QSAN Official Document

# Configuring NVMe-oF for VMware

## Best Practice

April 2026

# ANNOUNCEMENT

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# PREFACE

## Technical Support

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- Via the Web: https://www.qsan.com/technical_support
- Via Telephone: +886-2-77206355
- (Service hours: 09:30 - 18:00, Monday - Friday, UTC+8)
- Via Skype Chat, Teams / Skype ID: qsan.support
- (Service hours: 09:30 - 02:00, Monday - Friday, UTC+8, Summer time: 09:30 - 01:00)
- Via Email: support@qsan.com

## Information, Tip, and Caution

This document uses the following symbols to draw attention to important safety and operational information.



### INFORMATION

INFORMATION provides useful knowledge, definition, or terminology for reference.



### TIP

TIP provides helpful suggestions for performing tasks more effectively.


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## CAUTION

CAUTION indicates that failure to take a specified action could result in damage to the system.


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# 1. INTRODUCTION

In modern virtualized environments, storage performance and scalability are no longer optional, but fundamental to maintaining application responsiveness and operational efficiency. NVMe-oF has become a practical and cost-effective approach, providing high-performance storage using standard Ethernet infrastructure. When combined with enterprise-class storage platforms such as QSAN all-NVMe arrays, enterprises can build a balanced architecture that balances performance, reliability, and ease of maintenance.

Within the VMware ecosystem, NVMe-oF enables ESXi hosts to directly access NVMe-based storage pools hosted on QSAN arrays via TCP/IP networks. This approach eliminates reliance on dedicated architectures such as Fibre Channel or RDMA, while still providing low latency and high throughput characteristics suitable for mission-critical workloads.

From an architectural perspective, integrating NVMe-oF with a QSAN dual-controller system significantly improves high availability and path redundancy. VMware ESXi natively supports NVMe-oF multipathing, enabling seamless failover between controller paths. With proper configuration, uninterrupted I/O operations are ensured even during controller maintenance or unexpected failures—crucial for enterprise environments.

However, the reality is far more complex than advertised. NVMe-oF performance is highly dependent on network design and tuning. Factors such as network card capacity (e.g., 25GbE or higher), proper VLAN segmentation, TCP protocol stack optimization, and correct multipath configuration all directly impact final performance. Even in high-end systems, poor network design can create bottlenecks across the entire protocol stack, ultimately resulting in performance that struggles to surpass traditional iSCSI deployments.

This document outlines best practices for deploying NVMe-oF and QSAN systems in VMware environments. The goal is not only to achieve optimal performance but also to ensure stability, scalability, and predictable behavior under real-world workloads, thereby bridging the gap between theoretical capabilities and actual production results.


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# 2. CONFIGURE STEPS

This chapter will introduce the relevant storage configurations.

## 2.1. Environment

**Demonstration Environment**

- Storage
  - Model: XN4226D-4C
    Memory: 8 GB per controller
    Firmware: QSM 4.1.7
    Management Port IP: 192.168. 203.98
    CTRL 1 Data Port IP: 10.10.1.10
    CTRL 2 Data Port IP: 10.10.1.20
- Server
  - Model: ASUS Server
    OS: ESXi 8.0
    Server IP for management: 192.168. 203.250
    Server IP for data: 10.10.1.1

**Demonstration Topology**

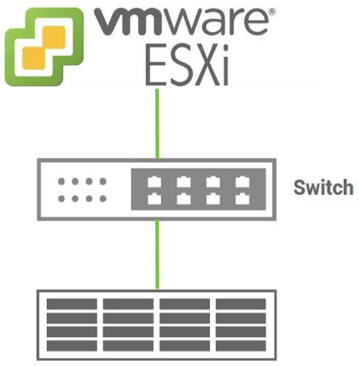



*Figure 2-1 Demonstration Topology*


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## 2.2. Configure Storage

1. Log in to the user interface using the **admin** account. Then create a pool, volume, and an NVMe-oF host group.

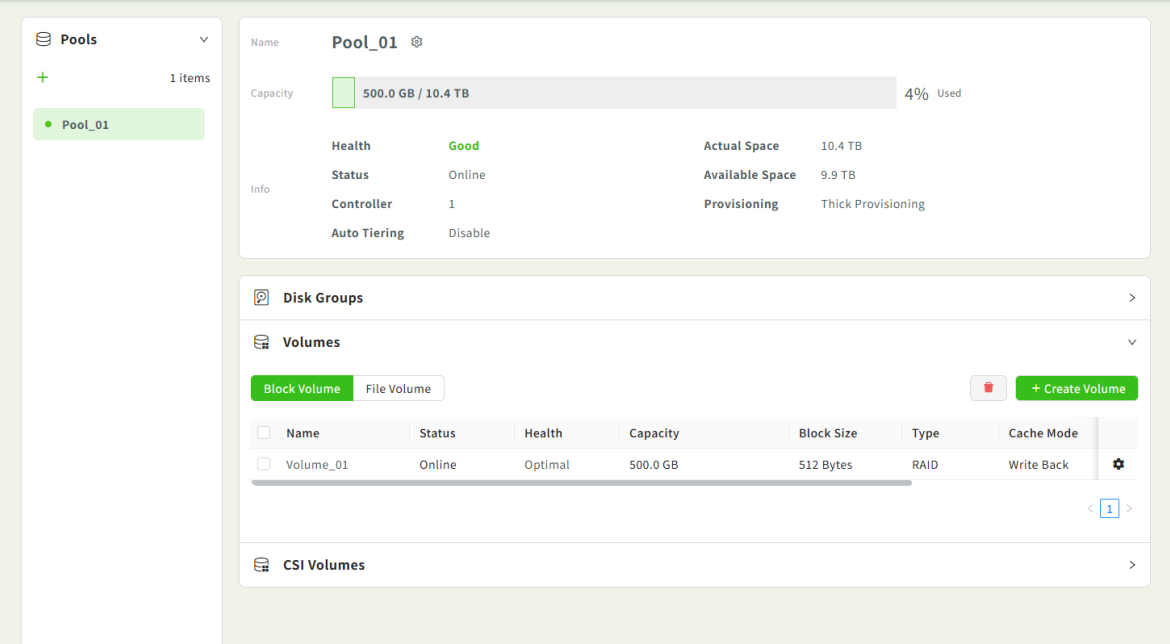



*Figure 2-2 Create a Pool and a Volume*

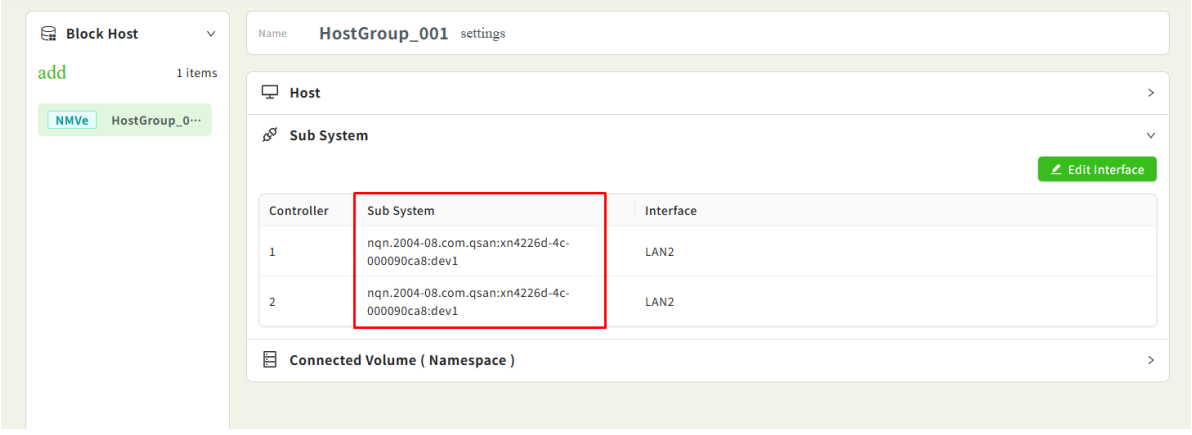



*Figure 2-3 Create an NVMe-oF Host Group*


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2. Configure the network IP in controller 1 and controller 2.

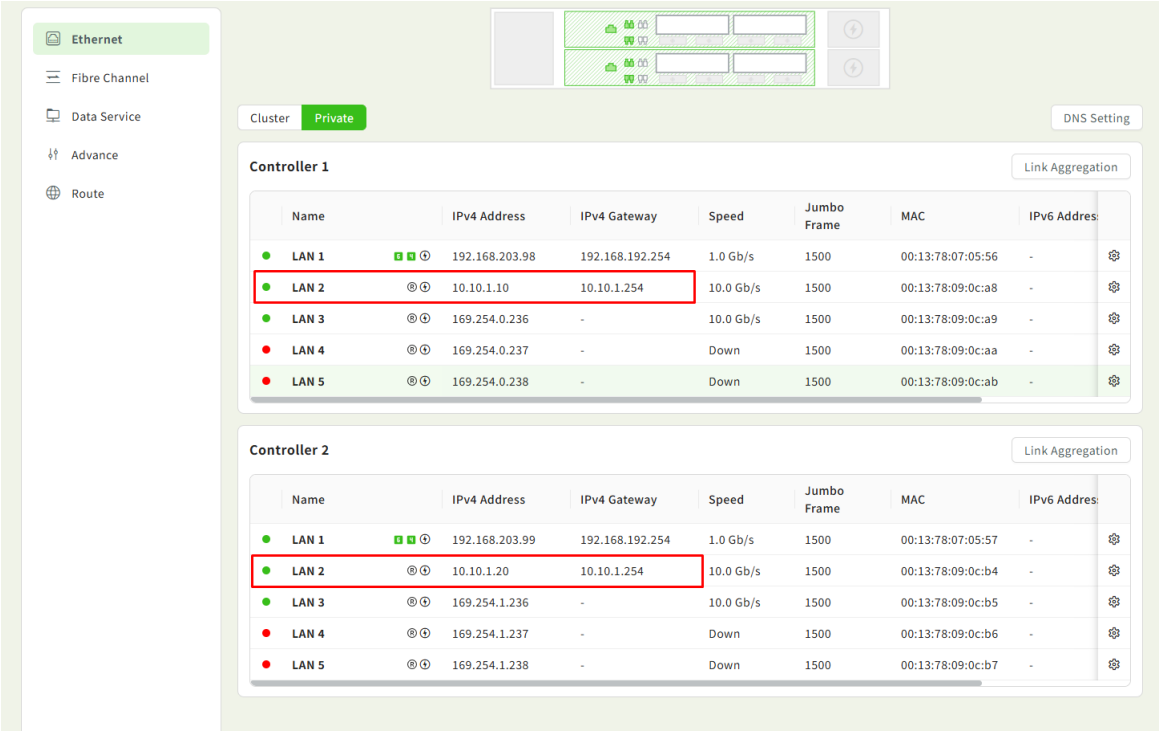



*Figure 2-4 Configure Network Settings*

## 2.3. Configure VMware

1. Log in to vCenter, add a new **vSwitch** and **VMkernel Adapter** named "vmk1". Note that you need to select **NVMe over TCP** when creating the **VMkernel adapter**.


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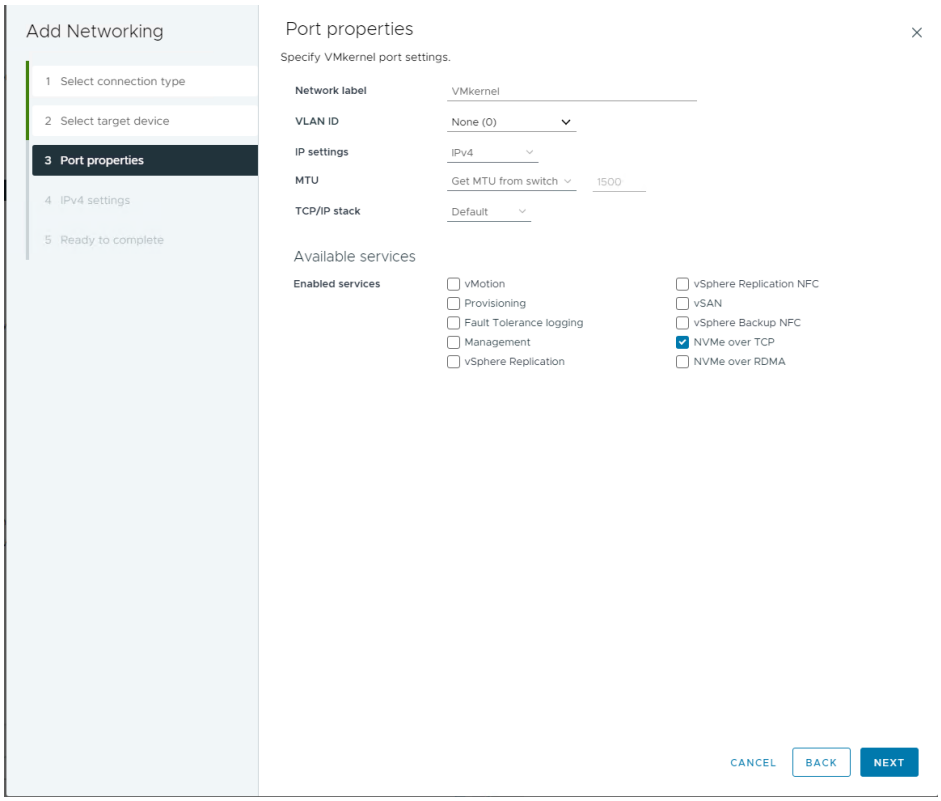



*Figure 2-5 Configure Network Settings in VMware Step 1*

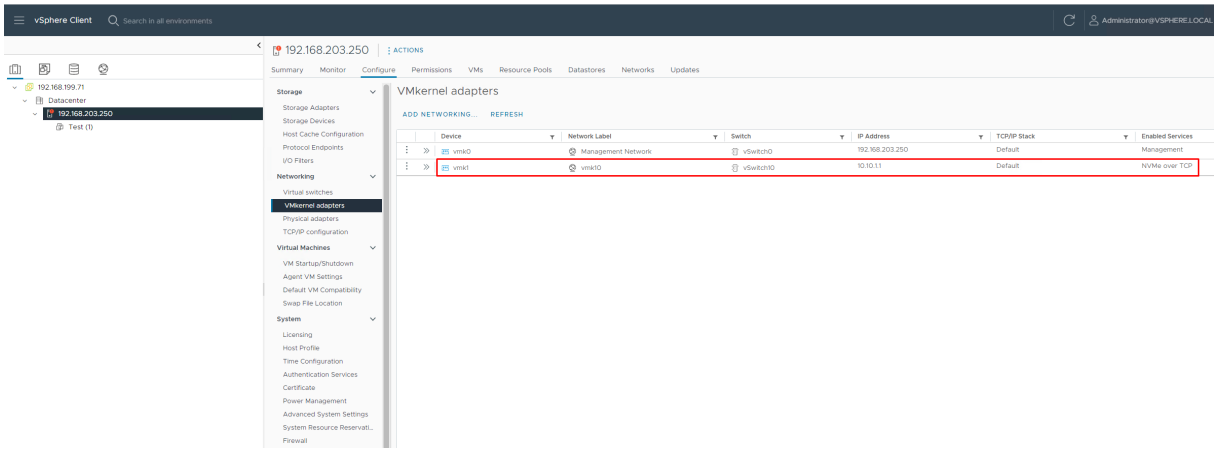



*Figure 2-6 Configure Network Settings in VMware-Step 2*


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2. Use third-party software to connect to the ESXi host via SSH and create a storage adapter using the following commands. Note that you need to enable the SSH service in ESXi first.

```
# esxcli nvme fabrics enable -d vmnic0 -p TCP
true
```

*Figure 2-7 Create a Storage Adapter-Step 1*

3. You can then find a **VMware NMVe over TCP Storage Adapter** on the **Storage Adapters** page.

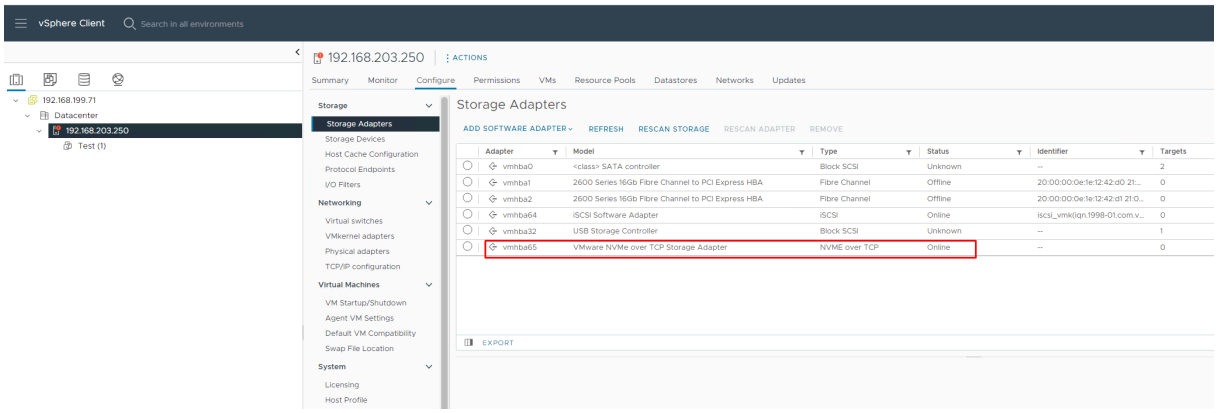



*Figure 2-8 Create a Storage Adapter-Step 2*

4. Use the following command to connect the ESXi host to the storage LUN via NVMe over TCP protocol. For a multipath configuration, simply execute this command to connect to both Controller 1 and Controller 2 simultaneously.

```
# esxcli nvme fabrics connect -a vmhba65 -i 10.10.1.10. -s nqn.2004-08.qsan.xn4226d-4c-00090ca8:dev1
# esxcli nvme fabrics connect -a vmhba65 -i 10.10.1.20. -s nqn.2004-08.qsan.xn4226d-4c-00090ca8:dev1
```

*Figure 2-9 Connect to NVMe-oF LUN via Multipath Step 1*


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5. Confirm that the **NVMe TCP Disk** has been detected by ESXi and is operating with multipath.

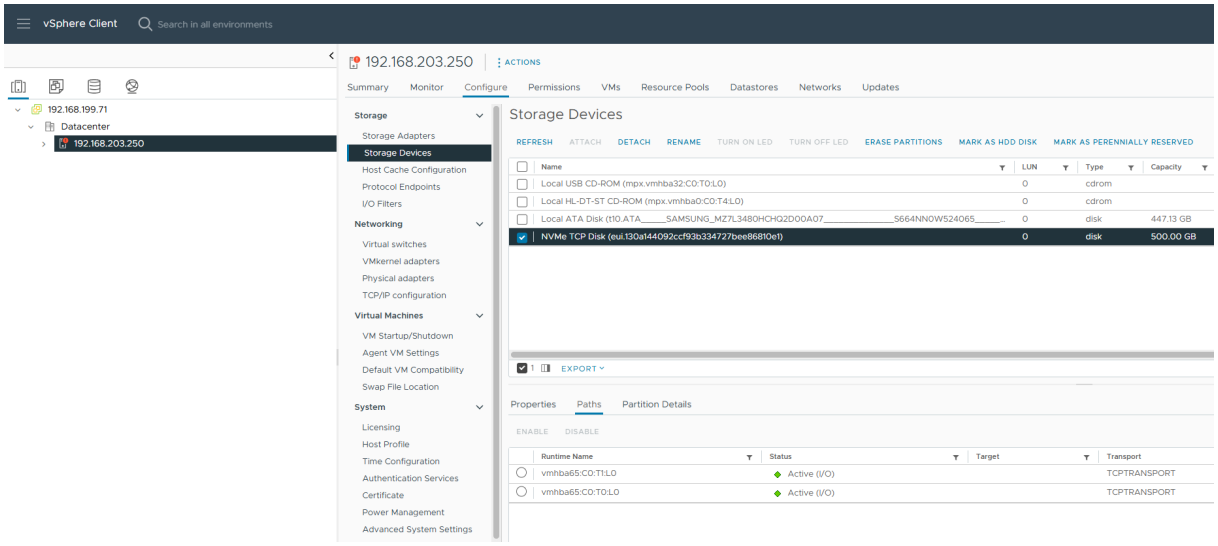



*Figure 2-10 Connect to NVMe-oF LUN via Multipath Step 2*

6. Finally, you can begin virtualization deployment using NVMe-oF simply by creating a datastore on the **Storage Device** and selecting it when creating a virtual machine.

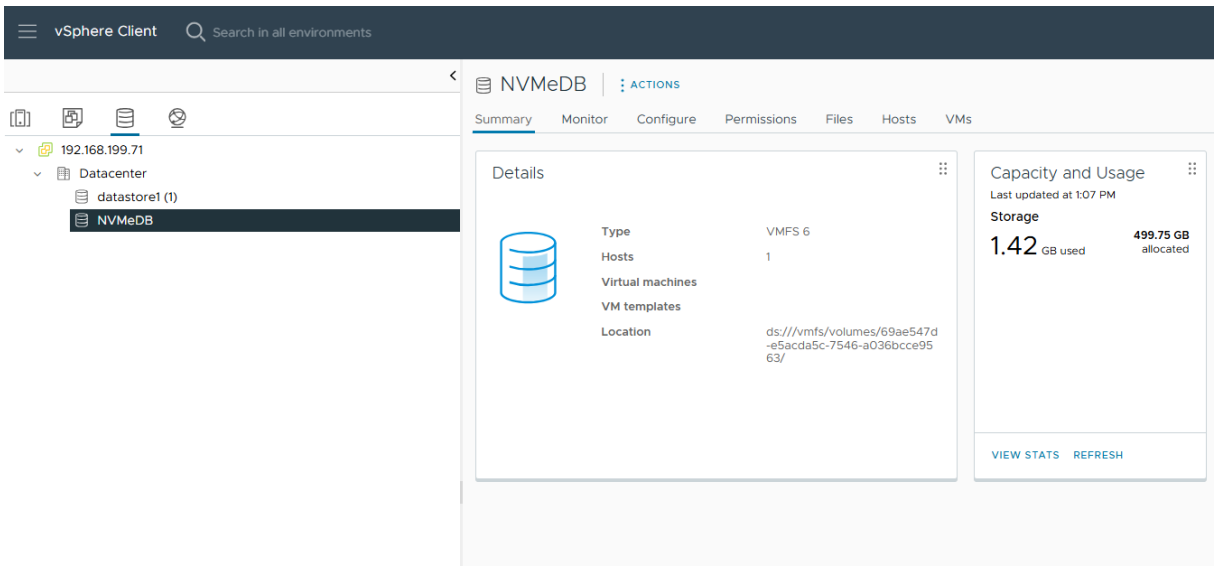



*Figure 2-11 Create a Datastore*


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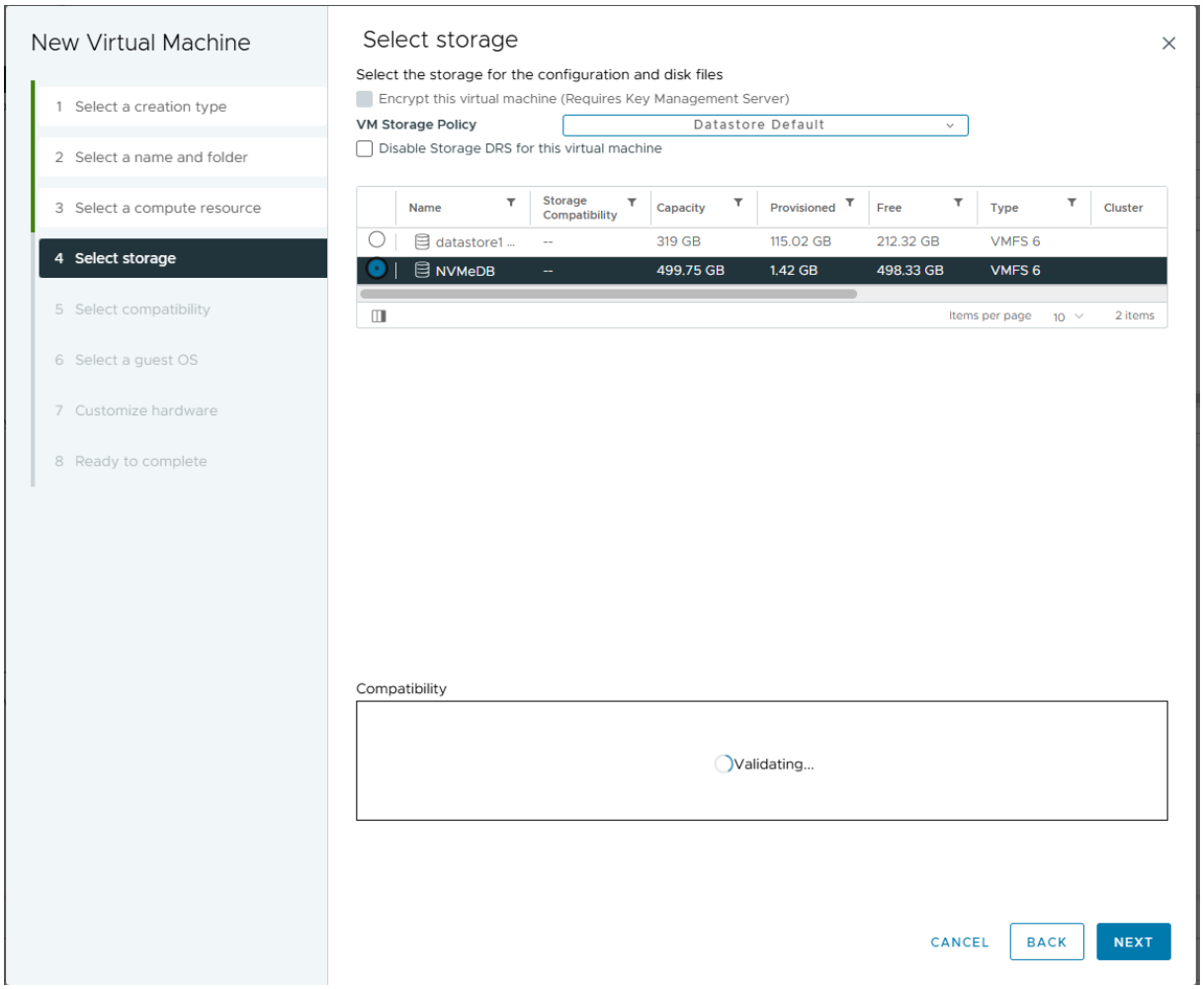



*Figure 2-12 Create a Virtual Machine*


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# 3. CONCLUSION

In summary, NVMe-oF offers a compelling pathway to modern VMware environments seeking to modernize storage connectivity without the cost and complexity of dedicated network architectures. When deployed with a QSAN all-NVMe array, it helps enterprises build high-performance, resilient, scalable, and operationally efficient storage architectures.

However, successful NVMe-oF adoption is more than just enabling the protocol and expecting enterprise-class performance. Actual production value depends on rigorous design choices, including appropriate hardware selection, a sound network architecture, proven multipath behavior, and meticulous end-to-end tuning.

With the right deployment strategy, QSAN storage, combined with VMware ESXi and NVMe-oF, achieves a viable balance between performance, availability, and cost-effectiveness. This makes it a solid foundation for agile and stable virtualized workloads. The goal is clear: to transform NVMe-oF from a promising technology option into a reliable production standard that continues to support business-critical operations.


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# 4. APPENDIX

## 4.1. Apply To

- QSM firmware 4.1.7 and later
- XEVO firmware 3.1.2 and later

## 4.2. Reference

Product Page for Unified Storage

- XN5 Series
- XN4 Series
- XN3 Series

Product Page for Block Storage

- XF5 Series
- XF4 Series
- XF3 Series

Document

- QSM 4 Software Manual
- XEVO 3 Software Manual


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