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White Paper

EMC IT's Replatform Proof of Concept to an Open, Scalable Platform

Applied Technology

Abstract

This white paper illustrates EMC IT's replatform POC from a legacy infrastructure (Sun and Solaris) to an open platform (x86 and Linux), expandable infrastructure (consolidated physical Oracle RAC and Grid) deployed on a Cisco Unified Computing System platform.

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Executive summary

This white paper will show EMC's CRM E-Business Suite database server replatform POC to Cisco's Unified Computing System (UCS) platform, and how EMC IT developed a method to migrate the database from RISC/SPARC to the target UCS platform and the performance improvements gained.

The migration creates a "bridge" from a legacy platform to an open platform that will enable and accelerate the following:

- A working, documented EMC IT procedure to migrate an 8 TB Oracle CRM E-Business Suite production database to an open platform (from Solaris/SPARC to Cisco's UCS/Linux/x86).
- The ability to get to an open and scalable computing platform UCS (x86). This gives EMC IT a platform to commence its "Journey to the Private Cloud."

In summary, the new UCS replatform POC infrastructure is up to 28 times more performant than the legacy Solaris platform, reducing end-user response times (see the "Business performance gains" section on page 12) and batch runtimes by over 60 percent.

Introduction

This white paper illustrates EMC IT's approach to a POC from a legacy, closed implementation of an CRM Oracle E-Business Suite database server on a Solaris platform to an open, expandable platform via an Oracle Real Application Clusters (RAC) and Grid architecture and support on a Cisco UCS platform.

Audience

This white paper is focused on the CIO, system architect, Oracle architect, storage architect, and supporting staff, focusing on Oracle Applications DBAs, server administrators, and network administrators.

EMC IT Oracle E-Business Suite challenges

EMC, like many large enterprises, has deployed enterprise-scale implementations of Oracle's ERP and CRM solutions to enable its business in Manufacturing, Finance, Quoting, Customer Service, Professional Services, Sales, and Marketing.

EMC's two enterprise-scale mission-critical systems support core revenue-generating functions ($15 billion in revenue for 2009) and are the sources for their Business Intelligence/Data Warehousing infrastructure. The following is a snapshot of the infrastructure and the EMC user community who utilize it:

- An ERP solution, supporting 20,000 employees with 2,000 concurrent users.
- A CRM solution, supporting 50,000 named users worldwide with peaks of over 4,000 concurrent users. This implementation is one of the top four Oracle Applications transactional systems in the world.

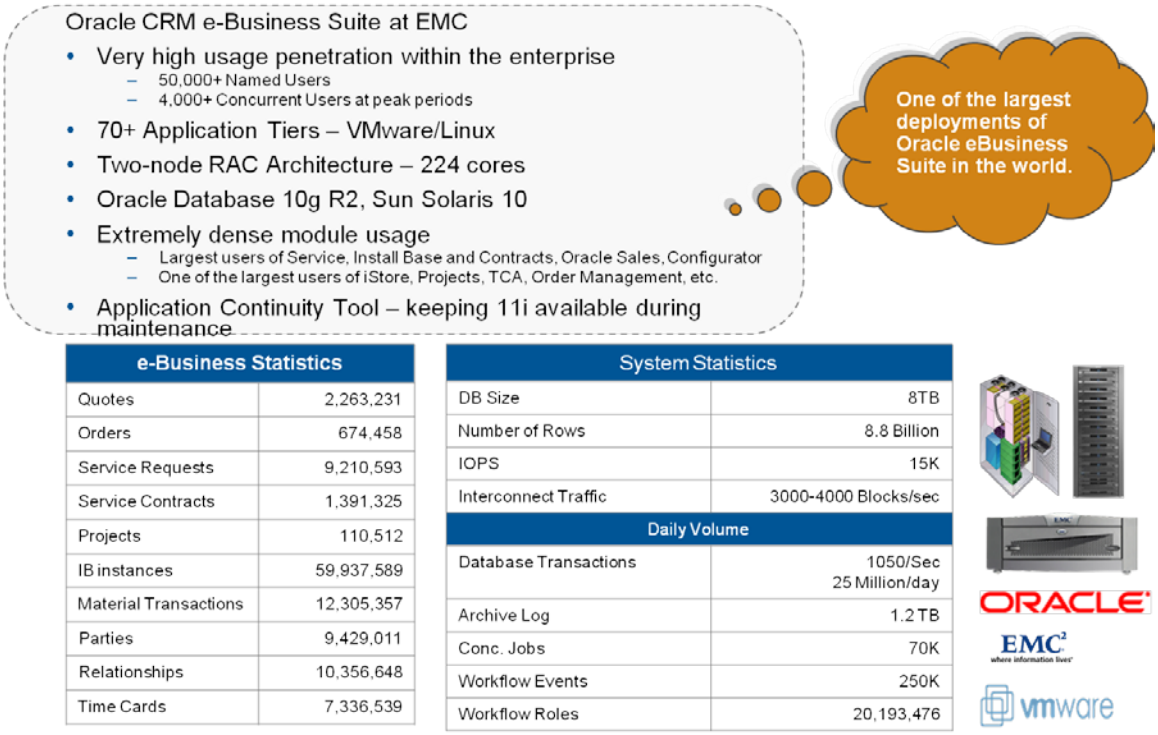

Figure 1. EMC's current E-Business Suite statistics and volumes

EMC IT's approach was to perform a POC to replatform from Sun Solaris to Cisco's UCS platform, an open expandable infrastructure, enabled by EMC technologies and best practices with the following components:

- Open – Linux/x86 platform (UCS) to replace legacy Solaris and legacy SPARC hardware
- Scalable – An Oracle RAC physical deployment to create a database grid that has the ability to grow via horizontal scaling out (by adding RAC nodes)
- Platform – Cisco's UCS platform

EMC IT's UCS replatform approach

The following section identifies the EMC legacy infrastructure of the EMC IT CRM E-Business Suite database server deployment.

Current architecture

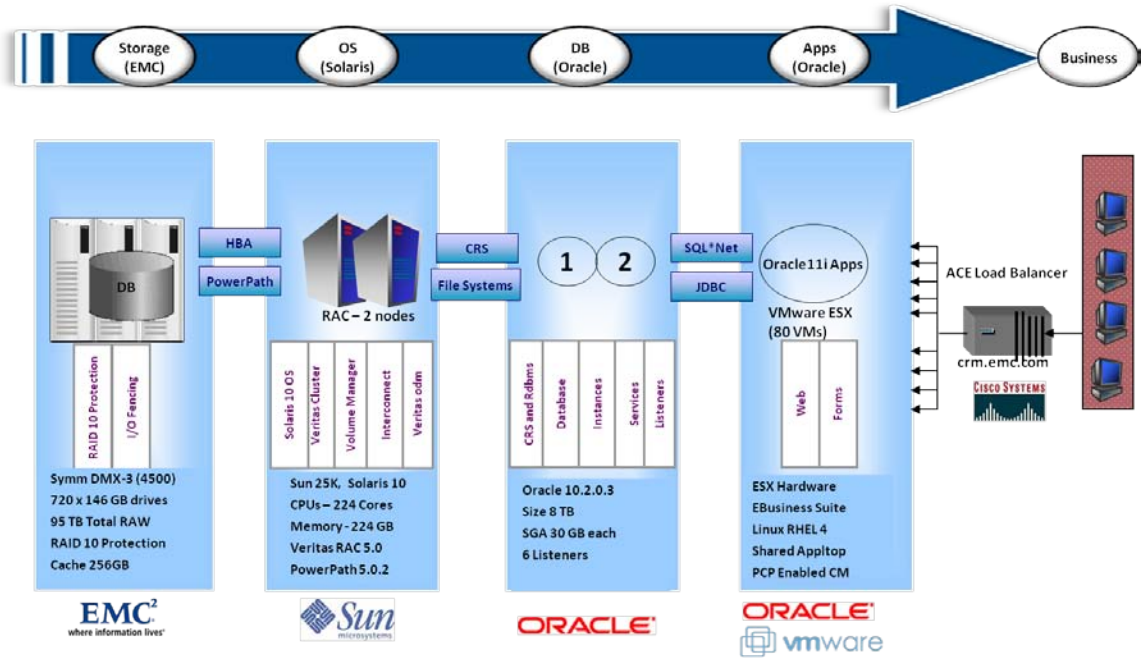

Figure 2. EMC's legacy E-Business Suite infrastructure

Challenges

Challenges of the legacy infrastructure include the following:

- Need to migrate away from proprietary UNIX to commodity hardware and Linux
- Aging infrastructure
- Legacy hardware has not kept pace
- Tied to a single vendor
- Legacy platform is "end of life"

EMC IT's UCS replatform infrastructure architecture

UCS replatform drivers

The following high-level replatform drivers illustrate the need to migrate EMC from a legacy deployment platform to an open, performant UCS platform.

- A variety of Sun SPARC server technologies deployed in EMC data centers (880, 25K)
- Currently deployed Sun platform was end of life
- High operational cost to support a Sun/SPARC platform

- Business service level objectives could not be met on the current Sun/SPARC deployment

Figure 3 is a high-level illustration of the EMC UCS replatform infrastructure architecture deployment.

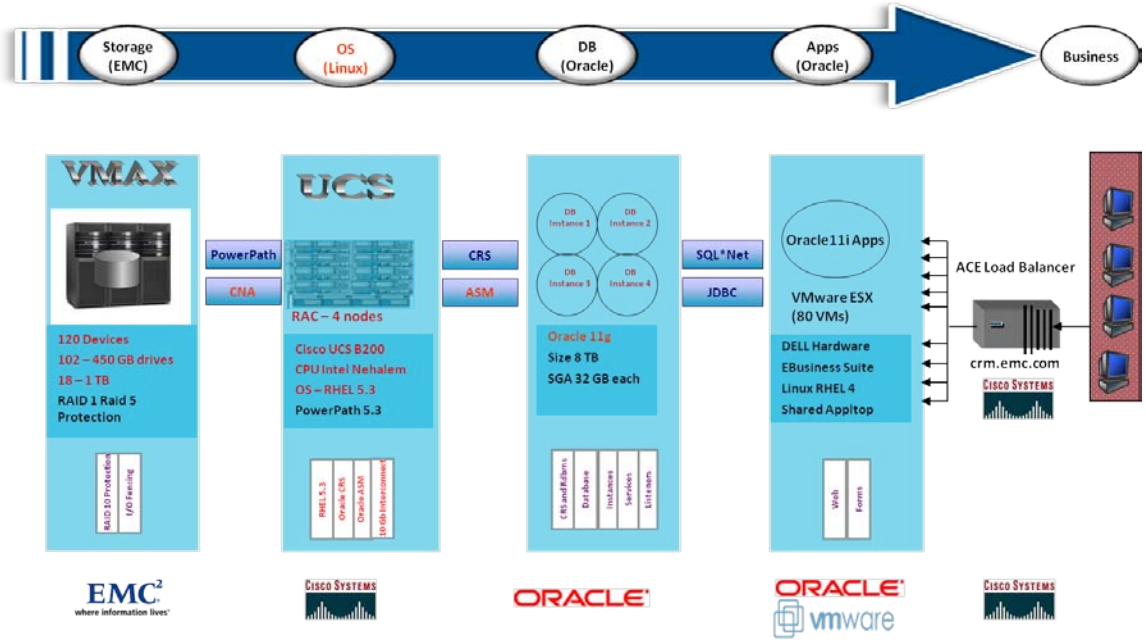

Figure 3. EMC's replatform POC deployment infrastructure

Benefits

The following are the high-level benefits for EMC to deploy on the Cisco UCS platform:

- Significantly lowers hardware, heating and cooling, service and support costs
- Better performance, especially transactional performance improvements (see the "Business performance gains" section). Intel Nehalem has "changed the equation"
- No longer tied to a vendor
- Would be a virtualization enabler, allowing a move to virtualization and EMC's "Journey to the Private Cloud"
- Allows greater agility and flexibility
- Simplifies the data center
- High availability is no longer cost-prohibitive

Storage

The following is a high-level description of the configuration and connectivity of the Symmetrix VMAX™ Single Engine (SE) storage array used for the POC:

- The configuration included 120 devices (102 x 450 GB drives, 18 x 1 TB drives)
- The disk format is RAID 1 and RAID 5 with concatenated metavolumes.
- SAN connectivity is:
  - 2 GB infrastructure
  - 4 Fibre Channel (FC) to the SAN

Table 1 illustrates the file system layout on the Symmetrix VMAX SE array connected to the POC's Cisco UCS platform.

Table 1. VMAX storage layout

Mount Point (# of mount points)	Meta Size	Meta/ FS	# of FS	GB	# m/c	m/c name	Notes
DB Tier							
asm	8	1	1	16	2	node1, node2	ext3
crs	16	1	1	32	2	node1, node2	ext3
oracle	35	1	1	70	2	node1, node2	ext3
oraconfig	2	1	1	2	1	node1, node2	Cluster disk shared (OCFS)
oradata/dataXX	210	1	46	9660	1	node1, node2	ASM disks shared
oradata/redoXX	10	1	8	80	1	node1, node2	ASM disks shared
arch	210	1	1	210	1	node1, node2	ASM disks shared
temp	100	1	1	100	1	node1, node2	ASM disks shared
imap	10	1	1	10	1	node1, node2	ext3, floats non-cluster FS
ctrlm	8	1	1	8	1	node1, node2	ext3, floats non-cluster FS
splex	70	1	1	70	1	node1, node2	ext3, floats non-cluster FS
OCR disk raw	1	1	1	1	1	node1, node2	Raw device
Vote disks raw	1	1	1	1	1	node1, node2	Raw device
Total (DB tier)	10360						

UCS POC domain

Cisco's Unified Computing System (UCS) is a strategic platform for EMC IT. At a high level it provides the following for the EMC vision of "Journey to the Private Cloud" computing:

UCS "unifies"

- It uses industry-standard x86.
- You need to wire once for SAN, NAS, and iSCSI.
- Virtualization adds control, scale, and performance.

Embedded management

- Increase scalability without added complexity
- Dynamic resource provisioning
- Integrate with a broad partner ecosystem

Energy-efficient

- Use fewer servers, switches, adapters, and cables
- Lower power and cooling requirements
- Increase compute efficiency by removing I/O and memory bottlenecks

Figure 4 is the high-level pre-production "UCS Domain" configuration used in the POC.

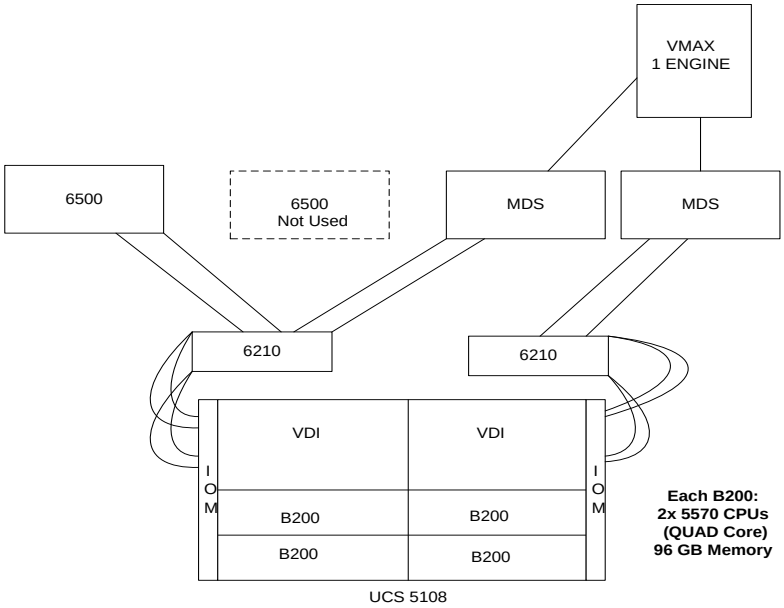

Figure 4. EMC's replatform "UCS domain" POC deployment infrastructure

Table 2 illustrates the technologies used in the construction and deployment of EMC IT's BI grid:

Table 2. EMC UCS replatform components

Technology	Components
Oracle software	Oracle Database 10.2.0.4 RAC ASM Grid Infrastructure 11.1.0.6
Operating system	Red Hat Enterprise Linux 5.3
Database servers	4 x pre-production UCS blade servers 2 sockets/4 cores (per socket) 10 gigabit Ethernet RAC interconnect integrated with the Converge Networking feature of UCS architecture
Storage array	EMC Symmetrix VMAX SE EMC Celerra® (NAS)
EMC software	EMC Virtual LUN with Auto-provisioning EMC TimeFinder®/Clone and TimeFinder/Snap EMC SRDF® EMC Disk Library (EDL) EMC NetWorker® EMC PowerPath ®

UCS replatform highlights

Enabling an open, expandable E-Business Suite database server to support a leading information vendor is done in a phased approach to see how the new technology, new infrastructures (physical/database), and operational process can be improved. This was a five-month, part-time activity to perform the UCS replatform POC.

The following are the highlights of the POC.

UCS replatform design (4th quarter 2009/1st quarter 2010)

The drivers for the UCS platform were done in an accelerated state over two quarters. The replatform of the Oracle Applications E-Business Suite database server was done on a UCS that was already deployed and being used for other activities.

It is important to remember that this POC did not utilize any of the optimal best practices for server, storage, or database tuning. This will be done in the deployment phase of the replatform of the database server.

POC's testing model

The ability to do a real-world simulation of EMC's "End of Quarter" Business Close is done by the Performance Test method used at EMC. Figure 5 illustrates the process.

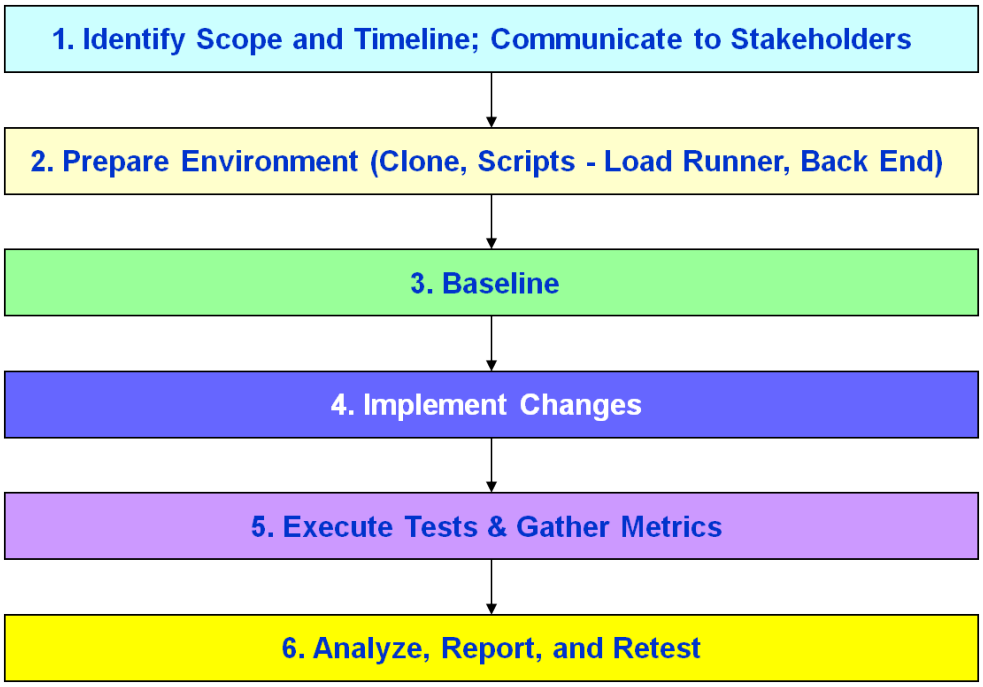

Figure 5. POC testing model

EMC's E-Business performance testing

The E-Business performance test is a forms-based (front-end) test done via the LoadRunner toolset and a custom EMC-developed tool that tested the database server (back end).

The testing re-creates an "End of Quarter" Business Close load that measures the following:

- Effects on user experience
- Average page response times
- Scalability testing

The "Business performance gains" section describes critical before and after test results from the replatform testing.

EMC IT platform migration method POC (4th quarter 2009/1st quarter 2010)

EMC developed a method to migrate its 11i intake from legacy UNIX to Linux via RMAN Convert. Figure 6 illustrates the steps in the migration method.

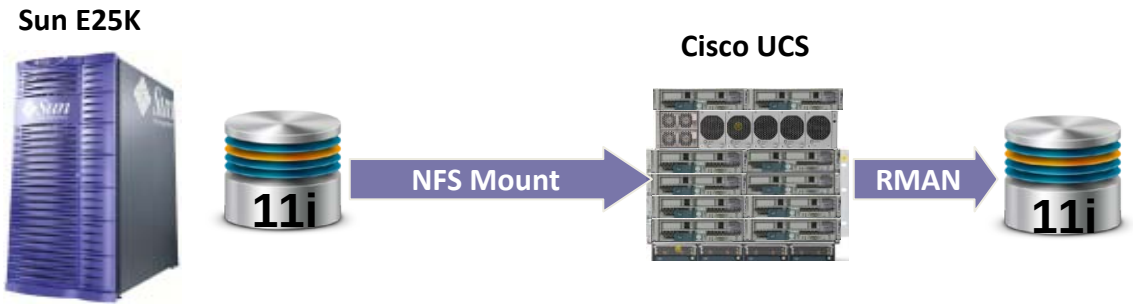

Figure 6. EMC's IT migration method

The following are the high-level steps taken:

1. NFS mount the datafile LUNs to the target UCS POC.
2. Put the database in "read-only" mode.
3. Create a Transportable Tablespace set.
4. Export the Transportable Tablespace metadata.
5. Export the E-Business apps user – norows to get all of the database code, synonyms, triggers, and sequences.
6. Export the SYSTEM schema to get all of the temporary tables.
7. Use the RMAN Convert datafile. Converting directly from the NFS mounts saves the time and space that would be required to copy them to the target database server.
8. Import the Transportable Tablespace metadata.
9. Import the E-Business apps user – ignore='Y'.
10. Import the SYSTEM Schema – ignore='Y'.
11. Rebuild Queue Tables.
12. Rebuild all Spatial Indexes.

Transportable Tablespaces (TTS)

The Transportable Tablespace feature allows users to move a user tablespace across Oracle databases. It's an efficient way to move bulk data between databases. If the source platform and the target platform are of different endianness, then an additional conversion step must be done on either the source or target platform to convert the tablespace being transported to the target format. If they are of the same endianness, then no conversion is necessary and tablespaces can be transported as if they were on the same platform.

Moving data using transportable tablespaces can be much faster than performing either an export/import or unload/load of the same data. This is because transporting a tablespace only requires the copying of datafiles from the source to the destination and then integrating the tablespace structural information.

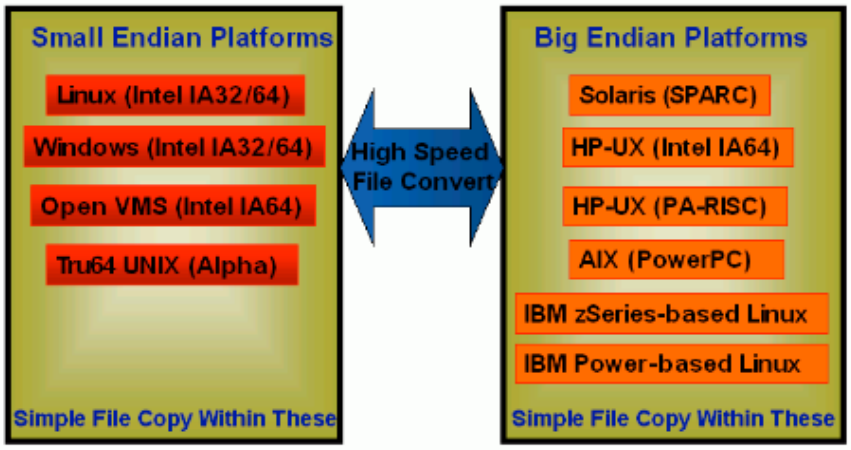

Figure 7. Platform migrations from small endian platforms to big endian platforms

Oracle-certified method (April 2010)

EMC IT joined the early adapters program in the first quarter of 2010 for using Transportable Tablespaces to migrate cross-platform. In addition, an Oracle Metalink note (Note 454574.1) was released in the second quarter of 2010 to serve as an officially supported method. This method only supports Oracle E-Business Suite 11.5.10.2 on Oracle 10.2.0.4. This method, as well as EMC IT's, will work on other versions from 10gR1 onward; however, Oracle is unlikely to willingly provide support for the migration.

The Metalink note fails to disclose the problems with using datapump export/import. EMC utilized the original export/import due to these problems. Many patches for expdp and impdp provide some benefit.

Business performance gains

The following section highlights results from the performance test that show the improvements on a *non-optimized multiple tenant (VDI and Oracle database servers) "UCS domain" and a Symmetrix VMAX SE*. The tests were the following:

- Two nodes were utilized with 100 percent back-end and front-end load.
- Four nodes were utilized with 100 percent back-end and front-end load.
- Four nodes were utilized with 200 percent back-end and front-end load.

The following table highlights important activities that are critical to EMC's business and the business transaction times with the legacy system (the column Base Avg Time) compared to times with the UCS replatform server.

Also in the table:

- CSI stands for Customer Service actions.
- CXP stands for Channel Express, which means external orders for EMC.
- DXP stands for Direct Express, which means internal orders generated by EMC Sales teams.

Table 3. Highlighted Business Transactions times - Legacy versus replatform server (UCS)

		Base	UCS
Script	Transaction Name	Avg Time	Avg Time
CSI - Browse	CSI_Group_Refresh	2.0	1.0
CSI - Browse	CSI_RefreshCount	0.6	0.5
CSI - Contracts	Check_QA	1.9	1.0
CSI - Contracts	Copy_Contract	0.4	0.4
CSI - Contracts	Load_Contract_Navigator	0.7	0.4
CSI - Contracts	Open_For_Update	0.7	0.4
CSI - Contracts	Preview_Renewal_Quote	11.5	5.6
CXP - Config	CXP_Step_24_Save_Configuration	27.4	3.3
DXP	DXP_Create_New_Version	133.6	36.3
DXP	DXP_Create_Opportunity	57.0	26.1
DXP	Dir_B_70_CreateQuote	1.9	0.3
DXP	DXP_Duplicate_Config_10_Times	250.6	22.8
DXP	Dir_B_33_Initiate_for_Approval	416.1	6.9
DXP	Dir_A_17_Launch_Config	7.8	3.7
DXP	Dir_A_19_Save_Config	27.9	3.4
DXP	DXP_Customer_Search	1.0	0.3
DXP	DXP_Search_Sales_Person	3.3	0.5
DXP	DXP_Submit_Order	14.7	2.4

Improvements with the new system were an "order of magnitude" over the legacy infrastructure:

- For Customer Service (CSI) actions, the "Preview Renewal Quote" transactions improved by 200 percent from 11.5 to 5.6 seconds.
- For Channel Express (CXP) actions, the "Save an Array configuration" transactions improved by 800 percent from 27.4 to 3.3 seconds.
- For Direct Express (DXP) actions, the "Create a new version" transactions improved by 360 percent from 133.6 to 36.3 seconds. The "Save a configuration" transactions improved by 820 percent from 27.9 to 3.4 seconds.

The following are some additional critical business operations that were dramatically improved on the POC replatform infrastructure:

Table 4. Business process legacy/baseline versus replatform server (UCS) improvements

Business process	**Legacy time (seconds)**	**UCS/VMAX time 4 Nodes, 100 % utilized (seconds)**	**Improvement**
CSI - Browse (Search for an SR to work on)	2.6	1.5	.9X , almost 1x
CSI - Contracts (Find, reprice, and renew a contract)	19.9	9.5	2.x
CSI - FSTP (Bring up a task in your work queue to work on)	2.9	.6	4.8x
CSI - SCFSIB (Find an open SR, based on a predefined set of priority rules, diagnose the problem, save info to SR, and dispatch a tech)	57.1	29.3	1.94x

CXP - Config (Log in to Channel Express, launch a configuration, configure Connectrix®, and save the configuration)	46.8	9.8	4.7x
CXP - Reprice (Reprice an existing quote, and place an order)	53.7	1.9	28x
DXP (Log in to Direct Express, price a quote, approve a quote, launch Configurator, configure Symmetrix DMX-4, save the configuration, duplicate the configuration, search for another customer, create an opportunity, and place the order)	1350.7	99.5	13.5x
Opp - Sales (Create opportunities, configure a new customer)	51.3	12.7	4x
TSE - Cost Budgets (Create and edit cost budgets)	7.6	1.7	4x
TSE - Revenue Forecast Version (Create and edit revenue forecasts)	7.9	1.8	4x
TSE - Staffing and Milestone (Create a staffing profile and milestones for a project)	8.8	1.9	4.6x
TSE - Timecard (Fill out and submit a project-related timecard)	1.3	.4	3x

Conclusion

The replatform POC to the Cisco Unified Computing System has accomplished the following for EMC IT:

- The ability to get to an open and scalable computing platform (x86) that the UCS will provide as a strategic architecture for EMC IT
- A working, documented EMC IT procedure to migrate an 8 TB production database to another platform (from Solaris/SPARC to Linux/x86)

This creates a bridge to an x86 platform that will enable acceleration to "Journey to the Private Cloud" computing.

As described previously, the use of a pre-production, non-optimized "UCS domain" with a Symmetrix VMAX SE array produced "order of magnitudes" improvements on critical business process for EMC. These improvements were 1 to 28 times faster than today's baseline. This has the impact of both clients and EMC employees seeing quicker responses for the following:

- Customer Services actions
- External orders to EMC
- Internal orders created by the EMC Sales team

A forthcoming white paper will detail the deployment to production of the Oracle E-Business Suite database server infrastructure from legacy to the open, scalable UCS platform. This paper will describe the correct, optimized deployments of the infrastructures (UCS, database, and so on) and the lessons learned from the official Metalink note on migration (Note 454574.1).

Acknowledgments

The author would like to thank EMC IT's POC replatform teams for assisting in the creation of this white paper.