Virtualization in Enterprise Environment

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Session Outline

- Virtualization technology overview
- Challenges in enterprise environment
- Q & A
Virtualization technology overview

- What’s virtualization
- OS virtualization
- Application virtualization
- Virtualization - Complex solutions
OS virtualization

- With x86 computer virtualization, a virtualization layer is added between the hardware and operating system. Hides the physical characteristics of a computing platform, instead showing another abstract computing platform.
OS/platform virtualization approaches

The main goal is to trap the privileged and critical instructions

- Hosted environment or bare metal hypervisor?
- Full emulation or paravirtualization?
- Do we have / use hardware support or not?
Platform virtualization – OS hosted architecture

- A hosted architecture installs and runs the virtualization layer as an application on top of an operating system and supports the broadest range of hardware configurations.

Figure 1. Virtual Machine Architecture

<table>
<thead>
<tr>
<th>Application 1</th>
<th>Application 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guest Operating System</td>
<td>Guest Operating System</td>
</tr>
</tbody>
</table>

Virtualization Software Layer

| Host Operating System |

x86/x64 Hardware

Source: Novell, Inc. December 2005
Platform virtualization – Bare metal hypervisor

- Hypervisor (bare-metal) architecture installs the virtualization layer directly on a clean x86-based system. Since it has direct access to the hardware resources rather than going through an operating system, a hypervisor is more efficient than a hosted architecture and delivers greater scalability, robustness and performance.

**Figure 2. Hypervisor-based VM Architecture**

<table>
<thead>
<tr>
<th>Application 1</th>
<th>Application 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guest Operating System</td>
<td>Guest Operating System</td>
</tr>
<tr>
<td><strong>Hypervisor Integrated with Host Operating System</strong></td>
<td></td>
</tr>
<tr>
<td>x86/x64 Hardware</td>
<td></td>
</tr>
</tbody>
</table>

Source: Novell, Inc. December 2005
x86 virtualization - Challenges

- x86 operating systems are designed to run directly on the bare-metal hardware, so they naturally assume they fully ‘own’ the computer hardware.
Platform virtualization – Emulation

Translates kernel code to replace nonvirtualizable instructions with new sequences of instructions that have the intended effect on the virtual hardware.

The virtual machine simulates hardware, which does not need to be the same as the system hardware. The guest operating systems can run under such a system without modification.

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Platform virtualization – Paravirtualization

While it is very difficult to build the more sophisticated binary translation support necessary for full virtualization, modifying the guest OS to enable paravirtualization is relatively easy.

The virtual machine provides an interface for guest operating systems to access the system hardware, allowing for greater performance. The guest operating systems must be ported to use the interface provided by the virtual machine.

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Platform virtualization – HW support

Hardware supported virtualization allows multiple operating systems to run in isolation at native speed. The guest operating systems can run under such a system without modification.
## Platform virtualization – Summary

<table>
<thead>
<tr>
<th>Technology</th>
<th>Guest OS needs to be modified</th>
<th>Overhead</th>
<th>CPU support required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full virtualization</td>
<td>No</td>
<td>High (SW)</td>
<td>No</td>
</tr>
<tr>
<td>Paravirtualization</td>
<td>Yes</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>HW virtualization</td>
<td>No</td>
<td>Medium (HW)</td>
<td>Yes</td>
</tr>
<tr>
<td>Hybrid virtualization</td>
<td>Yes</td>
<td>Low</td>
<td>Yes</td>
</tr>
</tbody>
</table>
What are the main drivers of server virtualization?
Platform virtualization – Server virtualization

- Consolidating servers
- Flexible test environment
- Usually easier than desktop
- No need for
  - Advanced display features
  - GPU acceleration
  - User personalisation (profiles)
Platform virtualization – Desktop virtualization

Virtualized Desktop Solutions

- Multiple Users Per Server: One operating system is used to service multiple users.
- Each User With Dedicated Blade: Each user has a dedicated blade system and operating system.
- Each User With Dedicated VM (VDI): Each user’s system is a virtual machine instead of a physical one.

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Platform virtualization – Client virtualization

Hypervisor running multiple desktop operating systems

Mature solutions for shared
- Storage
- Networking
- Cpu

New challenges
- Audio
- Graphics acceleration

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Application virtualization
Application virtualization – Terminal server hosted desktop
Application virtualization –Hosted applications

App 1  App 2  App 3

XenApp

Win2003/2008 server

Hardware

Citrix ICA protocol

Microsoft RDP protocol
Citrix XenApp – The same user experience
ICA (Citrix XenApp/XenDesktop) vs. RDP (MS Terminal Services) comparison

- Published applications (available in Win2008 too)
- Seamless windows
- SSL gateway or proxy
- Web interface
- Application-level load balancing
- HDX media streaming
Application Virtualization – Secure ICA protocol

Internet/ Unsecure Network

Demilitarized Zone (DMZ)

Secure Network

Client device(s)

Secure Gateway

Web Interface

Secure Ticket Authority

Web browser

Presentation Server Client

Citrix XML Service

Server Certificate

Root Certificate

Server Certificate

Root Certificate
Application virtualization – Isolated applications

- **Standard Operating System Environment:** In standard OS environments, applications install their settings onto the host operating system, hard-coding the entire system to fit that application's needs. Other applications' settings can be overwritten, possibly causing them to malfunction or break.
Application virtualization

- The Virtual Application Environment:
  With application virtualization, each application brings down its own set of configurations on-demand, and executes in a way so that only it sees its own settings.
Application virtualization

- **Side-by-Side Virtualization:** Each App-V enabled application brings down its own set of configurations and can run side by side without the settings conflicting with each other—or the host operating system. Despite this separation, inter-application communication with other App-V applications and those installed locally is preserved, allowing for cut and paste, OLE, and all other standard operations.
Application virtualization

- Scenarios:
  - Full
  - Lightweight
  - Standalone
- Application sequenced
- Streaming / MSI delivery
- Isolated application „played” by App-V client
  - Services
  - Files system
  - Registry
- Stream on first launch
- Feature Blocks
- Local cache

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Citrix XenDesktop – Remote desktop via ICA protocol

• What is Citrix XenDesktop (CXD) and why use it?
  – The ICA stack ported from Terminal Servers to Windows XP, Vista and Win7.
  – Support for more monitors and different configs than RDP.
  – Supports Flash web sites and streaming media.
  – Better audio quality.
  – No application remediation as it’s regular desktop OS.

• Which platforms will use CXD?
  – Virtual Machines running on hypervisors as a supplement to RDP.
  – Bare metal blades running in the data centres.
Virtual desktops vs. RDP machines

- Web interface
- XenDesktop
- WinXP / Win7
- XenDesktop
- WinXP / Win7
- Hypervisor
- WinXP / Win7
- Hardware

Protocols:
- HTTP protocol
- ICA protocol
- RDP protocol
Web interface

A screenshot of the Citrix XenApp - Applications - Windows Internet Explorer provided by Morgan Stanley web interface. The interface shows a web page with a navigation bar at the top and a main content area below. The main content area displays a list of desktops and applications available to the user. The user is logged in as 'krisegi'.
Client experience
Enterprise demands complex solutions

- DesktopOnDemand project
- 3 offerings:
  - Published Desktop Edition
  - Virtual PC Edition
  - Remote Workstation Edition
Multiple desktops (up to 40) invoked as user sessions running on a server in a Data Centre

Shared desktop for all users

The applications themselves are also provisioned as user sessions from a central location, rather invoked separately for each user.

Limited application set available (applications need to be repackaged to run under the Windows 2003 Server OS, which may not be cost-effective, or possible even, for all applications)
Multiple virtual machines (up to 15) will be provisioned (via a hypervisor) on a server hosted in a Data Centre. All desktop applications available, dedicated desktop for each user. Each virtual machine limited to a fixed number of CPUs and memory allocation on the backend server. Uses VMWare VI Server to provision the virtual machines.
DoD – Remote Workstation Edition

- Remote desktop is hosted on a dedicated blade, located in a Data Centre
- All desktop applications available, dedicated machine for each user
- High performance as dedicated hardware
- Designed for Traders and those with heavy system usage

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Virtualization summary

- Platform virtualization approaches
- Full / Para / HW assisted

- Application virtualization
  - Hosted applications (Citrix XenApp)
  - Streamed applications (Microsoft App-V)
  - Desktop virtualization (Citrix XenDesktop)

- Desktop virtualization scenarios: DesktopOnDemand project
Virtualization – Market Overview

• Application virtualization
  – Citrix XenApp / XenDesktop
  – Microsoft App-V
  – VMware ThinApp

• OS virtualization
  – VMware ESXi
  – Citrix XenServer
  – Microsoft Hyper-V
Thin Client devices vs. PC appliances

Diverse connectivity options:
- PCMCIA Slot
- PCI Slot
- USB 2.0 (2 in front, 2 in back)
- 10/100Base T Fast Ethernet
- Monitor DVI port
- Monitor connector
- Parallel port
- Serial port
- Stereo jack input/output
- PS/2 Mouse
- PS/2 Keyboard
- Power
How enterprise product is delivered?

- **Level 1 Support** (helpdesk, call center)
- **Level 2 Support** (requests, outages)
- **Level 3 Support** (troubleshooting, vendor escalation)
- **Product / project management**
- **Engineering**

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Latency challenges
Challenges in enterprise environment

- HW / asset / configuration management
- Patching
- Application deployments
- Maintenance work windows
- Escalation procedures / support flow
- High availability via redundancy and distribution of resources
- Global support coverage (follow-the-sun support model)
- SLAs
- Change management process
- 3rd party and in-house-built management tools, APIs
- Documentation (twiki)

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Business drivers of virtualization

General Business Drivers & Benefits for Virtualisation

- Simplified provisioning model for both desktops and development servers
- Improved handling of Compute Demand
- Work Area Recovery (WAR) Desktops
- Reduced power consumption
- FlexDesk Enabler
- Increased Server Density in DC
- Support Model simplified
- Facilitate build/management of remote offices
- Office heat & noise reduced
- Only the Thin Client is in the people space, majority of hardware is in DC
- PC Security improved
- Latency between PC and Backend processes minimised

Virtualisation = Flexibility

- A thin client draws much less power than a regular PC, so office power consumption is reduced. Even when the power consumption of the server is added, the ‘thin client + server’ combination is still more efficient than an ordinary PC.
- Virtualisation of test & QA servers allows for consolidation of the plant onto a smaller number of physical servers.
- Only the thin client needs to be located remotely.

- Costs for Move/Add/Change (MAC) Work reduced.