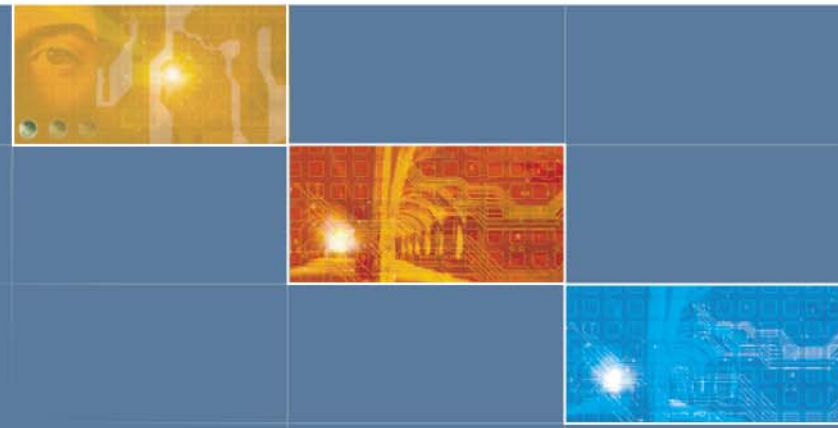

VMware® GSX Server™

Enterprise-Class Virtual Infrastructure for Intel-Based Servers

An Overview of VMware Virtual Machine Server Software

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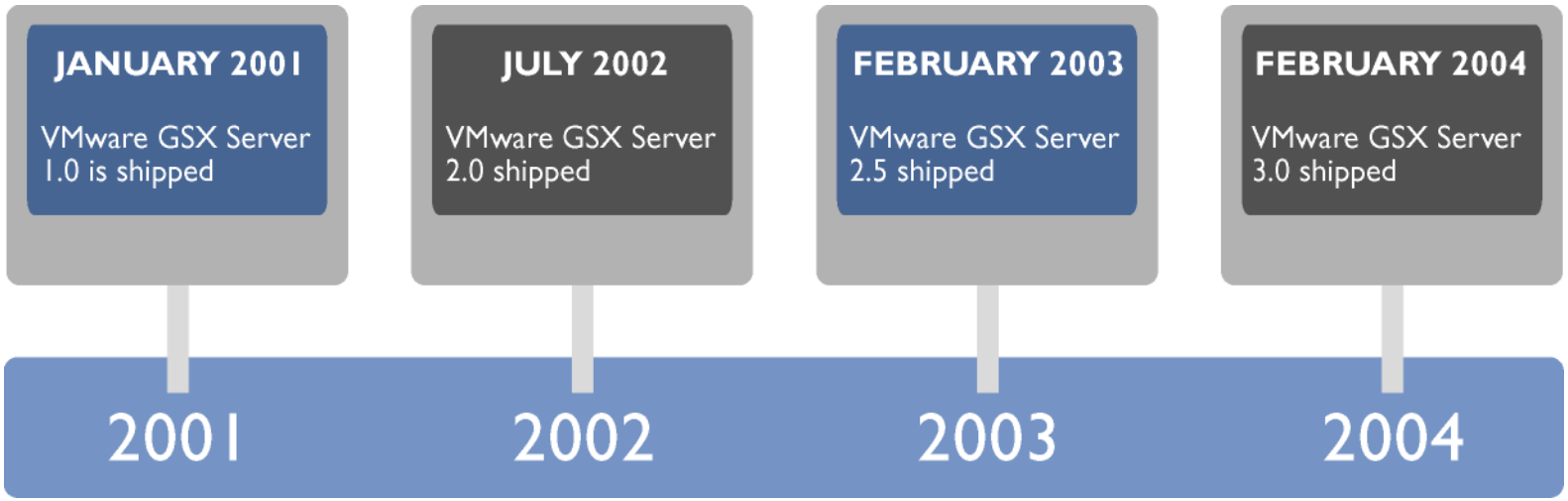
VMware GSX Server

Enterprise-Class Virtual Infrastructure for Intel-Based Servers



VMware GSX Server 3

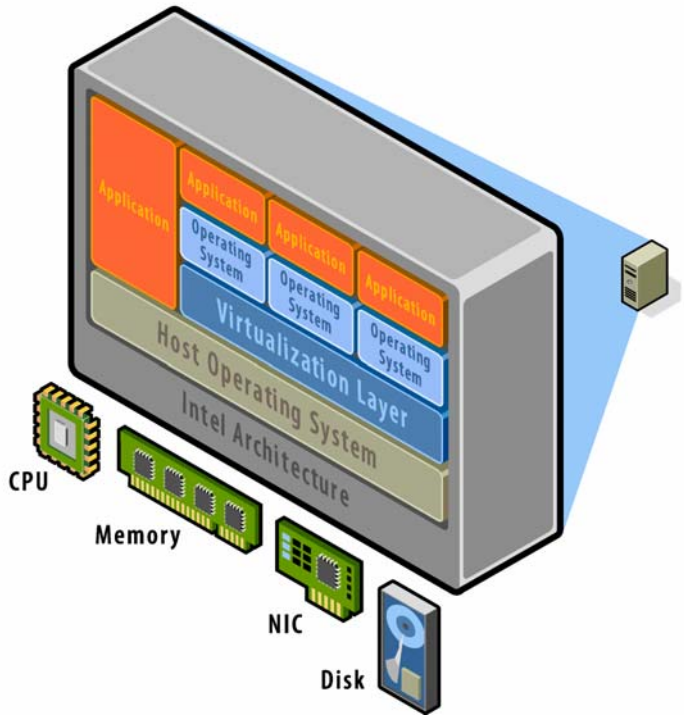
Enterprise-Class Virtual Infrastructure for Intel-Based Servers

- VMware GSX Server is virtual infrastructure for enterprise IT administrators who want to:
  - Streamline development and testing operations
  - Consolidate departmental workloads
- VMware GSX Server:
  - Enterprise-proven across thousands of customers for the last 3+ years
  - Preserves freedom of choice by installing on the widest variety of Windows and Linux operating systems
  - Offers an upgrade path to datacenter virtualization

VMware GSX Server

Enterprise-Class Virtual Infrastructure for Intel-Based Servers

- Installs like an application – easy to deploy and manage
- Integrates easily into Microsoft Windows® and Linux host environments
- Supports the widest selection of host and guest operating systems
- Device support inherited from host operating system
- Portable, hardware-independent virtual machines
- Can be managed by VirtualCenter
- Upgrade path to ESX Server



How Is It Used?

VMware GSX Server Applications

Streamline development and testing

Departmental server consolidation

Rapid provisioning

High availability

Streamline Development and Testing Operations

This section covers a specific solution scenario for VMware GSX Server

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Development & Testing Environment Challenges

- Replicating production environments on test & staging systems
  - Need expensive banks of test hardware or time consuming machine imaging
  - Patch management requires replica servers to test patch/app combinations
  - Need a solution for cataloging and storing numerous configurations
- Heterogeneous server proliferation
  - Provision and manage hardware from mix of vendors
  - 60% of enterprises plan on deploying mission-critical server apps on Linux
  - 58% will deploy both .NET and Java/J2EE applications
- Management and integration of software development processes and tools
  - Build and test is manual today
  - No automation of hardware-level setups

VMware GSX Server Applications:
Streamline Development and Testing

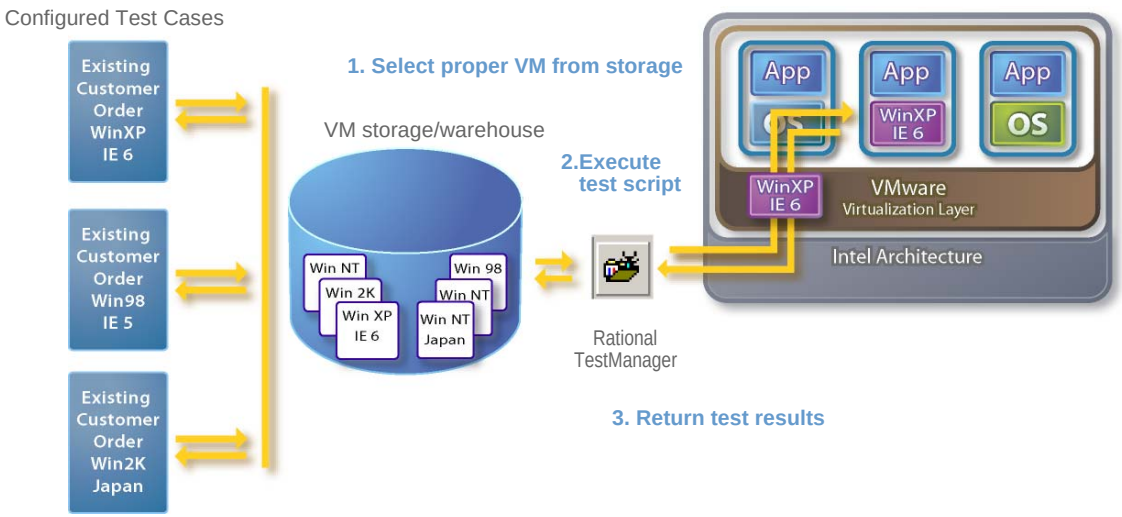
Features	Benefits
Integrates easily into any environment for ultimate versatility – installs like an application and runs on any standard X86 hardware	• 20% reduction in testing and development cycles • Increase IT development and QA teams' efficiency by 50%
VMware P2V Assistant quickly converts physical test machine images to VMs	• Provision new development and test machines in minutes instead of hours or days
Portable, hardware-independent virtual machines	• Maintain libraries of machine environments in encapsulated and hardware-independent virtual disk files
Integrates with IBM Rational TestManager test automation solution	• Automated test selection and execution to increase testing efficiency

VMware GSX Server Applications:
Streamline Development and Testing

- ✓ Manage large numbers of development and test machine environments
- ✓ Accelerate application development and testing processes
- ✓ Create virtual test banks without needing to buy, install, or configure additional hardware
- ✓ Access and share standardized development and testing environments anywhere, any time
- ✓ Use virtual machines as containers to exchange reproducible bugs between QA and development

GSX Server Solutions:
IBM/Rational VMware Test Automation Solution

- Integrates Rational TestManager and GSX Server for:
  - Automated test selection and execution
  - Reduced hardware needs for configuration testing
  - Resource-based virtual machine image management
- Included with Rational TestManager v2003
- Jointly marketed by Rational and VMware



Business Objects

Achieved 10:1 server consolidation ratio

The Challenge

Crystal Decisions unit needed to consolidate development and test servers to cut hardware costs and better manage IT infrastructure

The VMware Solution

VMware GSX Server deployed on Linux and Windows, saving money and streamlining testing and development processes

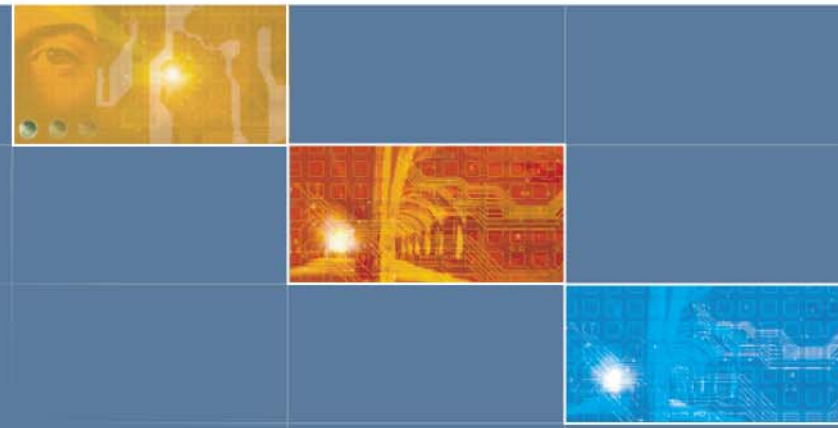
BUSINESS OBJECTS®

"Besides the space and cost savings, it's great because we can create all the test environments we need and run them on any Intel hardware without platform compatibility issues."

Drew Hawken
R&D Systems Lead
Crystal Decisions

- **Deployed throughout development, QA, support and production environments**
- **VMs run: SQL Server, Lotus Notes, Essbase, IIS , Exchange, SAP, Oracle, Crystal Decisions products**
- **Achieved 10:1 server consolidation ratio**
- **Create exact replicas of production systems in VMs for application testing, staging, patching and deployment**

Departmental Server Consolidation



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VMware GSX Server Applications:
Departmental Server Consolidation

Features	Benefits
Consolidate applications and infrastructure services onto fewer highly scalable, highly reliable enterprise-class servers	• Maximize server resource utilization • Reduce hardware and software costs by 48-80%
Large server support (up to 64GB of host memory, up to 32 host processors, up to 64 powered-on virtual machines)	• Deliver built-in headroom for expansion and scaling
Complete isolation of virtual machines and system encapsulation	• Capture full ROI in less than 6 months • Safely and reliably consolidate unreliable server applications
Easy migration of virtual machines to ESX Server	• Datacenter-class scalability for servers and virtual machines
Manage dozens of GSX Server hosts from VirtualCenter	• Manage farms of virtual machines from a single interface

VMware GSX Server Applications:
Departmental Server Consolidation

- ✓Consolidate applications and infrastructure services onto fewer highly scalable and reliable servers
- ✓Eliminate need to standardize environment on a single OS or hardware platform
- ✓Remove concern about application interaction or dependencies
- ✓Reduce TCO across computing infrastructure
- ✓Maximize hardware utilization
- ✓Simplify system management

Halliburton Company

Reduced TCO by 40%

The Challenge

To cost-effectively scale a well data monitoring service requiring one database server per well

The VMware Solution

Use VMware GSX Server to consolidate customer databases securely onto fewer servers with virtual machines

"With VMware GSX Server, we are able to run up to 10 database servers on a single server, which allows us to provide mainframe levels of reliability and data security at much lower cost."

Jody Powers
President, Halliburton Energy Services

- **Achieved a 4:1 server consolidation ratio and reduced TCO by 40%**
- **Improved uptime and reliability by more than 50%**
- **Provided mainframe levels of reliability and data security on Intel servers at lower cost**
- **Increased efficiency in provisioning and planning for growth**
- **Ensured cost-effective high availability for more applications**

Wendy's

Reduced server restoration time from hours to minutes

The Challenge

To manage server sprawl and growth while reducing overall IT costs and providing for disaster recovery

The VMware Solution

Deployed VMware GSX Server to control server population growth and increased server utilization from 18% to 40%+

- **Running 50+ mission-critical applications (PeopleSoft, payroll, D&B supply chain management, video database) in virtual machines**
- **Eliminated need to purchase 16 new servers**
- **Consolidated major program roll-out on three machines instead of 10**
- **Reduced time required to restore failed servers from 2+ hours to 2 minutes**
- **Easy disaster recovery using stored virtual machines**

High Availability

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VMware GSX Server Applications:
High Availability

Features	Benefits
Keep virtual machines in hot standby reserve without consuming CPU or memory resources	• Deliver affordable, scalable high availability
Supports standard network load balancing, standby, replication, and clustering of virtual machines	• Guarantee protection against non-hardware errors and single points of failure • Reduce hardware costs by 30-45% • Simplify set-up and configuration to reduce maintenance costs
Instantly restore a virtual machine with a software failure without rebooting the physical host	• Greatly speed up recovery from software failures and save 25-55% on downtime costs
Restored virtual machines can discard any unwanted changes or corruptions	• Ensure recovery of failed servers to a known good state
Common virtualization layer across all hardware	• Don’t need to have identical hardware at primary and secondary sites
Create clusters of virtual machines	• Provide software fault tolerance • Virtual machines can share SCSI cluster disks

VMware GSX Server Applications:
High Availability

- ✓Build virtual machine “clusters in a box” using standard clustering software to provide software fault tolerance
- ✓Mirror physical or virtual machines onto back up virtual machines
  - Hot standby virtual machine servers use no CPU or memory resources, only occupy disk space until powered on
  - Suspended virtual machines come online instantly without booting delays
- ✓Use snapshots to instantly restore a failed server in a virtual machine to a known good state
- ✓Turn any site into a disaster recovery site
  - Virtual machines don’t need matching hardware

Oak Associates

Cut server costs in half and saved $100,000

The Challenge

Improve hardware utilization and avoid need for idle duplicate hardware at disaster recovery site

The VMware Solution

Production servers moved to VMware GSX Server virtual machines and SAN replication used to mirror virtual machine data to remote site

OAK ASSOCIATES, ltd.

"With VMware, we can create at least five virtual machines on every server we purchase, so we can do so much more. It gives us headroom to experiment and improves our ability to serve the company."

Scott Hill
Sr. Technology Officer
Oak Associates

- **Consolidated accounting, antivirus, help desk and email servers in isolated VMs**
- **Running 60 server virtual machines on 12 servers**
- **No need for identical hardware at disaster recover site**
- **Cut server costs in half and saved $100,000**
- **Server provision time reduced from 10-15 days to just hours**

NeverFail

Reduced hardware and maintenance costs by 70%

The Challenge

Find less hardware-intensive approach to business continuity service that guarantees data security and server stability while reducing costs and time to market

The VMware Solution

VMware GSX Server eliminated need for one-to-one mirroring of servers, reducing hardware and maintenance costs by 70%

neverfail™ group

"By allowing operating environments to reside in software, as opposed to physical servers, VMware GSX Server enables us to recover many failed servers onto just one machine."

Richard Pursey
CEO, NeverFail

- **Delivered world's first disaster-recovery solution to combine real-time server continuity with rapid recovery on virtual machines**
- **Preserved full isolation and security of individual servers**
- **Consolidated up to 10 servers on more reliable and scalable hardware, providing headroom for future business growth**
- **Reduced hardware and maintenance costs**

Rapid Provisioning

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VMware GSX Server Applications:
Rapid Provisioning

Features	Benefits
Encapsulates entire state of virtual machine – memory, disk images, I/O devices	• Build pre-configured virtual machine servers once, deploy them anywhere, any time
Virtual machine states can be saved to a file	• Provision new servers as easily as copying a file • Keep up with demand for new servers, builds, and service packs while reducing hardware costs by 30-45%
Virtual machine states can be stored, transferred to another machine	• Manage server growth without creating server sprawl
Provides uniform platform so virtual machines are guaranteed to run even if physical hardware is different	• No need for homogeneous hardware platforms
Remotely monitor and manage virtual machines	• Reduce need for skilled system administrators in remote locations

VMware GSX Server Applications:
Rapid Provisioning

- ✓Maintain pre-configured servers for rapid deployment when/where needed
- ✓Increase operations efficiency by up to 50%
- ✓Configure, monitor, and control remote virtual machines with Remote Management features
- ✓Smoothes transition between testing, staging, and production environments, reducing regression testing cycle time by +20%
- ✓Meet SLAs but reduce space, management, and resource costs
- ✓Use encapsulated virtual machines from development to testing to production deployments – consistent virtual platform eliminates uncertainty due to hardware and OS variations

Florida Department of Transportation
Provisioned virtual servers faster and more easily

The Challenge

Provide developers with capacity on demand without compromising data center space and power limitations

The VMware Solution

Running dev/test environments in virtual machines consolidated on VMware GSX Server provided secure, stable platform to deploy services faster and more efficiently

"Running servers in virtual machines lets our staff work with a variety of system environments that simply wouldn't be feasible using real servers."

Clint Adkison
Database Administrator
Florida Department of Transportation

- **Provisioned virtual servers much faster and more easily than physical servers**
- **Achieved 5:1 server consolidation ratio**
- **Avoided expanding data center and adding additional power circuits**
- **Moved development environments to more reliable and scalable hardware**

CalPERS
Total savings in excess of $1 million

The Challenge

California Public Employees' Retirement System was running out of power and space; every application needed its own server

The VMware Solution

Deployed VMware GSX Server to run four applications on one server and benefit from server consolidation

"Without GSX Server, we would probably have at least 85 more servers than we do now since it's so hard to run more than one application on a system. Now, we can set up a new virtual machine in a couple of minutes instead of the several hours it takes for a physical server, and our end users never notice because performance is not compromised."

Ryan Goessling
System Software Specialist
CalPERS

- **Run variety of applications in production – domain controllers, call center applications, DNS, IIS, SNA, DHCP**
- **Save $35,000+ every time new server is provisioned – total savings in excess of $1 million**
- **Provision new systems in minutes – instead of hours**
- **Restore failed servers quickly**

How VMware GSX Server Works

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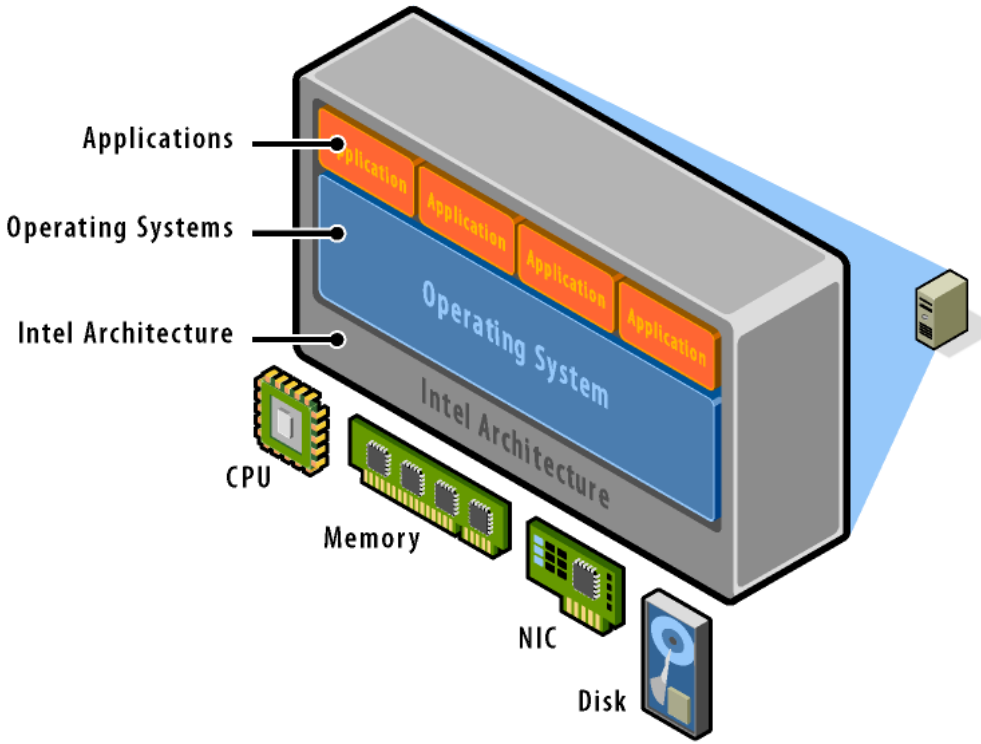
How Does VMware GSX Server Work?

Standard Intel Architecture

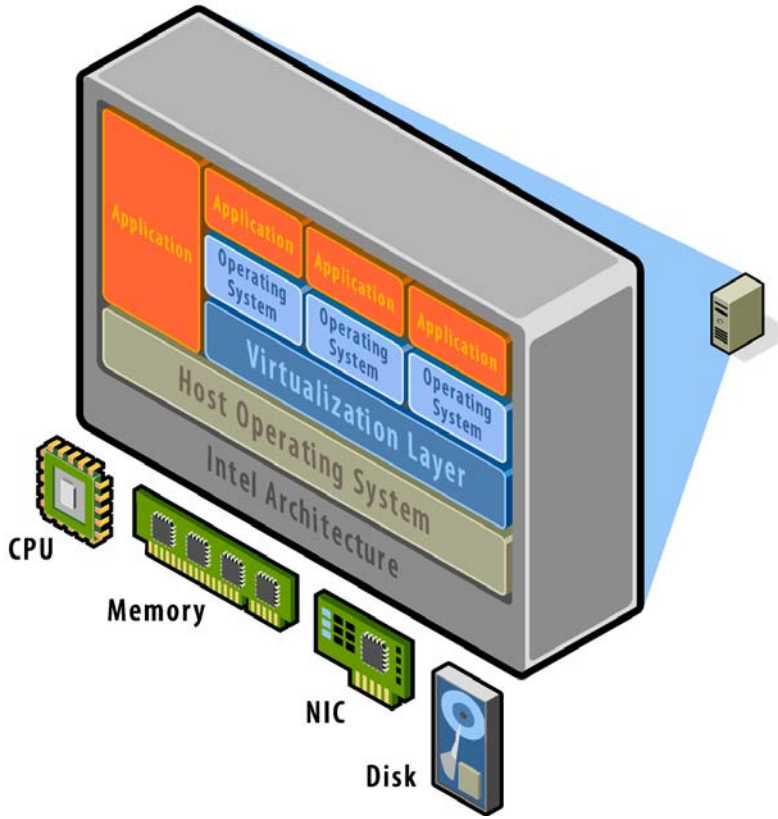
The standard Intel-based computer system architecture is comprised of layers –
a hardware layer, an operating system layer, and software application layers



How Does VMware GSX Server Work?

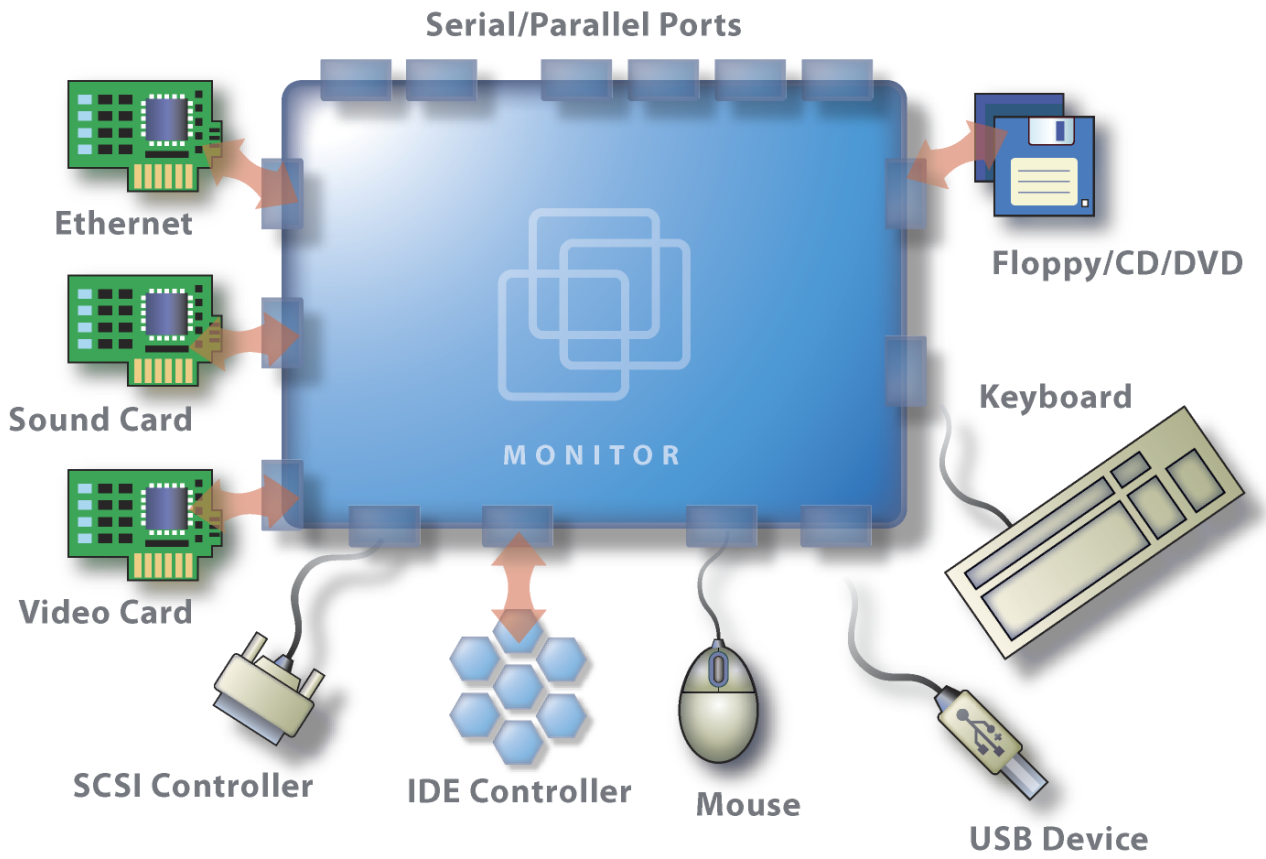
Intel Architecture with VMware GSX Server

The VMware virtualization layer sits between the hardware and software and allows users to create virtual machines.



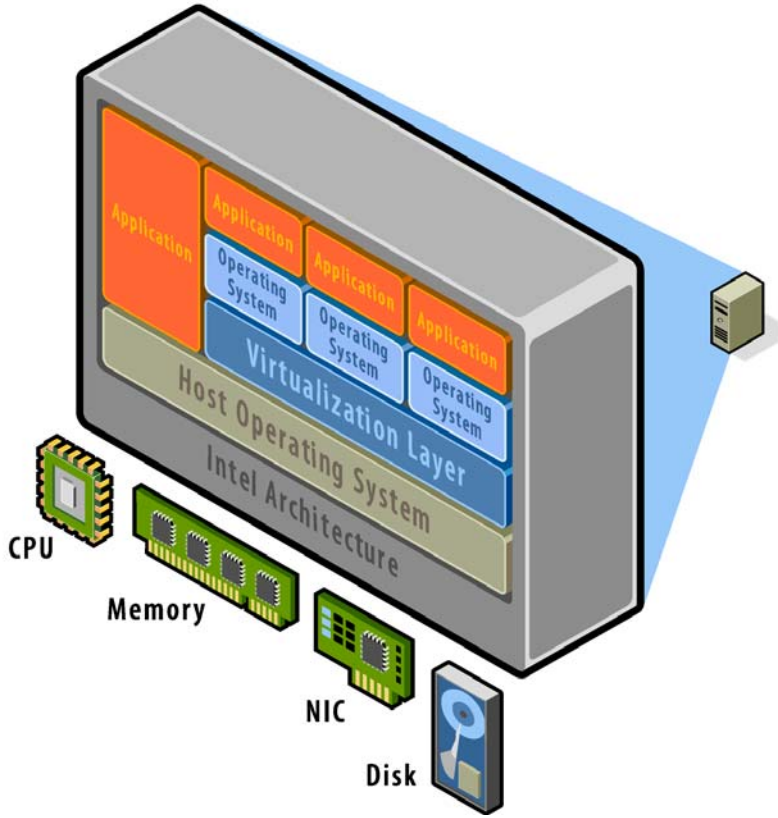
How Does VMware GSX Server Work?

Virtual machines are the full equivalent of a standard x86 machine



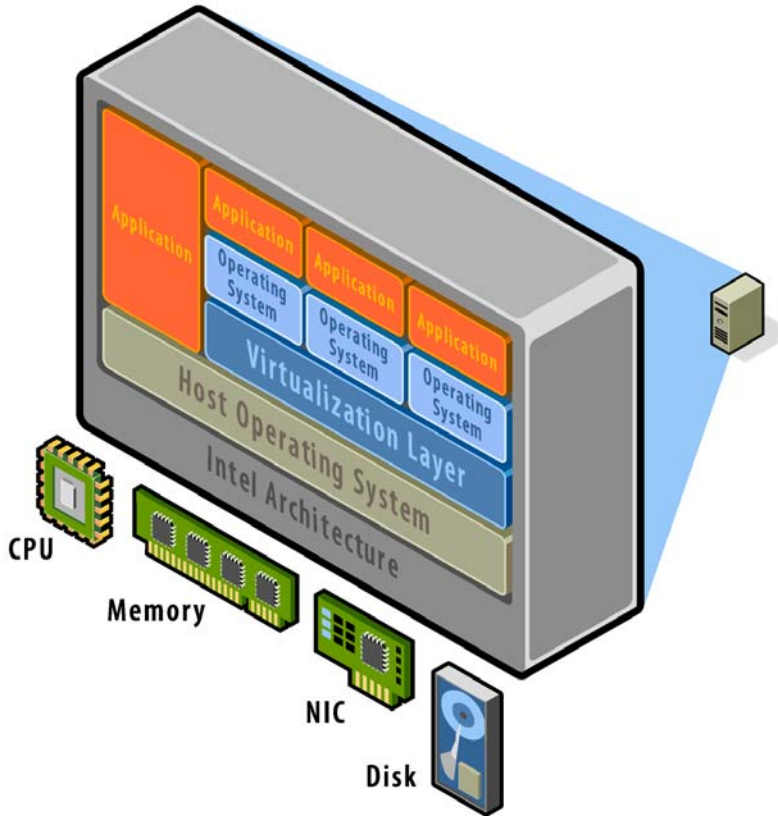
How Does VMware GSX Server Work?

- Virtualization layer maps physical hardware resources to virtual hardware resources
- Each virtual machine has own CPU, memory, disks, I/O devices, etc.
- High performance results from direct mapping on hardware



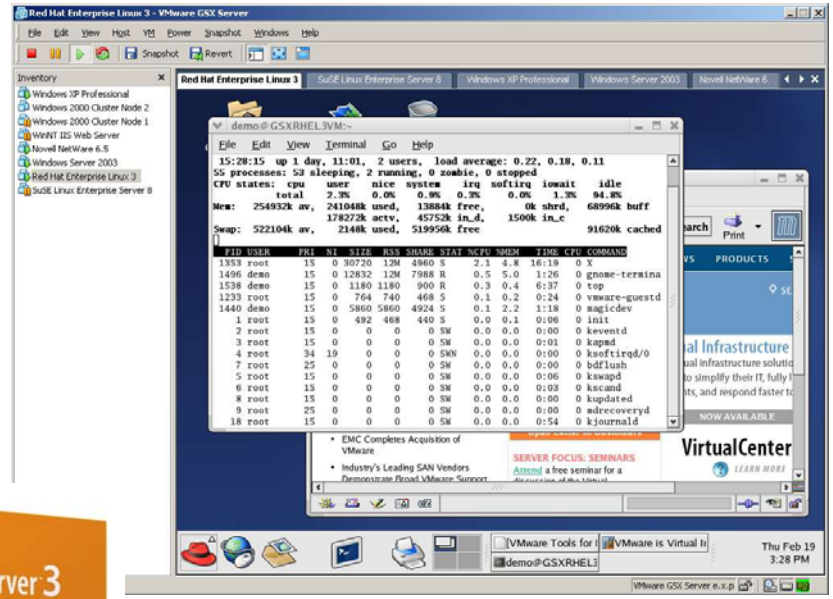
How Does VMware GSX Server Work?

- Extends existing host OS to support virtual machines in addition to applications
  - Installs and runs like an application
- Uses host OS services to implement virtual I/O devices
  - Device compatibility inherited from host OS



Key Features of VMware GSX Server

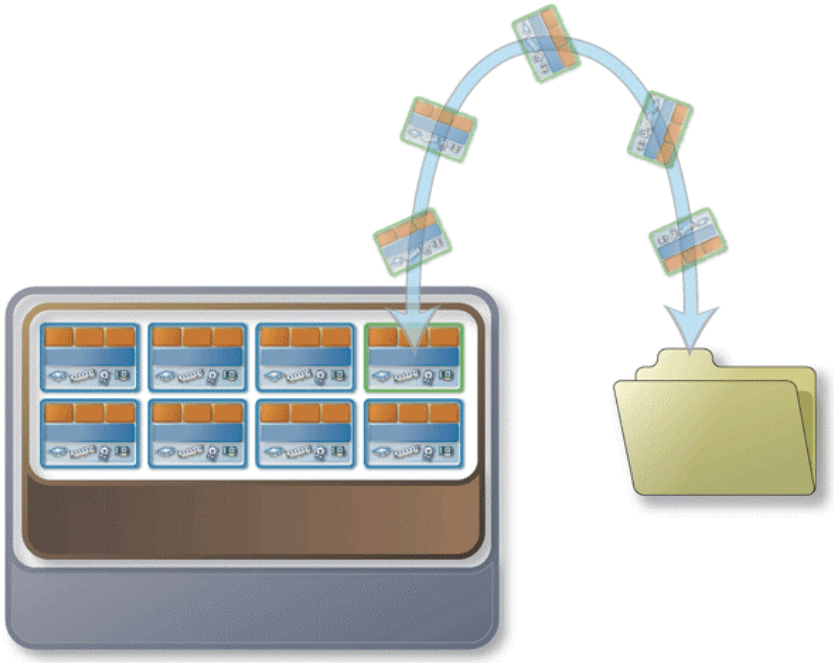
- Virtual machine isolation
- System encapsulation
- Compatibility
- Robust networking
- Remote management
- Automation
- Windows integration
- VirtualCenter-ready



Key Features of VMware GSX Server:
Virtual Machine Isolation

- Key to successful server consolidation
- Software failure in a virtual machine can't affect host or other virtual machines
- Software running in a virtual machine can't:
  - Access code or data of the host machine
  - Access code or data of other virtual machines

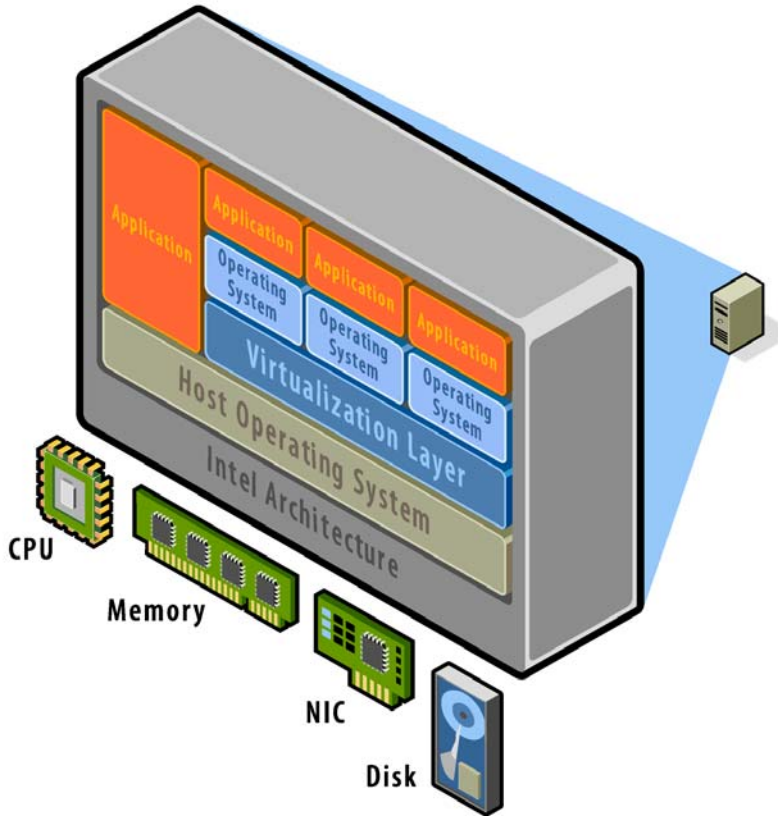
Key Features of VMware GSX Server:
System Encapsulation



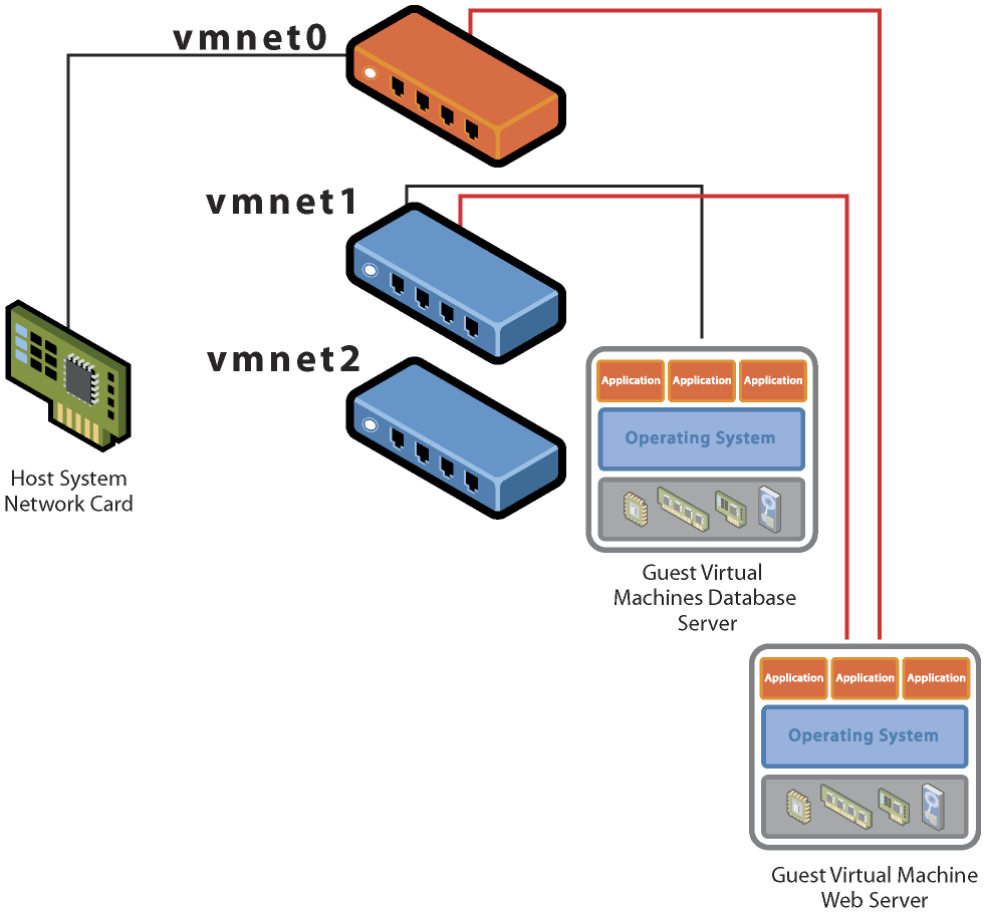
- Entire state of virtual machine is encapsulated:
  - Memory, disk images, I/O device state
- Virtual machine state can be saved to a file
  - Suspend/resume
  - Snapshots
- Virtual machine state can be stored or transferred to another machine
- Uniform platform
  - Virtual machines guaranteed to run even if physical hardware is different

Key Features of VMware GSX Server:
Compatibility

- All software that runs on ph hardware runs on virtual m
- Easiest way to maintain ba compatibility
  - Runs old applications while innovation
  - Freedom from the tyranny backward compatibility: run and applications on new O
- Everything else runs regard software complexity
- Virtual machines are comp across all VMware product

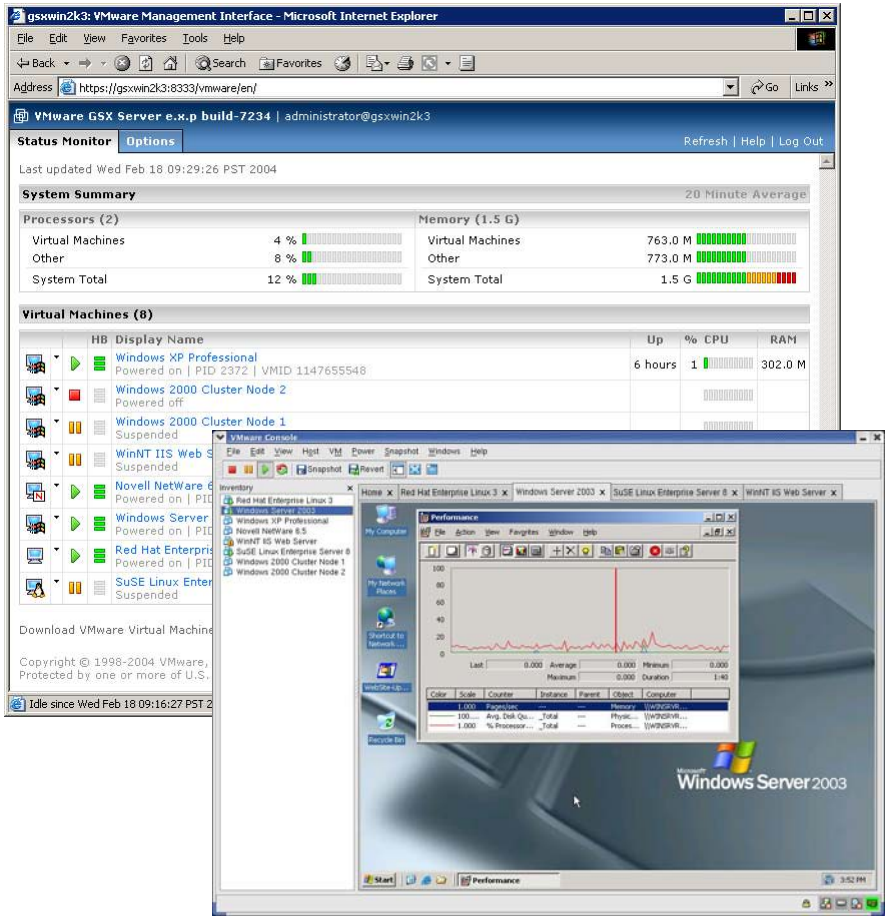


Key Features of VMware GSX Server:
Robust Networking



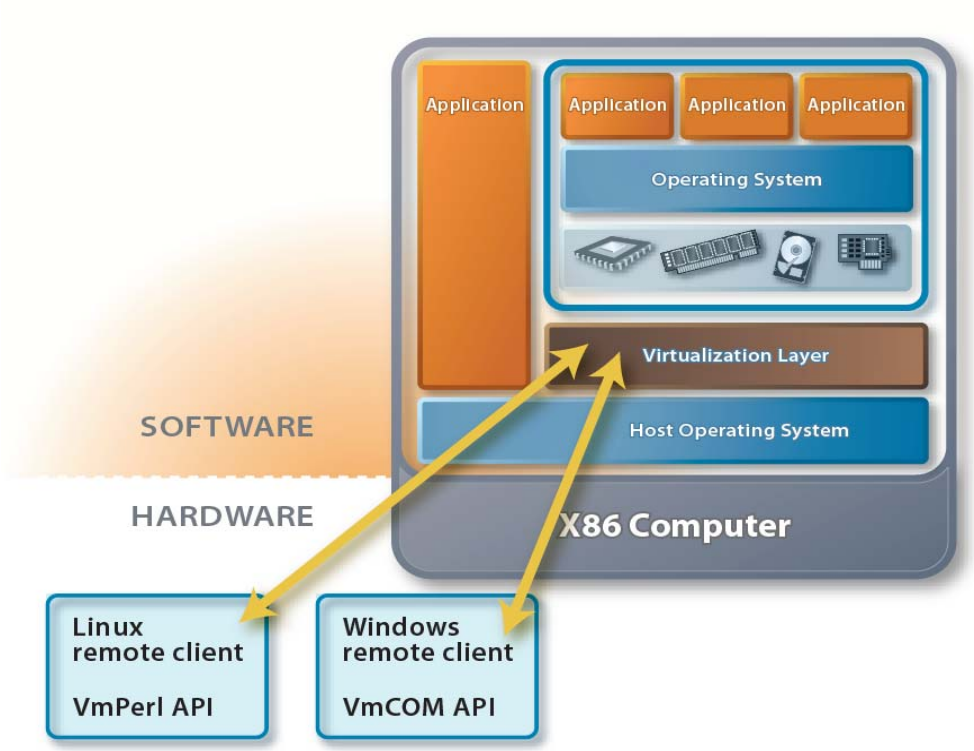
- Build complex network on a single server
  - Bridged networking
  - Host-only networking
  - NAT networking
- Allow virtual machines to join separate networks isolated from physical network

Key Features of VMware GSX Server:
Remote Management



- Web-based management interface
  - Create, modify, stop, start, suspend/resume virtual machines
  - Monitor CPU and memory usage
  - Access from any browser
- Virtual Machine Console
  - Windows and Linux versions
  - Create, configure & manage VMs
  - Full mouse and keyboard support
  - Remote full screen
  - Tabbed “quick switch” interface
  - Good low-bandwidth performance
- SSL security

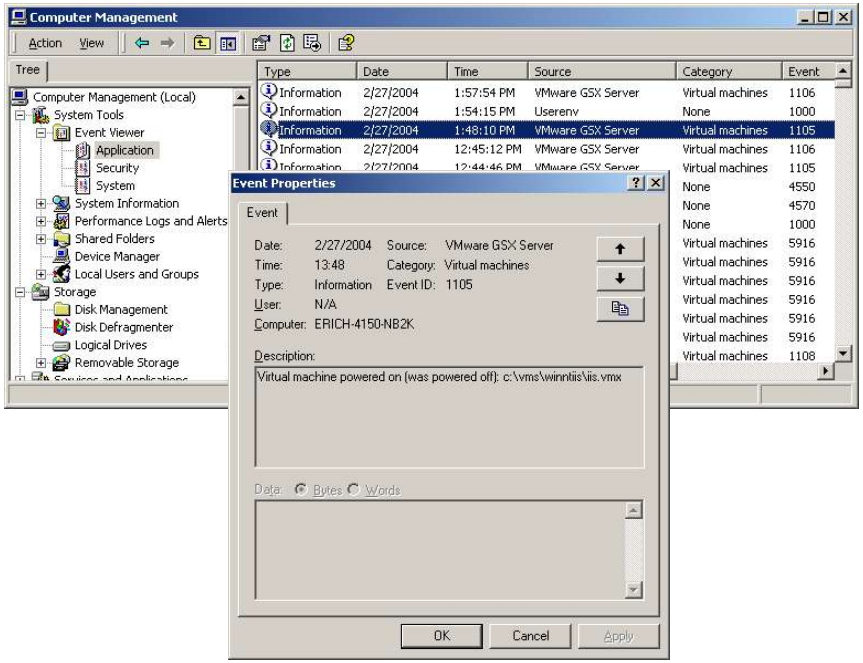
Key Features of VMware GSX Server:
Automation



COM and Perl APIs

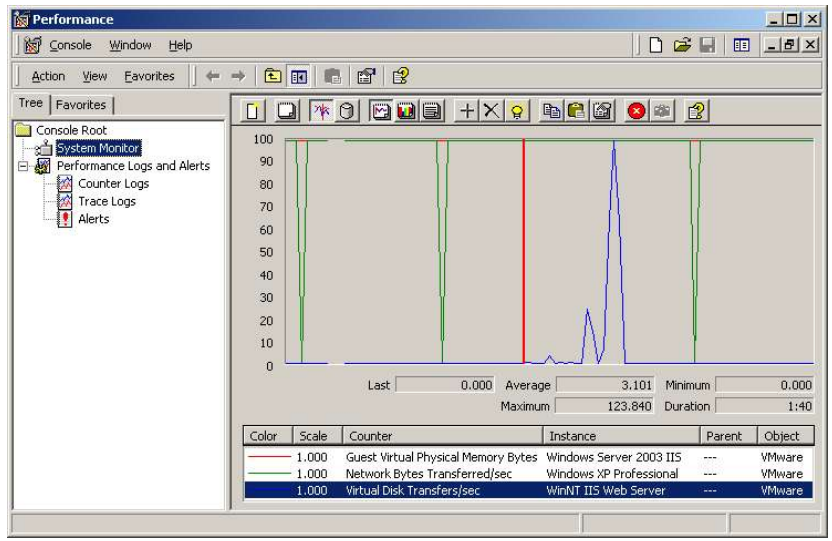
- Automate VM management tasks from local or remote systems
- Control virtual machines
  - Power on/off/reset
  - Suspend/resume
  - Connect/disconnect devices
- Monitor virtual machines
  - Get status and check heartbeat
- Pass data between host and virtual machine
- Respond to guest OS questions

Key Features of VMware GSX Server:
Windows Integration



- Windows Event Log integration
  - Monitor virtual machine state changes
  - Unique event IDs for easy integration with management tools

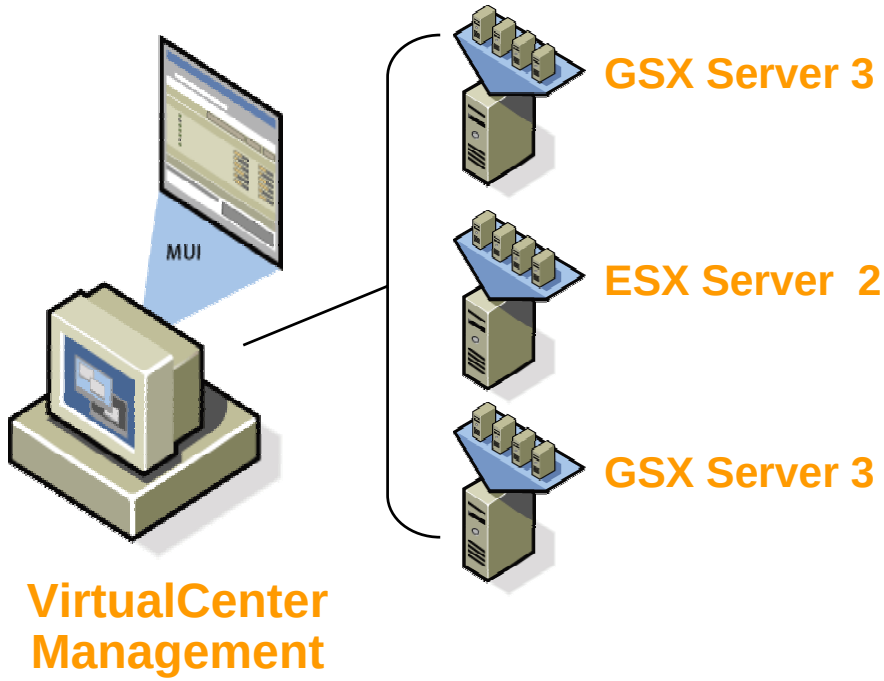
- Windows Performance Monitor integration
  - Track memory, network and disk activity in virtual machines



Key Features of VMware GSX Server:

Virtual Machine Server Management with VirtualCenter

- Move workloads across distributed physical servers
- Streamline server provisioning and management
- Monitor system availability and performance
- Manage distributed servers as a single pool of resources
- Available with next release of VirtualCenter

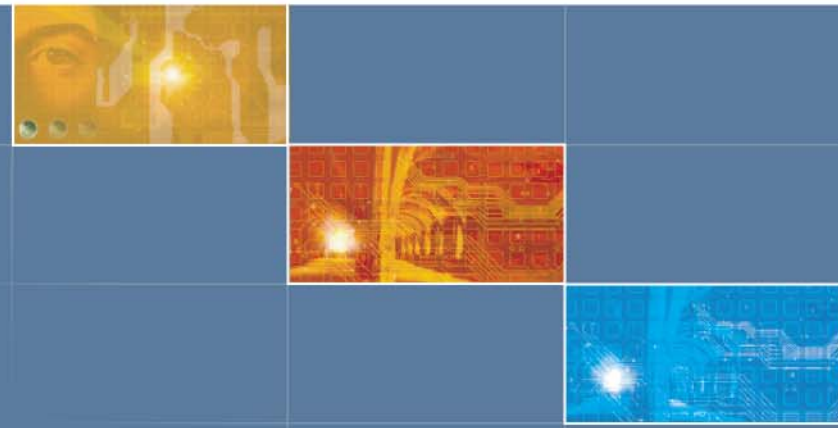


New and Enhanced Features of VMware GSX Server 3

- **More platform choices**
  - Supports latest Windows/Linux/NetWare OSes
- **Automated virtual test lab**
  - Integration with leading test automation solutions
  - Automatic VM start-up & shutdown
  - PXE provisioning of virtual machines
  - VMs can use remote client CD drives
- **Direct upgrade to ESX Server**
  - Seamless VM migration to ESX Server when highest performance and scalability needed
- **Centralized Management and provisioning**
  - VirtualCenter-based customization and provisioning of server VMs
  - Windows integration for performance monitoring and event logging
- **Enterprise-class server VMs**
  - 3.6GB per VM for server-class workloads
  - Teamed network adapter support, SCSI backup devices
  - 10-20% improvement in disk and networking performance

Comparison of VMware GSX Server 3 and ESX Server 2

	GSX Server 3	ESX Server 2
Computing power	GSX Server supports single CPU applications such as Web apps, DNS and Active Directory, print and file Servers, and custom VB applications	ESX Server provides virtual SMP to address the computing needs of databases, SAP, ERP, and Exchange
Disk and Network I/O	GSX Server supports intermediate disk and network I/O requirements	ESX Server offers higher performance for heavy disk and network I/O applications
Architecture	GSX Server is a hosted architecture and installs like an application on Linux and Windows	ESX Server is a hostless architecture and installs directly on the hardware
Consolidation ratios	GSX Server supports about 4 virtual machines per host CPU	ESX Server supports about 8 virtual machines per host CPU
Resource management	GSX Server provides static memory allocation	ESX Server provides fine-grained, dynamic resource management enabling customers to offer guaranteed SLA
VirtualCenter and VMotion	GSX Server is VirtualCenter-ready to enable customers to manage multiple GSX Server instances	ESX Server supports VirtualCenter and VMotion which allows running virtual machines to be moved



VMware GSX Server Customers

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Who Uses VMware GSX Server?

- **Financial Services**
  - Citibank
  - Fidelity Investments
  - JPMorgan Chase Bank
  - CalPERS
- **Health Care**
  - Humana
  - Kaiser Permanente
  - McKesson
- **Pharmaceutical**
  - Bristol Meyers Squibb
- **Retail**
  - Target
- **Manufacturing**
  - Boeing
  - Dow Corning
  - Ford Motor Company
  - Kimberly-Clark Corp.
- **Oil & Gas**
  - ChevronTexaco
  - Halliburton Energy Services
- **Government**
  - Central Intelligence Agency
  - Internal Revenue Service
  - U.S. Army

Who Uses VMware GSX Server?

- **Technology**
  - Cisco
  - Dell
  - Fujitsu-Siemens
  - Hewlett Packard - Compaq
  - IBM
  - Intel
  - Microsoft
  - NEC System Technologies
  - Novell
  - Panasonic
  - SAP
  - Sterling Commerce
  - Unisys
- **Telecommunications**
  - Cingular Interactive
  - Nokia
- **Training & Education**
  - MIT
  - Stanford University
- **Transportation & Freight**
  - Continental Airlines
  - United Parcel Service
- **Entertainment**
  - Broadcast Music, Inc.
  - Walt Disney Company

Who Uses VMware GSX Server?

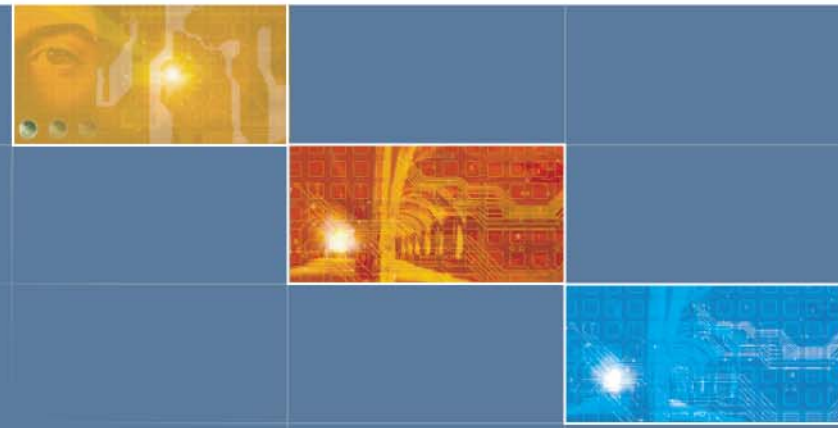
Why Does Your Business Need VMware GSX Server?

1. Reduce computing infrastructure TCO by up to 64 %
2. Reduce hardware and software costs by 40 percent
3. Reduce operations expenses - cost of labor and maintenance - by up to 70 %
4. Reduce downtime by 25-55 %
5. Reduce development and testing cycles from hours to minutes
6. Realize full return on investment (ROI) in less than 6 months

VMware GSX Server

Enterprise-Class Virtual Machines for Intel-based Servers

- The most widely deployed server virtualization product – over three years of proven success with thousands of enterprise customers
- Widest selection of supported host and guest OSes of any virtualization technology
- Integrates easily into any environment for ultimate versatility
- Supports largest Intel servers for best scalability
- Distributed by Egenera, HP, NEC Systems Technologies, and Unisys



End

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VMware GSX Server Leads the Competition

Benefit	VMware GSX Server 3	MS Virtual Server
Product Maturity	•Shipping 3+ years •Thousands customers running production workloads	Preview beta release out, not yet in beta or generally available
Freedom of Choice	Installs on all Windows server and Linux platforms	Windows Server 2003 only
Enterprise-class Server Consolidation	Features that support enterprise-class workloads: • 3.6GB per VM • Teamed network adapters • VM support for PXE • SCSI backup devices • VM clusters	Dev/Test Operations and Legacy Only
Broad Dev/Test Integration	Integration with leading Software Test Automation solutions to cover 70% of market.	None
Centralized Management & Provisioning	VMware VirtualCenter for multi-host VM provisioning and automated management	• No multi-host management • No automated provisioning
Seamless Upgrade to Datacenter Virtualization	Migrate VMs directly to ESX Server for datacenter-class performance	None