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

How to use this document?
1. Determine your workload profile requirement for your use case
2. Refer to vSAN ReadyNode profiles to determine the approximate configuration that meets your needs
3. Use vSAN Hardware Compatibility Guide to pick a vSAN ReadyNode aligned with the selected profile from the OEM server vendor of choice
4. Refer to blog What you can and cannot change in ReadyNode

vSAN All Flash Hardware Guidance (Intel)

<table>
<thead>
<tr>
<th></th>
<th>AF-8 Series</th>
<th>AF-6 Series</th>
<th>AF-4 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Storage Capacity per Node</td>
<td>12 TB</td>
<td>8 TB</td>
<td>4 TB</td>
</tr>
<tr>
<td>CPU Cores</td>
<td>24 core</td>
<td>24 core</td>
<td>20 core</td>
</tr>
<tr>
<td>Memory*</td>
<td>384 GB</td>
<td>256 GB</td>
<td>128 GB</td>
</tr>
<tr>
<td>Capacity Tier Flash</td>
<td>*12 TB (Minimum 3 drives in each disk group)</td>
<td>*8 TB (Minimum 3 drives in each disk group)</td>
<td>*4 TB (Minimum 2 drives in each disk group)</td>
</tr>
<tr>
<td></td>
<td>*SSD Endurance Class A or above</td>
<td>*SSD Endurance Class A or above</td>
<td>*SSD Endurance Class A or above</td>
</tr>
<tr>
<td></td>
<td>*SSD Performance Class C or above</td>
<td>*SSD Performance Class C or above</td>
<td>*SSD Performance Class C or above</td>
</tr>
<tr>
<td>Caching Tier Flash</td>
<td>*2x400 GB</td>
<td>*2x200 GB</td>
<td>*1x200 GB</td>
</tr>
<tr>
<td></td>
<td>*SSD Endurance Class D or above</td>
<td>*SSD Endurance Class C or above</td>
<td>*SSD Endurance Class C or above</td>
</tr>
<tr>
<td></td>
<td>*SSD Performance Class E or above</td>
<td>*SSD Performance Class C or above</td>
<td>*SSD Performance Class C or above</td>
</tr>
<tr>
<td>Recommended Cache/Capacity Choice</td>
<td>*All NVMe</td>
<td>*All SAS</td>
<td>*All SATAB</td>
</tr>
<tr>
<td></td>
<td>*NVMe + SAS</td>
<td>*NVMe + SATA/SAS</td>
<td>*NVMe + SATA/SAS</td>
</tr>
<tr>
<td>IO Controller**</td>
<td>Queue Depth &gt;= 512</td>
<td>Queue Depth &gt;=512</td>
<td>Queue Depth &gt;= 256</td>
</tr>
<tr>
<td>NIC</td>
<td>10 GbE or more</td>
<td>10 GbE or more</td>
<td>10 GbE or more</td>
</tr>
</tbody>
</table>
# vSAN All Flash Hardware Guidance (AMD)

<table>
<thead>
<tr>
<th></th>
<th>AMD-AF-8 Series</th>
<th>AMD-AF-6 Series</th>
<th>AMD-AF-4 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Storage Capacity per Node</td>
<td>12 TB</td>
<td>8 TB</td>
<td>4 TB</td>
</tr>
<tr>
<td>CPU Cores</td>
<td>32 core</td>
<td>24 core</td>
<td>16 core</td>
</tr>
<tr>
<td>Memory*</td>
<td>384 GB</td>
<td>256 GB</td>
<td>128 GB</td>
</tr>
<tr>
<td>Capacity Tier Flash</td>
<td>*12 TB (Minimum 3 drives in each disk group) *SSD Endurance Class A or above *SSD Performance Class C or above</td>
<td>*8 TB (Minimum 3 drives in each disk group) *SSD Endurance Class A or above *SSD Performance Class C or above</td>
<td>*4 TB (Minimum 2 drives in each disk group) *SSD Endurance Class A or above *SSD Performance Class C or above</td>
</tr>
<tr>
<td>Caching Tier Flash</td>
<td>*2x400 GB *SSD Endurance Class D or above *SSD Performance Class E or above</td>
<td>*2x200 GB *SSD Endurance Class C or above *SSD Performance Class D or above</td>
<td>*1x200 GB *SSD Endurance Class C or above *SSD Performance Class C or above</td>
</tr>
<tr>
<td>Recommended Cache/Capacity Choice</td>
<td>*All NVMe *NVMe + SAS</td>
<td>*All SAS *All NVMe *NVMe + SATA/SAS *SAS + SATA</td>
<td>*All SATA *All SAS *All NVMe *SAS + SATA *NVMe + SATA/SAS</td>
</tr>
<tr>
<td>IO Controller**</td>
<td>Queue Depth &gt;= 512</td>
<td>Queue Depth &gt;= 512</td>
<td>Queue Depth &gt;= 256</td>
</tr>
<tr>
<td>NIC</td>
<td>10 GbE or more</td>
<td>10 GbE or more</td>
<td>10 GbE or more</td>
</tr>
</tbody>
</table>

**Note:**

*Memory: Use balanced DIMM population as recommended by OEM partner to avoid any performance penalty (For example: Maintaining 1DIMM-Per-Channel is one of the recommendations)*

**Queue Depth: Queue Depth of the controller has to be the aggregated Queue Depth of all its connecting device (same or greater)**
## vSAN Hybrid Hardware Guidance (Intel)

<table>
<thead>
<tr>
<th></th>
<th>HY-8 Series</th>
<th>HY-6 Series</th>
<th>HY-4 Series</th>
<th>HY-2 Series</th>
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<tr>
<td><strong>Raw Storage Capacity per Node</strong></td>
<td>12 TB</td>
<td>8 TB</td>
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<td>2 TB</td>
</tr>
<tr>
<td><strong>CPU Cores</strong></td>
<td>24 core</td>
<td>20 core</td>
<td>16 core</td>
<td>6 core</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>384 GB</td>
<td>256 GB</td>
<td>128 GB</td>
<td>32 GB</td>
</tr>
<tr>
<td><strong>Capacity Tier Disk</strong></td>
<td>*12 TB (Minimum 3 drives in each disk group) *SAS 10K RPM</td>
<td>*8 TB (Minimum 3 drives in each disk group) *NL-SAS 7.2K RPM</td>
<td>*4 TB (Minimum 2 drives in each disk group) *NL-SAS 7.2K RPM</td>
<td>*2 TB (Minimum 2 drives in each disk group) *NL-SAS 7.2K RPM</td>
</tr>
<tr>
<td><strong>Caching Tier Flash</strong></td>
<td>*2x400 GB *SSD Endurance Class &gt;=E *SSD Performance Class &gt;=D</td>
<td>*2x200 GB *SSD Endurance Class &gt;=C *SSD Performance Class &gt;=D</td>
<td>*1x200 GB *SSD Endurance Class &gt;=C *SSD Performance Class &gt;=D</td>
<td>*1x200 GB *SSD Endurance Class &gt;=B *SSD Performance Class &gt;=B</td>
</tr>
<tr>
<td><strong>IO Controller</strong></td>
<td>Queue Depth &gt;= 512</td>
<td>Queue Depth &gt;= 256</td>
<td>Queue Depth &gt;=256</td>
<td>Queue Depth &gt;=256</td>
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<tr>
<td><strong>NIC</strong></td>
<td>10 GbE</td>
<td>10 GbE</td>
<td>10 GbE</td>
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# vSAN Hybrid Hardware Guidance (AMD)

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<tr>
<td>Raw Storage Capacity per Node</td>
<td>12 TB</td>
<td>8 TB</td>
<td>4 TB</td>
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<td>CPU Cores</td>
<td>32 core</td>
<td>24 core</td>
<td>16 core</td>
<td>8 core</td>
</tr>
<tr>
<td>Memory</td>
<td>384 GB</td>
<td>256 GB</td>
<td>128 GB</td>
<td>32 GB</td>
</tr>
<tr>
<td>Capacity Tier Flash</td>
<td>*12 TB (Minimum 3 drives in each disk group) *SAS 10K RPM</td>
<td>*8 TB (Minimum 3 drives in each disk group) *NL-SAS 7.2K RPM</td>
<td>*4 TB (Minimum 2 drives in each disk group) *NL-SAS 7.2K RPM</td>
<td>*2 TB (Minimum 2 drives in each disk group) *NL-SAS 7.2K RPM</td>
</tr>
<tr>
<td>Caching Tier Flash</td>
<td>*2x400 GB *SSD Endurance Class =&gt;D *SSD Performance Class =&gt;E</td>
<td>*2x200 GB *SSD Endurance Class =&gt;C *SSD Performance Class =&gt;D</td>
<td>*1x200 GB *SSD Endurance Class =&gt;C *SSD Performance Class =&gt;D</td>
<td>*1x200 GB *SSD Endurance Class =&gt;B *SSD Performance Class =&gt;B</td>
</tr>
<tr>
<td>IO Controller</td>
<td>Queue Depth =&gt; 512</td>
<td>Queue Depth =&gt; 256</td>
<td>Queue Depth =&gt;256</td>
<td>Queue Depth =&gt;256</td>
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<tr>
<td>NIC</td>
<td>10 GbE</td>
<td>10 GbE</td>
<td>10 GbE</td>
<td>10 GbE</td>
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</table>
# vSAN Edge Hardware Guidance

<table>
<thead>
<tr>
<th></th>
<th>SF-AF</th>
<th>SF-HY</th>
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<tbody>
<tr>
<td>Raw Storage Capacity per Node</td>
<td>0.6 TB</td>
<td>0.6 TB</td>
</tr>
<tr>
<td>Total CPU Cores</td>
<td>6 core</td>
<td>6 core</td>
</tr>
<tr>
<td>Memory*</td>
<td>32 GB</td>
<td>32 GB</td>
</tr>
<tr>
<td>Capacity Tier</td>
<td>*600 GB (Minimum 1 capacity drive in each disk group) *Performance Class C or above *Endurance Class A or above</td>
<td>*600 GB (Minimum 1 capacity drive in each disk group) *NL-SAS 7.2KRPM</td>
</tr>
<tr>
<td>Caching Tier Flash</td>
<td>*1x350 GB (Minimum 1 capacity drive in each disk group) *Performance Class C or above *Endurance Class C or above</td>
<td>*1x350 GB (Minimum 1 capacity drive in each disk group) *Performance Class B or above *Endurance Class B or above</td>
</tr>
<tr>
<td>IO Controller**</td>
<td>Queue Depth &gt;= 256</td>
<td>Queue Depth &gt;= 256</td>
</tr>
<tr>
<td>NIC</td>
<td>10 GbE or more</td>
<td>10 GbE or more</td>
</tr>
</tbody>
</table>
# Sizing Assumptions Used For vSAN ReadyNode Profiles

| Disk Group Caching Tier to Capacity Tier Ratio | *Disk Group Ratio: 1 SSD, 1 to 7 HDDs  
*>=10% anticipated used capacity  
* For all flash caching guideline, refer the blog here |
|-----------------------------------------------|
| ESXi Boot                                      | *Min. 4GB (USB/SD Card) (Recommended: 8 GB)  
*Min. 1 Dedicated SSD/HDD (Boot device needs to be in a separate controller than vSAN Datastore controller)  
*Min. 30GB SATADOM with endurance of 512-1024 TBW sequential  
*Min. 30GB M.2 SSD with min. endurance of 130 TBW (Recommended: mirrored M.2 SSD connected to on-board AHCI controller) |
| Network                                        | *(Dual port NIC) recommended for redundancy |
| SAS Expanders                                  | *SAS Expanders are supported only on a per platform basis. Check Ready Node listings for support. In absence of SAS expander support for a Ready Node, only 8 drives supported per controller.  
Add an extra controller if >8 drives are required. |
| Device Capacity                                | *The capacity point for caching and capacity tier is for guidance only. You can choose different capacity points as long as Performance and Endurance classes are met. |
### Design Considerations Used For vSAN ReadyNode Profiles

<table>
<thead>
<tr>
<th>Consideration</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Controller Queue Depth</strong></td>
<td>*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 vSAN. Some profiles require minimum queue depth of 512 as noted above.</td>
</tr>
</tbody>
</table>
| **Number of disk groups**                          | *The number of disk groups impacts fault isolation as well as rebuild/resync times.  
***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 vSAN. 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 vSAN 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 vSAN performance. Both 1G and 10G networks are supported. For larger, higher performing workloads, 10G interconnect is recommended. |
| **De-duplication, Compression and Erasure Coding Considerations** | *The sizing does not account for De-duplication, Compression and Erasure Coding. Please visit vSAN Sizing Calculator. If you want to size with storage efficiency turned on and then pick the right Ready Node profile. |
| **Device Protocol**                                | *The ReadyNode are certified with particular device type (SAS/SATA/NVMe/HDD). You are not allowed to change the device type. |
### Performance Classes for SSDs

<table>
<thead>
<tr>
<th>SSD PERFORMANCE CLASS</th>
<th>SSD Tier</th>
<th>WRITES PER SECOND</th>
</tr>
</thead>
</table>
| B                     | vSAN Hybrid - Caching
                       | vSAN All Flash - Capacity                                               | 5000 - 9999       |
| C                     | vSAN Hybrid - Caching
                       | vSAN All Flash - Capacity                                               | 10000 - 19999     |
| D                     | vSAN Hybrid - Caching
                       | vSAN All Flash - Caching for Medium workloads
                       | vSAN All Flash - Capacity                                               | 20000 - 29999     |
| E                     | vSAN Hybrid - Caching
                       | vSAN All Flash - Caching for Medium workloads
                       | vSAN All Flash - Capacity                                               | 30000 - 99999     |
| F                     | vSAN Hybrid - Caching
                       | vSAN All Flash - Caching for High workloads
                       | vSAN All Flash - Capacity                                               | 100000 - 349999   |
| G                     | vSAN Hybrid - Caching
                       | vSAN All Flash - Caching for High workloads
                       | vSAN All Flash - Capacity                                               | 350000+           |
## Endurance Classes for SSDs

<table>
<thead>
<tr>
<th>SSD ENDURANCE CLASS</th>
<th>SSD TIER</th>
<th>TB WRITES IN 5 YEARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>vSAN All Flash - Capacity</td>
<td>365</td>
</tr>
<tr>
<td>B</td>
<td>vSAN Hybrid - Caching</td>
<td>1825</td>
</tr>
<tr>
<td>C</td>
<td>vSAN All Flash - Caching for Medium workloads</td>
<td>3650</td>
</tr>
<tr>
<td>D</td>
<td>vSAN All Flash - Caching for High workloads</td>
<td>7300</td>
</tr>
</tbody>
</table>
vSAN Hardware Quick Reference Guide

Additional Resources

vSAN Ready Node Configurator
vSAN ReadyNode™ Sizer
HCI Assessment Tool
Disclaimer