

Accelerate Virtual Server Performance with All-Flash Storage



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This article is the third in a series that examines how to deploy all-flash storage for popular use cases.

The shift to virtual server infrastructure has been a defining trend in IT over the past decade or so. So much attention has been devoted to virtualization itself that sometimes it's easy to lose sight of the fact that virtual servers are not an end in and of themselves—it's the applications that run on the infrastructure that matter.

When you think virtual server performance, you must consider both the needs of the virtual machines and the applications running inside them. With more than 40,000 customers running VMware, NetApp understands this better than almost anyone in the storage industry.

In this article, we examine the unique performance and ecosystem support requirements of virtual server infrastructure and explain how all-flash storage delivers a return on investment (ROI) to justify the initial capital outlay.

Delivering Maximum Virtual Server Performance

Virtual Server Workloads and the I/O Blender Effect

Virtual server I/O performance is dominated in large part by what's commonly known as the "I/O blender effect." Hypervisors typically use some form of shared datastore to provide storage capacity for virtual machines. The I/O stream from many virtual

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Explore

NetApp Delivers Support for vSphere 6 and Virtual Volumes

NetApp just released versions of [NetApp Virtual Storage Console \(VSC 6.0\)](#) and [VASA provider](#) for clustered Data ONTAP to support the VMware vSphere 6 release, and was a Design and Reference Partner for Virtual Volume technology. This not only makes the NetApp implementation the standard, we are also currently the only vendor to support both NFS and SAN protocols with Virtual Volumes from a single platform. Check out these articles, blogs, and podcasts to learn more about this technology:

- [NetApp Unlocks the Power of VMware Virtual Volumes](#)
- [The Best Kept Secret in NetApp Data ONTAP 8.3](#)
- [The Definitive Guide to VVols on NetApp](#)
- [VMware Virtual Volumes with Rawlinson Rivera](#)
- [VMware vSphere 6 Launch with Duncan Epping](#)

NetApp Innovations for Hyper-V

When it comes to Microsoft Hyper-V, NetApp differentiates itself with comprehensive support for key features,

machines to any given datastore is, in effect, randomized; any sequential component to the I/O stream of any single virtual machine is lost and the I/O stream becomes completely random as seen by the storage.

As server hardware continues to scale in terms of core count and memory, the gap between the demands of virtual servers and the ability of storage to satisfy those demands is widening. Low server utilization is the result.

Satisfy Virtual Server Workloads with All-Flash

The ideal storage environment for virtualized environments must be able to overcome the I/O blender effect to deliver high read and write IOPS with consistent low latency. The right all-flash storage system does this and, in the process, improves overall server utilization. This translates to more virtual machines per server, fewer servers, and lower licensing costs for virtualization software—yielding significant ROI in addition to an overall increase in performance.

The storage decision for virtual environments goes beyond performance. In the end, the ability of an all-flash array to support the hypervisors and applications you run—both now and in the future—will likely be more important than any particular technical factor.

Supporting Heterogeneous Workloads

Server virtualization is a superset of the [database](#) and [VDI](#) workloads explored in previous articles in this series. VDI is simply a specialized case of a virtual environment. (Almost everything that was discussed in last month's VDI article—including the benefits of data reduction, high availability, and scaling—applies to this more general case.)

Virtualized infrastructure typically is shared by a large number of applications with disparate requirements and shifting priorities. The right storage helps you get the most from your virtual environment and the applications running in it.

including:

Offloaded Data Transfer (ODX). ODX support allows Microsoft Windows to offload any data transfer to NetApp storage, reducing the load on the host and network. This capability works within the same volume, between volumes on the same NetApp node, and between volumes on different nodes. Where possible, NetApp uses FlexClone technology for this purpose. Transfers complete in a fraction of the time without consuming additional storage. Finally, NetApp enables **this** offload to cross protocol boundaries, so you can use it regardless of storage protocol.

SMI-S. SMI-S is a SNIA standard interface for managing storage. It is used to fully integrate NetApp storage into the Microsoft environment. Instead of requiring third-party portals, you can manage storage directly from within Windows Server or Virtual Machine Manager.

SMB 3.0. NetApp was an early supporter of the SMB 3.0 protocol, and assisted in developing the initial specification. NetApp innovations include auto-location services for automatic SMB node balancing, plus the ability to use existing IP infrastructure without requiring RDMA-compatible NICs and switches.

Hypervisor Support

If you aren't doing so already, it's likely that you'll run multiple hypervisors in your data center within the next few years. For example, it is becoming common to run Microsoft® applications on Microsoft Hyper-V for cost reasons, even if Hyper-V isn't the primary hypervisor.

At the same time, hypervisors are evolving quickly, with major new features every year or so—many of which are directly tied to storage. The most obvious example is VMware Virtual Volumes. This new feature uses policy-based management to simplify and improve storage administration for both VMware admins and storage admins. This was discussed in a recent blog, [Why Virtual Volumes?](#) (We can almost guarantee that you'll be hearing a lot about Virtual Volumes over the coming months as VMworld 2015 approaches.)

The upshot is that the all-flash array you choose should support a diversity of hypervisors, and closely track new features. An all-flash array should also integrate with any other software you use to manage and run your virtual infrastructure.

Application Support

The set of applications that run on your virtual infrastructure likely ranges from basic infrastructure services to business-critical database applications. Having a storage quality-of-service mechanism to make sure that less-important services don't interfere with the I/O needs of more important ones is a benefit.

More complex applications often have very specific storage requirements, including a need for file-based NAS protocols. For instance, Microsoft is increasingly encouraging those who are deploying the latest versions of SQL Server to deploy on SMB 3.0 rather than on fibre channel. Even if it's not a requirement now, the ability to support high-performance NAS may be a future requirement.

Finally, there's application integration with storage. Direct integration for application-consistent snapshots, replication, and other application functions can be critical. Replication and cloning capabilities also streamline application development, and because so many of us are looking for ways to utilize cheap cloud resources for development, backup, DR, and other functions, cloud integration is an important consideration and a way to future-proof your infrastructure.

NetApp All-Flash FAS for Virtual Server Workloads

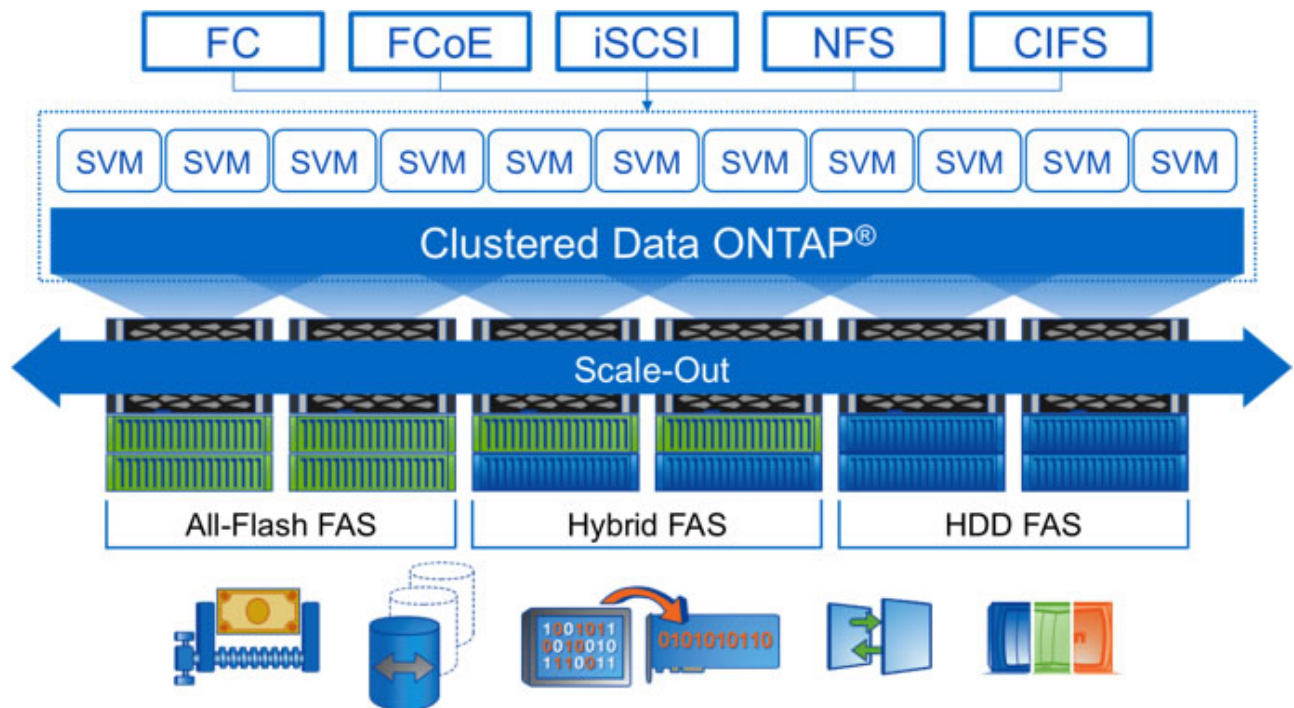
NetApp® All-Flash FAS storage combines proven performance with broad support for hypervisors and business applications. When it comes to virtual environments, no other all-flash storage vendor offers a feature set or a

partner and application ecosystem that compares. The NetApp clustered Data ONTAP® storage operating system combined with All-Flash FAS hardware don't just address point performance problems; the architecture streamlines your virtual infrastructure and helps you address your business challenges.

NetApp has spent two decades building out the feature set of Data ONTAP, including data management, data protection, data reduction, and application and partner support. We believe All-Flash FAS running clustered Data ONTAP is the best choice for virtual server environments.

As illustrated in Figure 1, All-Flash FAS delivers multiprotocol support, multi-tenancy, scale-out with homogeneous or heterogeneous storage, and data reduction and data management features—including compression, deduplication, cloning, and replication.

Figure 1) All-Flash FAS supports virtual server environments with a full-featured and flexible enterprise platform.



Source: NetApp, 2015

Data ONTAP delivers deployment advantages you can't get from other all-flash solutions.

- **Store secondary copies on HDD or in the cloud.** You need a second copy of your virtual server data for

disaster recovery. With Data ONTAP, secondary copies of data can be kept on non-flash storage or in the cloud, optimizing cost.

- **Save space with space-efficient clones.** NetApp's cloning technology lets you create near-instantaneous writeable copies of virtual machines. Clones only consume additional storage as changes are made, delivering up to 584:1 space reduction, providing substantial advantages. For instance, a hypervisor snapshot results in a 20% increase in storage consumed for metadata. NetApp can avoid this penalty, and achieve better density using its native cloning capability, while also decreasing provisioning time.
- **Put your data where you want it.** Clustered Data ONTAP makes it possible to move data to all-flash storage when it's needed—with no disruption to running applications. You can start on hybrid storage today, and migrate to all-flash in the future as your needs grow. Or you can run your most important virtual machines and application workloads on All-Flash FAS, and use hybrid storage for other virtual machines and transparently migrate between them.
- **Prioritize workloads with Storage Quality of Service.** [Storage Quality of Service](#) (QoS) helps you deliver predictable performance for business-critical applications running in a shared, virtual infrastructure environment.
- **More options to protect data.** Many of the applications running in your virtual environment are critical to your business. All-Flash FAS and Data ONTAP give you more options to protect that data, including disk-based backup, cloud backup, asynchronous replication, and full synchronous replication between sites up to 200km apart.

All-Flash FAS Performance and ROI

Because of its write-optimized design, All-Flash FAS delivers great performance for both VDI environments and other write-intensive applications, while [coming in at \\$55 per desktop](#) or less, a very competitive price. You can read complete details of our VDI testing in [TR-4307: NetApp All-Flash FAS Solution for VMware Horizon View](#).

We've been examining the impact of All-Flash FAS on virtual environments and applications. Preliminary results suggest that we can achieve up to a 4X increase in CPU utilization on servers simply by switching from disk storage to All-Flash FAS. In other words, upgrading to All-Flash FAS could enable you to increase server utilization levels and run more virtual machines per server. Doubling the number of virtual machines per server halves the number of servers you need, reducing direct and indirect hardware costs, as well as potentially reducing licensing costs.

The same math applies to databases such as SQL Server and Oracle. Because these two databases are now licensed on a per-core basis the savings are significant, offsetting the cost of upgrading to All-Flash FAS.

A Complete Ecosystem for Virtual Server Infrastructure

We've done extensive work over the years to make sure that our storage solutions work with the broadest range of virtualization software, and we've made a strong commitment to deliver deep integration for virtualization

ecosystems. In addition to VMware vSphere, Microsoft Hyper-V, and Citrix XenServer, we also support Oracle VM and KVM.

Figure 2) NetApp clustered Data ONTAP integration with popular hypervisors.

VMware® vSphere™ ESXi	<ul style="list-style-type: none">▪ Virtual Storage Console (VSC) for vSphere WebClient▪ VAAI and VASA Provider▪ Backup and Restore Virtual Machines▪ VVOL Support
Citrix XenServer	<ul style="list-style-type: none">▪ Sharefile Integration▪ Backup and Restore Virtual Machines
Microsoft Hyper-V™	<ul style="list-style-type: none">▪ PowerShell Script Support▪ Citrix PVS VDI Provisioning Script for Hyper-V 2012▪ Shift VMDK to VHD Migration Script▪ Backup and Restore Virtual Machines

Source: NetApp, 2015

VMware

As noted earlier, NetApp has a huge installed base of joint customers with VMware. Our long collaboration results in deeper integration and better outcomes for customers. For example, general availability of VMware vSphere 6 was announced in March 2015, with VMware Virtual Volumes among the many new features. NetApp followed the release closely with its [release of the latest NetApp Virtual Storage Console \(VSC 6.0\) and VASA provider](#) for clustered Data ONTAP to support the vSphere 6 release. (See sidebar, "NetApp Delivers Unparalleled Support for VMware Virtual Volumes" to learn more.)

Hyper-V

NetApp made early investments in Hyper-V support, introducing NetApp SnapManager® for Hyper-V software and the OnCommand Plug-in for Microsoft to coincide with the initial release of Hyper-V in Windows Server 2008. That early investment allowed us to help drive the Hyper-V roadmap and is responsible today for the innovations we offer for Hyper-V users. All of these capabilities extend to the Azure cloud via the Data Fabric. (See the sidebar, "NetApp Innovations for Hyper-V" for details.)

XenServer, KVM, and Docker

NetApp believes in supporting and enabling all forms of virtualization. We were early backers of Citrix, including integration with Citrix ShareFile and Citrix Cloud Platform. As workloads shift to KVM, Oracle VM, Docker, and other emerging cloud and virtualization platforms, we too are shifting. We're not merely supporting these platforms; we're developing innovative ways to leverage our storage ecosystem to drive business value and operational efficiency. (Read, [Quickly Deliver Applications with Docker Container Technology](#) to learn more about Docker.)

The Right Storage Choice for Virtual Server Infrastructure

If you're looking for an all-flash array to satisfy the needs of virtual infrastructure you have to pay careful attention to both architecture and ecosystem support. All-Flash FAS combines optimized write architecture with proven data reduction and data management features to create an ideal storage environment for virtual infrastructure. With unmatched integration with all the major hypervisors as well as popular enterprise applications—including Microsoft SQL Server, Microsoft Exchange, Microsoft SharePoint, Oracle and SAP—All-Flash FAS is the perfect choice for accelerating your virtual server infrastructure.

And, because All-Flash FAS is based on Data ONTAP, it integrates with your clustered Data ONTAP ecosystem, giving you a wider range of storage options—from all-flash for maximum performance to SATA disk for maximum capacity—to meet the needs of all your virtualized applications. Data movement is handled by storage without disruptions, offloading busy servers; our [Data Fabric approach](#) simplifies moving virtual machines and data from your data centers to the cloud.

References

Selected Best Practices

- [VMware vSphere 5 on NetApp Clustered Data ONTAP Best Practices](#)
- [Microsoft Hyper-V over SMB 3.0 with Clustered Data ONTAP: Best Practices](#)
- [NetApp SnapManager 2.1 for Hyper-V on Clustered Data ONTAP 8.3](#)
- [Citrix XenServer and NetApp Storage Best Practices](#)
- [Software-Defined Storage with NetApp and VMware](#)

VDI

- [NetApp All-Flash FAS Solution For Nonpersistent Desktops with VMware Horizon View](#)
- [NetApp All-Flash FAS Solution For Persistent Desktops with VMware Horizon View](#)

FlexPod

- [FlexPod Datacenter with Microsoft SharePoint 2013, VMware, and Cisco ACI](#)
- [All Available FlexPod Design Guides for VMware and Hyper-V](#)

Glenn Sizemore is a reference architect in the Infrastructure Cloud Engineering team, where he specializes in cloud and automation, with a focus on Microsoft solutions. He is co-author of the "FlexPod DataCenter with Microsoft Private Cloud Fast Track" reference architectures, and he develops best practices for using Microsoft software with NetApp storage environments.

Andrew Sullivan has worked in the IT industry for more than 10 years, with extensive experience in database development, DevOps, and virtualization. He currently focuses on storage and virtualization automation and VMware ecosystem integration, driving simplicity into everyday workflows.

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