

Virtualized SAP: Optimize Performance with Cisco Data Center Virtual Machine Fabric Extender and Red Hat Enterprise Linux and Kernel-Based Virtual Machine

What You Will Learn

The virtualization of SAP environments to accommodate standardization and easier management is gaining momentum in data centers.

Using a typical enterprise resource planning (ERP) workload as benchmarking profile, SAP performance in a virtualized environment can be increased by 24 percent when the environment is upgraded from Red Hat Enterprise Linux (RHEL) Release 5.5 to RHEL Release 6.1. Additional performance gains can be attained by employing Cisco® Data Center Virtual Machine Fabric Extender (VM-FEX) technology in the Cisco Unified Computing System™ (Cisco UCS™).

Cisco Data Center VM-FEX enables performance gains either in the form of up to 11 percent more users or as reduced database access latency, effectively speeding up user queries by up to 29 percent.

This document shows how you can improve virtualized SAP performance with RHEL and Cisco Data Center VM-FEX.

Introduction

In today's economic climate, enterprises are taking a closer look within their IT departments to identify potential areas in which cost-saving strategies can be implemented to help reduce operating expenses (OpEx). A critical challenge that IT departments face today is development of an infrastructure that enables high performance, flexibility, redundancy, high availability, and ease of management, while at the same time reducing costs, hardware footprints, and complexity.

The need to contain physical server sprawl has led to adoption of large-scale server virtualization in data centers, and it is common for multiple virtual SAP instances to run on a single X86-based server. Server virtualization has added a new level of network management complexity. Virtual switches within each physical host have increased the number of network management points by an order of magnitude and have challenged traditional administrator roles and workflows. Virtual switching within the hypervisor also taxes host CPU resources and has associated overheads that affect virtual machine I/O performance.

As this document shows, virtualized SAP performance in a Red Hat Linux environment can be enhanced with Cisco Data Center VM-FEX technology, and performance concerns can be addressed by consolidating the virtual switch and physical switch into a single management point.

HIGHLIGHTS

Optimized for Performance

Cisco® Data Center Virtual Machine Fabric Extender (VM-FEX) and Red Hat Linux deliver an integrated and performance-optimized solution to handle a SAP virtual machine execution environment:

- Enables increase from 2900 users to 3600 users with improved system response time
- Enables increase from 2900 users to 4000 users with standard (1second) system response time

Cisco Unified Computing System™ (Cisco UCS™) High-Performance Platform

Cisco UCS provides a flexible, high-performance platform that can be optimized and easily scaled for any size of virtualized SAP deployment.

Cisco UCS Concepts and Benefits

The Cisco Unified Computing System is an innovative set of technologies that help meet the challenges and deliver on the requirements of the data center. It is a next-generation data center platform that unites computing, networking, storage access, and virtualization resources into a cohesive system that is managed centrally and designed to reduce total cost of ownership (TCO), improve energy efficiency, and increase business agility and responsiveness.

Cisco UCS is built to meet today's demands while being ready to accommodate future technologies, including more powerful processors and faster Ethernet standards. In addition, its unified architecture uses industry-standard technologies to provide interoperability and investment protection

Cisco is focused on delivering products and technologies that bridge the goals of virtualization. Cisco UCS provides a flexible and robust infrastructure to meet current and future business needs.

Cisco Fabric Extender Technology and Data Center VM-FEX

Cisco Fabric Extender Technology (FEX Technology) provides a unified access architecture across any environment: traditional, virtualized, or high-performance computing. It helps enable operational simplicity at scale, with a single point of management and policy enforcement on the access parent switch, across a multitude of 10 Gigabit Ethernet ports.

The Cisco UCS 2100 and 2200 Series Fabric Extenders are an essential part of the Cisco UCS solution and help simplify cabling, management, and diagnostics.

Cisco Data Center VM-FEX is the next step in fabric extender evolution. It extends port expander technology to virtual machines, eliminating the need for hypervisor-embedded Layer 2 software switches and simplifying management and administration by consolidating virtual and physical switching infrastructure into a single switching infrastructure with a single management point.

Cisco Data Center VM-FEX can relieve hypervisor CPU cycles from Layer 2 virtual machine switching. It also can improve performance by making the host CPU cycles available for data processing needs and increase I/O throughput through less latency for network traffic.

Cisco Data Center VM-FEX is implemented by Cisco virtual interface card (VIC) technologies such as the Cisco UCS VIC 1240 and 1280 and the Cisco UCS M81KR VIC, which are converged network adapters (CNAs) designed for both single-OS and virtual machine–based deployments. Cisco UCS VICs support static or dynamic virtualized interfaces, including up to 256 virtual network interface cards (vNICs). Each virtual machine interface is provided with a virtual Peripheral Component Interconnect Express (PCIe) device and a virtual port on a switch.

Red Hat Enterprise Linux 6

For nearly a decade, the world-class RHEL platform has had a reputation as a reliable, high-performance, high-value alternative to proprietary UNIX systems. Customers with the most demanding mission-critical requirements have been turning to RHEL as their platform of choice since 2002. As older proprietary systems have declined, Red Hat solutions have provided the next generation of performance and features for enterprise customers throughout the world and in all industries. RHEL powers a wide range of the world's mission-critical, Internet, and high-performance computing (HPC) workloads, as well as the majority of the early cloud environments. Bringing the power of Cisco UCS to these workloads offers customers a long-term platform for deploying powerful computing infrastructure.

Red Hat Kernel-Based Virtual Machine

The Red Hat Kernel-Based Virtual Machine (KVM) is a virtualization package for Linux on the x86 hardware platform created and maintained as open source software. Red Hat KVM uses x86 hardware virtualization extensions (such as Intel VT-x) to implement a hypervisor that hosts virtual machines as user-space processes. Cisco UCS supports Red Hat KVM-based Red Hat Enterprise Virtualization (RHEV) as the hypervisor in a server virtualization system.

Test Methodology

Setup 1.

A SAP 2-tier environment was set up consisting of the system under test and a load driver with a typical ERP workload and a response time of less than one second from the user perspective. The system tested was a Cisco UCS B200 M2 Blade Server (with an Intel Xeon processor X5680 and 96 GB of memory) with RHEL 5.5 (kernel version 2.6.18-194.el5) and SAP MaxDB 7.8 (build 009-123-199-949) as a single virtual machine on Red Hat KVM. It shares the housing, a Cisco UCS 5100 Series Blade Server Chassis, physically with the driver used for the user simulation. Together with the Network File System (NFS) attached storage, a NetApp FAS 3270A, all components reside in a single rack. The SAP software release used for all measurements was SAP Enhancement Package 4 for SAP ERP 6.0 (kernel 701 pl 37). Figures 1 and 2 show the setup.

Figure 1. Simplified Physical Setup

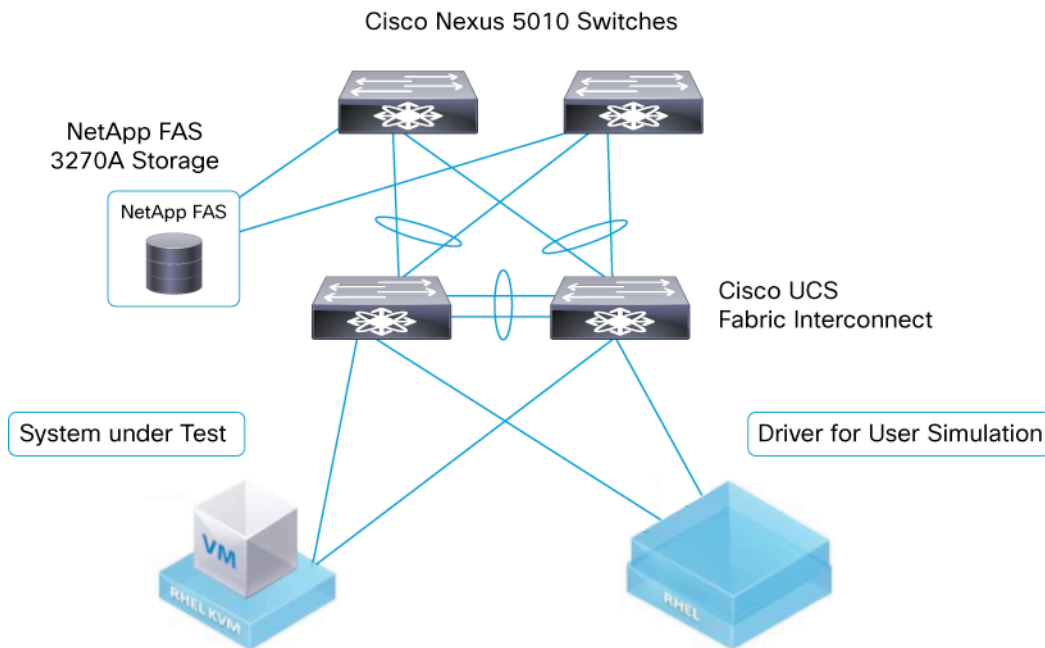
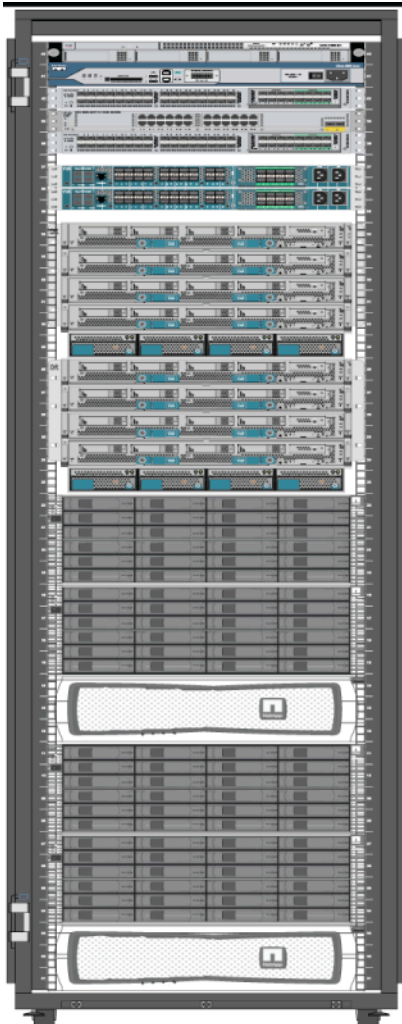


Figure 2. Physical Setup: Rack Front View



The performance tests were running on a Cisco FlexPod infrastructure solution.

- System under test: Cisco UCS B200 M2 Blade Server with two Intel Xeon processors X5680, 96 GB of memory, and a Cisco VIC
- Load generator: Cisco UCS B200 M1 Blade Server with two Intel Xeon processors X5570, 48 GB of memory, and a Cisco VIC
- Storage: NetApp FAS 3270A with Fibre Channel and NFS

The SAP system (binaries, configuration, and database) was mounted from the storage using NFS.

- One volume to store the operating system disk image
- One volume for binaries and the database log
- One volume with four qtrees for the database data

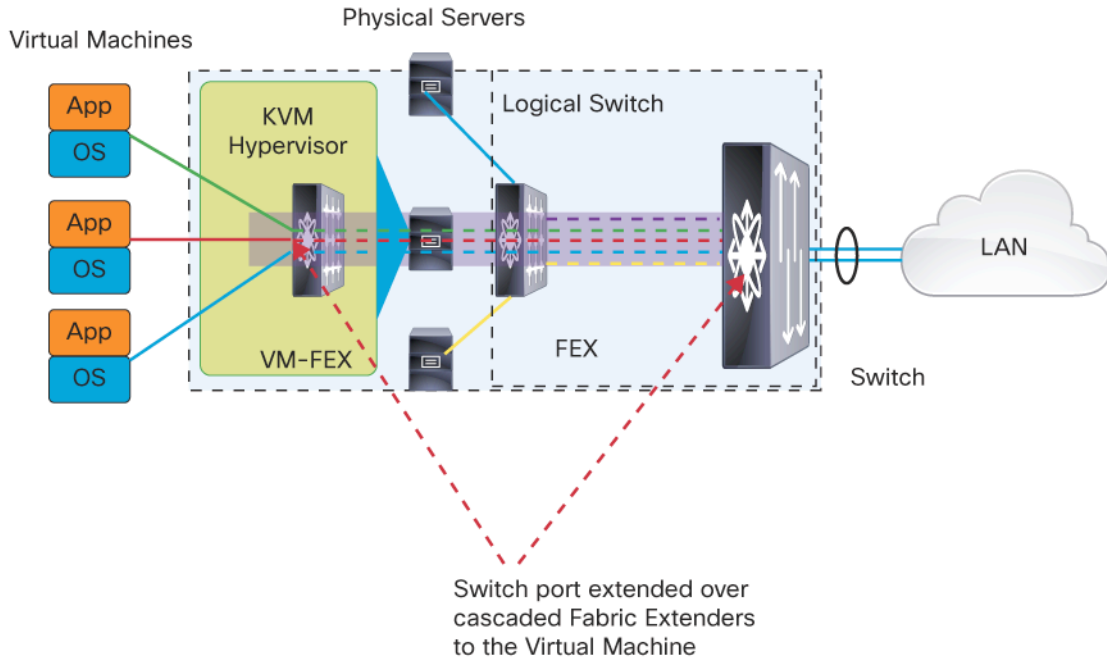
Setup 2.

Setup 1 was upgraded to RHEL 6.1 (kernel version 2.6.32-131.0.15.el6.x86_64), and the measurement was repeated.

Setup 3.

Setup 2 was reconfigured with Cisco Data Center VM-FEX (including hypervisor bypass), and the same SAP user load was applied as in Setup 2 (Figure 3).

Figure 3. Extending the Virtual Network to the Virtual Machine



Setup 4.

While keeping Setup 3, the SAP user load was further increased until a response time of less than one second from the user perspective could no longer be maintained.

Results and Benefits

In Setup 1, a SAP user number of 2900 was reached according to the specified rules.

After an upgrade to Red Hat Enterprise Linux 6.1 (Setup 2) the number of users reached was 3600, an increase of 24 percent without any other modification.

Adding Cisco Data Center VM-FEX for Red Hat KVM (Setup 3) and maintaining the user load at 3600, the database request times (latency for database access) decreased from 21 milliseconds (ms) to 15 ms. This 29 percent decrease in latency translates to an improved user experience while working with this system: the SAP system response time, comparable to the response time from the user perspective, drops from 0.9 second to 0.2 second, a difference very noticeable from the user side.

In addition, the user load on the test system was increased to the maximum (Setup 4), which was reached at 4000 simulated users. While sacrificing improved system latency for optimized system load, this result means that 11 percent more users can be supported by the system employing Cisco Data Center VM-FEX without additional hardware expenses.

Figure 4. Improvement with Cisco Data Center VM-FEX

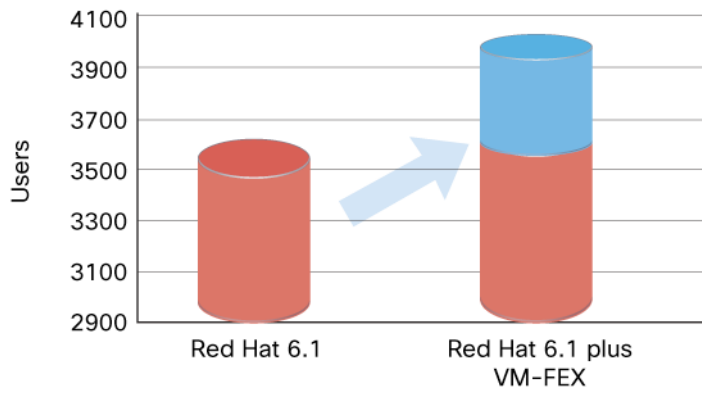
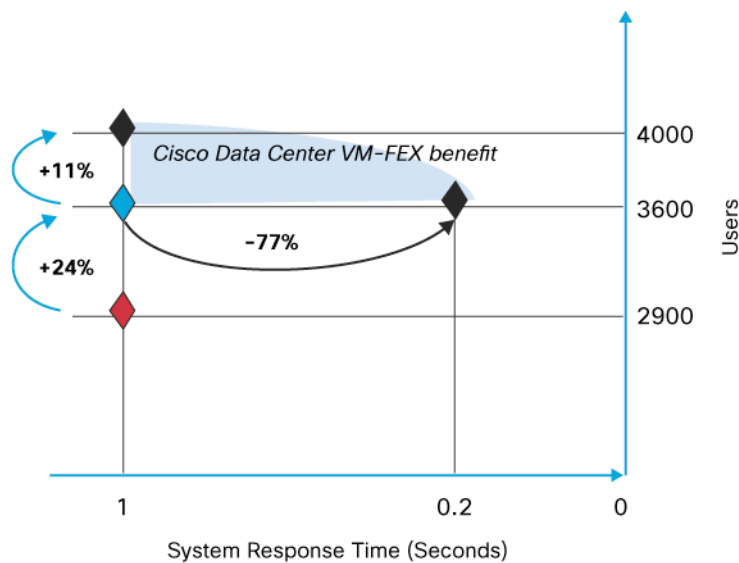


Figure 5 summarizes all the improvement in a single diagram.

Figure 5. Summary of Improvement with Red Hat Linux and Cisco Data Center VM-FEX



- ◆ RHEL 5.5 with Software-Based Bridge
- ◆ RHEL 6.1 with Software-Based Bridge
- ◆ RHEL 6.1 with Cisco Data Center VM-FEX
- ↻ Improvement in Number of Users (More is Better)
- ↻ Improvement in Response Time (Less is Better)

You see the boost in numbers from an upgrade to Red Hat Enterprise Linux 6.1 and the additional headroom you get by employing Cisco Data Center VM-FEX, which can be used in both directions, in support for more users and faster system response times.

Conclusion

The measurements conducted show how the current version of Red Hat Enterprise Linux and the adoption of Cisco Data Center VM-FEX technology together improve throughput and latency in today's virtualized SAP environments in the data center. Without upgrading or modifying existing hardware, improvements of up to 35 percent in SAP user numbers are possible, leading to a more economical use of infrastructure or leaving headroom for future growth.

Although this document focuses only on performance aspects, a Red Hat and Cisco Data Center VM-FEX deployment offers additional advantages in such areas as ease of management, quality of service (QoS), and security. These will be discussed in other documents.

Why Cisco and Red Hat?

In delivering the industry's first unified computing platform, Cisco and its industry partners, including Red Hat, have delivered on the promise of data center virtualization. The Cisco Unified Computing System architecture, along with Red Hat Enterprise Virtualization and Red Hat Enterprise Linux technologies, deliver a more manageable, reliable, flexible, and scalable solution in comparison to alternatives on the market. With a unique systems approach to architecture, technology, partnerships, and services, Cisco UCS streamlines data center resources, scales service delivery, and radically reduces the number of devices requiring setup, management, power and cooling, and cabling.

For More Information

- For information about SAP Standard Application Benchmarks and Sales and Distribution (SD) Benchmark, see <http://www.sap.com/benchmark>.
- For more information about Red Hat KVM, see <http://www.linux-kvm.org>.
- For more information about RHEL, see the Red Hat Enterprise Virtualization for Servers Installation Guide available at <http://www.redhat.com>.
- For a complete list of all Cisco UCS B-Series Blade Servers documentation, see the Cisco UCS B-Series Servers documentation roadmap available at <http://www.cisco.com/go/unifiedcomputing/b-series-doc>.
- Additional documentation describing the configuration limits for Cisco UCS 6100 and 6200 Series Fabric Interconnects running Cisco UCS Manager Release 2.0 is available at http://www.cisco.com/en/US/docs/unified_computing/ucs/sw/configuration_limits/2.0/b_UCS_Configuration_Limits_2_0.html.
- For a complete list of all Cisco UCS C-Series Rack-Mount Servers documentation, see the Cisco UCS C-Series Servers documentation roadmap available at <http://www.cisco.com/go/unifiedcomputing/c-series-doc>.
- For information about how to install and configure the Cisco Data Center VM-FEX components in Cisco UCS with RHEV for Servers, see:
 - http://www.cisco.com/en/US/docs/unified_computing/ucs/sw/vm_fex/kvm/cli/config_guide/b_CLI_KVM_VM-FEX_UCSM_Configuration_Guide.pdf
 - http://www.cisco.com/en/US/docs/unified_computing/ucs/sw/vm_fex/kvm/gui/config_guide/b_GUI_KVM_VM-FEX_UCSM_Configuration_Guide.pdf



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