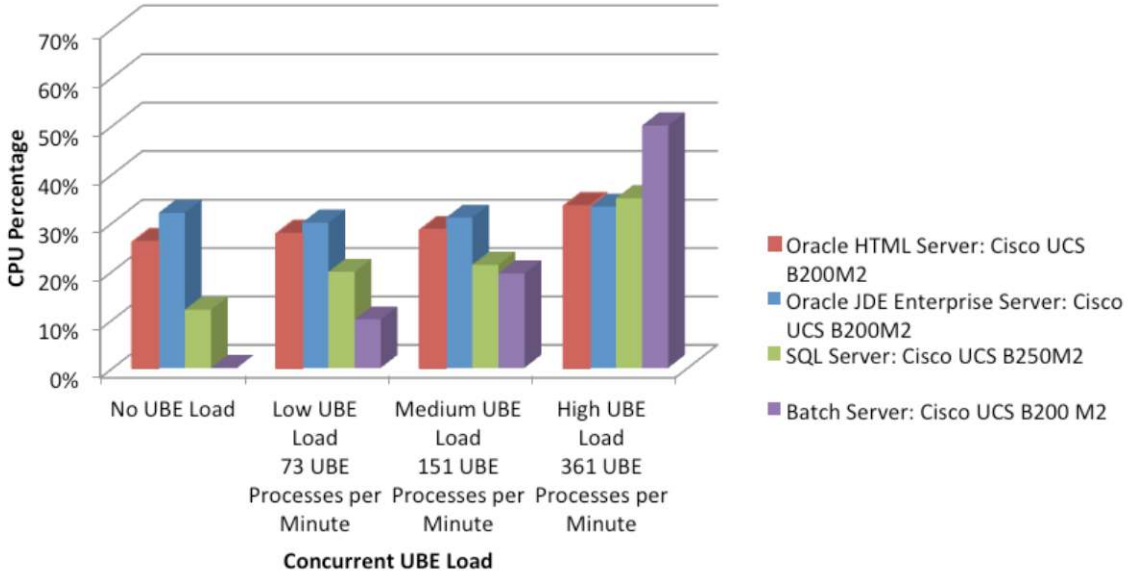


CPU Utilization

The HTML server, JDE E1 server for interactive applications, and JDE E1 enterprise server for batch processing were deployed on separate Cisco UCS B200 M2 Blade Servers configured with two Intel Xeon X5690 processors. The Microsoft SQL database server was deployed on a Cisco UCS B250 M2 Blade Server configured with two Intel Xeon X5680 processors.

Figure 15 illustrates the average CPU utilization across all four JD Edwards tiers.

Figure 15. JDE E1 CPU Utilization for Interactive Applications with Batch Processing on Separate Cisco UCS B200 M2 Servers



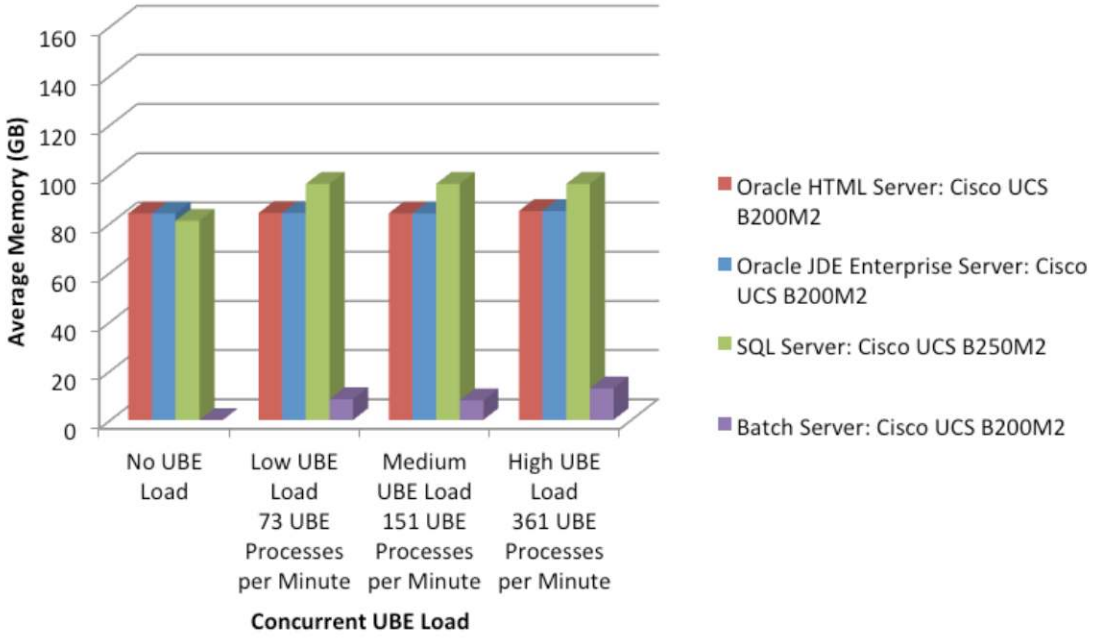
Observations include:

- Average CPU utilization on the HTML server and JDE E1 enterprise server for interactive applications remained almost steady across the test. This result was expected because the workload on the UBE batch server was the only load that was increased.
- CPU utilization on the Microsoft SQL database server increased from 12 percent with 5000 interactive users and no UBE load to about 35 percent with the same 5000 interactive users and a high UBE load of 361 UBE processes per minute.
- For low to medium batch loads, the CPU utilization on the JDE E1 batch server varied from 10 to 20 percent, but at a high UBE load of 361 UBE processes per minute, the batch server was stressed, with an average CPU utilization of almost 50 percent.

Memory Utilization

In this test scenario, the batch server was deployed on a separate Cisco UCS B200 M2, which had the same physical memory configuration of 96 GB as used for the JDE E1 server for interactive applications and batch processes. Figure 16 illustrates the memory utilization for a batch load with 5000 interactive users.

Figure 16. Memory Utilization for Interactive Applications with Batch Processing on Separate Physical Servers



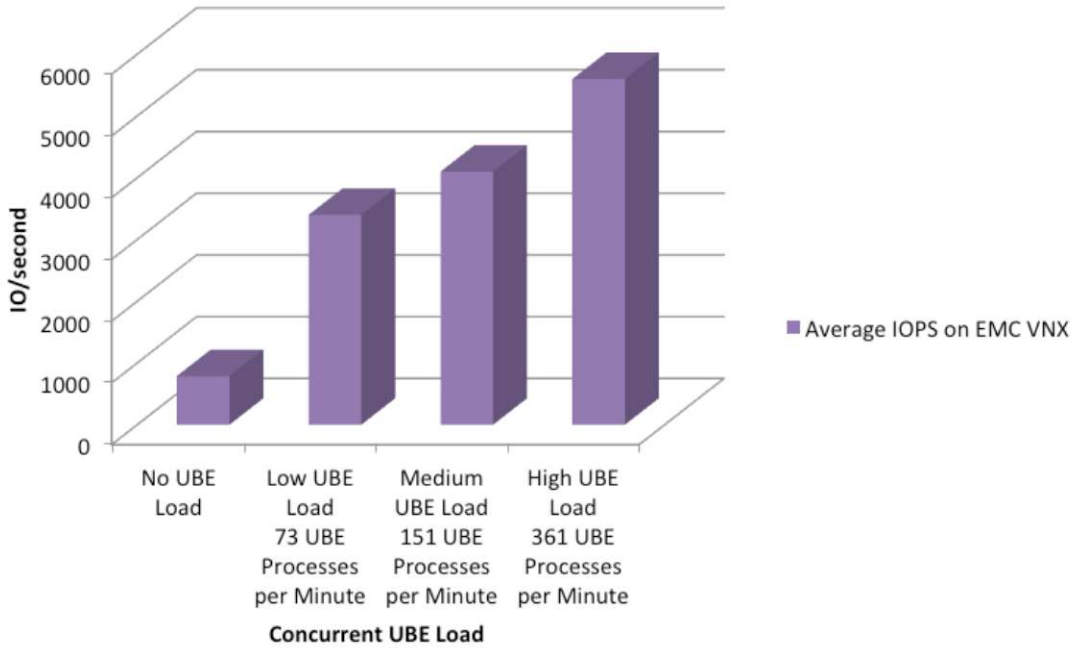
Observations include:

- Because the batch server was deployed on a separate server and the interactive load was constant at 5000 users, the result was as expected: that memory utilization for the HTML server and JDE E1 enterprise server for interactive applications was almost same as that of 5000 users without any UBE load.
- Memory utilization on the Microsoft SQL database server increased to about 96 GB with a low batch load of 73 UBE processes per minute and remained almost same for low to high batch loads.
- All through the various batch loads, the memory utilization on the batch server was just 10 to 14 percent of the total physical memory assigned.

I/O Performance

Figure 17 illustrates the total average IOPS measured on EMC VNX5300 with the help of EMC NAR files.

Figure 17. Average IOPS on EMC VNX5300 for Interactive Applications with Batch Processing on Separate Physical Servers



Observations include:

- The number of IOPS generated on EMC VNX5300 increased from about 800 to 5600 IOPS for 5000 users with no batch processing to 5000 users with a high batch load of 361 UBE processes per minute.
- About 90 to 95 percent of the total IOPS were generated from the Microsoft SQL database server. This expected behavior was expected because the UBE processes run significantly stressed the LDF and the MDF of the database server.
- The response time observed from the EMC-generated NAR files was less than 5 ms for the duration of the test.

Sizing Guidelines for Oracle's JDE E1 on Cisco UCS

Sizing ERP deployments is a complicated process, and proper sizing largely depends on the inputs provided by customers about how they intend to use the ERP system and about their priorities in terms of end-user and corporate expectations.

Typical Cisco UCS server configurations in ideal lab conditions for small, medium, and large workloads are listed in Table 4. The exact configuration may vary depending on the customer workload and technology landscape. For recommendations, contact Cisco.

Table 4. Suggested Minimum Server Configurations

Workload Type	Component	Suggested Minimum Configuration		
		Blade Type	CPU Type	Memory
Small (fewer than 500 users)	Deployment server	Cisco UCS B200 M2	Dual-socket Intel Xeon X5620	12 GB
	HTML server	Cisco UCS B200 M2	Dual-socket Intel Xeon X5650	24 GB
	JDE E1 enterprise server for interactive applications and batch processing	Cisco UCS B200 M2	Dual-socket Intel Xeon X5650	48 GB
	Database server	Cisco UCS B250 M2	Dual-socket Intel Xeon X5650	48 GB
Medium (500 to 1500 users)	Deployment server	Cisco UCS B200 M2	Dual-socket Intel Xeon X5620	12 GB
	HTML server	Cisco UCS B200 M2	Dual-socket Intel Xeon X5650	48 GB
	JDE E1 server for interactive applications	Cisco UCS B200 M2	Dual-socket Intel Xeon X5650	48 GB
	JDE E1 server for batch processing	Cisco UCS B200 M2	Dual-socket Intel Xeon X5650	48 GB
	Database server	Cisco UCS B250 M2	Dual-socket Intel Xeon X5650	96 GB
Large (more than 1500 users)	Deployment server	Cisco UCS B200 M2	Dual-socket Intel Xeon X5620	12 GB
	HTML server 1	Cisco UCS B200 M2	Dual-socket Intel Xeon X5650	48 GB
	HTML server 2	Cisco UCS B200 M2	Dual-socket Intel Xeon X5650	48 GB
	JDE E1 server 1 for interactive applications	Cisco UCS B200 M2	Dual-socket Intel Xeon X5650	48 GB
	JDE E1 server 2 for interactive applications	Cisco UCS B200 M2	Dual-socket Intel Xeon X5650	48 GB
	JDE E1 server 1 for batch processing	Cisco UCS B200 M2	Dual-socket Intel Xeon X5650	48 GB
	JDE E1 server 2 for batch processing	Cisco UCS B200 M2	Dual-socket Intel Xeon X5650	48 GB
	Database server 1	Cisco UCS B250 M2	Dual-socket Intel Xeon X5650	96 GB
	Database server 2	Cisco UCS B250 M2	Dual-socket Intel Xeon X5650	96 GB

Conclusion

The Cisco Oracle Competency Center has provided considerable information in this document by testing and benchmarking Oracle's JD Edwards environment on the Cisco UCS platform. The benchmark test result demonstrate that the Cisco UCS blade server and EMC VNX storage infrastructure for Oracle's JDE E1 with Microsoft Windows 2008 R2 and Microsoft SQL Server 2008 R2 can provide extremely competitive and optimized performance.

Oracle's JDE E1 customers run their applications on various customized workloads. To simulate a customer's production environment, Cisco tested various combinations of JDE E1 deployments. By simulating interactive-only user workloads on Cisco UCS servers, these tests demonstrated that Cisco UCS servers can successfully scale to 7500 interactive users, with resource utilization scaling almost linearly with increasing user load.

Oracle's JDE E1 batch processing is another important activity. Cisco tested JDE E1 batch processing by running only UBE processes on the Cisco server and was able to obtain very high UBE throughput of 546 UBE processes per minute with just 25 percent CPU utilization on the JDE E1 batch server.

Processing of JDE E1 interactive applications with batch workloads is another typical customer deployment. Cisco demonstrated that there is little variation in interactive user response time for 1000 and 5000 concurrent interactive users, along with very high UBE throughput of more than 300 UBE processes per minute.

Cisco UCS provides a set of pre-integrated data center components that includes blade servers, adapters, fabric interconnects, and extenders integrated within a common embedded management system. Cisco UCS implements stateless model-based management: administrators manipulate a model of a desired system

configuration and associate the model's service profile with hardware resources, and the system configures itself to match the model. This automation, provided in the form of Cisco UCS service profiles, optimizes scaling and simplifies operations because the computing resources are managed as a pool of resources, with no added complexity when scaling Oracle's JDE E1 environment. The innovations and exceptional performance resulting from the combination of Cisco UCS servers and EMC VNX storage makes this infrastructure an excellent choice for Oracle's JD Edwards EnterpriseOne deployments.

For More Information

- http://www.cisco.com/en/US/netsol/ns1155/index.html
- http://www.emc.com/storage/vnx/vnx-series.htm

Appendix A: Batch Workload Mix

Table 5 summarizes the mix of long- and short-running UBE processes for low, medium, and high batch workloads.

Table 5. Batch Workload Mix

UBE Name	Description	Long or Short Running
R03b31	Activity log report	Short
R03b155	Accounts receivable summary analysis	Short
R0004p	User-defined code (UDC) record types print	Short
R0006p	Business unit report	Short
R0008p	Date patterns report	Short
R0010p	Company constants report	Short
R0012p1	Automatic accounting instruction (AAI) report	Short
R0014	Payment terms report	Short
R0018p	Tax detail report	Short
R01402w	Who's who report	Short
R41542	Item ledger as of record generation	Short
R42072	Price category print	Short
R41411	Select items cost count	Short
R31410	Work order processing	Long
R42565	Sales order invoicing	Long
R43500	Purchase order print	Long
R3483	MRP report	Long

Appendix B: JD Edwards Enterprise One Interactive Transactions

Table 6 summarizes the details of scripts executed for Interactive applications with a 500 concurrent user workload.

Table 6. JD Edwards Enterprise One Interactive Transactions

Transaction Name	Description	Virtual Users per transaction for 500 interactive user workload
H03B102E_OK	Apply Receipts	50
H0411I_1_FIND	Supplier Ledger inquiry	50

Transaction Name	Description	Virtual Users per transaction for 500 interactive user workload
H051141E_Row_OK	Daily Time Receipt	10
H17500E_Find	Case Management Add	25
H31114U_OK	Work Order Completion	15
H3411AE_Post_OK	MRP Messages (WO Orders)	10
H3411BE_Post_OK	MRP Messages (OP Orders)	10
H3411CE_Post_OK	MRP Messages (OT Orders)	10
H4113E_OK	Inventory Transfer	25
H42101E_Submit_Close	Sales Order Entry – 10 Line Items	125
H42101U_SubmitClose	Sales Order Update	25
H4310E_Post_OK	Purchase Order Entry – 25 Line Items	100
H4312U_OK	Purchase Order Receipts	10
H4314U_Row_OK	Voucher Match	10
H4915AU_Find	Ship Confirmation – Approval only	15
H4915CE_Find	Ship Confirmation – Confirm/Ship only	5
H4915CU_Find	Ship Confirmation – Confirm and Change Entry	5

Appendix C: JD Edwards Enterprise Server Configuration

Some of the important configuration settings for JDE initialization files are detailed below

- JDE.ini
  - Kernel configurations:

    Security kernels 60

    Call Object kernels 400

    Workflow kernels 30

    Metadata kernels 1
  - [JDENET]

    maxNetProcesses=40

    maxNetConnections=8000

    maxKernelProcesses=1000

    maxNumSocketMsgQueue=400

    maxIPCQueueMsgs=200

    maxLenInlineData=4096

    maxLenFixedData=16384

    maxFixedDataPackets=2000

    internalQueueTimeOut=90
  - [JDEIPC]

    maxNumberOfResources=3000

    maxNumberOfSemaphores=1000

    startIPCKeyValue=6000

avgResourceNameLength=40

avgHandles=200

hashBucketSize=53

maxMsgqMsgBytes=5096

maxMsgqEntries=1024

maxMsgqBytes=65536

msgQueueDelayTimeMillis=40

- jdbj.ini
  - JDBj-CONNECTION POOL

    minConnection=5

    maxConnection=800

    poolGrowth=5

    initialConnection=25

    maxSize=500
- jas.ini
  - OWWEB

    MAXUser=500

    OWVirtualThreadPoolSize=800
  - JDENET

    maxPoolSize=500

Disclaimer

The testing conducted to gather these results was performed at the end of July 2012. Some of the products that make up the test solution set may now have new versions. Therefore, a similar configuration based on newer versions of software and hardware combinations could yield different results.

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Printed in USA C51-714609-01 08/12