



NetApp Verified Architecture

Spectrum Scale SAN mode with NetApp EF600 and Brocade Fibre Channel fabrics for media and entertainment NVA design

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Abstract

NetApp has historically provided Fibre Channel (FC) solutions to customers as a Broadcom OEM partner. With the NetApp market leadership position in Non-Volatile Memory Express (NVMe) over Fibre Channel (NVMe/FC) technology, NetApp is enabling its own customers to deliver superior IT performance for their most important, mission-critical enterprise SAN applications. This document provides details on how to design an IBM Spectrum Scale parallel file system SAN mode solution using NetApp® E-Series storage systems, Emulex HBAs, and Brocade SAN switches for the media and entertainment market. This solution covers the all-NVMe NetApp EF600 all-flash array and offers performance characterization based on Frametest benchmarking, a tool widely used in the media and entertainment industry for testing.

In partnership with



TABLE OF CONTENTS

Executive summary	3
Use case summary	3
Solution overview	4
Target audience.....	4
Solution technology	4
Technology requirements	5
Hardware requirements	6
Software requirements	6
Solution verification	7
Test results	7
Conclusion	9
Where to find additional information	9
Version history.....	9

LIST OF TABLES

Table 1) Software requirements.	6
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LIST OF FIGURES

Figure 1) EF600 technical overview.	5
Figure 2) Frametest read bandwidth.	7
Figure 3) Frametest read response times.....	7
Figure 4) Frametest write bandwidth	8
Figure 5) Frametest write response time.	8
Figure 6) Average CPU usage across all clients during a 36-read streams test and a 10-write streams test.	8

Executive summary

As commercial video industry technologies continue to grow and improve, so do editing and storage requirements, along with the need to produce video in higher resolutions. With these changes come greater production demands and a need for massive bandwidth from the underlying production storage systems. These changes can overwhelm the proprietary media storage systems traditionally used in these environments.

The NetApp EF600 with Spectrum Scale provides broadcasters, media studios, and media content aggregators with a high-performance and high-capacity streaming tier that also optimizes rack space power and cooling.

An EF600 array provides massive read performance of 41.13GBps of video throughput in a 2U building block, serving up to 36 simultaneous uncompressed 4k read streams with zero dropped frames.

Additionally, the Brocade SAN Gen 6 and Gen 7 family of low-latency 32Gb and 64Gb FC switches meets the demand of media data facilities for near-line-rate throughput and low-latency video streaming. The Brocade FC switches are available from NetApp and can be enabled for the NetApp AutoSupport® call-home service.

Given the mission-critical nature of the media and entertainment applications, such as billing systems and enterprise resource planning (ERP) systems and raw content editing and post-production workflows, Brocade dedicated SAN fabrics offer solutions that are faster and more reliable than any other protocol. With 48% less overhead per frame compared to Ethernet, and the ability to handle a 40% more workload without requiring retransmission or error checking, Brocade FC is built specifically for low-latency flash storage.

Also, Brocade supports the high-end network infrastructure requirements and demands of today's digital asset management (DAM) and rich media search technologies. As mass customization of media continues to grow, Brocade offers industry-leading network reliability, scalability, and security to support today's and tomorrow's demands for broadcasters and content creation and production firms.

Brocade provides industry-leading high availability and reliability that enable organizations to use the latest DAM solutions in broadcast and post-production environments. The Brocade features include:

- High-availability (HA) applications that require load balancing or high availability
- Fabric OS (FOS) advanced protocols that efficiently transport large image files with the correct priority for the application
- Nondisruptive upgrade; very strong resiliency
- Power and cooling efficiencies; performance in high-density environments
- High-performance networks that ensure ability to scale and provide fast access to content libraries as required
- Network resiliency and redundancy
- Massive performance
- Ultra-low latency
- A full native support for NVMe

Use case summary

Although there is a push for Ethernet adoption in the media and entertainment industry, FC storage networks continue to be a critical enabler of today's content creation and media workflows. As video resolution and frame rates continue to grow, so does FC network storage within the media and entertainment market. Expanding and upgrading the existing high-performance, easy-to-manage, highly

available, and high-performing FC SAN fabrics is an ideal choice for system administrations and other IT professionals in media and entertainment in order to support the new demanding 8K and 4K workflows.

This solution applies to the following use cases that require a high-performance network within a Spectrum Scale environment:

- The ingest and playout of high-bandwidth media streams
- The need for either a high-bandwidth or lower-cost high-capacity streaming tier
- High resolution media asset management
- Online media archiving
- Centralized storage to provision content creation workstations and to broadcast playout workstations

Solution overview

With leading-edge NVMe technology, NetApp E-Series, together with Brocade FC switches, Emulex HBAs, and a file system such as Spectrum Scale, dramatically streamlines workflow and improves productivity. This combination creates a shared repository that supports flexible, reliable, unmatched, predictable, high-performance streaming and massive scalability, even with high bitrate media content. This repository also includes:

- A single namespace and virtually limitless bandwidth or capacity
- Near-linear bandwidth scalability; both scale-up and scale-out configurations
- Supports direct access for Linux and Windows clients while macOS access is provided through SMB

Growing media and entertainment companies are challenged to find storage tier solutions that both satisfy their high-density, high-bandwidth requirements, while also optimizing rack space power and cooling. The NetApp EF600 array fulfills these solution requirements.

The architecture demonstrated in this design guide shows the capabilities of a single, high-performance building block by using a single EF600 array with high-performing NVMe drives. Additional EF600 arrays can be added to the IBM Spectrum Scale cluster to allow for virtually unlimited scale out of performance and capacity.

The value of this solution comes from the proven ability of NetApp and Brocade FC storage network to support content creation and media workflows with a high number of high-resolution video streams coupled with the ability to transmit data in order, on time, and without corruption. This solution comes in a 2U rack space, which can provide savings in both footprint and power and cooling costs.

Target audience

The target audience for the solution includes the following groups:

- Media content aggregators and distribution companies
- Broadcasters and networks
- Film studios
- Multimedia corporations
- Sports leagues

Solution technology

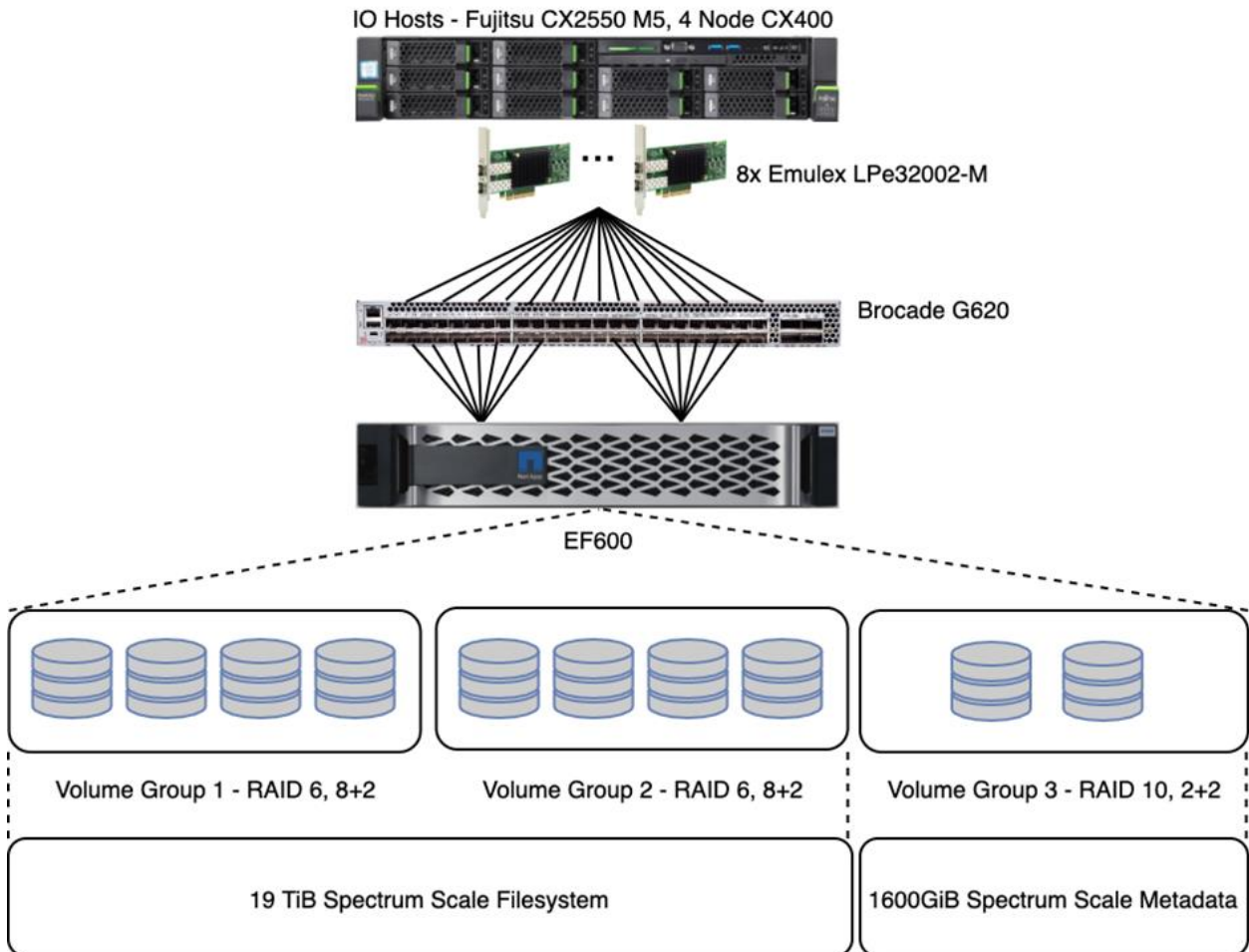
Using a proven validated design by NetApp and Broadcom's Brocade and Emulex divisions, NetApp and Broadcom provide an end-to-end NVMe-powered FC solution, from host to storage controller. This solution can help you realize the promise and benefits of NVMe/FC technology. With a system that yields

the fastest access, simplified management, and utilization of critical data, you can accelerate your time to innovation and leverage the following features:

- This Spectrum Scale solution consists of at least four Spectrum Scale clients that stream video to and from an EF600 array.
- This solution also includes SAN fabric components from Broadcom's Brocade 32G FC switches and Emulex Gen6 HBAs, which are leaders in the SAN fabric space.
- The EF600 array has 24x NVMe drives and is provisioned into two 8+2 RAID 6 volume groups. These groups are striped into a single Spectrum Scale file system and one 2+2 RAID 10 volume group used for metadata storage.
- With NVMe/FC support, Broadcom Gen 6 and 7 FC Fabrics, and NetApp E-series arrays, were' ready to enter a new era of wider adoption of NVMe for media and entertainment environments. This is possible today with NetApp storage and the industry's first end-to-end NVMe/FC platform.

Figure 1 shows the technical components of the EF600 solution.

Figure 1) EF600 technical overview.



Technology requirements

This section covers the technology requirements for the Spectrum Scale Brocade and NetApp SAN solution.

Hardware requirements

This section provides the hardware components that are required to implement the solution.

Server: Fujitsu multinode server

- Fujitsu CX400 M4 w/ 4x CX2550 M5 nodes:
 - Per CX2550 M5 Node CPU - 2x Intel(R) Xeon(R) Gold 6136 CPU @ 3.00GHz
 - Per CX2550 M5 Node Memory - 192GB

Storage network: Broadcom FC SAN Fabric

- FC SAN fabric:
 - 8x Emulex LPe32002-M Gen6 HBA (2x per CX2550 M5 node)
 - 1x Brocade G620 Gen6 FC Switch

Storage: NetApp E-Series arrays

- EF600 with 16x 32Gb FC ports:
 - 24x MZWLJ1T9HBJR-0G3– 1.6TB NVMe drives
 - 2x 8+2 RAID 6 volume groups (data volumes)
 - 4x 2.92TiB volumes per volume group with 512KiB segment size (capacity is 16% under provisioned per NVMe drive guidelines)
 - 1x 4 drive RAID 10 volume group (metadata volumes)
 - 4x 400GiB Volumes with 128KiB segment size

Software requirements

This design includes Spectrum Scale file system version 5.0.5-1. Spectrum Scale file system is a versatile, high-performance shared file system that offers heterogeneous, block-based access to a single storage system or striped across multiple external storage systems.

This example consists of tests that were performed to an EF600 storage target running NetApp SANtricity® firmware version 11.63.

Although the clients in this design were running Red Hat Enterprise Linux (RHEL) 7.8, with Device Mapper for failover support, a wide variety of host operating systems are supported. For a full listing of support operating system combinations, consult the [NetApp Interoperability Matrix](#).

Table 1 lists the software components that are required to implement the solution. The software components that are used in any particular implementation of the solution might vary based on customer requirements.

Table 1) Software requirements.

Software	Version or other information
Client OS	RHEL 7.8
Spectrum Scale	5.0.5-1
Brocade FOS	8.1.0a or later
Emulex lpfc driver	12.6.240.27 Firmware 12.0.193.13
SANtricity	11.63

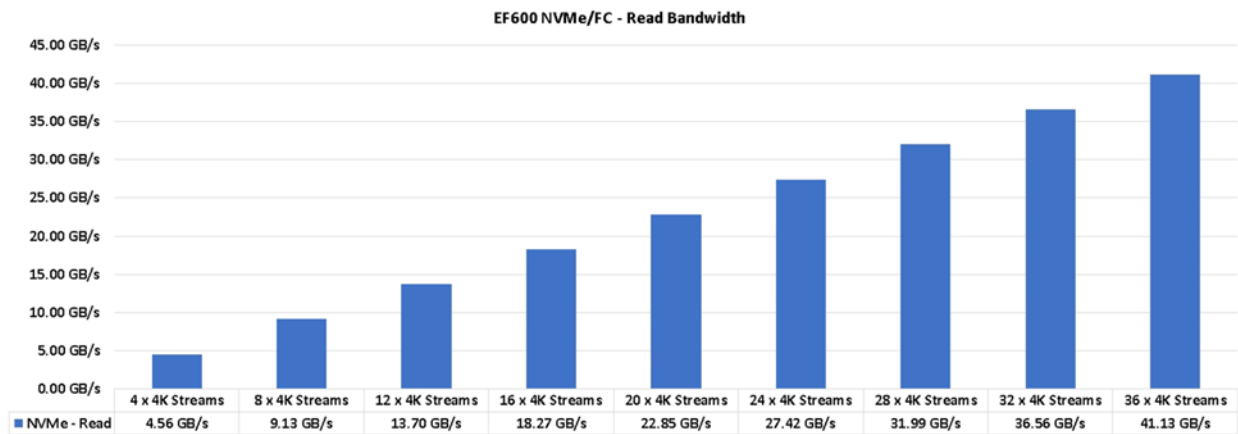
Solution verification

For this solution, NetApp studied the performance of EF600 storage systems and Broadcom's Brocade and Emulex divisions SAN Fabric to determine the performance gain of using NVMe/FC to support content creation and media workflows with a high number of high-resolution video. The industry standard Frametest benchmarking tool was used to generate uncompressed 4k streams at 24 frames per second. Multiple single-threaded Frametest instances were started on each host and scaled up to find the maximum number of streams that could run simultaneously without dropping frames. Each stream generated 10,000 frames to ensure consistency.

Test results

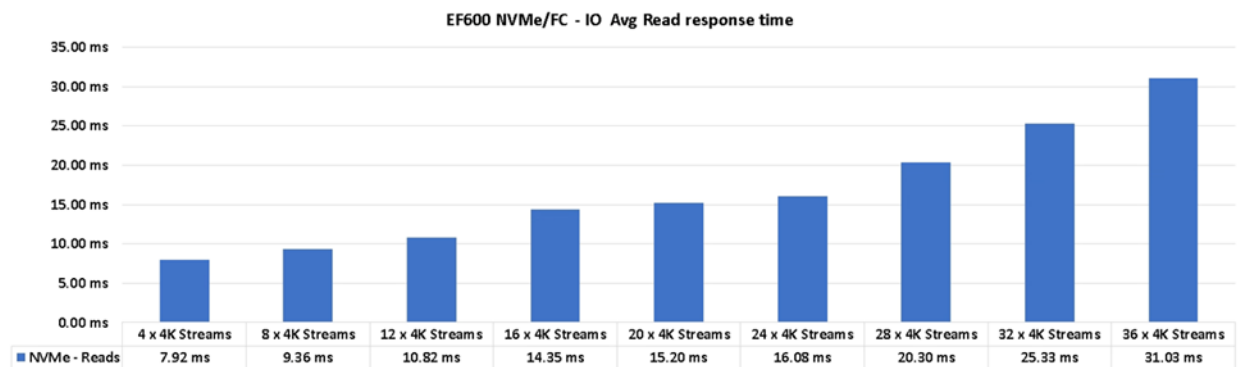
Using NVMe/FC protocol, the solution achieved up to 36 read streams with no drop frames, for a total bandwidth of 41.13GBps.

Figure 2) Frametest read bandwidth.



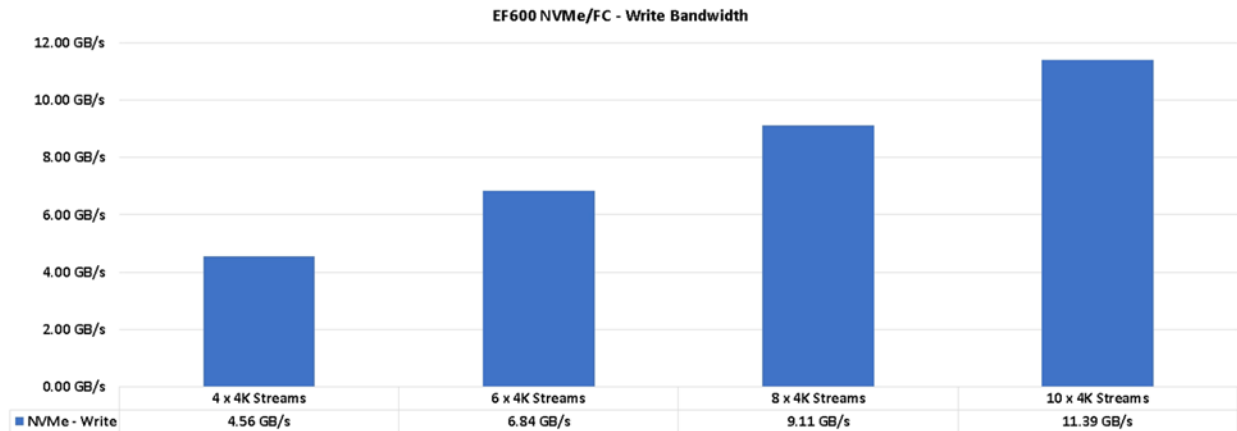
Additionally, I/O response times were low, with an average response time of 31.03ms, with 36 streams. Figure 3 illustrates the average response times, as the number of streams were increased.

Figure 3) Frametest read response times.



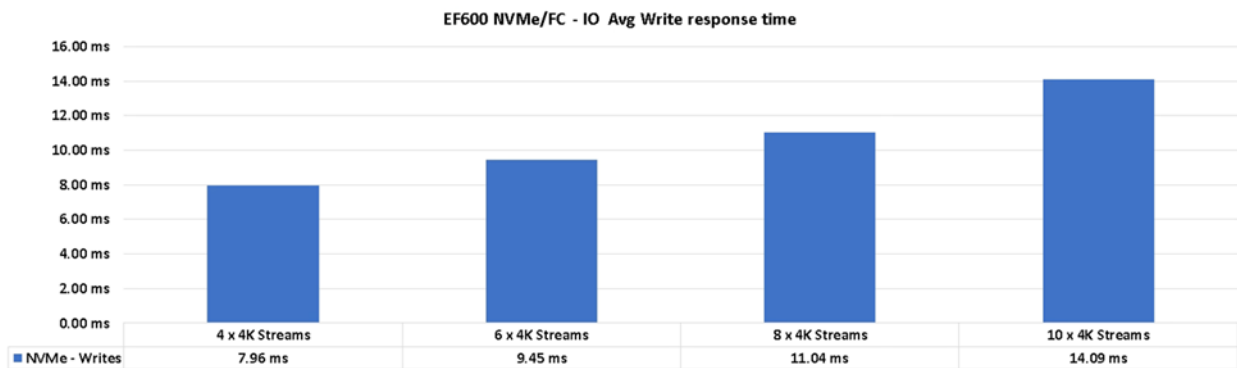
During write testing with NVMe/FC, the solution achieved up to 10 write streams with no dropped frames, for a total bandwidth of 11.39GBps writes.

Figure 4) Frametest write bandwidth



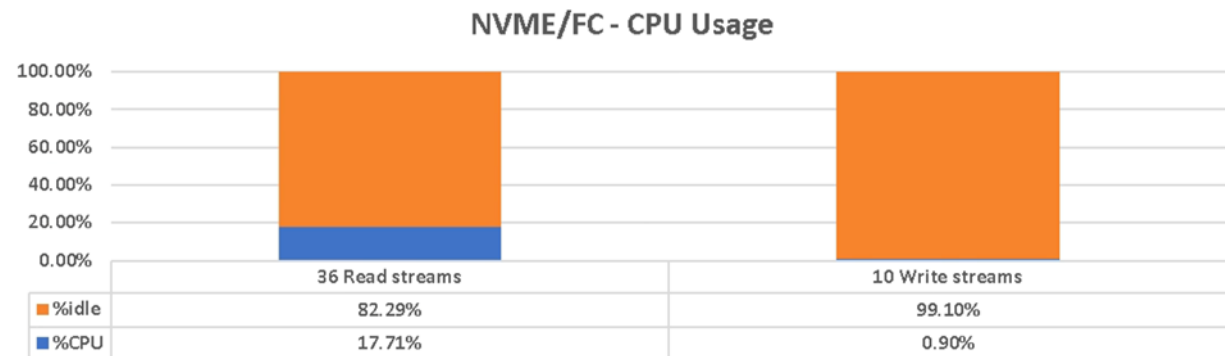
The average write response times at 10 streams was 14.09ms. Figure 5 illustrates the average response times as the number of streams were increased.

Figure 5) Frametest write response time.



NVMe/FC CPU usage was low as well, with the overall CPU load of 17.7% at 36 read streams and 0.9% at 10 write streams.

Figure 6) Average CPU usage across all clients during a 36-read streams test and a 10-write streams test.



Conclusion

Data storage requirements in media and entertainment have increased drastically due to numerous factors such as the fast-paced advances in the audio and video technology with 3D, HD streaming, AR, VR, high dynamic range, and higher frame rates, ever-increasing low-latency requirements, and the integration to business intelligence and analytics. NetApp and Brocade have partnered together to offer a solution that addresses these unique challenges and requirements.

Using Spectrum Scale with the NetApp EF600 and Brocade SAN Gen 6 and Gen 7 family provides a high-performing, shared storage system that is optimized to support many uncompressed 4k video streams, serving up to 36 simultaneous 4k uncompressed streams at 24fps, in only 2U of rack space.

The NetApp EF-Series solution for high-performance commercial video industry technologies partnered with Brocade FC SAN Fabrics enables customers to leverage best-in-class, end-to-end, modern SAN and NVMe technologies to both meet the editing and storage requirements and to deliver business-critical IT services today while preparing for the future.

With the EF-Series, NetApp, in collaboration with Brocade and Emulex, has created a SAN array that is both future-ready and usable today—and it's easy to implement with your current operational processes and procedures. The NetApp EF-Series flash array plus Broadcom's Emulex and Brocade 32Gb and 64Gb FC HBAs and switches are market leaders in delivering high performance, consistent low latency, and advanced HA features for your NVMe/FC environment.

Where to find additional information

To learn more about the information that is described in this document, review the following documents and/or websites:

- NetApp Media and Entertainment Storage Solutions
<https://www.netapp.com/us/solutions/industry/media-entertainment-storage-solutions.aspx>
- E-Series for Media Solutions Brief
<https://www.netapp.com/us/media/ds-e-series-media.pdf>
- NetApp Product Documentation
<https://docs.netapp.com>
- Brocade Fibre Channel networking products
<https://www.broadcom.com/products/fibre-channel-networking/directors/x6-directors>
<https://www.broadcom.com/products/fibre-channel-networking/switches/>
- Brocade and NetApp partner documents
<https://www.broadcom.com/company/oem-partners/fibre-channel-networking/netapp>
- Emulex Gen 6 HBA
<https://www.broadcom.com/products/storage/fibre-channel-host-bus-adapters/lpe32002-m2>

Version history

Version	Date	Document version history
Version 1.0	May 2021	Initial release.

Refer to the [Interoperability Matrix Tool \(IMT\)](#) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

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