

VMware ESX Server

Platform for virtualizing servers, storage and networking

What Is VMware ESX Server?

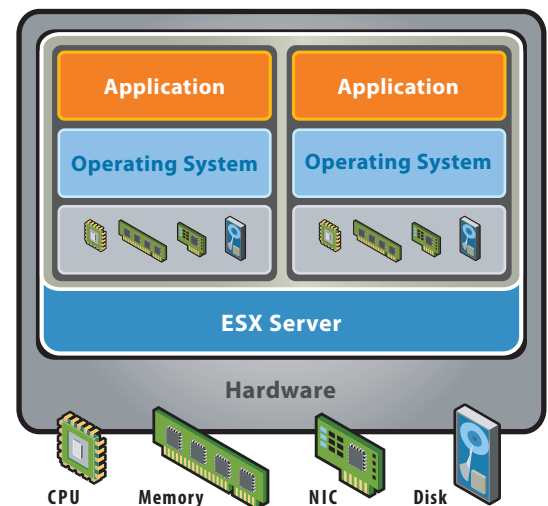
VMware® ESX Server is the foundation for the dynamic, self-optimizing IT infrastructure. VMware ESX Server is a robust, production-proven virtualization layer that abstracts processor, memory, storage and networking resources into multiple virtual machines. ESX Server allows IT organizations to:

- Increase hardware utilization and dramatically decreases capital and operating cost by sharing hardware resources across a large number of virtual machines that run side-by-side on the same server.
- Improve service levels even to the most resource-intensive applications with advanced resource management, high availability, and security features.

ESX Server delivers the highest levels of performance, scalability and robustness required for enterprise IT environments.

How Is VMware ESX Server Used in the Enterprise?

- **Implement Production Server Consolidation and Containment.** Contain server sprawl by running software applications in virtual machines on fewer, highly scalable, reliable enterprise-class servers.
- **Provide Advanced Business Continuity Protection at Lower Cost.** Deliver high availability for critical applications with cost-effective virtualization-based solutions.
- **Streamline Software Test & Development.** Consolidate disparate development, testing and staging environments involving multiple operating systems and multi-tier applications on the same hardware.
- **Secure and Manage Enterprise Desktops.** Provide standardized enterprise desktop environments hosted in virtual machines accessed through thin clients or PCs.
- **Re-host Legacy Applications.** Migrate legacy operating systems and software applications to virtual machines running on new hardware for better reliability.



VMware ESX Server virtualizes server storage and networking, allowing multiple applications to run in virtual machines on the same physical server.

How Does VMware ESX Server Work?

ESX Server installs directly on the server hardware, or “bare metal”, and inserts a robust virtualization layer between the hardware and the operating system. ESX Server partitions a physical server into multiple secure and portable virtual machines that can run side by side on the same physical server. Each virtual machine represents a complete system—with processors, memory, networking, storage and BIOS—so that Windows, Linux, Solaris and NetWare operating systems and software applications run in virtualized environment without any modification. Sharing the physical server resources among a number of virtual machines increases hardware utilization and dramatically decreases capital cost. The bare metal architecture gives ESX Server complete control over the server resources allocated to each virtual machine and provides for near-native virtual machine performance and enterprise-class scalability.

Virtual machines have built-in high availability, resource management and security features that provide better service levels to software applications than static physical environments.

KEY FEATURES

Architecture

- **Bare-metal architecture.** ESX Server inserts a robust virtualization layer directly on the server hardware for near-native virtual machine performance, reliability and scalability.
- **CPU virtualization.** Increase server utilization without the risk of critical services being starved for CPU resources. ESX Server uses intelligent process scheduling and load balancing across available processors to manage the execution of virtual machine processing.
- **Virtualization for storage.** Leverage high performance shared storage to centralize virtual machine file storage for greater manageability, flexibility and availability.
 - » **Virtual disk files.** Simplify virtual machine storage management. Virtual machines see their own private virtual disk files. However, outside the virtual machine, the virtual disks are simply large files that can be copied, moved, archived and backed up as easily as any other file.
 - » **VMFS cluster file system.** Store virtual disk files on high performance shared storage such as Fibre Channel or iSCSI SAN. VMFS is a cluster file system which enables multiple installations of ESX Server to have concurrent fast access to the same virtual machine storage. Since virtual machines are hardware independent and portable across servers, VMFS ensures that individual servers are not single points of failure and enables resource balancing across multiple servers.
 - » **Logical volume manager.** Manage the interaction between the physical storage arrays and VMFS with flexibility and reliability.
 - Dynamic volume resizing. Aggregate multiple storage disks into a single VMFS volume. Resize LUNs and add new heterogeneous LUNs to a VMFS volume on the fly.
 - Automatic volume re-signaturing. Simplify the use of array-based snapshot technology. Re-signaturing automatically recognizes snapshot VMFS volumes.
- New- Partial online operation. Volume continues to function even if some LUNs are lost.
- » **Raw device mapping.** Optionally, map SAN LUNs directly to a virtual machine in order to enable application clustering and array-based snapshot technology while profiting from the manageability benefits of VMFS.
- » **Fibre Channel HBA consolidation.** Share expensive storage network components across many virtual machines while maintaining hardware fault tolerance.
- » **Write-through I/O.** Ensure precise recovery of virtual machines in the event of server failure. Write-through I/O enables virtual machines to have the same recovery characteristics as a physical system running the same operating system.
- » **Boot from SAN.** Run ESX Server installations on diskless configurations of blade and rack mount servers by booting from SAN. Simplify backups and disaster recovery by eliminating the need to separately backup local attached server disks.
- **Virtualization for networking.** Network virtual machines like physical machines. Build complex networks within a single ESX Server or across multiple installations of ESX Server for production deployments or development and testing purposes.
 - » **Virtual NICs.** Configure each virtual machine with one or more virtual NICs. Each of those network interfaces can have its own IP address and even its own MAC address. As a result, virtual machines are indistinguishable from physical machines from a networking standpoint.
 - » **Virtual switches.** Create a simulated network within an ESX Server with virtual switches that connect virtual machines.
 - » **New – Expanded port configuration policies.** Simplify port configuration by utilizing a single configuration object across large groups of ports. The configuration object specifies all information needed to enable a port: NIC teaming policy (now per port instead of per virtual switch), VLAN tagging, Layer 2 security, and traffic shaping.

- » **VLAN.** Overlay a logical LAN on top of physical LANs to isolate network traffic for security and load segregation purposes. ESX Server VLANs are compatible with standard VLAN implementations from other vendors. Modify network configurations without having to change actual cabling and switch setups. VLANs keep broadcast traffic limited to the VLAN, reducing the network load of broadcast packets on other switches and network segments.

Performance and Scalability

Leveraging eight years of R&D and experience from more than 20,000 customer deployments, ESX Server 3 delivers unparalleled performance and scalability. With ESX Server 3, even the most resource intensive production applications such as databases, ERP and CRM, can be virtualized.

- **New – Enhanced virtual machine performance.** Benefit from better virtual machine performance in ESX Server 3. Performance improvements have been achieved through:
 - » multi-virtual machine scalability
 - » improved memory management unit (MMU) handling
 - » significant networking enhancements
 - » Linux native posix thread library (NPTL) support
- **Advanced memory management**
 - » **RAM over-commitment.** Increase memory utilization by configuring virtual machine memory that safely exceeds the physical server memory. For example, the sum of the memory of all virtual machines running on a server with 8GB physical memory can be 16GB.
 - » **Transparent page sharing.** Utilize available memory more efficiently by storing memory pages identical across multiple virtual machines only once. For example, if several virtual machines are running Windows Server 2003, they will have many identical memory pages. Transparent page sharing consolidates those identical pages into a single memory location.

- » **Memory ballooning.** Shift memory dynamically from idle virtual machines to active ones. Memory ballooning artificially induces memory pressure within idle virtual machines, forcing them to use their own paging areas and release memory for active virtual machines.
- **New – Improved power management.** Lower the data center utility bill with improved power management. ESX Server enters a low power “halt” state when a CPU is not scheduled.
- **New – 4-Way Virtual SMP.** Enable a single virtual machine to use up to four physical processors simultaneously. ESX Server 3 extends this unique feature from two to four processors. With 4-way Virtual SMP even the most processor intensive software applications like databases and messaging servers can be virtualized.
- **New – 16GB RAM for virtual machines.** Run the most memory-intensive workloads in virtual machines with a memory limit extended to 16GB.
- **New – Support for powerful physical server systems.** Take advantage of very large server systems with up to 32 logical CPUs and 64GB RAM for large scale server consolidation and DR projects.
- **New – Support for up to 128 powered-on virtual machines.** Take advantage of very large server systems for enterprise-class server consolidation and containment. The maximum number of powered-on virtual machines has been extended from 80 to 128.
- **New – Flexible virtual switches.** Scale up to handle more virtual machines. Virtual switches can be created with any number of ports from 8 to 1016, and the maximum number of virtual switches has been raised from 128 to 248.
- **New – Wake-on LAN.** Enable higher consolidation ratios by allowing virtual machines to go on stand-by mode when not used.

Interoperability

ESX Server 3 is the only virtualization product optimized, rigorously tested and certified across the complete IT stack of servers, storage, operating systems, and software applications allowing for enterprise-wide standardization.

- **Hardware.** ESX Server 3 has been certified with industry-leading rack, tower and blade servers from Dell, HP, IBM, Fujitsu Siemens, NEC, Sun Microsystems and Unisys.
 - » **New – Support for Sun Microsystems and Unisys hardware systems**
 - » **New – Support for Intel White-Box standard specifications**
 - » **Support for dual core processors.** ESX Server 3 supports AMD and Intel dual-core processors.
- **Storage.** ESX Server 3 is certified with a wide range of storage systems from EMC, Dell, HP, IBM, and Network Appliance
 - » **Heterogeneous storage arrays.** Utilize a wide variety of heterogeneous storage devices in the same VMFS volume.
 - » **New – NAS and iSCSI SAN support.** By supporting lower-cost, more easily managed shared storage, ESX Server 3 further reduces total cost of ownership of IT environments. Advanced VMware Infrastructure features like VMotion and VMware HA are fully supported with NAS and iSCSI environments.
 - » **New – 4GB Fibre Channel SAN support.**
- **Operating systems.** ESX Server 3 is the only virtualization platform that supports a wide range of unmodified operating systems including Windows, Linux, Solaris and Novel NetWare.
 - » **New – Experimental 64-bit guest operating system support**
 - » **New – Solaris 10 operating system support**
- **Software applications.** Run software applications from over 250 software vendors in VMware virtual machines.
- **Support for other virtual machine formats.** ESX Server 3 can run virtual

machines created in non-VMware formats. Using the free VMware Virtual Machine Importer users can run Microsoft® Virtual Server and Virtual PC, and Symantec® LiveState Recovery virtual machines in ESX Server.

Manageability

Advanced manageability and usability features in ESX Server 3 enable management of entire virtualized IT environment.

- **New – SMI-S-compliant management interfaces.** Monitor virtual storage using any standard SMI-S-aware storage management tool.
- **New – Virtual Infrastructure Client.** Manage ESX Server 3, virtual machines, and (optionally) VirtualCenter Server with a common user interface.
- **New – Virtual Infrastructure Web access.** Manage ESX Server 3 with simple Web interface (formerly known as the Management User Interface, or MUI).
- **New – Virtual machine shortcuts.** Enable self-help for end users with direct access to virtual machines through a Web browser.
- **New – Remote devices.** Install software in a virtual machine running on a server from the CD-ROM of a desktop without leaving your desk.

Distributed Resource Optimizations

- **Resource management for virtual machines.** Define advanced resource allocation policies for virtual machines to improve service levels to software applications. Establish minimum, maximum, and proportional resource shares for CPU, memory, disk and network bandwidth. Modify allocations while virtual machines are running. Enable applications to dynamically acquire more resources to accommodate peak performance.
 - » **CPU capacity prioritization.** CPU capacity is assigned to virtual machines on a “fair share” basis and CPU resource controls also allow an absolute minimum level of CPU capacity to be provided to critical virtual machines.

- » **Storage I/O traffic prioritization.** Ensure that critical virtual machines receive priority access to storage devices. I/O traffic from virtual machines to disk can be prioritized on a “fair share” basis.
- » **Network Traffic Shaper.** Ensure that critical virtual machines receive priority access to network bandwidth. Network traffic from virtual machines can be prioritized on a “fair share” basis. Network Traffic Shaper manages virtual machine network traffic to meet peak bandwidth, average bandwidth and burst size constraints.
- **New – Resource Pools.** Aggregate collections of hardware resources virtualized by ESX Server into unified logical resources that can be allocated to virtual machines on-demand. Resource pools increase flexibility and hardware utilization.

High Availability

ESX Server 3 delivers data center-class high availability for virtual machines

- **Shared storage.** Eliminate single points of failure by storing virtual machine files on shared storage such as Fibre Channel or iSCSI SAN, or NAS. Use SAN mirroring and replication features to keep updated copies of virtual disk at disaster recovery sites.
- **SAN transparency.** Use native SAN storage for virtual machines with the same ease and flexibility as virtual disk files. Raw device mapping lets virtual machines use standard SAN LUN data stores in addition to special-purpose VMFS formatted LUNs for virtual disk files. Offload file-level backup and replication of virtual machine data to SAN-based utilities. Easily configure clusters of virtual and physical machines with shared SAN data stores for cost effective high availability.
- **Built-in storage access multipathing.** Ensure shared storage availability with SAN multipathing for Fibre Channel or iSCSI SAN, and NIC teaming for NAS.

- **New – Enhanced NIC teaming.** Give each networked virtual machine built-in NIC failover and load balancing enabling greater hardware availability and fault tolerance. New NIC teaming policies allow users to configure multiple active and standby adapters. Teaming configuration may be different for different port groups on the same virtual switch and different groups can even select different teaming algorithms for the same team.
- **Support for Microsoft® clustering Services.** Cluster virtual machines running Microsoft® Windows operating system across physical hosts.

Security

- **Compatibility with SAN security practices.** Enforce security policies with LUN zoning and LUN masking.
- **VLAN tagging.** Enhance network security by tagging and filtering network traffic on VLANs. Limit the scope of broadcast domains.
- **Layer 2 network security policies.** Enforce security for virtual machines at the Ethernet layer that is not available with physical servers. Disallow promiscuous mode sniffing of network traffic, MAC address changes, and forged source MAC transmits.

How Can I Purchase VMware ESX Server?

- VMware ESX Server is included in VMware Infrastructure 3 Starter, Standard and Enterprise.
- The version of ESX Server included in VMware Infrastructure 3 Starter has the following limitations:
 - Can be used with local storage and NAS only. Cannot be used with SAN
 - Can be deployed on servers with up to 4 physical CPUs and up to 8 GB of memory
- ESX Server is not available for purchase as stand-alone product.

Product Specifications and System Requirements

For detailed product specifications and system requirements refer to:

- ESX Server requirements in the VMware Infrastructure Installation and Upgrade guide located at http://www.vmware.com/support/pubs/vi_pubs.html.
- Compatibility guides:
 - The VMware Infrastructure Systems Compatibility Guide, I/O Compatibility Guide and SAN Compatibility Guide located at http://www.vmware.com/support/pubs/vi_pubs.html.