# Considerations for FC configurations

ONTAP 9

NetApp
September 06, 2022

This PDF was generated from https://docs.netapp.com/us-en/ontap/san-config/fc-config-concept.html on September 06, 2022. Always check docs.netapp.com for the latest.

# Table of Contents

Considerations for FC configurations . . . 1
- Considerations for FC configurations overview . . . 1
- Ways to configure FC and FC-NVMe SAN hosts with single nodes . . . 1
- Ways to configure FC & FC-NVMe SAN hosts with HA pairs . . . 3
- FC switch configuration best practices . . . 5
- Supported number of FC hop counts . . . 5
- FC target port supported speeds . . . 5
- FC Target port configuration recommendations . . . 6

# Considerations for FC configurations

## Considerations for FC configurations overview

You should be aware of several things when setting up your FC configuration.

- You can set up your FC configuration with single nodes or HA pairs using a single fabric or multifabric.
- You should configure two FC data LIFs per node.

  This creates redundancy and protects against loss of data access.

- You should configure one management LIF for every storage virtual machine (SVM) supporting SAN.
- Multiple hosts, using different operating systems, such as Windows, Linux, or UNIX, can access the storage solution at the same time.

  Hosts require that a supported multipathing solution be installed and configured. Supported operating systems and multipathing solutions can be verified on the Interoperability Matrix.

- ONTAP supports single, dual, or multiple node solutions that are connected to multiple physically independent storage fabrics; a minimum of two are recommended for SAN solutions.

  This provides redundancy at the fabric and storage system layers. Redundancy is particularly important because these layers typically support many hosts.

- The use of heterogeneous FC switch fabrics is not supported, except in the case of embedded blade switches.

  Specific exceptions are listed on the Interoperability Matrix.

- Cascade, partial mesh, full mesh, core-edge, and director fabrics are all industry-standard methods of connecting FC switches to a fabric, and all are supported.

  A fabric can consist of one or multiple switches, and the storage controllers can be connected to multiple switches.

**Related information**

NetApp Interoperability Matrix Tool

## Ways to configure FC and FC-NVMe SAN hosts with single nodes

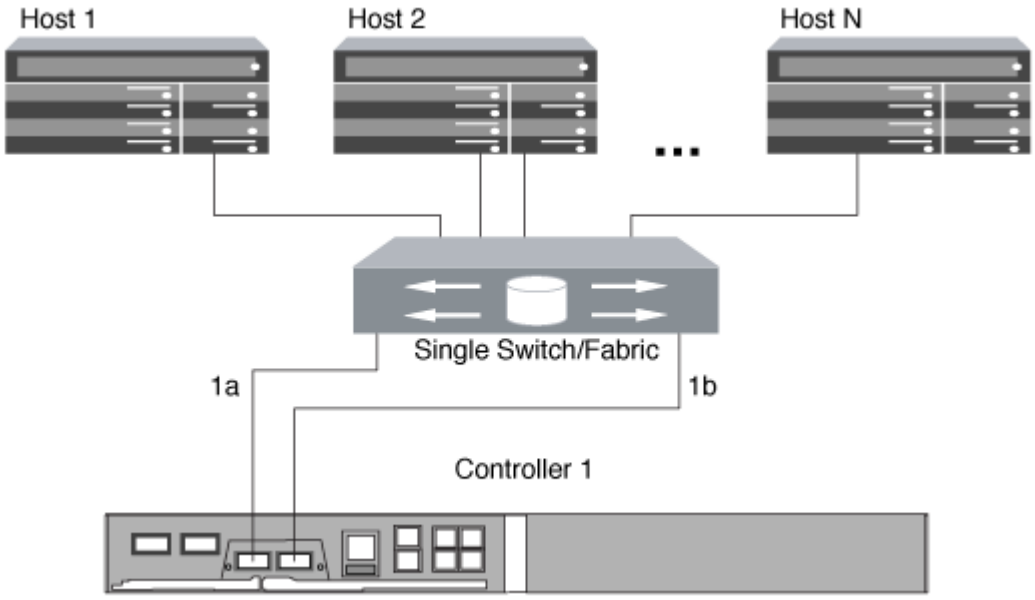
You can configure FC and FC-NVMe SAN hosts with single nodes through one or more fabrics. N-Port ID Virtualization (NPIV) is required and must be enabled on all FC switches in the fabric. You cannot directly attach FC or FC-NMVE SAN hosts to single nodes without using an FC switch.

You can configure FC or FC-NVMe SAN hosts with single nodes through a single fabric or multifabrics. The FC target ports (0a, 0c, 0b, 0d) in the illustrations are examples. The actual port numbers vary depending on the model of your storage node and whether you are using expansion adapters.

## Single-fabric single-node configurations

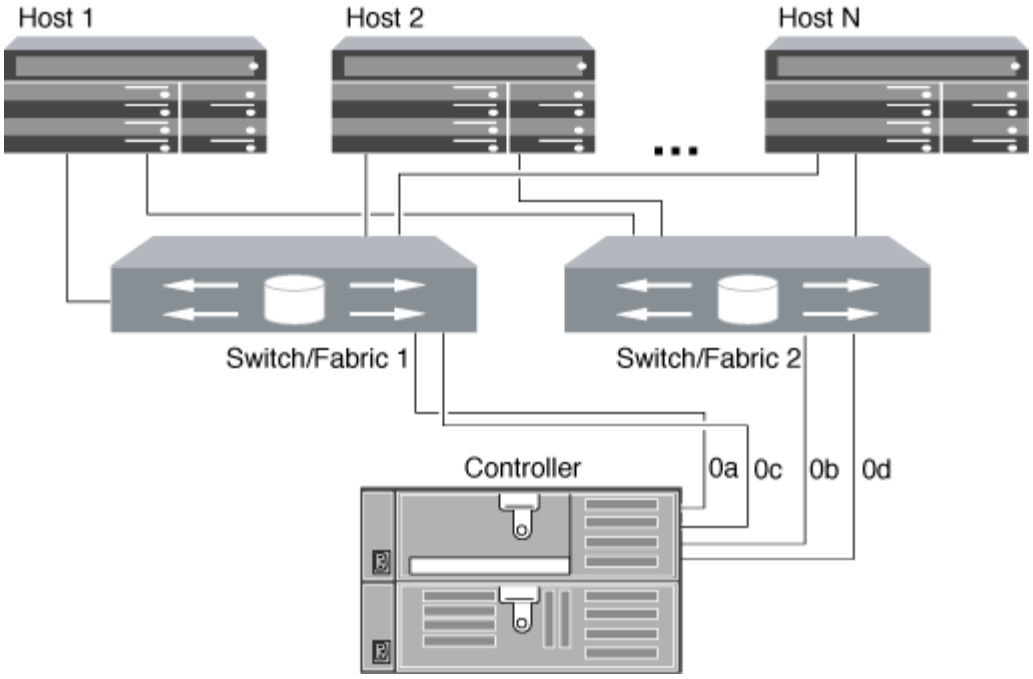
In single-fabric single-node configurations, there is one switch connecting a single node to one or more hosts. Because there is a single switch, this configuration is not fully redundant. All hardware platforms that support FC and FC-NVMe support single-fabric single-node configurations. However, the FAS2240 platform requires the X1150A-R6 expansion adapter to support a single-fabric single-node configuration.

The following figure shows a FAS2240 single-fabric single-node configuration. It shows the storage controllers side by side, which is how they are mounted in the FAS2240-2. For the FAS2240-4, the controllers are mounted one above the other. There is no difference in the SAN configuration for the two models.




## Multifabric single-node configurations

In multifabric single-node configurations, there are two or more switches connecting a single node to one or more hosts. For simplicity, the following figure shows a multifabric single-node configuration with only two fabrics, but you can have two or more fabrics in any multifabric configuration. In this figure, the storage controller is mounted in the top chassis and the bottom chassis can be empty or can have an IOMX module, as it does in this example.




**Related information**

NetApp Technical Report 4684: Implementing and Configuring Modern SANs with NVMe/FC

# Ways to configure FC & FC-NVMe SAN hosts with HA pairs

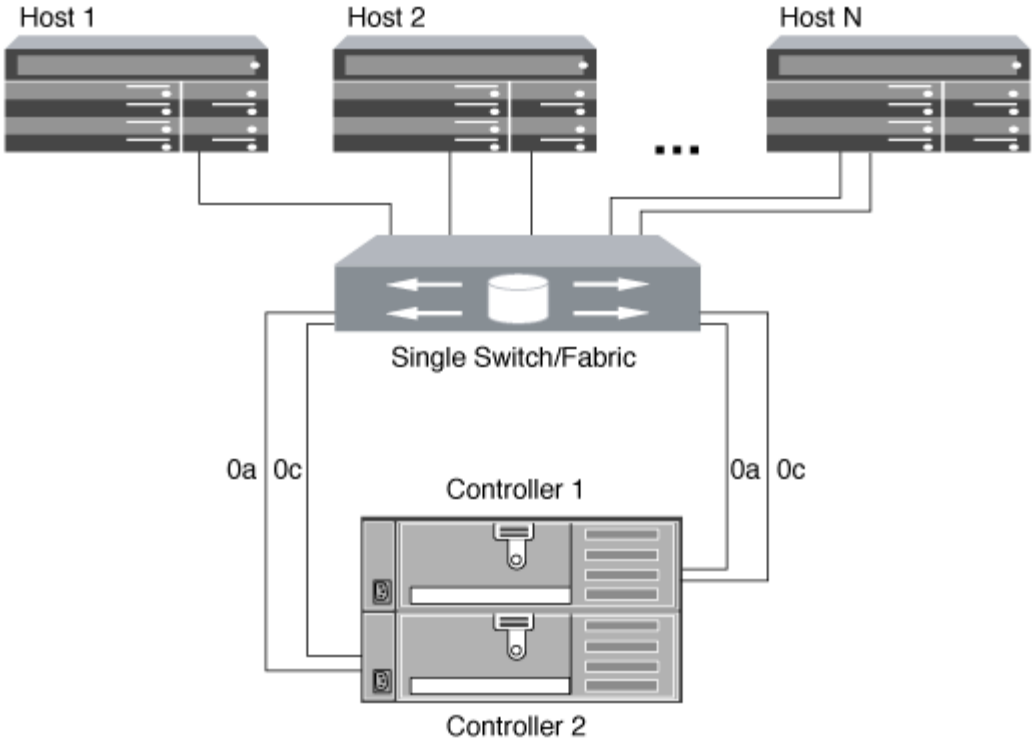
You can configure FC and FC-NVMe SAN hosts to connect to HA pairs through one or more fabrics. You cannot directly attach FC or FC-NVMe SAN hosts to HA pairs without using a switch.

You can configure FC and FC-NVMe SAN hosts with single fabric HA pairs or with multifabric HA pairs. The FC target port numbers (0a, 0c, 0d, 1a, 1b) in the illustrations are examples. The actual port numbers vary depending on the model of your storage node and whether you are using expansion adapters.

## Single-fabric HA pairs

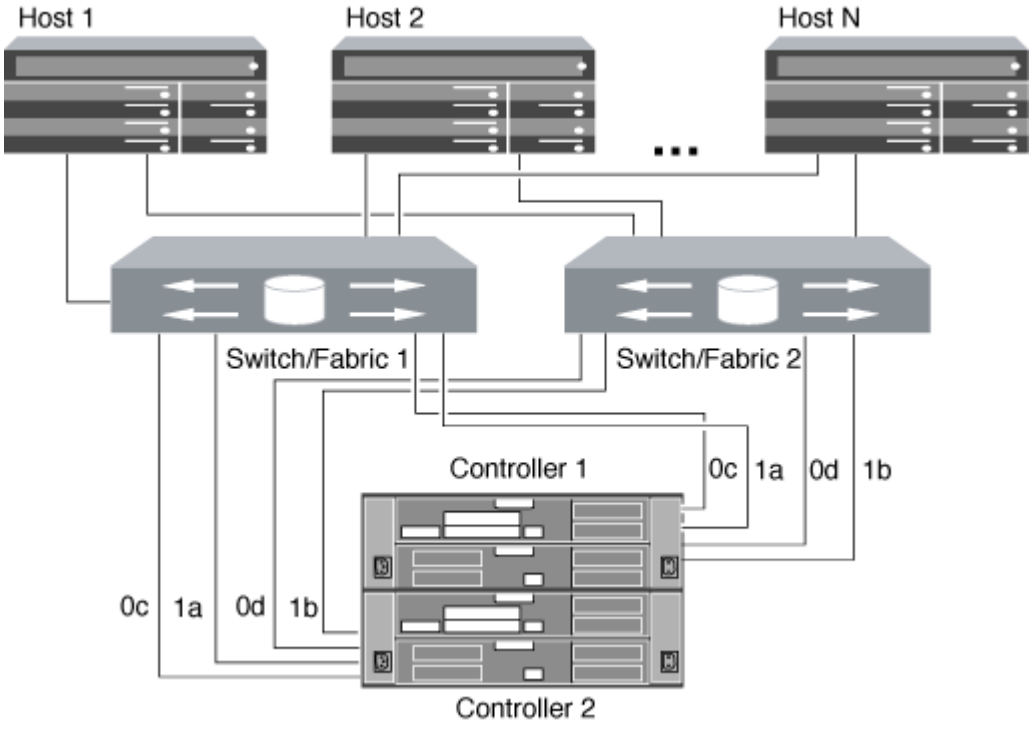
In single-fabric HA pair configurations, there is one fabric connecting both controllers in the HA pair to one or more hosts. Because the hosts and controllers are connected through a single switch, single-fabric HA pairs are not fully redundant.

All platforms that support FC configurations support single-fabric HA pair configurations, except the FAS2240 platform. The FAS2240 platform only supports single-fabric single-node configurations.




## Multifabric HA pairs

In multifabric HA pairs, there are two or more switches connecting HA pairs to one or more hosts. For simplicity, the following multifabric HA pair figure shows only two fabrics, but you can have two or more fabrics in any multifabric configuration:



# FC switch configuration best practices

For best performance, you should consider certain best practices when configuring your FC switch.

A fixed link speed setting is the best practice for FC switch configurations, especially for large fabrics because it provides the best performance for fabric rebuilds and can significantly save time. Although autonegotiation provides the greatest flexibility, FC switch configuration does not always perform as expected, and it adds time to the overall fabric-build sequence.

All of the switches that are connected to the fabric must support N_Port ID virtualization (NPIV) and must have NPIV enabled. ONTAP uses NPIV to present FC targets to a fabric.

For details about which environments are supported, see the NetApp Interoperability Matrix Tool.

For FC and iSCSI best practices, see Best Practices for Scalable SAN - ONTAP 9.

# Supported number of FC hop counts

The maximum supported FC hop count between a host and storage system depends on the switch supplier and storage system support for FC configurations.

The hop count is defined as the number of switches in the path between the initiator (host) and target (storage system). Cisco also refers to this value as the *diameter of the SAN fabric*.

| Switch supplier | Supported hop count |
|---|---|
| Brocade | 7 for FC5 for FCoE |
| Cisco | 7 for FCUp to 3 of the switches can be FCoE switches. |

**Related information**

NetApp Downloads: Brocade Scalability Matrix Documents

NetApp Downloads: Cisco Scalability Matrix Documents

# FC target port supported speeds

FC target ports can be configured to run at different speeds. You should set the target port speed to match the speed of the device to which it connects. All target ports used by a given host should be set to the same speed. FC target ports can be used for FC-NVMe configurations in the exact same way they are used for FC configurations.

You should set the target port speed to match the speed of the device to which it connects instead of using autonegotiation. A port that is set to autonegotiation can take longer to reconnect after a takeover/giveback or other interruption.

You can configure onboard ports and expansion adapters to run at the following speeds. Each controller and expansion adapter port can be configured individually for different speeds as needed.

| 4 Gb ports | 8 Gb ports | 16 Gb ports | 32 Gb ports |
|---|---|---|---|
| • 4 Gb<br>• 2 Gb<br>• 1 Gb | • 8 Gb<br>• 4 Gb<br>• 2 Gb | • 16 Gb<br>• 8 Gb<br>• 4 Gb | • 32 Gb<br>• 16 Gb<br>• 8 Gb |

UTA2 ports can use an 8 Gb SFP+ adapter to support 8, 4, and 2 Gb speeds, if required.

# FC Target port configuration recommendations

For best performance and highest availability, you should use the recommended FC target port configuration.

The following table shows the preferred port usage order for onboard FC and FC-NVMe target ports. For expansion adapters, the FC ports should be spread so that they do not use the same ASIC for connectivity. The preferred slot order is listed in NetApp Hardware Universe for the version of ONTAP software used by your controller.

FC-NVMe is supported on the following models:

- AFF A300

  The AFF A300 onboard ports do not support FC-NVMe.

- AFF A700
- AFF A700s
- AFF A800

The FAS22xx and FAS2520 systems do not have onboard FC ports and do not support add-on adapters.

| Controller | Port pairs with shared ASIC | Number of target ports: Preferred ports |
|---|---|---|
| FAS9000, AFF A700, AFF A700s and AFF A800 | None | All data ports are on expansion adapters. See NetApp Hardware Universe for more information. |
| 8080, 8060 and 8040 | 0e+0f<br>0g+0h | 1: 0e<br>2: 0e, 0g<br>3: 0e, 0g, 0h<br>4: 0e, 0g, 0f, 0h |

| Controller | Port pairs with shared ASIC | Number of target ports: Preferred ports |
|---|---|---|
| FAS8200 and AFF A300 | 0g+0h | 1: 0g<br>2: 0g, 0h |
| 8020 | 0c+0d | 1: 0c<br>2: 0c, 0d |
| 62xx | 0a+0b<br>0c+0d | 1: 0a<br>2: 0a, 0c<br>3: 0a, 0c, 0b<br>4: 0a, 0c, 0b, 0d |
| 32xx | 0c+0d | 1: 0c<br>2: 0c, 0d |
| FAS2554, FAS2552, FAS2600 series,FAS2720,FAS2750, AFF A200 and AFF A220 | 0c+0d<br>0e+0f | 1: 0c<br>2: 0c, 0e<br>3: 0c, 0e, 0d<br>4: 0c, 0e, 0d, 0f |

**Copyright Information**

Copyright © 2022 NetApp, Inc. All rights reserved. Printed in the U.S. No part of this document covered by copyright may be reproduced in any form or by any means-graphic, electronic, or mechanical, including photocopying, recording, taping, or storage in an electronic retrieval system- without prior written permission of the copyright owner.

Software derived from copyrighted NetApp material is subject to the following license and disclaimer:

THIS SOFTWARE IS PROVIDED BY NETAPP “AS IS” AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY DISCLAIMED. IN NO EVENT SHALL NETAPP BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

NetApp reserves the right to change any products described herein at any time, and without notice. NetApp assumes no responsibility or liability arising from the use of products described herein, except as expressly agreed to in writing by NetApp. The use or purchase of this product does not convey a license under any patent rights, trademark rights, or any other intellectual property rights of NetApp.

The product described in this manual may be protected by one or more U.S. patents, foreign patents, or pending applications.

RESTRICTED RIGHTS LEGEND: Use, duplication, or disclosure by the government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.277-7103 (October 1988) and FAR 52-227-19 (June 1987).

**Trademark Information**

NETAPP, the NETAPP logo, and the marks listed at http://www.netapp.com/TM are trademarks of NetApp, Inc. Other company and product names may be trademarks of their respective owners.