Configuration Maximums

vSphere 6.0

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VMware, Inc.
3401 Hillview Ave.
Palo Alto, CA 94304
www.vmware.com

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Introduction 1

When you select and configure your virtual and physical equipment, you must stay at or below the maximums supported by vSphere 6.0.

The limits presented in the following sections represent tested, recommended limits, and are fully supported by VMware.

- Virtual Machine Maximums
- ESXi Host Maximums
- vCenter Server Maximums
- Platform Services Controller
- vCenter Server Extensions
- VMware vSphere Flash Read Cache
- VMware Virtual SAN
- Virtual Volumes
- Network I/O Control

The limits presented in the guide are applicable to ESXi host and vCenter Server. The limits can be affected by other factors, such as hardware dependencies. For more information about supported hardware, see the appropriate ESXi hardware compatibility guide. Consult individual solution limits to ensure that you do not exceed supported configurations for your environment.

Virtual Machine Maximums 2

The virtual machine maximums represent limits applicable to compute, memory, storage virtual adapters and devices, network virtual devices, virtual peripheral ports, and graphics video device.

Table 2-1. Virtual Machine Maximums

Item	Maximum
Compute	
Virtual CPUs per virtual machine (Virtual SMP)	128
Memory	
RAM per virtual machine	4 TB *The actual value supported is 4080 GB and not 4096 GB.*
Virtual machine swap file size	4 TB *VMFS3 with 1MB block maximum swap size is 255 GB. Recommended solution is VMFS5, not VMFS3 with bigger block size.*
Storage Virtual Adapters and Devices	
Virtual SCSI adapters per virtual machine	4
Virtual SCSI targets per virtual SCSI adapter	15 *Any combination of disk or VMDirectPath SCSI target.*
Virtual SCSI targets per virtual machine	60
Virtual disk size	62 TB
IDE controllers per virtual machine	1 *Supports two channels (primary and secondary) each with a master and slave device.*
IDE devices per virtual machine	4 *Devices can be either CD-ROM or disk.*
Floppy controllers per virtual machine	1
Floppy devices per virtual machine	2 *BIOS is configured for one floppy device.*
Virtual SATA adapters per virtual machine	4
Virtual SATA devices per virtual SATA adapter	30 *Devices can be either CD-ROM or disk*
Networking Virtual Devices	
Virtual NICs per virtual machine	10 *Any combination of supported virtual NICs.*

Table 2-1. Virtual Machine Maximums (Continued)

Item	Maximum
Virtual Peripheral Ports	
USB host controllers per virtual machine	1 *USB 1.x, 2.x and 3.x supported. One USB host controller of each version 1.x, 2.x, or 3.x can be added at the same time.*
USB devices connected to a virtual machine	20 *Guest operating systems might have lower limits than allowed by vSphere.*
Parallel ports per virtual machine	3
Serial ports per virtual machine	32
Miscellaneous	
Concurrent remote console connections to a virtual machine	40
Graphics video device	
Video memory per virtual machine	512 MB

ESXi Host Maximums 3

ESXi host maximums represents the maximums for compute, memory, storage, networking maximums, and cluster and resource pool.

This chapter includes the following topics:

Compute Maximums

The ESXi host compute maximums represents the limits for host CPU, virtual machine, and fault tolerance.

Table 3-1. Compute Maximums

Item	Maximum
Host CPU maximums	
Logical CPUs per host	480
NUMA Nodes per host	16
Virtual machine maximums	
Virtual machines per host	1024
Virtual CPUs per host	4096
Virtual CPUs per core	32 *The achievable number of vCPUs per core depends on the workload and specifics of the hardware. For more information, see the latest version of Performance Best Practices for VMware vSphere.*
Fault Tolerance maximums	
Virtual disks	16
Virtual CPUs per virtual machine	4
RAM per FT VM	64 GB

Table 3-1. Compute Maximums (Continued)

Item	Maximum
Virtual machines per host	4
Virtual CPU per host	8

Memory Maximums

The ESXi host maximums represents the limits for ESXi host memory.

Table 3-2. ESXi Host Memory Maximums

Item	Maximum
RAM per host	6 TB *12 TB is supported on specific OEM certified platform. Please refer to VMware Hardware Compatibility Limits for guidance on the platforms that support vSphere 6.0 with 12 TB of physical memory.*
Number of swap files	1 per virtual machine

Storage Maximums

The ESXi host storage maximums represents the limits for virtual disks, iSCSI physical, NAS, Fibre Channel, FCoE, Common VMFS, and VMFS5.

Table 3-3. Storage Maximums

Item	Maximum
Virtual Disks	
Virtual Disks per Host	2048
iSCSI Physical	
LUNs per server	256
Qlogic 1 Gb iSCSI HBA initiator ports per server	4
Broadcom 1 Gb iSCSI HBA initiator ports per server	4
Broadcom 10 Gb iSCSI HBA initiator ports per server	4
NICs that can be associated or port bound with the software iSCSI stack per server	8
Number of total paths on a server	1024
Number of paths to a LUN (software iSCSI and hardware iSCSI)	8
Qlogic iSCSI: dynamic targets per adapter port	64
Qlogic iSCSI: static targets per adapter port	62
Broadcom 1 Gb iSCSI HBA targets per adapter port	64
Broadcom 10 Gb iSCSI HBA targets per adapter port	128

Table 3-3. Storage Maximums (Continued)

Item	Maximum
Software iSCSI targets	256 *The sum of static targets (manually assigned IP addresses) and dynamic targets (IP addresses assigned to discovered targets) may not exceed this number.*
NAS	
NFS mounts per host	256
Fibre Channel	
LUNs per host	256
LUN size	64 TB
LUN ID	1023
Number of paths to a LUN	32
Number of total paths on a server	1024
Number of HBAs of any type	8
HBA ports	16
Targets per HBA	256
FCoE	
Software FCoE adapters	4
Common VMFS	
Volume size	64 TB *For VMFS3 volumes with 1 MB block size, the maximum is 50 TB.*
Volumes per host	256
Hosts per volume	64
Powered on virtual machines per VMFS volume	2048
Concurrent vMotion operations per VMFS volume	128
VMFS3	
Raw device mapping size (virtual and physical)	2 TB minus 512 bytes
Block size	8 MB
File size (1 MB block size)	256 GB
File size (2 MB block size)	512 GB
File size (4 MB block size)	1 TB
File size (8 MB block size)	2 TB minus 512 bytes
Files per volume	Approximately 30,720
VMFS5	
Raw Device Mapping size (virtual compatibility)	62 TB
Raw Device Mapping size (physical compatibility)	64 TB
Block size	1 MB *1MB is default block size. Upgraded VMFS5 volumes inherit the VMFS3 block size value.*

Table 3-3. Storage Maximums (Continued)

Item	Maximum
File size	62 TB
Files per volume	Approximately 130,690

Networking Maximums

Networking maximums represent achievable maximum configuration limits in networking environments where no other more restrictive limits apply (for example, vCenter Server limits, the limits imposed by features such as HA or DRS, and other configurations that might impose restrictions must be considered when deploying large scale systems).

Table 3-4. Networking Maximums

Item	Maximum
Physical NICs	
e1000e 1 Gb Ethernet ports (Intel PCI-e)	24
igb 1 Gb Ethernet ports (Intel)	16
tg3 1 Gb Ethernet ports (Broadcom)	16 *with NetQueue enabled* 32 *with NetQueue disabled* *The NetQue is enabled by default in vSphere 6.0.*
bnx2 1 Gb Ethernet ports (QLogic)	16
nx_nic 10 Gb Ethernet ports (NetXen)	8
elxnet 10Gb Ethernet ports (Emulex)	8
ixgbe 10 Gb Ethernet ports (Intel)	16
bnx2x 10 Gb Ethernet ports (QLogic)	8
Infiniband ports (refer to VMware Community Support)	N/A *Mellanox Technologies InfiniBand HCA device drivers are available directly from Mellanox Technologies. Go to the Mellanox Web site information about support status of InfiniBand HCAs with ESXi. http://www.mellanox.com*
Combination of 10 Gb and 1Gb ethernet ports	Sixteen 10 Gb and four 1 Gb ports
nmlx4_en 40 GB Ethernet Ports (Mellanox)	4
VMDirectPath limits	
VMDirectPath PCI/PCIe devices per host	8 *A virtual machine can support 6 devices, if 2 of them are Teradici devices.*
SR-IOV Number of virtual functions	1024 *SR-IOV supports up to 43 virtual functions on supported Intel NICs and up to 64 virtual functions on supported Emulex NICs. The actual number of virtual functions available for passthrough depends on the number of interrupts vectors required by each of them and on the hardware configuration of the host. Each ESXi host has a limited number of interrupt vectors. When the host boots, devices on the host such as storage controllers, physical network adapters, and USB controllers consume a subset of the total number of vectors. Depending upon the number of vectors these devices consume, the maximum number of potentially supported VFs could be reduced.*
SR-IOV Number of 10 G pNICs	8
VMDirectPath PCI/PCIe devices per virtual machine	4
vSphere Standard and Distributed Switch	

Table 3-4. Networking Maximums (Continued)

Item	Maximum
Total virtual network switch ports per host (VDS and VSS ports)	4096
Maximum active ports per host (VDS and VSS)	1016
Virtual network switch creation ports per standard switch	4088
Port groups per standard switch	512
Static/Dynamic port groups per distributed switch	10,000
Ephemeral port groups per distributed switch	1016
Ports per distributed switch	60,000
Distributed virtual network switch ports per vCenter	60,000
Static/dynamic port groups per vCenter	10,000
Ephemeral port groups per vCenter	1016
Distributed switches per vCenter	128
Distributed switches per host	16
VSS portgroups per host	1000
LACP - LAGs per host	64
LACP - uplink ports per LAG (Team)	32
Hosts per distributed switch	1000
NIOC resource pools per vDS	64
Link aggregation groups per vDS	64

Cluster and Resource Pool Maximums

The ESXi host cluster and resource pool maxmimums represents limits for cluster and resource pool.

Table 3-5. Compute Maximums

Item	Maximum
Cluster (all clusters including HA and DRS)	
Hosts per cluster	64
Virtual Machines per cluster	8000
Virtual machines per host	1024
Powered-on virtual machine config files per datastore in an HA cluster	2048 *This limit does not apply to virtual disks. A virtual machine enabled with Fault Tolerance counts as two virtual machines.*
FT virtual machines per cluster	98
FT virtual machines vCPU per Cluster	256
Resource Pool	
Resource pools per host	1600
Children per resource pool	1100

Table 3-5. Compute Maximums (Continued)

Item	Maximum
Resource pool tree depth	8 *Additional 4 resource pools are used by system internals.*
Resource pools per cluster	1600

Using Maximum Values for More than One Configuration Option

If any one of the configuration options listed in the above tables is used at its maximum limit value, the ESXi host and vCenter Server with default configuration should be able to withstand the values.

If more than one configuration options (such as number of virtual machines, number of LUNs, and number of VDS ports) are used at their maximum limit, some of the processes running on the host might run out of memory. This might cause the host to keep disconnecting from the vCenter Server. In such a case, you need to increase the memory pool for these host processes so that the host can withstand the workload you are planning. You need to increase your memory pool size in correlation to the number of configuration options you are using at the maximum value.

vCenter Server Maximums

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The vCenter Server maximums represents limits for vCenter Server scalability, user interface, concurrent operations, and vCenter Server Appliance.

Table 4-1. vCenter Server Maximums

Item	Maximum
vCenter Server Scalability	
Hosts per vCenter Server	1000
Powered-on virtual machines per vCenter Server	10,000
Registered virtual machines per vCenter Server	15,000
Linked vCenter Servers	10
Hosts in linked vCenter Servers	4000
Powered-on virtual machines in linked vCenter Servers	30,000
Registered virtual machines in linked vCenter Servers	50,000
Concurrent vSphere Web Clients connections to vCenter Server	180
Number of host per datacenter	500
MAC addresses per vCenter Server (using default VMware OUI)	65,536
User Interface	
USB devices connected per vSphere Client	20
Concurrent operations	
vMotion operations per host (1 Gb/s network)	4
vMotion operations per host (10 Gb/s network)	8
vMotion operations per datastore	128
Storage vMotion operations per host	2
Storage vMotion operations per datastore	8
vCenter Server Appliance	
Hosts (with embedded vPostgres database)	1000
Virtual machines (with embedded vPostgres database)	15,000
Hosts (with Oracle database)	1000
Virtual machines (with Oracle database)	15,000
vCenter Server Windows embedded/packaged vPostgres	

Table 4-1. vCenter Server Maximums (Continued)

Item	Maximum
Hosts (with embedded vPostgres database)	20
Virtual machines (with embedded vPostgres database)	200
Content Library	
Total CL items per VC (across all libraries)	200
Total number of libraries per VC	20
Total items per library	200
Maximum number of subscribers per library	5
Host Profile	
Hosts	21
Powered On virtual machines	100
Datastores	120
Profile Created	1200
Profile Attached	1000

Platform Services Controller 5

The Platform Services Controller maximums represent limits for domain or replication, identity source, enhanced linked mode or lookup service, and VMware Certificate Authority (VMCA).

Table 5-1. Platform Service Controller maximums

Item	Maximum
Domain/Replication	
Maximum PSCs per vSphere Domain	8
Maximum PSCs per site, behind a load balancer	4
Maximum objects within a vSphere Domain (Users and Groups)	1,000,000
Maximum tolerance for time skew between PSC nodes	5 minutes
Identity Source	
Maximum Active Directory or OpenLDAP Groups per User for best performance	1015
Enhanced Linked Mode/Lookup Service	
Maximum number of VMware Solutions connected to a single PSC	4 *This limit is based on the test performed using only vCenter Server.*
Maximum number of VMware Solutions in a vSphere Domain	10
VMCA/Certificate	
Maximum number of subordinate Certificate Authority servers in the chain within VMware Certificate Authority	6
Maximum cryptographic hash used for PSC Node certificate	1
Maximum RSA Public Key length used for PSC Node certificate	16,384

vCenter Server Extensions 6

The vCenter Server Extensions represents limits for VMware vCenter Update Manager, VMware vCenter Orchestrator, and Storage DRS.

This chapter includes the following topics:

VMware vCenter Update Manager

The VMware vCenter Update Manager maximums represent limits for concurrent operations.

Table 6-1. vCenter Update Manager Maximums

Item	Maximum
Concurrent Operations	
VMware Tools scan per ESXi host	90
VMware Tools upgrade per ESXi host	24
Virtual machine hardware scan per host	90
Virtual machine hardware upgrade per host	24
VMware Tools scan per VUM server	90
VMware Tools upgrade per VUM server	75
Virtual machine hardware scan per VUM server	90
Virtual machine hardware upgrade per VUM server	75
ESXi host scan per VUM server	75
ESXi host remediation per VUM server	71
ESXi host upgrade per VUM server	71
Cisco DVS update and deployment	70

VMware vCenter Orchestrator

The VMware vCenter Orchestrator maximums represents limits for vCenter Server systems, ESXi instances, virtual machines and supported workflows.

Table 6-2. vCenter Orchestrator Maximums

Item	Maximum
Connected vCenter Server systems	20
Connected ESXi instances	1280
Connected virtual machines	35,000 *15,000 per vCenter Orchestrator Cluster node.*
Concurrent running workflows	300

Storage DRS

Ensure that you configure storage DRS within the limits defined as storage DRS maximums.

Table 6-3. Storage DRS Maximums

Item	Maximum
Virtual disks per datastore cluster	9000
Datastores per datastore cluster	64
Datastore clusters per vCenter	256

VMware vSphere Flash Read Cache 7

Ensure that you configure vMware vSphere Flash Read Cache within the limits defined by flash read cache maximums.

Table 7-1. Flash Read Cache Maximums

Item	Maximum
Virtual flash resource per host	1
Maximum cache for each virtual disk	400 GB
Cumulative cache configured per host (for all virtual disks)	2 TB
Virtual disk size	16 TB
Virtual host swap cache size	4 TB
Flash devices per virtual flash resource	8

VMware Virtual SAN

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The VMware Virtual SAN maximums represents limits applicable for virtual SAN ESXi host, virtual SAN cluster, virtual SAN virtual machines, virtual SAN VM storage policy, and virtual networking.

Table 8-1. Virtual SAN Maximums.

Item	Maximum
Virtual SAN ESXi host	
Virtual SAN disk groups per host	5
Magnetic disks per disk group	7
SSD disks per disk group	1
Spinning disks in all diskgroups per host	35
Components per Virtual SAN host	9000
Cache tier maximum devices per host	5
Capacity tier maximum devices per diskgroup	7
Capacity tier maximum devices	35
Virtual SAN Cluster	
Number of Virtual SAN hosts in a cluster	64
Number of datastores per cluster	1
Virtual SAN virtual machines	
Virtual machines per host	200
Virtual machines per cluster	6400
Virtual machine virtual disk size	62 TB
Disk stripes per object	12
Percentage of flash read cache reservation	100
Failure to tolerate	3 *for VM virtual disk size <= 16 TB* 1 *for VM virtual disk size > 16 TB*
Percentage of object space reservation	100
Virtual SAN networks/physical network fabrics	2

Virtual Volumes

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Ensure you configure the virtual volume size within the maximums defined.

Table 9-1. Virtual Volumes

Item	Maximum
Data Virtual Volume Size	62 TB
Number of Virtual Volumes bound to a host	64,000
Number of PEs per host	256
Storage Container size	2^64
Storage Container per host	256
Maximum outstanding PE I/O operations	128 *The outstanding PE I/O operations is configurable up to 4096.*
Configured VPs per host	128
Maximum configured VVol managed storage arrays per host	64

Network I/O Control (NIOC) 10

Ensure you configure VMware vSphere Network I/O Control within the maximums defined.

Table 10-1. NIOC

Item	Maximum
Number of resource pools	10000
Number of uplinks per vds	32
Number of uplinks per host	32
Number of vNIC per host	5120
Max pNIC bandwidth	Approximately 10 Gbits/sec *for 10G pNIC* Approximately 1 Gbits/sec *for 1G pNIC*

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