

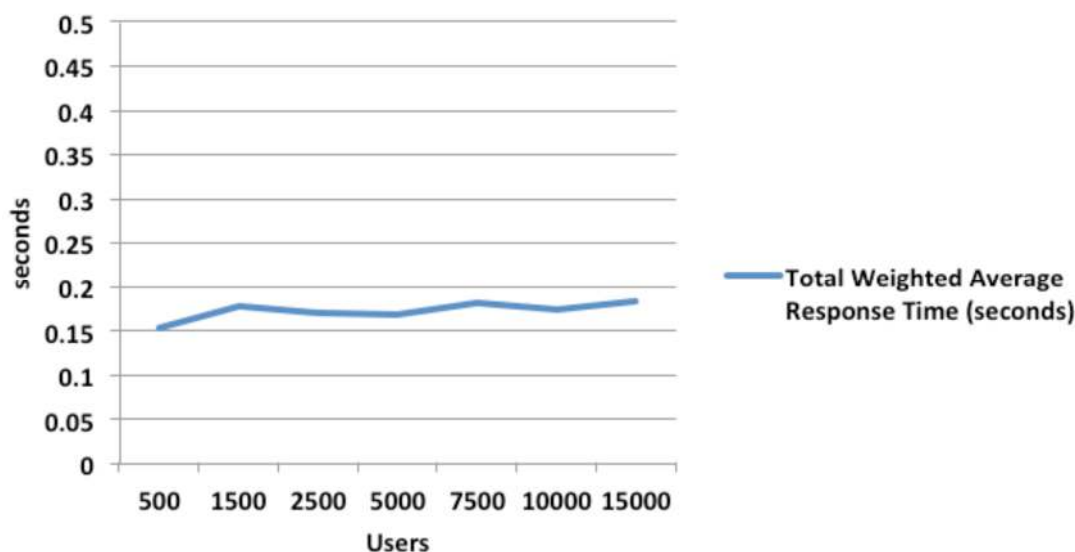
Performance Benchmark Testing of Oracle JD Edwards on Cisco Unified Computing System

Executive Summary

This white paper 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®). The deployment and testing was conducted in a Cisco® Oracle Competency Center to measure the performance of Oracle's JDE E1 Release 9.0.2 with Oracle's JDE E1 Day in the Life (DIL) test kit. The configuration included a Microsoft SQL Server 2008 R2 database deployed on Cisco UCS B-Series Blade Servers using the EMC® VNX5300™ storage system.

For scalability to be studied and understood, an adequate workload needs to be applied so that the systems under test can be stressed and can show the optimum utilization of the architecture under peak loads. Cisco UCS servers easily scaled to an impressive 15000 concurrent users, with a weighted average response time of around 0.182 seconds for JDE E1 DIL kit transactions (Figure 1).

Figure 1. Response Time of Cisco UCS Servers



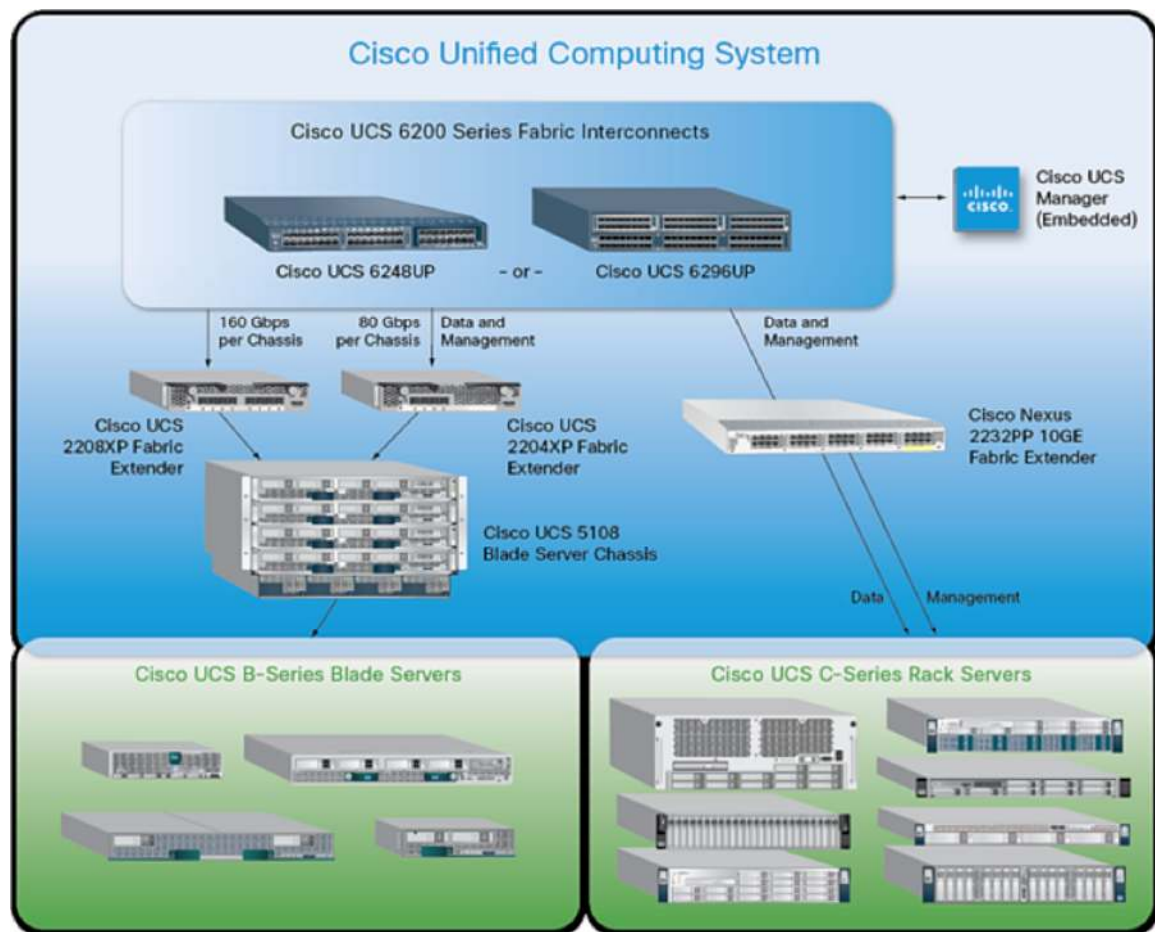
Introduction

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, multichassis 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 2). 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 that enables more rapid return on investment (ROI).

Figure 2. Cisco UCS: 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), Financials, and Customer Relationship Management (CRM).

In the Cisco Oracle Competency Center, JDE E1 was deployed on Cisco UCS B200 M3Blade Servers, which provide exceptional performance for large-data-set workloads along with high memory capacity and throughput.

The enterprise-class Cisco UCS B200 M3 extends the capabilities of the Cisco Unified Computing System portfolio in a half-blade form factor. The Cisco UCS B200 M3 Server harnesses the power of the Intel® Xeon® E5-2600 processor product family, up to 768 GB of RAM, two hard drives, and up to 8 x 10GE to deliver exceptional levels of performance, memory expandability, and I/O throughput for nearly all applications.

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

The 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 creates additional benefits that can be derived when using products such as:

- **Fast Cache:** Dynamically absorbs unpredicted spikes in system workloads.
- **FAST VP:** Tiers data from high-performance to high-capacity drives in one-gigabyte increments, with Fully Automated Storage Tiering for Virtual Pools, resulting in overall lower costs, regardless of application type or data age.
- **FAST Suite:** Automatically optimizes for the highest system performance and the lowest storage cost simultaneously (includes FAST VP and FAST Cache).
- **EMC PowerPath®:** Provides automated data path management and load-balancing capabilities for heterogeneous server, network, and storage deployed in physical and virtual environments. For additional information visit: <http://www.emc.com/collateral/software/data-sheet/l751-powerpath-ve-multipathing-ds.pdf>.
- **EMC Unisphere™:** Delivers simplified management via a single management framework for all NAS, SAN, and replication needs. For additional information on Unisphere, visit: <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 that exercises representative transactions of the most popular JDE E1 applications, including SCM, SRM, HCM, CRM, and Financial Management. This complex mixture of applications simulates workloads to more closely reflect customer environments.

Test Environment

The configuration of JDE E1 on Cisco UCS blade servers with Microsoft Windows 2008 R2 and Microsoft SQL Server included:

- **JDE HTML Server:** A single Cisco UCS B200 M3 Blade Server was deployed for scaling up to 7500 concurrent users. A second Cisco UCS B200 M3 Blade Server was deployed to scale beyond 7500 users to 15000 concurrent users. Each server was equipped with two Intel Xeon E5-2690 2.9-GHz processors and 256 GB of physical memory. These servers were configured with multiple instances of Oracle

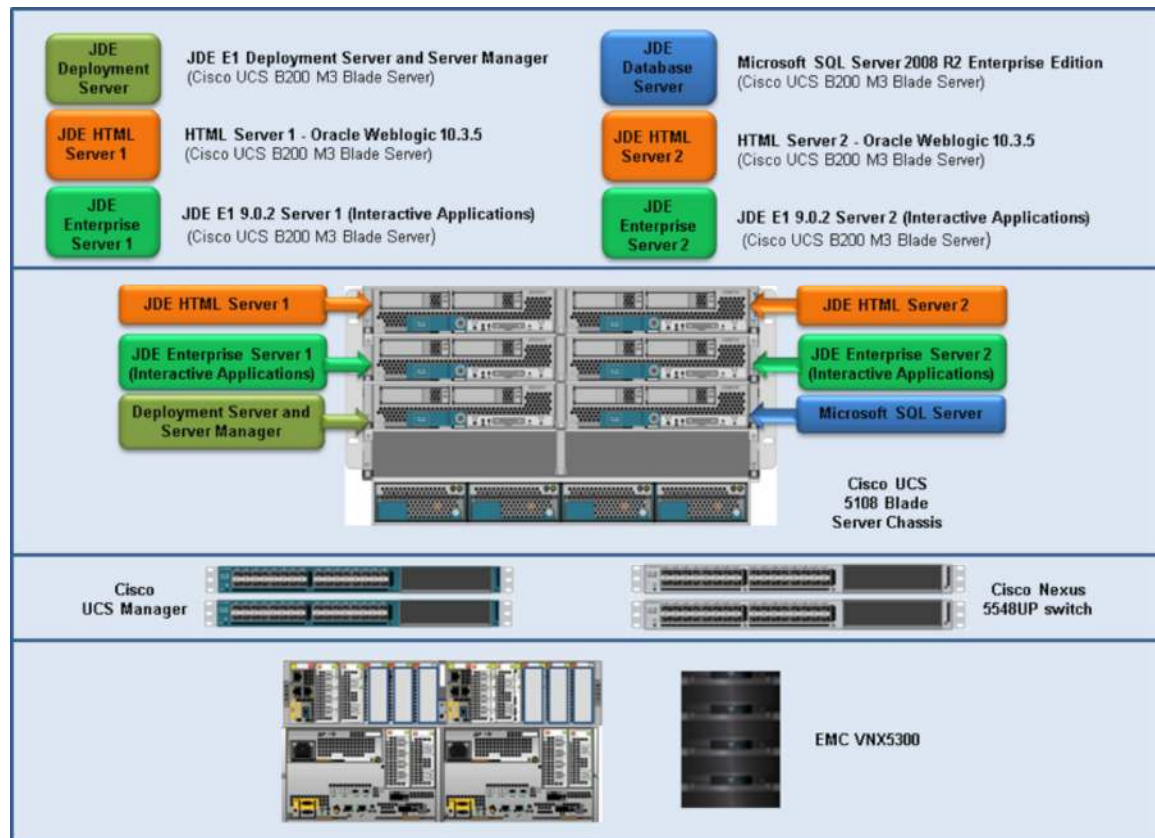
WebLogic Server 10.3.5 and load balanced through an Oracle HTTP server. JDE HTML Server version 8.98.4.6 was used for this test.

- **JDE Enterprise Server:** Similar to JDE HTML Server, a single Cisco UCS B200 M3 Blade Server was deployed for scaling up to 7500 concurrent users. A second Cisco UCS B200 M3 Blade Server was deployed to scale beyond 7500 users to 15000 concurrent users. Each server was equipped with two Intel Xeon E5-2690 2.9-GHz processors and 128 GB of physical memory. JDE E1 Release 9.0, Update 2, with Tools Release 8.98.4.6 was deployed on the Enterprise Server.
- **JDE Database Server:** The JDE Database Server was deployed on a single Cisco UCS B200 M3 Blade Server for scaling to 15,000 concurrent users. Cisco UCS B200 M3 Blade Server was equipped with two Intel Xeon E5-2690 2.9-GHz processors and 256 GB of physical memory. The database tier was configured with Microsoft SQL Server 2008 R2 Enterprise Edition.
- **JDE Deployment Server and Server Manager:** A Cisco UCS B200 M3 server was equipped with two Intel Xeon E5-2665 2.4-GHz processors and 32 GB of physical memory.

Microsoft Windows 2008 R2 Enterprise Edition is the base operating system for all these essential components of the JDE E1 test deployment.

Figure 3 illustrates the essential components of the JDE E1 deployment on Cisco UCS blade servers.

Figure 3. Oracle JD Edwards Essential Components for Deployment on the Cisco UCS

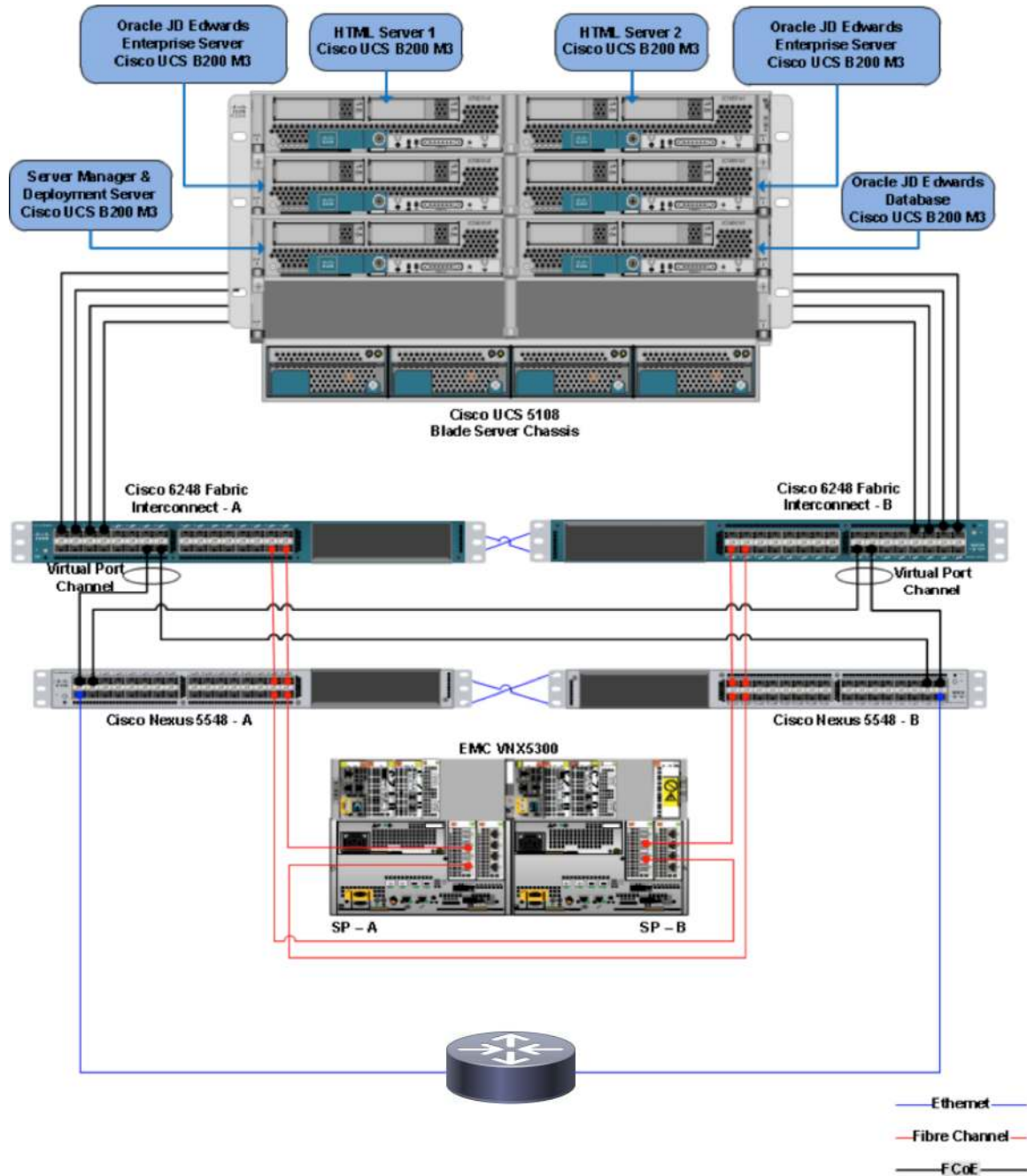


Infrastructure Components

The deployment architecture for the test run is shown in Figure 4 and includes the following components:

- The Cisco UCS 5100 Series 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 32 1/10-Gbps fixed Ethernet, FCoE, and Fibre Channel ports, and one expansion slot.
- The Cisco Nexus® 5548UP Switch is a 1RU 10 Gigabit Ethernet switch offering up to 960-Gbps throughput and up to 48 ports. It offers 32 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 supports 2.5-inch, 10k RPM SAS drives in a 2RU disk array enclosure (DAE) that can hold up to 25 drives, as well as supporting 15k RPM SAS drives in a 3.5-inch form factor using a 15 drive DAE. With the performance focus in this project, the 3.5-inch 15k RPM SAS drives were used. Efficiency features available for the EMC VNX5300 include FAST Cache and FAST VP.

Figure 4. Deployment Architecture for Oracle's JDE E1 on Cisco UCS



Workload Mix

The JDE E1 DIL kit is a set of 17 scripts that include Oracle, Oracle SCM, SRM, HCM, CRM, and FMS.

Table 1 shows the transaction mix used for the JD Edwards interactive test with the JDE E1 DIL kit.

Table 1. Workload Mix

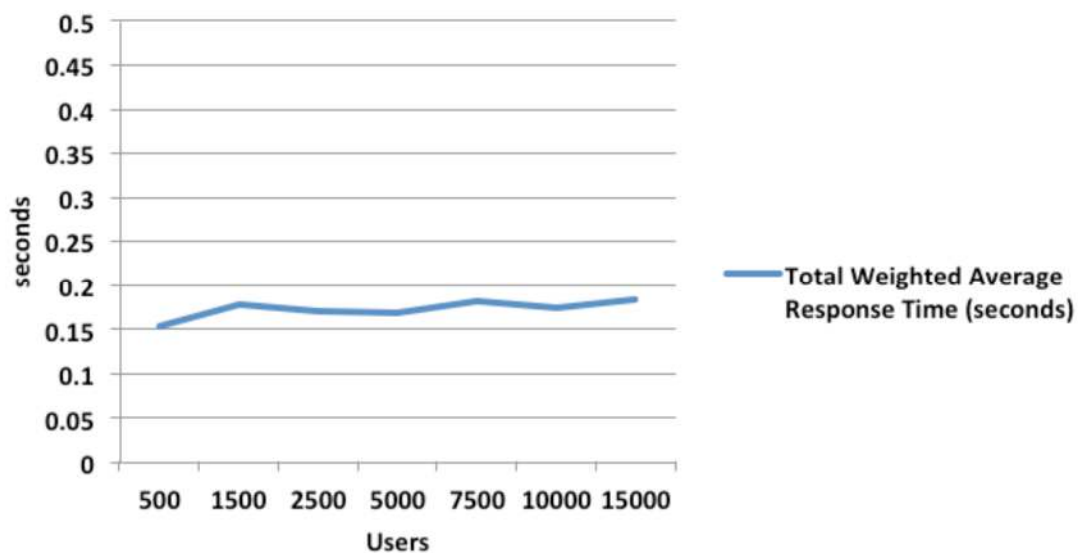
Oracle Application	Percentage Weight
Financial Management System	20
Supplier Relationship Management	24
Supply Chain Management	49
Customer Relationship Management	5
Human Capital Management	2
	100%

Summary of Test Results

The interactive version of the JDE E1 DIL kit was run for 500 to 15,000 concurrent interactive users and was deployed on Cisco UCS servers.

Figure 5 shows the weighted average response time for 500 to 15,000 interactive users.

Figure 5. Oracle JDE E1 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 seconds for 500 to 15,000 concurrent users.

Test Results

The interactive version of the JDE E1 DIL kit was run to capture the end-user response time with important system characteristics such as CPU, memory, and I/O across the test system. All three components of the JDE E1 deployment—HTML server, Enterprise Server, and Microsoft SQL database server—were monitored through Microsoft Windows Performance Monitor (PerfMon), a Microsoft Windows monitoring tool.

User Response Time

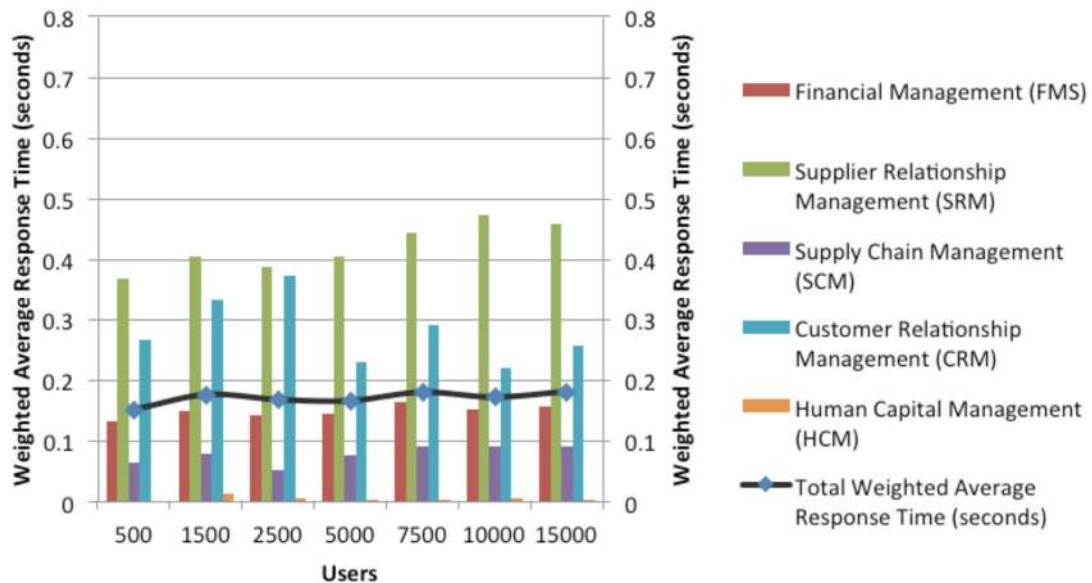
User response time was captured at the LoadRunner Controller for all 17 interactive JDE E1 DIL test scripts. The five JD Edwards applications measured in the JDE E1 DIL Kit were:

- 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 Workload Mix section of this document.

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

Figure 6. Oracle's JDE E1 DIL Kit Wighted Average Response Time



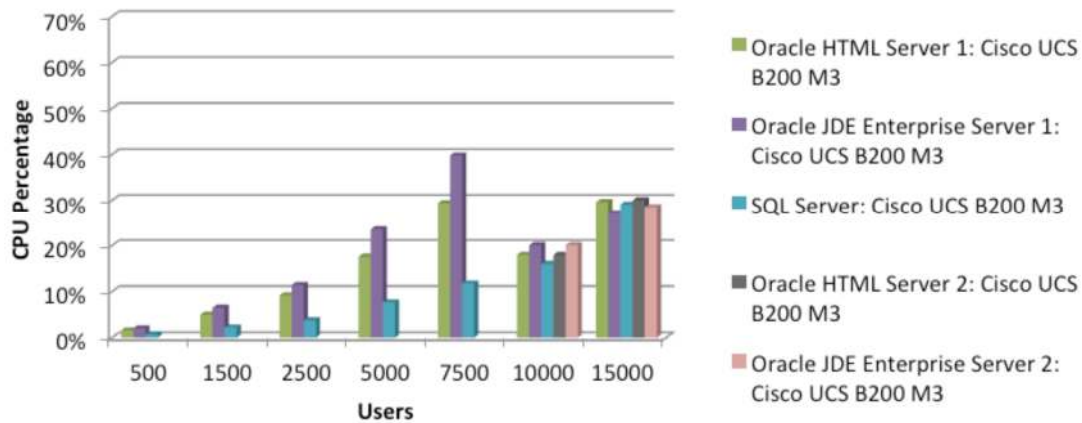
As detailed in Figure 6, the total weighted average response time for interactive tests was always below 0.2 seconds during the scalability test for 500 to 15,000 concurrent users.

CPU Utilization

The HTML server, Enterprise Server, and Microsoft SQL database server were deployed on separate Cisco UCS B200 M3 Blade Servers configured with two Intel Xeon E5-2690 processors. A single physical node of HTML and Enterprise Servers was utilized for scaling to 7500 users. Two physical nodes each, of HTML and Enterprise Servers, were deployed in the scalability test to scale from 7500 users to 15,000 users. During the scalability test from 500 to 15,000 users, a single physical node of SQL server was utilized.

Figure 7 illustrates the average CPU utilization across all three JD Edwards tiers.

Figure 7. JDE E1 CPU Utilization



Observations:

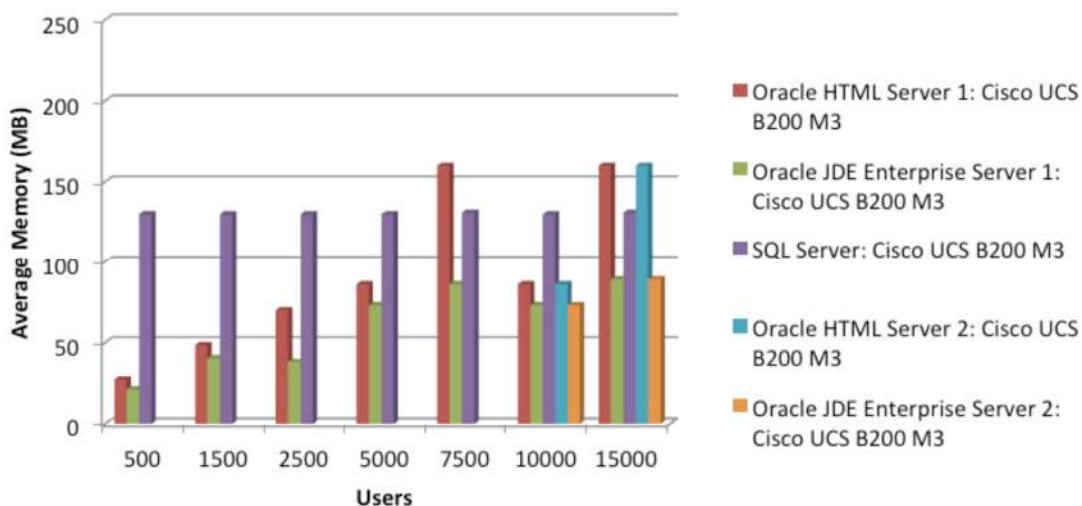
- CPU stress was seen more on the application tier than on the database tier.
- CPU utilization gradually increased, reflecting the linear scalability of the workload.

Memory Utilization

Memory utilization for the test with 500 to 15,000 users across all the three JD Edwards technology tiers is illustrated in Figure 8.

JDE Enterprise servers were configured with 128 GB of memory. SQL Server and HTML servers were configured with 256 GB of memory. The operating memory speed of all the deployed servers was configured to a maximum of 1600 MHz.

Figure 8. JDE E1 Memory Utilization



Observations:

- Memory utilization on JDE HTML Server was dependent on the number of Oracle WebLogic instances configured with various workloads. The maximum heap size of each Oracle WebLogic instance was set to 3 GB.
- 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 Universal Batch Engine (UBE) processes.

I/O Performance

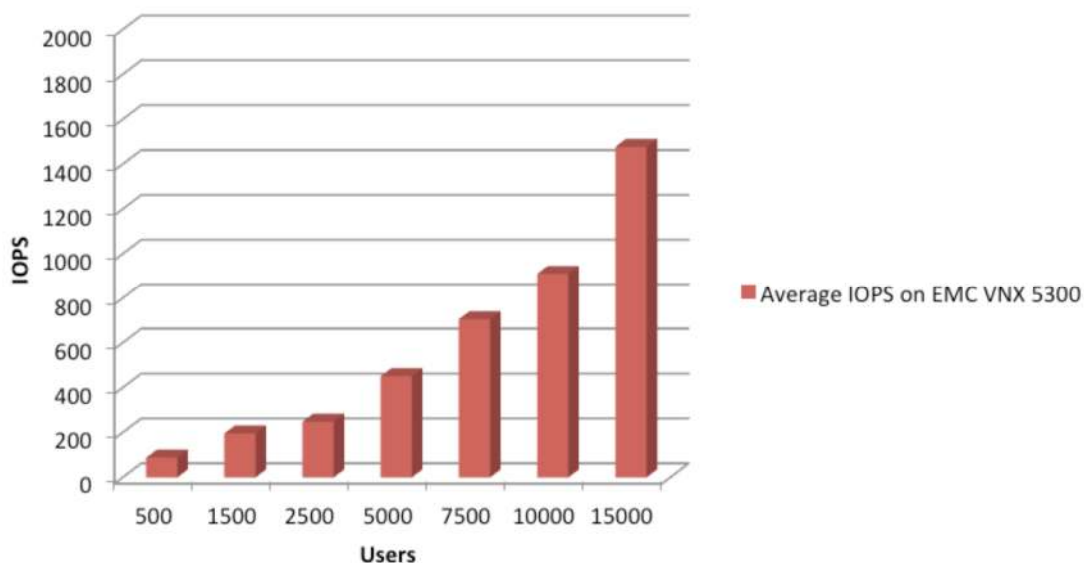
The EMC VNX5300 was configured as the storage system for each of the three components of the JDE E1 deployment: HTML server, JDE E1 server, and Microsoft SQL database server. The Cisco UCS servers were booted from the SAN (EMC VNX5300), which allows unleashing of the full capabilities of Cisco UCS statelessness. 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.

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

Figure 9 illustrates disk I/O performance captured during the scalability test for 500 to 15,000 JDE E1 interactive users.

Figure 9. JDE E1 Disk I/O



Observations:

- The number of I/O operations per second (IOPS) on the database server scaled linearly, reflecting the gradual increase in the user count.
- The IOPS count on the HTML and Enterprise Servers was very low.

Conclusion

The tests 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. Cisco UCS servers were able to successfully scale to 15,000 users with a weighted average response time of 0.182 seconds across the range of tested user workloads.

Cisco UCS infrastructure provides rapid deployment through the use of Cisco UCS service profiles, optimizes scaling with the capability to scale up to 20 chassis, and simplifies operations because the computing resources are managed as a pool, with no added complexity to scale the JDE E1 environment. The innovations and exceptional performance resulting from the combination of the Cisco UCS servers and EMC VNX storage makes this infrastructure an ideal solution for Oracle's JD Edwards EnterpriseOne deployments.

Disclaimer

The testing conducted to gather these results was performed at the end of April 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.

Appendix A: Test System Specifications

Table 2 summarizes the test configuration of JDE E1 on Cisco UCS servers.

Table 2. Test Configuration for Oracle's JDE E1 on Cisco UCS

JDE HTML server	<ul style="list-style-type: none">• 2 x 1 Cisco UCS B200 M3 Blade Server equipped with two Intel Xeon E5-2690 2.9-GHz processors and 256 GB of physical memory• Oracle WebLogic 10.3.5 on Microsoft Windows 2008 R2 Enterprise Edition
JDE E1 Enterprise Server	<ul style="list-style-type: none">• 2 x 1 Cisco UCS B200 M3 Blade Server equipped with two Intel Xeon E5-2690 2.9-GHz processors and 128 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 Database server	<ul style="list-style-type: none">• Cisco UCS B200 M3 Blade Servers equipped with two Intel Xeon E5-2690 2.9-GHz processors and configured with 256 GB of physical memory• Microsoft SQL Server 2008 R2 Enterprise Edition
Deployment server and server manager	<ul style="list-style-type: none">• Cisco UCS B200 M3 Blade Server equipped with two Intel Xeon X5665 2.4-GHz processors and configured with 32 GB of physical memory
Test client	<ul style="list-style-type: none">• LoadRunner 9.5 on Microsoft Windows 2003 Server
Storage	<ul style="list-style-type: none">• EMC VNX5300
Operating system (64-bit)	<ul style="list-style-type: none">• Microsoft Windows 2008 R2 Enterprise Edition

For More Information

<http://www.cisco.com/en/US/netsol/ns1155/index.html>

<http://www.emc.com/storage/vnx/vnx-series.htm>



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