

XenSource XenEnterprise 3.1 hardware assisted server virtualization software – introduction and installation for HP ProLiant servers



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Executive summary

XenSource XenEnterprise 3.1 software enables the consolidation of multiple operating systems onto a single physical HP ProLiant server. It supports Linux and Microsoft® Windows® unmodified operating systems as well as virtualization-ready Linux operating systems. XenEnterprise 3.1 software leverages hardware assisted virtualization from both Intel® and AMD™:

- Intel Virtualization Technology (VT) for Intel 64 architecture (formerly known as Intel Extended Memory 64 Technology, or Intel EM64T) in Intel Xeon® processors
- AMD Virtualization™ (AMD-V™) for AMD64 instruction set and architecture in AMD Opteron™ processors

XenSource is a member of the HP Developer and Solution Partner Program, (DSPP), <http://www.hp.com/go/dspp>. The DSPP program enables HP partners to access HP hardware and testing facilities to verify that the partner's software executes on HP ProLiant servers. XenSource, Inc. is responsible for all support of XenSource software, including any bundled software components running on ProLiant or HP BladeSystem servers.

XenEnterprise 3.1 software was tested by HP and XenSource on HP ProLiant blade server hardware. This document provides a lab-validated proof point and an introduction to the value and architecture of XenEnterprise 3.1 server virtualization software. A hardware bill-of-materials and step-by-step installation guide for the specific hardware and software tested are included. Several HP ProLiant rack mount and blade servers were tested including the dual-core ProLiant BL460c, BL465c, BL480c, DL380 G5, DL385 G2, and DL580 G3 servers.

Introduction

Server virtualization methods are rapidly evolving as multiple hardware and software companies compete to deliver the solution required to address the challenges of today's enterprise data centers and of small and medium business markets. This document specifically addresses x64 server virtualization, enabling the consolidation of multiple operating systems with software from XenSource on HP hardware.

XenSource offers other software products including XenServer and XenExpress which provide a subset of the functionality found within XenEnterprise. This document contrasts XenEnterprise 3.1 to other server virtualization technologies to provide the reader with the value and benefits of XenEnterprise 3.1.

Note: x64 is a generic industry term referring to both Intel 64 architecture and AMD64 processors. These provide execution of 32- and 64-bit operating systems and applications. Currently, XenEnterprise supports the server virtualization of several popular 32-bit operating systems.

Server virtualization

As Moore's law continues to prove true, the performance of a single server often exceeds the data center's requirements for a given application or set of applications. While the number of logical systems required for the data center continues to grow, the utilization of individual servers continues to diminish. Contemporary multi-core scaling of processors exacerbates the performance disparity, as many applications can not make use of the large number of cores these systems provide. Through server virtualization, multiple operating systems may execute concurrently on a single server, addressing this dissonance. The resulting consolidated server may support several separate operating systems and applications while providing the required performance, security and reliability from a small subset of physical servers.

Hardware assisted virtualization

Intel and AMD have both released hardware-assisted virtualization technologies. While there are differences between the capabilities, each improves the performance of server virtualization by reducing the complexity of software required for implementing processor virtualization. XenEnterprise 3.1 leverages hardware-assisted virtualization on Intel or AMD processors that support hardware assisted virtualization.

Paravirtualization

Paravirtualization is a software approach to reducing disk or network virtualization overhead. By leveraging XenSource device drivers installed into the guest operating system, virtualization overhead of the network and disk I/O may be reduced. This approach may be leveraged to extend the features and support of the hypervisor. For example, drivers may be required for optimized memory management within a virtual machine.

Native OS support

Server virtualization software that supports an unmodified guest operating system provides native OS support. Depending on the requirements of the guest operating system, XenEnterprise may provide native OS support or leverage a paravirtualization approach.

Software emulation of hardware

Another approach to server virtualization is software emulation of hardware. This approach has enabled several software companies to produce products that allow multiple, unmodified, guest operating systems to concurrently execute on a single server with legacy processors. Depending on the application, this may result in a more computationally intensive method than hardware-assisted virtualization or paravirtualization and thus the virtualization overhead may be larger. XenEnterprise 3.1 leverages hardware-assisted virtualization, when available, and paravirtualization as required, for legacy processors to ensure low virtualization overhead.

Xen hypervisor

The open source Xen hypervisor provides the virtualization engine for XenEnterprise. Xen leverages the hardware-assisted virtualization capabilities built into Intel and AMD processors to create an abstraction layer between physical hardware and virtual resources.

Adaptive Enterprise

As IT systems serve businesses in competitive markets, IT requirements have become more dynamic. New applications translate into a competitive advantage, and cost management creates a desire to minimize idle system capacity. Both initiatives drive the requirement for a more dynamic system infrastructure. The HP Adaptive Enterprise provides a vision for companies to align IT capabilities with changing business requirements. The specific architecture and configuration of a data center is still unique to an individual company, yet each company may seek to increase flexibility while providing better overall utilization of IT infrastructure resources. The vision of the HP Adaptive Enterprise is that each company benefits from a dynamic infrastructure that matches the competitive nature of its business.

The HP BladeSystem

The HP BladeSystem provides an ideal hardware infrastructure with which an enterprise may consolidate up to sixteen physical servers into a single rack-mount enclosure. Power, SAN storage interconnects and Ethernet switches may all be integrated within the enclosure reducing cabling costs. Keyboard, video and mouse connections are also consolidated through integrated remote console access via iLO (HP Integrated Lights-Out) 2. The HP BladeSystem requires only a few cables to the network backbone to the optional integrated SAN and Ethernet switches; just one or two cables would be required to connect as many as 16 server nodes to the traditional enterprise data center.

ProLiant blade servers

Award winning HP ProLiant servers are now offered in a blade form factor.

HP StorageWorks SB40c storage blade

The direct attached storage of the ProLiant BL460c or BL465c may be expanded by the use of an SB40c storage blade which occupies an adjacent slot in the HP BladeSystem c7000 enclosure. Six hot swap SFF (Small Form Factor) SATA (Serial ATA) or SAS (Serial Attached SCSI) drives are leveraged to provide up to 876 Gigabytes of raw disk capacity in addition to the two hot swap drive slots on the blade server.

XenEnterprise

The XenEnterprise software provides a virtualization platform upon which companies may deploy a mix of Linux and Windows 32-bit operating systems within the multiple guests of a consolidation server. In the consolidation server, virtualization complexities and configuration details are managed by the software. XenEnterprise provides a graphical remote administration console based in Java™, which may be run from a Windows or Linux graphical desktop. Multiple servers may be managed from this administration tool. Live relocation of executing virtual servers will be provided in a release due in mid-2007.

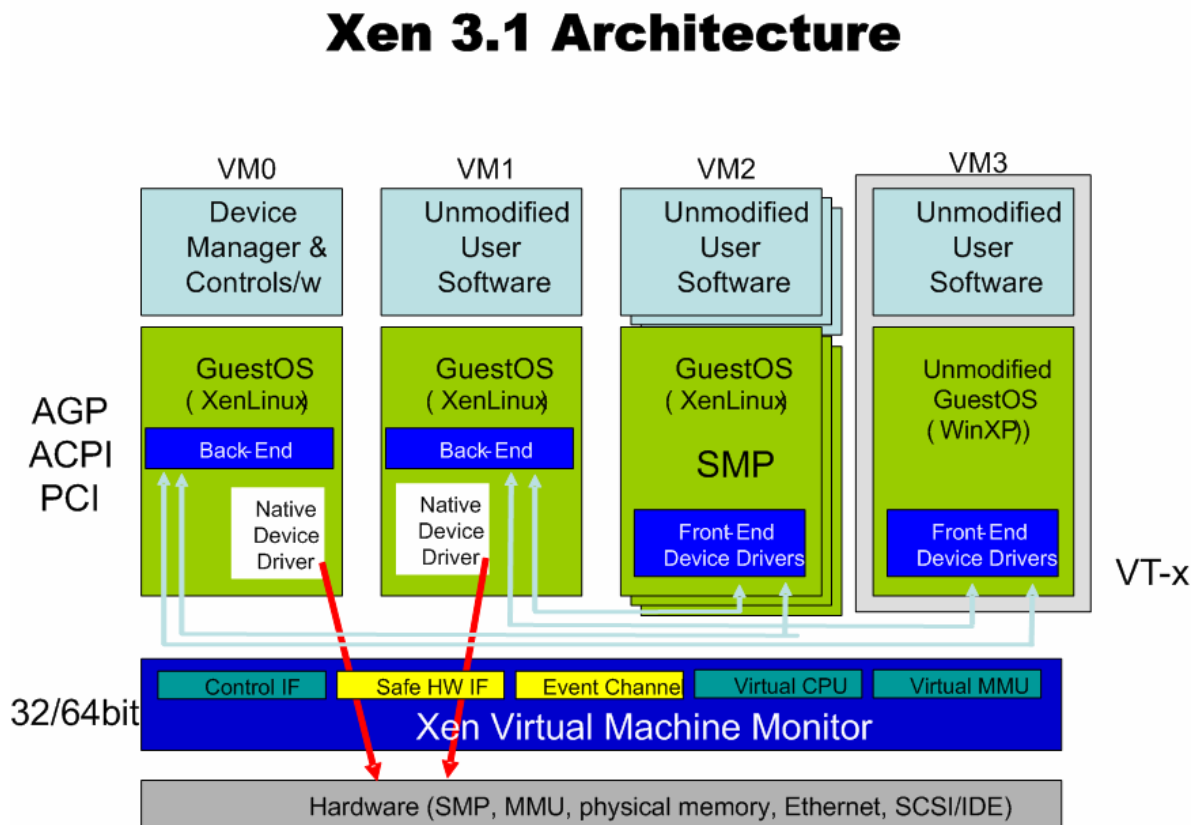
Efficiency

The efficiency of the virtualization platform is the key to maximizing the value of the resulting virtualized platform. The Xen hypervisor leverages hardware-assisted virtualization and paravirtualization, both of which may provide performance enhancements, which reduce virtualization overhead.

Xen hypervisor architecture

Figure 1 below, provides a graphic of the Xen hypervisor.

Figure 1. Xen 3.1 Architecture



Each physical server required is typically installed by use of the XenEnterprise CD-ROM. A license is required for each physical server. The servers boot via DAS (Directly Attached Storage).

Supported guest operating systems

Currently hypervisors typically support a subset of popular operating system distributions and releases available in the market. Check the XenSource website for the latest support matrix. Provided below is the current list of XenEnterprise supported guest operating systems.

XenEnterprise 3.1 currently supports the following 32 bit operating systems:

Microsoft Windows

(only on XenEnterprise servers equipped with Intel VT-enabled or AMD-V CPUs):

- Microsoft Windows Server 2003 Standard Edition (SP0, SP1, R2)
- Microsoft Windows Server 2003 Enterprise Edition (SP0, SP2, R2)
- Microsoft Windows XP SP2

Linux

- Red Hat Enterprise Linux 4.1, 4.4 (installed via network vendor media repository)
- Red Hat Enterprise Linux 3.6, 3.7, 3.8 (installed via physical-to-virtual (P2V) of existing instance)
- Red Hat Enterprise Linux 4.1, 4.2, 4.3, 4.4 (installed via P2V of existing instance)
- Novell SUSE Linux Enterprise Server 9 SP2 and 9 SP3 (installed via P2V of existing instance)
- Debian 3.1 Sarge (installed via built-in template)

Simplicity of XenEnterprise

The XenEnterprise virtualization platform requires very few steps from initial platform installation to the guest OS startup of the consolidation server. A simple proof of concept may be performed by completing the basic installation and management tasks described below.

Installation and basic management tasks:

- Install XenEnterprise (The Base OS is bundled)
- Install the XenEnterprise Administrator Console
- Connect to the XenEnterprise server using the Administrator Console
- Create a virtual machine and install Windows Server 2003
- Create a virtual machine and install Red Hat Linux

A brief review is provided for each task.

Install XenEnterprise

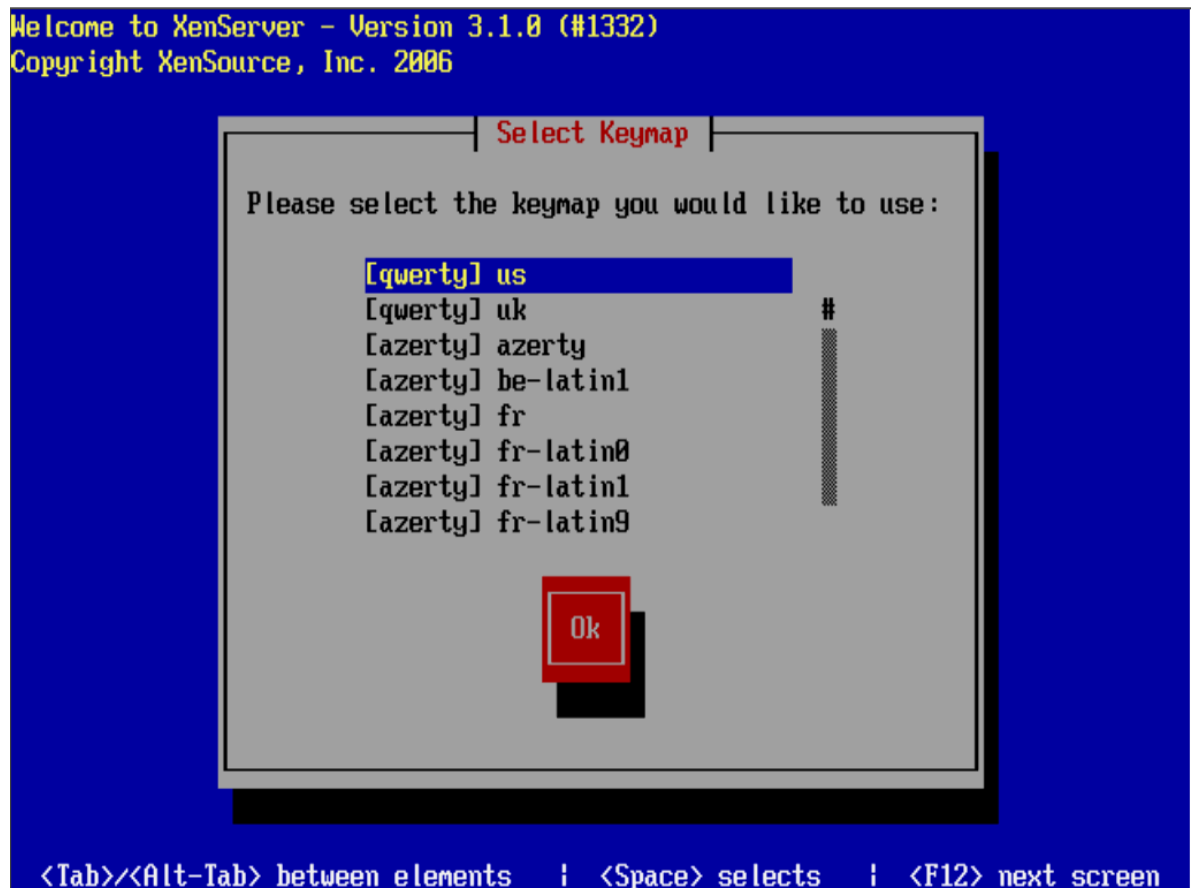
Follow these steps to install the XenEnterprise software onto the ProLiant server. A ProLiant BL460c server was tested in this example. See the Tested configuration BOM, (Bill of Materials) for details.

1. Connect to the Onboard Administrator of the c7000 enclosure via a web browser. Use the Insight Display of the c7000 enclosure to identify the IP address of the Onboard Administrator. A physical tag attached to the Onboard Administrator card shows the default password.
2. Connect to the console of the ProLiant blade server. Click on the graphic of the specific server onto which you wish to install the software. The iLO 2 Virtual Media function was leveraged through the Integrated Remote Console Full Screen URL. Click **ilo** and then click **Integrated Remote Console Full Screen**.

3. Use the ROM Based Setup Utility of the server to **enable** the **hardware assisted virtualization** of the processor. Watch the screen during the POST (Power On Self Test) process. When prompted for setup, press **F9**. Utilize the **Advanced Processor Settings** menu. Press **F10** to save and exit.
4. Insert the XenEnterprise CD-ROM into the local server. Click on the **Drives** button of the iLO 2 tool bar, press the associated **Mount** button. Reboot the server by pressing the **Power** button and then the **Press and Hold** button; to restore power to the server, press the **Momentary Press** button.
5. Accept the defaults, other than configuring local preferences. The **Installation Media** tested was **CD-ROM**. The **System Time** was configured by the **manual time entry** method. The default time offered was accepted.
6. Remove the CD-ROM when prompted and reboot the server.

Below, Figure 2 provides a graphic of the initial XenEnterprise installation screen.

Figure 2. Initial XenEnterprise setup screen



The XenEnterprise software was tested in a lab environment with a connection to the Internet via a NAT server configured to provide IP addresses via DHCP. This ensured that, on reboot, the XenEnterprise server would receive an IP address from the lab infrastructure and that guest operating systems could be patched and tested.

Figure 3 provides a graphic of the XenServer after completing a reboot.

Figure 3. XenEnterprise XenServer host screen

```
XenServer Host 3.1.0-1332

System Booted: 2006-10-09 08:24

Your XenServer Host has now finished booting. To manage this
server please use the XenServer Administrator Console
application. You can install the XenServer Administrator Console
for Windows and Linux from the XenServer install media.

You can connect to this system using one of the following network
addresses :

10.101.0.124
10.99.0.221

localhost login:
```

Make note of the IP address(es) displayed as it(they) will be required when connecting via the Administrator Console.

Install the XenEnterprise Administrator Console

The XenEnterprise Administrator Console may be installed on one or more Windows or Linux workstations. The Administrator Console need only be started when an administrator needs to connect and manage the XenEnterprise server. An example of the Windows installation is provided.

1. Insert the XenEnterprise CD-ROM into the Windows workstation. Navigate to the client_install directory of the CD-ROM. Start the windows installation of the XenEnterprise Administrator Console, xenenterprise_client.exe.
2. Respond to the typical prompts and remove the CD-ROM, when the installation is completed.

Connect to the XenEnterprise server using the Administrator Console

Start the Administrator Console, connect to the XenEnterprise server, and apply the license file. Perform the following commands on the Windows workstation where the XenEnterprise Administrator Console was installed.

1. **Start / All Programs / XenSource XenEnterprise / Administrator Console.**
Enter the password into the Administrator Console.
2. Add the XenEnterprise server. Select **File / Add XenEnterprise Server** and enter the IP address displayed on the console of the XenEnterprise server collected earlier (reference Figure 3). Enter the password configured during installation.
3. Apply the license. Select **XenServer Host / License Key** and navigate to the license file provided by XenSource. Press the **Apply License** button.

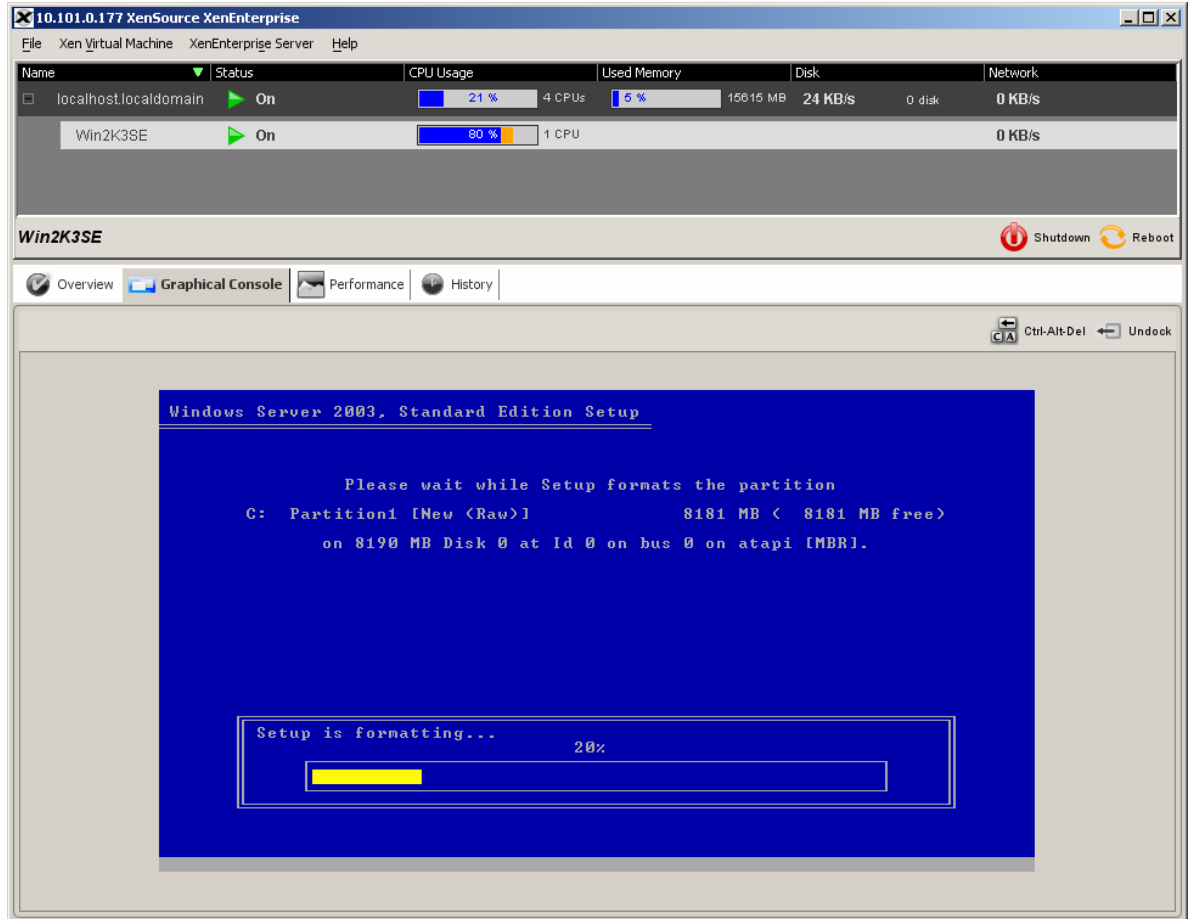
Create a virtual machine and install Windows Server 2003

From the XenEnterprise Administrator Console, enter the following commands. A Windows Server 2003 Standard Edition CD-ROM was inserted into the XenEnterprise server.

1. Select the XenEnterprise server to which the virtual machine is to be installed. Click one of the servers shown in the top window.
2. Click on **Install XenVM** in the middle navigation bar.
3. In the **Install From:** drop down dialog box select **Windows 2003 Server Standard Edition**.
4. Enter a unique name; i.e., **WIN2K3SE**.
5. Adjust the **memory**, **disk size**, and **network interfaces** as required and click the **Install** button.
6. The Graphical console will be displayed after a brief delay.
7. Click in the graphical console and continue the installation.

Figure 4 provides an example.

Figure 4. Installing Windows Server 2003 into a virtual machine



After completing the Windows installation, restart the virtual machine as instructed and press the **Graphical Console** tab. The Windows virtual machine is now ready for use.

Patching

Patch the new Windows network server leveraging preferred local procedures. The Windows update server method was tested.

Remote access

Configure the server for remote access leveraging preferred local methods. Windows RDP (Remote Desktop Protocol) was tested.

Optimized I/O drivers

The optimized (paravirtualized) disk and network drivers may be installed by stopping the Windows virtual machine and changing the CD-ROM settings to xpwindrivers.iso. Use Windows Explorer to navigate to the CD-ROM drive and install the drivers.

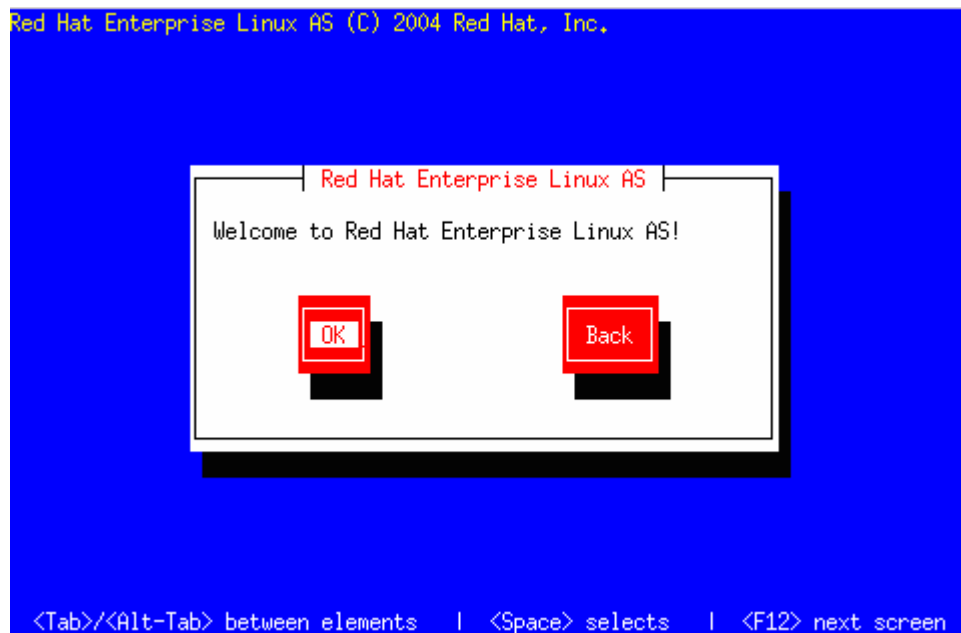
Create a virtual machine and install Red Hat Linux

From the XenEnterprise Administrator Console, enter the following commands. A Linux NFS server on the lab test network provided the required Red Hat network install files.

1. Select the XenEnterprise server to which the virtual machine is to be installed. Click one of the servers shown in the top window.
2. Click on the **Install XenVM** in the middle navigation bar.
3. In the **Install From:** drop down dialog box, select **Red Hat Enterprise Linux 4.1 Repository**.
4. Enter a unique name; i.e., **rh4up1srv1**.
5. Accept the default **memory**, **disk size**, and **network interfaces** and click the **Install** button.
6. Click the **Text Console** tab and a window will be displayed after a brief delay.
7. Continue the installation as you typically would from a physical server console.

Figure 5 provides an example.

Figure 5. Installing Red Hat Linux into a virtual machine



After the Red Hat installation is complete, reboot the server as directed, log into the Red Hat virtual machine's text console and configure the server via the command line interface for use as required. The Red Hat virtual machine is now ready for use.

Patching

Patch the new Red Hat network server leveraging preferred local procedures such as the Red Hat Update network. DO NOT update kernel or glibc packages – use the paravirtualization-optimized versions of these provided by XenSource.

Remote access

Configure the server for remote access leveraging preferred local methods. Typically, one might configure the SSH daemon for a command line interface or VNCserver to facilitate graphical user interface remote access. VNCserver was tested.

Paravirtualization

The paravirtualization drivers are already installed when leveraging the **Red Hat Enterprise Linux 4.1 Repository** method.

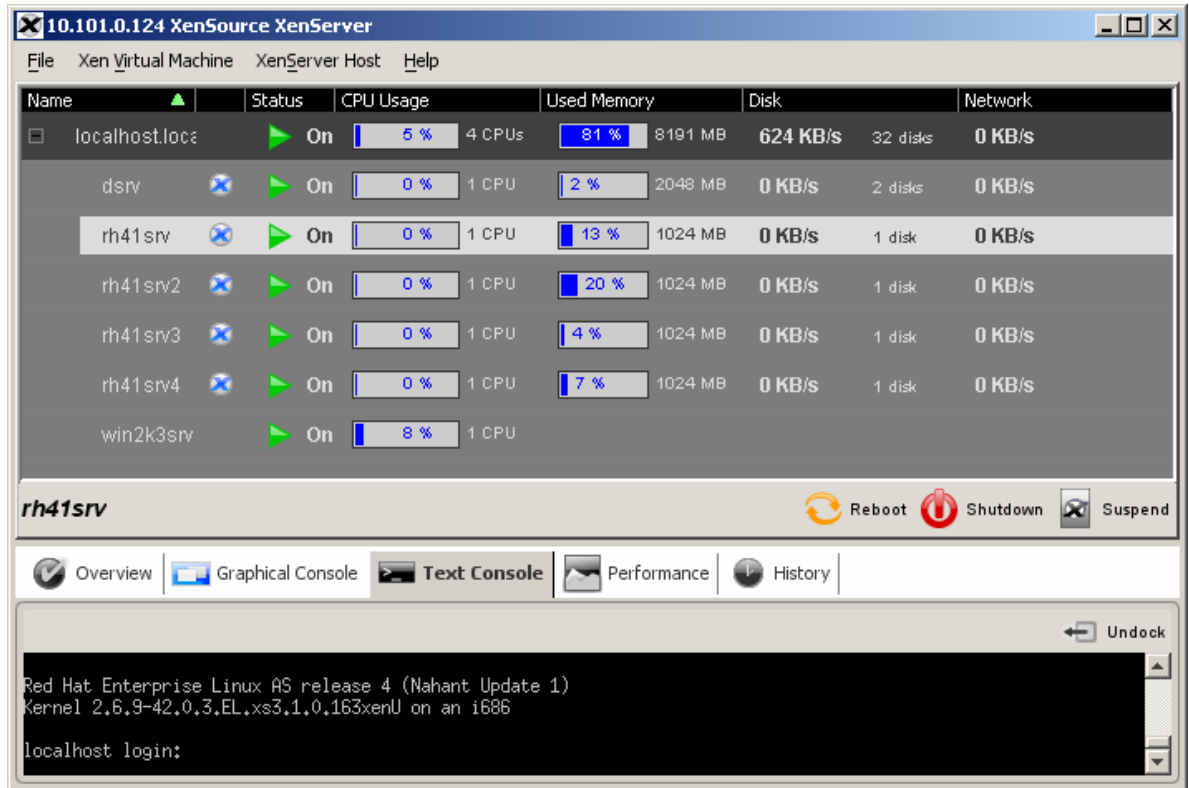
Management of virtual machines

The XenEnterprise Administrator Console, shown in Figure 6 below, provides basic management of the virtual machines.

To change the virtualization options, including RAM, disk, or network configurations, follow these simple steps.

1. Shutdown the server through the virtual machine's **Text Console** or **Graphical Console**.
2. Once the Status of the virtual machine shows "Off", click the **Overview** tab and edit the values as required.
3. Press the **Apply** button and then press the **Start** button.

Figure 6. XenEnterprise Administrator Console



Third-party software companies intend to provide management tools that provide extended management of the XenSource hypervisor (and specifically XenSource products) including HP.

Hardware and software requirements

Hardware requirements

Only one ProLiant server is required; management must be accomplished from a separate server, workstation, or laptop connected to the network. Several rack-mount ProLiant servers and ProLiant blade servers were tested. The specific servers tested are detailed below; one would expect similar results from other ProLiant servers. All servers detailed below support hardware-assisted virtualization. If a server other than those listed below is considered, review the specifications to confirm that the processor supports hardware-assisted virtualization. Internal disk storage is required, unless an external storage array is leveraged.

Software requirements

The following software was tested for the installation described in this guide:

- Red Hat Enterprise Linux Advanced Server 4.0 Update 1 32bit – lab NFS server
- XenEnterprise software 3.1 – CD-ROM

- XenEnterprise License file – provided by XenSource
- Java 5 – downloaded from Sun.com
- Microsoft Windows Server 2003 Standard Edition 32bit – CD-ROM.

Tested configuration BOM

Table 1. Hardware BOM

Quantity	Description	Part number
c-Class HP BladeSystem		
1	HP BLc7000 1 PH 2 PS 4 Fan Full ICDC Kit	403321-B21
2	HP BLc7000 Encl Pwr Sply IEC320 Option	412138-B21
6	HP BLc7000 Encl Single Fan Option	412140-B21
2	HP ProLiant BL460c G1 5160 2G 1P Svr	416656-B21
2	HP ProLiant BL465c G1 2218 DC 1P 2G Svr	407235-B21
2	HP ProLiant BL480c G1 5160 4G 2P Svr	416669-B21
2	HP 40A HV CORE ONLY CORDED PDU	252663-D75
8	72GB 10K SAS 2.5 HP HDD ALL	375861-B21
2	HP X5160 BL460c G1 KIT	416660-B21
2	HP ProLiant BL465c G1 O2218 KIT	411948-B21
16	HP 2GB FBD PC2-5300 2X1GB KIT	397411-B21
c-Class Ethernet switch		
2	HP BLC BNT 1GBE2 SWITCH OPT KIT	410917-B21

Figure 7 provides a graphic of the tested HP BladeSystem.

Figure 7. Tested BladeSystem



Support

XenSource is a member of the HP Developer and Solution Partner Program. Through this partnership, HP and XenSource have jointly performed a lab validation of the following ProLiant servers with XenSource XenEnterprise 3.1 software.

ProLiant blade servers:

- BL460c
- BL465c
- BL480c

Rack mount ProLiant servers:

- DL380 G5
- DL385 G2

XenSource, Inc. is responsible for all support of XenSource software including any bundled software components running on the ProLiant or BladeSystem servers.

Contact XenSource for more information.

Summary

This solution overview of the XenSource XenEnterprise virtualization platform reviews both HP ProLiant rack mount and blades servers. The resulting virtualization platform provides an efficient consolidation server capable of hosting multiple Linux and Windows server instances, each in a separate virtual machine.

Both large and small businesses may effectively leverage the resulting consolidation server for geographically distributed applications in retail locations or regional offices. The highly effective ProLiant remote management capabilities of iLO 2 are standard on many of the ProLiant rack mount and blade servers. Reducing the number of physical servers required to be purchased and maintained is a logical approach to cost control. In a consolidation server, the reliability of the base server is paramount; ProLiant servers are well proven in the most demanding environments.

HP would like to thank XenSource for their contribution to this industry and their partnership with HP.

For more information

XenSource Software: XenEnterprise Software Home, <http://www.xensource.com/>

HP.com - ProLiant servers - Industry standard servers, <http://www.hp.com/go/proliant>

To help us improve our documents, please provide feedback at www.hp.com/solutions/feedback

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