vmware®

Configuration Maximums

VMware® vSphere 5.5

When you select and configure your virtual and physical equipment, you must stay at or below the maximums supported by vSphere 5.5. The limits presented in the following tables represent tested, recommended limits, and they are fully supported by VMware.

- "Virtual Machine Maximums" on page 1

- "ESXi Host Maximums" on page 2

- "vCenter Server Maximums" on page 7

- "vCenter Server Extensions" on page 7

- "vCloud Director" on page 9

- "VMware vSphere Flash Read Cache" on page 9

- "VMware Virtual SAN" on page 9

The limits presented in this document 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.

Configuration Maximums for vSphere 5.5 covers ESXi and vCenter Server.

Virtual Machine Maximums

Table 1 contains configuration maximums related to virtual machines.

Table 1. Virtual Machine Maximums

Item	Maximum
Compute	
Virtual CPUs per virtual machine (Virtual SMP)	64
Memory	
RAM per virtual machine	1TB
Virtual machine swap file size	1TB[1]
Storage Virtual Adapters and Devices	
Virtual SCSI adapters per virtual machine	4
Virtual SCSI targets per virtual SCSI adapter	15[2]
Virtual SCSI targets per virtual machine	60
Virtual Disks per virtual machine (PVSCSI)	60
Virtual disk size	62TB
IDE controllers per virtual machine	1[3]
IDE devices per virtual machine	4[4]
Floppy controllers per virtual machine	1

Table 1. Virtual Machine Maximums (Continued)

Item	Maximum
Floppy devices per virtual machine	2^5
Virtual SATA adapters per virtual machine	4
Virtual SATA devices per virtual SATA adapter	30^4
Networking Virtual Devices	
Virtual NICs per virtual machine	10^6
Virtual Peripheral Ports	
USB host controllers per virtual machine	1^7
USB devices connected to a virtual machine	20^8
Parallel ports per virtual machine	3
Serial ports per virtual machine	4
Miscellaneous	
Concurrent remote console connections to a virtual machine	40
Graphics video device	
Video memory per virtual machine	512MB

1. VMFS3 with 1MB block maximum swap size is 255GB. Recommended solution is VMFS5, not VMFS3 with bigger block size.
2. Any combination of disk or VMDirectPath SCSI target.
3. Supports two channels (primary and secondary) each with a master and slave device.
4. Devices can be either CD-ROM or disk.
5. BIOS is configured for one floppy device.
6. Any combination of supported virtual NICs.
7. 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.
8. Guest operating systems might have lower limits than allowed by vSphere.

ESXi Host Maximums

The following tables contain configuration maximums related to ESXi hosts.

Compute Maximums

Table 2 contains configuration maximums related to ESXi host compute resources.

Table 2. Compute Maximums

Item	Maximum
Host CPU maximums	
Logical CPUs per host	320
NUMA Nodes per host	16
Virtual machine maximums	
Virtual machines per host	512
Virtual CPUs per host	4096

Table 2. Compute Maximums (Continued)

Item	Maximum
Virtual CPUs per core	32^1
Fault Tolerance maximums	
Virtual disks	16
Virtual CPUs per virtual machine	1
RAM per FT VM	64GB
Virtual machines per host	4

1. 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*.

Memory Maximums

Table 3 contains configuration maximums related to ESXi host memory.

Table 3. Memory Maximums

Item	Maximum
RAM per host	4^1TB
Number of swap files	1 per virtual machine

1. Up to 6TB is supported for ESXi 5.5 Update 2 and later.

Storage Maximums

Table 4 contains configuration maximums related to ESXi host storage.

Table 4. Storage Maximums

Item	Maximum
Virtual Disks	
Virtual Disks per Host	2048
iSCSI Physical	
LUNs per server	256
Qlogic 1Gb iSCSI HBA initiator ports per server	4
Broadcom 1Gb iSCSI HBA initiator ports per server	4
Broadcom 10Gb 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 1Gb iSCSI HBA targets per adapter port	64^1
Broadcom 10Gb iSCSI HBA targets per adapter port	128
Software iSCSI targets	256^1
NAS[2]	
NFS mounts per host	256
Fibre Channel	
LUNs per host	256

Table 4. Storage Maximums (Continued)

Item	Maximum
LUN size	64TB
LUN ID	255
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	64TB[5]
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)	2TB minus 512 bytes
Block size	8MB
File size (1MB block size)	256GB
File size (2MB block size)	512GB
File size (4MB block size)	1TB
File size (8MB block size)	2TB minus 512 bytes
Files per volume	Approximately 30,720
VMFS5	
Raw Device Mapping size (virtual compatibility)	62TB
Raw Device Mapping size (physical compatibility)	64TB
Block size	1MB[3]
File size	62TB
Files per volume	Approximately 130,690

1. The sum of static targets (manually assigned IP addresses) and dynamic targets (IP addresses assigned to discovered targets) may not exceed this number.
2. Contact your storage array vendor or NFS server vendor for information about the maximum NFS volume size.
3. 1MB is default block size. Upgraded VMFS5 volumes inherit the VMFS3 block size value.
4. Maximum file size for upgraded VMFS5 is 2TB minus 512 bytes, irrespective of the file system block size.
5. For VMFS3 volumes with 1MB block size, the maximum is 50TB.

Networking Maximums

The following limits represent achievable maximum configuration limits for networking in 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 5 contains configuration maximums related to ESXi host networking.

Table 5. Networking Maximums

Item	Maximum
Physical NICs	
e1000e 1Gb Ethernet ports (Intel PCI-e)	24
igb 1Gb Ethernet ports (Intel)	16
tg3 1Gb Ethernet ports (Broadcom)	32
bnx2 1Gb Ethernet ports (Broadcom)	16
nx_nic 10Gb Ethernet ports (NetXen)	8
be2net 10Gb Ethernet ports (Serverengines)	8
ixgbe 10Gb Ethernet ports (Intel)	8
bnx2x 10Gb Ethernet ports (Broadcom)	8
Infiniband ports (refer to VMware Community Support)	N/A[1]
Combination of 10Gb and 1Gb ethernet ports	Eight 10Gb and Four 1Gb ports
mlx4_en 40GB Ethernet Ports (Mellanox)	4
VMDirectPath limits	
SR-IOV Number of virtual functions	64[2]
SR-IOV Number of 10G pNICs	8
VMDirectPath PCI/PCIe devices per virtual machine	16
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	6500
Ephemeral port groups per distributed switch	1016
Ports per distributed switch	60000
Distributed virtual network switch ports per vCenter	60000
Static/dynamic port groups per vCenter	10000
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

Table 5. Networking Maximums (Continued)

Item	Maximum
NIOC resource pools per vDS	64
Link aggregation groups per vDS	64

1. 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

2. 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.

Cluster and Resource Pool Maximums

Table 6 contains configuration maximums related to ESXi host clusters and resource pools.

Table 6. Cluster Maximums

Item	Maximum
Cluster (all clusters including HA and DRS)	
Hosts per cluster	32
Virtual machines per cluster	4000
Virtual machines per host	512
Powered-on virtual machine config files per datastore in an HA cluster[1]	2048
Resource Pool	
Resource pools per host	1600
Children per resource pool	1024
Resource pool tree depth	8[2]
Resource pools per cluster	1600

1. This limit does not apply to virtual disks. A virtual machine enabled with Fault Tolerance counts as two virtual machines.

2. Additional 4 resource pools are used by system internals.

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

Table 7 contains configuration maximums related to vCenter Server.

Table 7. vCenter Server Maximums

Item	Maximum
vCenter Server Scalability	
Hosts per vCenter Server	1000
Powered-on virtual machines per vCenter Server	10000
Registered virtual machines per vCenter Server	15000
Linked vCenter Servers	10
Hosts in linked vCenter Servers	3000
Powered-on virtual machines in linked vCenter Servers	30000
Registered virtual machines in linked vCenter Servers	50000
Concurrent vSphere Client connections to vCenter Server	100
Concurrent vSphere Web Clients connections to vCenter Server	180
Number of host per datacenter	500
MAC addresses per vCenter Server (using default VMware OUI)	65536
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)	100
Virtual machines (with embedded vPostgres database)	3000
Hosts (with Oracle database)	1000
Virtual machines (with Oracle database)	10000

vCenter Server Extensions

The following tables contain configuration maximums related to vCenter Server extensions.

- "VMware vCenter Update Manager" on page 8
- "VMware vCenter Orchestrator" on page 8
- "Storage DRS" on page 8

VMware vCenter Update Manager

Table 8 contains configuration maximums for vCenter Update Manager.

Table 8. 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
ESXi host upgrade per cluster	1
Cisco VDS update and deployment	70

VMware vCenter Orchestrator

Table 9 contains configuration maximums for vCenter Orchestrator.

Table 9. vCenter Orchestrator Maximums

Item	Maximum
Connected vCenter Server systems	20
Connected ESXi instances	1280
Connected virtual machines	35000[1]
Concurrent running workflows	300

1. 15000 per vCenter Orchestrator Cluster node.

Storage DRS

Table 10 contains configuration maximums for Storage DRS.

Table 10. Storage DRS

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

vCloud Director

Table 11 contains configuration maximums related to vCloud Director.

Table 11. vCloud Director Maximums

Item	Maximum
Registered virtual machines	50000
Powered-On virtual machines	30000
Organizations	10000
Virtual machines per vApp	128
vApps per Organization	5000
Number of networks	10000
Hosts	3000
vCenter Servers	20
Virtual Data Centers	10000
Datastores	1024
Catalogs	10000
Media	1000
Users	25000

VMware vSphere Flash Read Cache

Table 12 contains configuration maximums related to Flash Read Cache.

Table 12. Flash Read Cache Maximums

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

VMware Virtual SAN

Table 13 contains configuration maximums related to VMware Virtual SAN

Table 13. 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

Item	Maximum
Spinning disks in all diskgroups per host	35
Components per Virtual SAN host	3000
Virtual SAN Cluster	
Number of Virtual SAN nodes in a cluster	32
Number of datastores per cluster	1
Virtual SAN virtual machines	
Virtual machines per host	100[1]
Virtual machines per cluster	3200[2]
Virtual machine virtual disk size	2032GB
Virtual SAN VM Storage Policy	
Disk stripes per object	12
Percentage of flash read cache reservation	100
Failure to tolerate	3
Percentage of object space reservation	100
Virtual Networking	
Virtual SAN networks/physical network fabrics	2

1. On a 32 node cluster, number of virtual machines with VMware HA is 64.
2. On a 32 node cluster, number of virtual machines with VMware HA is 2048.