

Virtual SAN Hardware Quick Reference Guide

The purpose of this document is to provide sample server configurations as directional guidelines for use with VMware® Virtual SAN™. Use these guidelines as your first step toward determining the configuration for Virtual SAN.

How to use this document

1. Determine your workload profile requirement for VDI or Server use case
2. Refer to node profiles to determine the approximate configuration that meets your needs
3. Use [Virtual SAN Ready Nodes](#) document to identify pre-configured options from server vendors OR If you choose to build your own node, refer to [VSAN Hardware Compatibility Guide](#)

Virtual SAN 6.0 All Flash Hardware Guidance

	VDI - NODE PROFILES		SERVER PROFILES	
	Linked Clones	Full Clones	High	Medium
Number of VMs per Node*	Up to 200	Up to 200	Up to 120	Up to 60
IOPs per Node	N/A	N/A	Up to 80K	Up to 50K
Raw Storage Capacity per Node	1.6 TB	9.6 TB	12 TB	8 TB
CPU**	2x12 core	2x12 core	2x12 core	2x12 core
Memory	256 GB	256 GB	384 GB	256 GB
Capacity Tier Flash	4x400 GB SSD Endurance Class A or above Performance Class C or above	12x800 GB SSD Endurance Class A or above Performance Class C or above	12x1 TB SSD Endurance Class A or above Performance Class C or above	8x1 TB SSD Endurance Class A or above Performance Class C or above
Caching Tier Flash	1x400 GB SSD Endurance Class C or above Performance Class E	2x400 GB SSD Endurance Class C or above Performance Class E	2x400 GB SSD Endurance Class D or above Performance Class F or above	2x200 GB SSD Endurance Class C or above Performance Class D or above
IO Controller***	Queue Depth >=512	Queue Depth >=512	Queue Depth >= 512	Queue Depth >=512
NIC	10 GbE (Jumbo Frames Enabled)	10 GbE (Jumbo Frames Enabled)	10 GbE	10 GbE

* VM density can vary based on use case

** Assumes latest generation CPU architecture

*** Pass through mode recommended; additional controller may be required depending on maximum number of drives supported by the controller

Virtual SAN 6.0 Hybrid Hardware Guidance

	VDI - NODE PROFILES		SERVER PROFILES		
	Linked Clones	Full Clones	High	Medium	Low
Number of VMs per Node*	Up to 200	Up to 200	Up to 100	Up to 50	Up to 20
IOPs per Node	N/A	N/A	Up to 40K	Up to 20K	Up to 4K
Raw Storage Capacity per Node	1.6 TB	9.6 TB	12 TB	8 TB	5 TB
CPU**	2x12 core	2x12 core	2x12 core	2x12 core	1x6 core
Memory	256 GB	256 GB	384 GB	256 GB	64 GB
Capacity Tier HDD	4x300 GB SAS 10K RPM	12x900 GB SAS 10K RPM	12x1.2 TB SAS 10K RPM	1x8 TB NL-SAS 7.2K RPM	5x1 TB NL-SAS 7.2K RPM
Caching Tier Flash	1x400 GB SSD Endurance Class >=C Performance Class >=E	2x400 GB SSD Endurance Class >=C Performance Class >=E	2x400 GB SSD Endurance Class >=D Performance Class >=E	2x200 GB SSD Endurance Class >=C Performance Class >=D	1x200 GB SSD or Endurance Class >=B Performance Class >=B
IO Controller***	Queue Depth >=512	Queue Depth >=512	Queue Depth >= 512	Queue Depth >=256	Queue Depth >=256
NIC	10 GbE (Jumbo Frames Enabled)	10 GbE (Jumbo Frames Enabled)	10 GbE	10 GbE	1 GbE

* VM density can vary based on use case

** Assumes latest generation CPU architecture

*** Pass through mode recommended; additional controller may be required depending on maximum number of drives supported by the controller

Sizing Assumptions Used For Virtual SAN Node Profiles

	VDI		SERVER		
	Linked Clones	Full Clones	High	Medium	Low
Infrastructure Sizing Assumptions	<ul style="list-style-type: none"> Average VM Instance Size: 2 vCPU; 1.5GB vRAM; 20GB vmdk IOPS Mix assumption: 30% Read, 70% Write Memory utilization: 70% Caching Tier to Capacity Tier Ratio >= 10% anticipated used capacity Storage utilization: 90% Disk group ratio: 1 SSD, 3 to 7 HDD's Minimum 2 disk groups/node ESXi Boot: >= 4GB USB/SD card or 1 dedicated HDD or >=16GB SLC SATADOM Vmdk size assumes non-persistent desktops Minimum two server side network adapter uplinks (eg; Dual port NIC) recommended for redundancy 	<ul style="list-style-type: none"> Average VM Instance Size: 2 vCPU; 1.5GB vRAM; 40GB vmdk IOPS Mix assumption: 30% Read, 70% Write Memory utilization: 70% Caching Tier to Capacity Tier Ratio >=10% anticipated used capacity Storage utilization: 70% Disk group ratio: 1 SSD, 4 to 7 HDD's Minimum 2 disk groups/node ESXi Boot: >= 4GB USB/SD card or 1 dedicated HDD or >=16GB SLC SATADOM Vmdk size assumes persistent desktops Minimum two server side network adapter uplinks (eg; Dual port NIC) recommended for redundancy 	<ul style="list-style-type: none"> Average VM Instance Size: 2 vCPU; 6GB vRAM; 2x60GB vmdk IOPS Mix assumption: 70% Read, 30% Write; 4K Block Size Memory utilization: 70% Caching Tier to Capacity Tier Ratio >=10% anticipated used capacity Storage utilization: 70% Disk group ratio: 1 SSD, 1 to 7 HDD's Minimum 2 disk groups/node ESXi Boot: >= 4GB USB/SD card or 1 dedicated HDD or >=16GB SLC SATADOM Minimum two server side network adapter uplinks (eg; Dual port NIC) recommended for redundancy 	<ul style="list-style-type: none"> Average VM Instance Size: 2 vCPU; 6GB vRAM; 2x60GB vmdk IOPS Mix assumption: 70% Read, 30% Write; 4K Block Size Memory utilization: 70% Caching Tier to Capacity Tier Ratio >=10% anticipated used capacity Storage utilization: 70% Disk group ratio: 1 SSD, 1 to 7 HDD's Minimum 2 disk groups/node ESXi Boot: >= 4GB USB/SD card or 1 dedicated HDD or >=16GB SLC SATADOM Minimum two server side network adapter uplinks (eg; Dual port NIC) recommended for redundancy 	<ul style="list-style-type: none"> Average VM Instance Size: 2 vCPU; 6GB vRAM; 2x60GB vmdk IOPS Mix assumption: 70% Read, 30% Write; 4K Block Size Memory utilization: 70% Caching Tier to Capacity Tier Ratio >=10% anticipated used capacity Storage utilization: 70% Disk group ratio: 1 SSD, 1 to 7 HDD's 1 disk groups/node ESXi Boot: >= 4GB USB/SD card or 1 dedicated HDD or >=16GB SLC SATADOM Minimum two server side network adapter uplinks (eg; Dual port NIC) recommended for redundancy

Design Considerations Used For Virtual SAN Node Profiles

Controller Queue Depth	Controller queue depth impacts the rebuild/resync times. A low controller queue depth may impact the availability of your production VMs during rebuild/resync. A minimum queue depth of 256 is required in Virtual SAN. Some profiles require minimum queue depth of 512 as noted above.
Number of disk groups	The number of disk groups impacts fault isolation as well as rebuild/resync times. <ul style="list-style-type: none"> • Fault isolation: Configuring more than 1 disk group allows better tolerance against SSD failures since data is spread across more disk groups. • Rebuild/resync times: Configuring more than 1 disk group allows faster rebuilds/resyncs.
Number of capacity drives (HDDs in Hybrid config / SSD in All Flash Configs) in a disk group	The number of capacity tier drives in a disk group has an impact of the performance of Virtual SAN. While a single capacity tier drive is the minimum requirement for a disk group, for better performance when there are more VMs, and better handling of rebuild/resync activities, we recommend configuring more than 1 capacity tier drive per caching tier SSD per our guidance above.
Class of SSDs	The class of SSD you choose has a direct impact on the performance of your overall system.
Balanced vs Unbalanced cluster	An unbalanced cluster can impact Virtual SAN performance as well as the rebuild/resync times. A balanced cluster delivers more predictable performance even during hardware failures. In addition, performance impact during resync/rebuild is minimal when the cluster is balanced.
1G vs 10G Ethernet	The choice of 1G vs 10G Ethernet has an impact of the Virtual SAN performance. Both 1G and 10G networks are supported. For larger, higher performing workloads, 10G interconnect is recommended.

Performance Classes for SSDs

SSD PERFORMANCE CLASS	WRITES PER SECOND
B	5,000 - 10,000
C	10,000 - 20,000
D	20,000 - 30,000
E	30,000 - 100,000
F	100,000+

Endurance Classes for SSDs

SSD ENDURANCE CLASS	SSD TIER	TB WRITES IN 5 YEARS
A	VSAN All Flash - Capacity	365
B	VSAN Hybrid - Caching	1825
C	VSAN All Flash - Caching for Medium workloads	3650
D	VSAN All Flash - Caching for High workloads	7300

Additional Resources

For more detail on Virtual SAN Design guidance, see

1. [Virtual SAN Hardware Guidance](#)

2. [Virtual SAN Design and Sizing Guide](#)

3. [Virtual SAN Sizing Calculator](#)

