

Configuration Maximums

vSphere 6.5

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Updated Information

This *Configuration Maximums* is updated with each release of the product or when necessary.

This table provides the update history of the *Configuration Maximums*.

Revision	Description
EN-002346-00	Initial release.
EN-002346-01	Updated Number of iSCSI sessions per Node to 128 in Chapter 8, “VMware Virtual SAN,” on page 25

Introduction

When you select and configure your virtual and physical equipment, you must stay at or below the maximums supported by vSphere 6.5.

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

- [Chapter 2, “Virtual Machine Maximums,”](#) on page 9
- [Chapter 3, “ESXi Host Maximums,”](#) on page 11
- [Chapter 4, “vCenter Server Maximums,”](#) on page 17
- [Chapter 5, “Platform Services Controller,”](#) on page 19
- [Chapter 6, “vCenter Server Extensions,”](#) on page 21
- [Chapter 7, “VMware vSphere Flash Read Cache,”](#) on page 23
- [Chapter 8, “VMware Virtual SAN,”](#) on page 25
- [Chapter 9, “Virtual Volumes,”](#) on page 27Virtual Volumes
- [Chapter 10, “Network I/O Control \(NIOC\),”](#) on page 29
- [Chapter 11, “Storage Policies,”](#) on page 31
- [Chapter 12, “Managed Virtual Disks,”](#) on page 33

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

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	6128 GB
Virtual machine swap file size	6128 GB <i>VMFS3 with 1 MB block maximum swap size is 255 GB. Recommended solution is VMFS5, not VMFS3 with bigger block size.</i>
Storage Virtual Adapters and Devices	
Virtual SCSI adapters per virtual machine	4
Virtual SCSI targets per virtual SCSI adapter	15 <i>Any combination of disk or VMDirectPath SCSI target.</i>
Virtual SCSI targets per virtual machine	60
Virtual NVMe adapters per virtual machine	4
Virtual NVMe targets per virtual SCSI adapter	15
Virtual NVMe targets per virtual machine	60
Virtual disk size	62 TB
IDE controllers per virtual machine	1 <i>Supports two channels (primary and secondary) each with a master and slave device.</i>
IDE devices per virtual machine	4 <i>Devices can be either CD-ROM or disk.</i>
IDE CDROM devices per virtual machine	4
Floppy controllers per virtual machine	1
Floppy devices per virtual machine	2 <i>BIOS is configured for one floppy device.</i>
Virtual SATA adapters per virtual machine	4

Table 2-1. Virtual Machine Maximums (Continued)

Item	Maximum
Virtual SATA devices per virtual SATA adapter	30 <i>Devices can be either CD-ROM or disk</i>
Networking Virtual Devices	
Virtual NICs per virtual machine	10 <i>Any combination of supported virtual NICs.</i>
Virtual RDMA Adapters per Virtual Machine	1
Virtual Peripheral Ports	
USB host controllers per virtual machine	1 <i>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.</i>
USB devices connected to a virtual machine	20 <i>Guest operating systems might have lower limits than allowed by vSphere.</i>
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	2 GB

ESXi Host Maximums

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,”](#) on page 11
- [“Memory Maximums,”](#) on page 12
- [“Storage Maximums,”](#) on page 12
- [“Networking Maximums,”](#) on page 14
- [“Cluster and Resource Pool Maximums,”](#) on page 15
- [“ESXi Graphics Maximums,”](#) on page 16
- [“Using Maximum Values for More than One Configuration Option,”](#) on page 16

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	576
NUMA Nodes per host	16
Virtual machine maximums	
Virtual machines per host	1024
Virtual CPUs per host	4096
Virtual CPUs per core	32
<i>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.</i>	
Fault Tolerance maximums	
Virtual disks	16
Disk size	2 TB
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	12 TB <i>12 TB is supported on specific OEM certified platform. See VMware Hardware Compatibility Limits for guidance on the platforms that support vSphere 6.0 with 12 TB of physical memory.</i>
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, VMFS5, and VMFS6.

Table 3-3. Storage Maximums

Item	Maximum
Virtual Disks	
Virtual Disks per Host	2048
iSCSI Physical	
LUNs per server	512
Cavium (Qlogic) 1 Gb iSCSI HBA initiator ports per server	4
Cavium (Qlogic) 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	2048
Number of paths to a LUN (software iSCSI and hardware iSCSI)	8
Cavium (Qlogic) 1 Gb iSCSI HBA targets per adapter port	64
Cavium (Qlogic) 10 Gb iSCSI HBA targets per adapter port	128
Software iSCSI targets	256 <i>The sum of static targets (manually assigned IP addresses) and dynamic targets (IP addresses assigned to discovered targets) may not exceed this number.</i>
NAS	
NFS mounts per host	256
Fibre Channel	
LUNs per host	512

Table 3-3. Storage Maximums (Continued)

Item	Maximum
LUN size	64 TB
LUN ID	0 to 16383
Number of paths to a LUN	32
Number of total paths on a server	2048
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 <i>For VMFS3 volumes with 1 MB block size, the maximum volume size is 50 TB.</i>
Volumes per host	512
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 / VMFS-6	
Raw Device Mapping size (virtual compatibility)	62 TB
Raw Device Mapping size (physical compatibility)	64 TB
Block size	1 MB <i>1MB is the default block size. Upgraded VMFS5 volumes inherit the VMFS3 block size value.</i>
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).

Note For all NIC devices that are not listed in the table below, the maximum number of ports supported is 2.

Table 3-4. Networking Maximums

Item	Maximum
Physical NICs	
igbn 1 Gb Ethernet ports (Intel)	16
ntg3 1 Gb Ethernet ports (Broadcom)	32
bnx2 1 Gb Ethernet ports (QLogic)	16
elxnet 10 Gb 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 <i>Mellanox Technologies InfiniBand HCA device drivers are available directly from Mellanox Technologies. Go to the Mellanox Web site for information about support status of InfiniBand HCAs with ESXi. http://www.mellanox.com .</i>
Combination of 10 Gb and 1 Gb ethernet ports	Sixteen 10 GB and four 1 GB ports
nmlx4_en 40 Gb Ethernet Ports (Mellanox)	4
nmlx5_core 25 Gb Ethernet Ports (Mellanox)	4
nmlx5_core 50 Gb Ethernet Ports (Mellanox)	4
nmlx5_core 100 Gb Ethernet Ports (Mellanox)	4
i40en 10 Gb Ethernet Ports (Intel)	8
i40en 40 Gb Ethernet Ports (Intel)	4
qedentv 25 Gb Ethernet Port (Qlogic)	4
qedentv 50 Gb Ethernet Port (Qlogic)	4
qedentv 100 Gb Ethernet Port (Qlogic)	2
VMDirectPath limits	
VMDirectPath PCI/PCIe devices per host	8 <i>A virtual machine can support 6 devices, if 2 of them are Teradici devices.</i>
SRIOV	

Table 3-4. Networking Maximums (Continued)

Item	Maximum
SR-IOV Number of virtual functions per host	1024 <i>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 interrupt 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.</i>
SR-IOV Number of 10 G pNICs per host	8
VMDirectPath PCI/PCIe devices per virtual machine	4
vSphere Standard and Distributed Switch	
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	2000
NIOC resource pools per vDS	64

Cluster and Resource Pool Maximums

The ESXi host cluster and resource pool maximums represent limits for cluster and resource pool.

Table 3-5. Cluster and Resource Pool Maximums

Item	Maximum
Cluster (all clusters including HA and DRS)	
Hosts per cluster	64

Table 3-5. Cluster and Resource Pool Maximums (Continued)

Item	Maximum
Virtual Machines per cluster	8000
Virtual machines per host	1024
Powered-on virtual machine config files per datastore in an HA cluster	2048 <i>This limit does not apply to virtual disks. A virtual machine enabled with Fault Tolerance counts as two virtual machines.</i>
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
Resource pool tree depth	8 <i>Additional 4 resource pools are used by system internals.</i>
Resource pools per cluster	1600

ESXi Graphics Maximums

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

Table 3-6. GPU based Graphics Maximums

Item	Maximum
Maximum number of shared physical GPUs	16
Maximum virtual graphics memory per virtual machine	2GB

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

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	2000
Powered-on virtual machines per vCenter Server	25,000
Registered virtual machines per vCenter Server	35,000
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
Number of host per datacenter	2000
MAC addresses per vCenter Server (using default VMware OUI)	65,536
vSphere Web Client User Interface	
Concurrent vSphere Web Clients (Flex) connections to vCenter Server (<i>Limit is applicable for both linked mode and per VC</i>)	180
Maximum mixed vSphere Client (HTML5) + vSphere Web Client simultaneous connections per VC	60 (30 Flex, 30 maximum HTML5)
Maximum supported inventory for vSphere Client (HTML5)	10,000 VMs, 1,000 Hosts
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
Non-vMotion provisioning operations per host	8
vCenter Server Windows embedded/packaged vPostgres	
Hosts (with embedded vPostgres database)	20

Table 4-1. vCenter Server Maximums (Continued)

Item	Maximum
Virtual machines (with embedded vPostgres database)	200
Content Library	
Total content library items per VC (across all libraries)	2000
Biggest content library item size	1 TB
Total number of libraries per VC	1000
Total items per library	1000
Maximum number of concurrent sync operations on the published library's VC	16 <i>This limit is applicable to libraries published by vCenter Server and not to third party libraries.</i>
Host Profile	
Hosts	21
Powered On virtual machines	100
Datastores	256
Profile Created	500
Profile Attached	500

Storage DRS

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

Table 4-2. Storage DRS Maximums

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

Platform Services Controller

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	10
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
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

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,”](#) on page 21
- [“VMware vRealize Orchestrator,”](#) on page 22

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	30
Virtual machine hardware scan per host	90
Virtual machine hardware upgrade per host	30
VMware Tools scan per VUM server	200
VMware Tools upgrade per VUM server	200
Virtual machine hardware scan per VUM server	200
Virtual machine hardware upgrade per VUM server	200
ESXi host scan per VUM server	232
ESXi host patch remediation per VUM server	232
ESXi host upgrade per VUM server	232

VMware vRealize Orchestrator

The VMware vRealize 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 <i>15,000 per vRealize Orchestrator Cluster node.</i>
Concurrent running workflows	300

VMware vSphere Flash Read Cache

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

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 (Hybrid) 64 (All-Flash)
Number of datastores per cluster	1
Virtual SAN virtual machines	
Virtual machines per host	200
Virtual machines per cluster	6000
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
Percentage of object space reservation	100
Virtual SAN networks/physical network fabrics	2
Virtual SAN iSCSI Target	
Number of iSCSI LUNs per Cluster	1024
Number of iSCSI Targets per Cluster	128
Number of iSCSI LUNs per Target	256
Max iSCSI LUN size	62 TB

Table 8-1. Virtual SAN Maximums. (Continued)

Item	Maximum
Number of iSCSI sessions per Node	128
iSCSI IO queue depth per Node	4096
Number of outstanding writes per iSCSI LUN	128
Number of outstanding IOs per iSCSI LUN	256
Number of initiators who register PR key for a iSCSI LUN	64

Virtual Volumes

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 <i>The outstanding PE I/O operations is configurable up to 4096.</i>
Configured VPs per host	128
Maximum configured VVol managed storage arrays per host	64

Network I/O Control (NIOC)

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 <i>for 10G pNIC</i> Approximately 1 Gbits/sec <i>for 1G pNIC</i>

Storage Policies

The storage policy maximums represents the limits for storage policies.

Table 11-1. Storage Policies

Item	Maximum
Maximum number of virtual machine storage policies	1024
Maximum number of VASA providers	1024
Maximum number of rule sets in virtual machine storage policy	16
Maximum capabilities in virtual machine storage policy rule set	64
Maximum vSphere tags in virtual machine storage policy	128

Managed Virtual Disks

You must configure the managed virtual disks within the maximums defined.

Table 12-1. Managed Virtual Disks

Item	Maximum
Maximum managed virtual disks	10000

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