



Netapp Interoperability Matrix

Storage Solution : FAS SAN Host

NetApp® FC, FCoE, iSCSI and NAS (NFS) Storage System Interoperability

The NetApp Interoperability Matrix (IMT) defines the components and versions that have been qualified and which can be used to construct FC/FCoE, iSCSI and NFS configurations that are supported end-to-end by NetApp. NetApp partners with operating system, I/O stack and hardware component vendors during their development and release cycles in order to provide support and interoperability at or within certain periods following the vendors general availability release. For support of configurations not included in the NetApp Interoperability Matrix, including pre-general-availability releases, or to obtain support for your particular configuration via the NetApp Product Variance Request (PVR) process, please contact your NetApp account team or partner. If you experience technical issues with NetApp storage systems in configurations not listed in the NetApp Interoperability Matrix, NetApp provides support per the SUPPORT SERVICES TERMS - <http://www.netapp.com/us/how-to-buy/stc.aspx> ; resolution may require changing the configuration to one currently listed in the matrices or working with your account team or partner through the PVR process.

NetApp provides complimentary host utilities for FC/FCoE, iSCSI, and NFS storage systems that ensure proper integration with host operating system, I/O stack and host hardware components, and use of the NetApp host utilities is required for generally supported configurations within the NetApp Interoperability Matrix. The applicable host utilities are specified in the rows and notes of the host operating system interoperability matrices.

Non-disruptive Upgrade of Data ONTAP

Non-disruptive upgrade of Data ONTAP and other system-level components is supported for SAN and NFS environments.

Minor NDU (within a Data ONTAP version family) is supported in Data ONTAP 6.5.3 and later.

Major NDU (between Data ONTAP version families) is supported in Data ONTAP 7.0.6 and later to Data ONTAP 7.2.3 and later for Data ONTAP 7.2.x target releases.

Major NDU is supported from Data ONTAP 7.1.2 and later to Data ONTAP 7.2.3 and later for Data ONTAP 7.2.x target releases.

Major NDU is supported from Data ONTAP 7.2.3 and later to Data ONTAP 7.3 GA and later for Data ONTAP 7.3.x target releases.

NDU Documentation - For complete information about non-disruptive upgrade, see the Data ONTAP Upgrade Guide for either Data ONTAP 7.2.5.1 or 7.3, available on NSS

NetApp storage systems are built on a common operating system infrastructure - Data ONTAP®. Unless otherwise noted in the matrices, support by the Data ONTAP operating system is the criterion used to determine whether a system configuration is qualified in a particular environment rather than the particular hardware model of the system. All system models that run a qualified Data ONTAP version are equivalent for support purposes. The NetApp storage systems below run the Data ONTAP operating system and support the FC, iSCSI and NFS protocols (list refers to stand-alone and high-availability storage systems). Refer to the Host Operating System matrices above for details about Data ONTAP versions qualified with a particular host.

NetApp Upgrade Advisor - an online tool available on the NOW (NetApp on the Web) site for all systems with a valid support contract that are configured to send AutoSupport messages. When you submit your system identification and target release, the Upgrade Advisor compares AutoSupport data about your system to known requirements and limitations of the target release and generates an upgrade plan (and optionally a back-out plan) with recommended preparation and execution procedures. The Upgrade Advisor not only dramatically simplifies the process of qualifying your environment for a successful upgrade; the automated mechanism significantly reduces the potential for human error. In conjunction with the Upgrade Advisor, NetApp best practice for NDU strongly recommends review of the Data ONTAP Upgrade Guide and Release Notes. For more information, see AutoSupport home on NOW at <http://now.netapp.com/NOW/asuphome/>

Native Host OS Multipath

Accessing NetApp and third party storage systems from a single host in which the host is using native OS multipath is supported with Data ONTAP 7.3 and later, as long as the NetApp configuration requirements are met, as specified in the NetApp Host Utilities documents.

DataONTAP DSM and Shared SAN Host Support for Heterogeneous Storage Support

NetApp supports SAN host configurations in which hosts servers are attached to heterogeneous storage systems, i.e. NetApp and non-NetApp storage systems. All components in the configuration must be supported by the respective storage vendors. NetApp Best Practices recommendation for such heterogeneous coexistence are:

Each Vendor's target port be configured in its own zone (single-initiator zoning).

When creating host-based volume containers, striped and concatenated volumes must not span vendor storage systems.

There should be no conflict in the MPIO versions required by NetApp Data ONTAP DSM and the non-NetApp DSM. This should be compared with the MPIO version required by the non-NetApp DSMs. Data ONTAP DSM requires the latest MPIO version supported by Microsoft DDK.

DataONTAP DSM install scripts, sets certain disk, MPIO and HBA registries and tunables to specific values to handle NetApp controller, path outages during faults.

Non-NetApp DSMs may set the same registry and tunables to different values and this could have implications to both the DSMs. The general recommendation is to install DataONTAP DSM after the installation of non-NetApp DSM(s).

Making sure that any Microsoft hotfix, driver versions required by the non-NetApp DSM does not conflict with DataONTAP DSM requirement.

To troubleshoot coexistence issues, NetApp Technical support should be engaged. Tech support will need an nSANity output from the affected hosts to help understand the configuration. In addition, it will also be useful to get the details about required MPIO versions, if any, for the non-NetApp systems as well as details about registry, host tunables, hotfixes etc. as mentioned in the earlier paragraphs and have them handy before engaging NetApp Tech support.

Symantec Veritas Storage Foundation DMP Multipath

Accessing NetApp and third-party storage systems from a single host can be supported via successful PVR qualification, as long as the configuration uses the NetApp Array Support Libraries for the applicable host operating environment and NetApp configuration requirements are met, as specified in the NetApp Host Utilities.

NetApp Multipathing and EMC PowerPath co-existence

For all host operating systems, NetApp recommends using separate adapters to connect to each vendor's storage. Using separate adapters reduces the chances of conflicting drivers and settings. For connections to NetApp storage, ensure the adapter model, BIOS, firmware, and driver are listed as supported in the NetApp Interoperability Matrix Tool (IMT).

NetApp recommends that single initiator zoning is configured for each of the host ports to the appropriate storage target ports, one zone for each of the host initiator ports from HBA1 to the EMC storage target ports being utilized and different single initiator zones for the host initiator ports from HBA2 to the NetApp storage target ports being utilized by the host. Single Initiator zoning has one host initiator port and all of the storage target ports that are being utilized for connectivity in one zone.

This should be configured before any changes are made on the host.

Set the required or recommended timeout values and other storage parameters for the host. Always install the NetApp software or apply the NetApp settings last.

- a. For Windows install either the Data ONTAP DSM for Windows MPIO or the Windows Host Utilities version listed in the IMT for your configuration.
- b. For ESX, apply host settings using Virtual Storage Console for VMware vSphere (VSC).
- c. For Linux, apply the values from the Linux Host Utilities version listed in the IMT for your configuration.
- d. For AIX, apply the values from the AIX Host Utilities version listed in the IMT for your configuration.
- e. For Solaris, apply the values from the Solaris Host Utilities version listed in the IMT for your configuration.
- f. For HP-UX, use the HP-UX default storage settings.

EFI boot support

EFI (Extensible Firmware Interface), or UEFI (Unified Extensible Firmware Interface), is a replacement for the older server BIOS firmware. UEFI-based servers can SAN boot from a LUN on a NetApp storage system. The steps for configuring the new UEFI boot are different, but the concepts are the same as booting a system with server BIOS. See your server and storage adapter documentation for specific configuration steps.

SAN boot using standard EFI or UEFI boot is supported only for hosts running HP-UX 11iv2, HP-UX 11iv3, and later. Check the specific configuration in IMT to be sure SAN booting is supported.

For all other host operating systems, SAN boot is supported only using the UEFI Legacy Option (BootBIOS).

Ethernet Switch Support

NetApp supports all traditional (non-Data Center Bridging) and enhanced (Data Center Bridging capable) Ethernet switches with iSCSI and NAS. Specific model numbers are not listed in IMT

For FCoE configurations, only the models specifically listed in IMT are supported.

Ethernet Host NIC, TCP/IP Offload (TOE) Adapter, Host Bus Adapter (HBA), and Converged Network Adapter (CNA) Model Support

Standard rack and tower servers (listed by CPU architecture and OS)

- NetApp supports Fibre Channel HBAs by specific model and driver reference in the IMT for listed configurations on standard rack and tower servers.
- NetApp supports the FCoE functionality of CNAs by specific model and driver reference in the IMT for listed configurations on standard rack and tower servers.
- NetApp supports the iSCSI offload functionality of CNAs by specific model and driver reference in the IMT for listed configurations on standard rack and tower servers.
- NetApp supports 1GbE and 10GbE iSCSI offload adapters by specific model and driver reference in the IMT for listed configurations on standard rack and tower servers.
- NetApp supports all 1GbE and 10GbE NICs (network interface cards), 10GbE CNAs, and built-in Ethernet adapters on the server motherboards for software iSCSI and NAS configurations on standard rack and tower configurations. Specific NIC or adapter models are not listed. The rest of the configuration must be listed in the IMT.
- NetApp supports all 1GbE and 10GbE TCP/IP offload (TOE) adapters for software iSCSI and NAS configurations on standard rack and tower configurations. Specific TOE models are not listed. The rest of the configuration must be listed in the IMT.

NetApp supports third-party HBA models that are based on original equipment manufacturer models from Brocade, Emulex and QLogic. The HBA must be used with NetApp-qualified driver and firmware levels and within configurations outlined in the IMT. For example, to use a QLogic HBA with an IBM model number, find the equivalent QLogic model and use the QLogic HBA model to find supported configurations in the IMT. This applies only to standard rack and tower servers. For blade server configurations, see below.

You can find mappings from the third-party HBA model number to the vendor part number at these locations:

QLogic

<http://www.qlogic.com/Products/adapters/Pages/FibreChannelAdapters.aspx> (click the Show link for your adapter series, then open the OEM-Branded Adapters link)

Emulex

<http://www.emulex.com/products/fibre-channel-hbas.html>

Blade servers (listed by specific blade server models)

- NetApp specifically lists supported mezzanine cards and integrated adapters for blade server configurations within the IMT. You must use the drivers and firmware required by the blade vendor, as listed in the IMT. Drivers, firmware and BootBIOS must be downloaded from the blade vendor's web site or from a location specified by the blade vendor.
- You must use the exact mezzanine card or integrated adapter listed in the IMT for FC, FCoE, and iSCSI offload configurations. Do not attempt to map a model number from one manufacturer to another.
- NetApp supports all 1GbE and 10GbE NICs (network interface cards), 10GbE CNAs, and built-in Ethernet adapters on the server motherboards for software iSCSI and NAS blade server configurations. Specific NIC or adapter models are not listed. The rest of the blade server configuration must be listed in the IMT.
- NetApp supports all 1GbE and 10GbE TCP/IP offload (TOE) adapters for software iSCSI and NAS blade server configurations. Specific NIC or adapter models are not listed. The rest of the blade server configuration must be listed in the IMT.

Third-party Certifications with NetApp Storage Systems

Beyond qualification by NetApp and listing in the NetApp Interoperability Matrix, NetApp participates in the certification activities of ecosystem parties, as listed below. For additional certifications not listed herein, please work with your account team or partner through the PVR process.

Microsoft

Windows Server Catalog

Microsoft Cluster Server

VMware

Hardware Compatibility List

Cisco

Cisco Partner Network

Oracle

Solaris Ready

Cluster Open Storage

Symantec (Veritas)

Hardware Compatibility List

IBM

PowerVM (VIO Server)
SAN Volume Controller

Hewlett Packard

HP BladeSystem SAN Checkmark
HP-UX Mass Storage Solutions Interoperability Program

Brocade

Brocade Partner Network

Third-party Virtualization Appliance Support - IBM Storage Virtualization Controller (SVC)

NetApp supports IBM's support of FAS storage systems with SVC. In the event of configuration support situations, NetApp will diagnose basic storage hardware operations and IBM support owns overall connectivity and configuration management and support for SVC deployments. SVC configurations require a NetApp PVR for support, which provides an escalation process to IBM support and/or IBM SVC engineering. IBM maintains supported configurations for IBM N series and FAS storage systems at http://www-01.ibm.com/support/docview.wss?uid=ssg1S1003277&rs=555#_IBM_N_Series

Virtualization

Microsoft Windows virtualization support is represented in IMT through the Host OS components: Microsoft Windows Server 2008 Hyper-V, Microsoft Windows Server 2008 Hyper-V SP2, Microsoft Windows Server 2008 Hyper-V R2, Microsoft Windows Server 2008 Hyper-V R2 SP1 and Microsoft Windows Server 2012 Hyper-V.

This provides support for both the combined download Microsoft® Hyper-V™ Server 2008/2012 the dedicated stand-alone product, which contains only the Windows Hypervisor, Windows Server driver model and virtualization components, as well as support for Microsoft Windows Server 2008/2012 Hyper-V which is the Windows Server running the Hyper-V as a role. Note that Microsoft Windows Server 2008/2012 Hyper-V does not run on Standard Edition.

Third Party Hypervisors

Third Party Hypervisors are hypervisors that are not specifically listed in the IMT and are not specifically qualified by NetApp. This includes hypervisors running in public cloud hyperscaler environments such as Amazon Web Services, Microsoft Azure, etc.

- NetApp supports the use of third party virtualization solutions (both public cloud and on-premise hypervisors) when connectivity to the NetApp target is established within the GuestOS via iSCSI and where the Guest OS adheres to supported IMT configurations that are found by querying the Guest OS as the Host OS component.
- The third party vendor of the Hypervisor product owns overall connectivity and configuration management for access to the Guest OS's.

Description of NetApp support services are set forth at <http://www.netapp.com/us/services-support/services/operations/services-descriptions.aspx>

Server Side Cache Solutions

Server side cache solutions that operate in a write-through/write-around/read-only mode, such as directCache and ioTurbine from Fusion-io, are compatible with the SAN host configurations listed in the NetApp SAN Interoperability Matrix.

Data coherency validation, for example where cache contents are automatically invalidated when a SnapDrive for Windows restore is performed, is documented at the following location:<https://kb.netapp.com/support/index?page=content&id=3013621>

CFmode Column Removal

All SAN rows are supported with Cluster Failover Mode (CFMode) SSI (Single System Image). All other CFModes have been retired. Rows that support additional CFModes are copied here: <http://support.netapp.com/knowledge/docs/olio/guides/cfmode/CFmode-removal.xls> with the CFModes they support listed.

Oracle

ASM

Oracle ASM is a lightweight combined volume manager and filesystem. NetApp supports the use of ASM with SAN connectivity where (a) the configuration is generally supported by Oracle and conforms to all Oracle configuration requirements and (b) the complete configuration can be found within the NetApp Interoperability Matrix in every respect with the exception of the volume manager and filesystem. For example, when deploying ASM on AIX, the configuration must include a supported version of the AIX operating system, HBA, HBA driver, and multipathing software. The columns for filesystem and volume manager can be disregarded.

Caution – when using the Oracle Unbreakable Enterprise Kernel with asmlib, care must be taken when performing an upgrade ONTAP of an ASM diskgroup created using ONTAP 8.0.3 and earlier or ONTAP 8.1 and earlier. Changes in the SCSI target software introduced in ONTAP 8.0.4 and 8.1.1 interfere with asmlib communication. See Oracle document ID 1500460.1 for details.

Oracle RAC

NetApp supports the use of SAN resources under control of Oracle RAC. Support will be offered where (a) the configuration conforms to all Oracle requirements and (b) the complete configuration can be found within the NetApp Interoperability matrix.

Support is limited to issues arising from SAN connectivity itself. Customers seeking assistance with configuration and management of Oracle RAC should contact Oracle or NetApp Professional Services. When a support issue cannot be clearly linked to a problem with connectivity to NetApp hardware and software, the NetApp support center may require the customer to open a case with the Oracle or the OS vendor in order to provide additional analysis.

Support For Windows Server 2003

For Windows Server 2003, NetApp will provide reasonable best efforts support for Data ONTAP interoperability. For issues diagnosed and determined by NetApp to be Windows Server 2003 host related, it is customer's responsibility to adhere to what Microsoft recommends for problem resolution. With Microsoft ending support for Windows Server 2003, customer must follow Microsoft's recommendations and guidelines to address host specific issues.

Data ONTAP OS Release Support

When a Data ONTAP release is listed as supported, then all patch releases are supported as well.

However, if the IMT does list a patch release, then only that patch and later patch releases in that Major (8.2, 8.3) / Minor (8.2.1, 8.2.2, 8.3.1, 8.3.2) / maintenance release streams are supported. For example, in the FAS SAN Host solution area, ESX 5.5 support for SAN Clustered Data ONTAP 8.2 begins with Data ONTAP 8.2.3P3. Earlier patches of 8.2.3P1 (including 8.2.3 itself) and other minor releases of 8.2.1, 8.2.3 are not supported, but any later patches, such as 8.2.3P4 or later, have implied support. For other minor releases like 8.2.4+ these will need to be verified as supported via the IMT for the solution.

FPOLICY

Partner vendors test and certify fpolicy solutions with NetApp. NetApp does not test or certify partner vendor fpolicy solutions. Please confirm with your vendor if your version and mode of ONTAP is supported.

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End of Support

At its discretion, NetApp will continue to provide support for existing installations of vendor end-of-support configurations even after general support has ended from the applicable vendor. This support will be limited in accordance with the support model provided by the vendor in which an upgrade may be the only solution. Support of NetApp storage systems and software is provided according to NetApp's standard warranty and support lifecycle

Search Criteria

Solution;
FAS SAN Host

Host HBA
QLogic SANblade QLE2462 Driver : 2.1.30.0 (Inbox) ;
QLogic SANblade QLE2460 Driver : 2.1.30.0 (Inbox) ;

FAS SAN Host

Name	Status	Foot notes	Protocol	Host Utilities	Host OS (OS)	Host Platform	Software Initiator	Host HBA	Host Volume Manager	Host Multipath	Host File System	Host Clustering	Host Feature	ONTAP OS (NETAPP OS)
20170120-010219211	Supported	Info: 183,185,7910, 8606 Alerts: 38,5579,6135, 7293,7911	FC	Not Applicable	VMware ESXi 6.5	x86-64 Rack Server	Not Applicable	QLogic SANblade QLE2462 {Spec=Dual- Port 4Gb PCIe FC HBA, Aliases=EMC PN QLE2462- E, HP PN AD300A, HP PN AE312A, IBM PN 39R6527, Oracle PN SG- XPCIE2FC- QF4, SUN PN SG- XPCIE2FC- QF4, Driver=2.1.30. 0 (Inbox), Firmware=8.01 .02 }; QLogic SANblade QLE2460 {Spec=Single- Port 4Gb PCIe FC HBA, Aliases=EMC PN QLE2460- E, HP PN AE311A, IBM PN 39R6525, Oracle PN SG- XPCIE1FC- QF4, SUN PN SG- XPCIE1FC- QF4, Driver=2.1.30. 0 (Inbox), Firmware=8.01 .02 }	VMware Distributed with ESX	VMware Distributed with ESX	VMware ESX RDM; VMFS	VMware HA	VMware Fault Tolerance; VMware ESX Vmotion; VMware ESX Storage Vmotion; VMware ESX Storage DRS; VMware ESX DRS; Qlogic SAN Boot Yes (BIOS 3.24)	Data ONTAP 8.2.4 7-Mode

Name	Status	Foot notes	Protocol	Host Utilities	Host OS (OS)	Host Platform	Software Initiator	Host HBA	Host Volume Manager	Host Multipath	Host File System	Host Clustering	Host Feature	ONTAP OS (NETAPP OS)
20161114-035555124	Supported	Info: 183,185,7910, 8606 Alerts: 38,5579,6135, 7293,7911	FC	Not Applicable	VMware ESXi 6.5	x86-64 Rack Server	Not Applicable	QLogic SANblade QLE2462 {Spec=Dual-Port 4Gb PCIe FC HBA, Aliases=EMC PN QLE2462-E, HP PN AD300A, HP PN AE312A, IBM PN 39R6527, Oracle PN SG-XPCIE2FC-QF4, SUN PN SG-XPCIE2FC-QF4, Driver=2.1.30.0 (Inbox), Firmware=8.01.02 }; QLogic SANblade QLE2460 {Spec=Single-Port 4Gb PCIe FC HBA, Aliases=EMC PN QLE2460-E, HP PN AE311A, IBM PN 39R6525, Oracle PN SG-XPCIE1FC-QF4, SUN PN SG-XPCIE1FC-QF4, Driver=2.1.30.0 (Inbox), Firmware=8.01.02 }	VMware Distributed with ESX	VMware Distributed with ESX	VMware ESX RDM; VMFS	VMware HA	VMware Fault Tolerance; VMware ESX Vmotion; VMware ESX Storage Vmotion; VMware ESX Storage DRS; VMware ESX DRS; Qlogic SAN Boot Yes (BIOS 3.24)	ONTAP 9.2; ONTAP 9.1; ONTAP 9.0; Clustered Data ONTAP 8.3.2; Clustered Data ONTAP 8.2.4

Alerts

Note ID	Text
38	The use of default VMFS3.HardwareAcceleratedLocking=1 setting is required for interoperability and optimal shared storage I/O performance. See NetApp KB 3013935 for additional information. http://kb.netapp.com/support/index?page=content&id=3013935
6135	For information regarding supported VAAI configurations please reference KB 3013572. https://kb.netapp.com/support/index?page=content&id=3013572
7911	When using zoning with more than 64 members per zone there is the chance that some paths will be marked as dead if the FCID changes for a given member. You can run the following command to avoid this situation - esxcli system module parameters set -p lpfc_nlp_slab_cnt=128 -m lpfc

Netapp Interoperability Matrix

5579	<p>There are multiple options for configuring VMware vSphere with Data ONTAP per NetApp best practices:</p> <p>The NetApp Virtual Storage Console (VSC) provides all functionality previously found in the ESX Host Utilities kit. You are required to have VSC installed if you will be using VMware ESXi Virtual Volumes (VVOLs). Please refer to the Virtual Storage Console storage solution view in IMT for supported configurations.</p> <ol style="list-style-type: none"> 1. For configuration instructions for VMware vSphere 6.x, please see NetApp KB article 1015266: https://kb.netapp.com/support/index?page=content&actp=LIST&id=1015266 2. For configuration instructions for VMware vSphere 5.x, please see NetApp KB article 1013275: https://kb.netapp.com/support/index?page=content&id=1013275&actp=LIST&showDraft=true 3. For configuration instructions for VMware vSphere 4.x, please see NetApp KB article 1013162: https://kb.netapp.com/support/index?page=content&id=1013162&actp=LIST&showDraft=true 4. Please see NetApp KB article 3013622 for information on the guest OS tunings needed for VMware deployments: https://kb.netapp.com/support/index?page=content&id=S:3013622&actp=LIST
7293	<p>Below mentioned Guest OS Microsoft host clustering options are not supported with ESXi 6.0U1 and below versions for this configuration.</p> <p>Microsoft Cluster Service (MSCS) - Windows 2003 Microsoft Windows Failover Clustering (WFC) - Windows 2008, Windows 2012</p> <p>To avail Guest OS Microsoft host clustering support with this configuration, please upgrade your host to ESXi 6.0U2 or later</p>

Info

Note ID	Text
7910	Direct attachment of storage is not supported with this configuration
183	With ESX 3.x/4.x and later, any approved software iSCSI initiator in a supported virtual machine(VM)/Guest OS is supported. Please refer to the respective Operating System support statements on IMT for approved Software Initiators.
185	Support for any other VMware ESX supported Guest OS requires PVR.
8606	NetApp supports the O/S vendor-specific versions of the host filesystems listed in the interoperability matrix, but no longer specifies them by vendor. Instead host filesystems are now listed generically. This configuration was edited in Dec-2016 to remove specific (or less general) host filesystem information from the "Host Filesystems" field and replace it with more general components. NetApp support overall has not been reduced in any way by this change. IMT is not an exhaustive hardware support matrix for all aspects of the host-side configuration. The customer should verify the supportability of their configuration with all appropriate hardware vendor HCL/interoperability matrices.