

Dell EMC Ready Architectures for VDI

Designs for Citrix Virtual Apps and Desktops on VxRail and vSAN Ready Nodes

April 2019

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Design Guide

Abstract

This design guide provides technical considerations and best practices for the integration of Citrix Virtual Apps and Desktops core components for virtual desktop infrastructure (VDI) and hosted applications on Dell EMC VxRail hyper-converged appliances or vSAN Ready Nodes in a VMware vSphere environment.

Dell EMC Solutions

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Executive summary

Business challenge

In the past, moving from traditional PCs to a virtual desktop infrastructure (VDI) solution was challenging. A classic VDI implementation of 100 applications and 1,000 users could take 250 days or more, and the final cost was often unpredictable. Organizations today require end-to-end desktop and application virtualization infrastructure solutions that are flexible, reliable, scalable, and easy to deploy.

Desktop virtualization helps improve service delivery and competitiveness by simplifying how IT works on systems, dramatically reducing the complexity of the system and making it more flexible. The IT team can then move from being a largely reactive technical group to playing a proactive role in the strategic organization. Dell EMC can assist IT teams in this journey while improving user experience with the Dell EMC Ready Architectures for VDI.

Some challenges that organizations face today include:

- **Workforce empowerment**— Personal technology is driving newer and higher expectations. People want the same benefits at work as they have on their personal devices. They want faster, easier-to-use devices and applications that fit their specific needs. Technology itself has become a way to attract and retain the best talent. It has become a differentiator and a job perk.
- **Optimized IT resources**—Organizations that manage a large number of traditional PCs find that the task is becoming increasingly complex. With desktop virtualization, you move applications, data, and the OS (the desktop) to the data center. IT can centrally manage the virtual desktop from the data center and save time and money by troubleshooting PCs remotely instead of physically visiting each PC.
- **Improved security**—Organizations require the ability to control data, recover from disasters, apply policies, comply with regulations, and monitor risk. Maintaining data and application security, as well as compliance, are the leading IT concerns in organizations of all sizes. Mobile office trends and bring-your-own device initiatives mean that more devices and sensitive data are out of direct IT control, increasing the risk for data theft, viruses, malware, and ransomware attacks. In addition, traditional antivirus solutions cannot keep up with the amount of new malware that is created daily. Non-security IT specialists also tend to find security and compliance complex.
- **Cost management**—Organizations must monitor and optimize the total cost of ownership (TCO), achieve greater utilization from infrastructure assets, and reduce energy use.

Technology solution

Dell EMC Ready Architectures for VDI on vSAN-based appliances provide a quick and easy way to simplify and extend your VMware environment. Since Ready Architectures for VDI combine compute, storage, virtualization, and management, these solutions are ideal for VDI.

The Ready Architectures for VDI are built on industry-leading Dell EMC VxRail appliances or vSAN Ready Nodes appliances. These true hyper-converged infrastructure (HCI) platforms provide performance, flexibility, and scale for VDI environments.

- Dell EMC recommends VxRail appliances for an enhanced VDI solution that leverages a wide range of software, tools, and resources co-developed by Dell EMC and VMware. The VMware hyper-converged software is vSphere-ready and based on vSAN Software-Defined Storage (SDS). The Dell EMC deployment and support tools integrate the software management within VxRail Manager. Data protection and replication are included and can support either hybrid or all-flash storage configurations.
- Dell EMC vSAN Ready Nodes do not include the full automation suite that is available in VxRail appliances, but they provide more flexibility in platform choices. vSAN Ready Nodes offer the confidence that your pre-validated configuration will work with vSAN technology as well as the Citrix Virtual Apps and Desktops suite.

Installing Citrix Virtual Apps and Desktops with its VDI components on VxRail appliances or vSAN Ready Nodes enables organizations to quickly deliver Microsoft Windows virtual desktops or server-based hosted shared sessions on a wide variety of endpoint devices.

Key benefits

Dell EMC offers comprehensive, flexible, and efficient VDI solutions that are designed and optimized for your organization's needs. These VDI solutions are easy to plan, easy to deploy, and easy to run.

With two different vSAN-based appliance options to choose from, Dell EMC has the ideal configuration to start or extend your data center. While VxRail and vSAN Ready Nodes have the same underlying technology (VMware vSAN), each provides unique benefits. VxRail offers a turn-key solution to deploying and managing infrastructure with additional software features to assist throughout the appliance lifecycle. vSAN Ready Nodes require similar architectural design elements, but do not include the software components and elements that are found in the VxRail product. However, vSAN Ready Nodes offer a greater array of platforms and additional peripheral device choices.

Dell EMC Ready Architectures for VDI offer several key benefits:

- **VxRail Manager lifecycle management**—The integrated VxRail software lifecycle management keeps software updates and patches current. Updates are easy to install and safe to implement, because all software components are engineered, tested, and released as a bundle. Administrators are notified through the VxRail Manager when updates are available. Perform updates in your production environment with no downtime while VxRail Manager intelligently deploys important updates. VxRail Manager lifecycle management reduces complexity, makes the infrastructure more secure, and removes the risk. (VxRail Manager is available only on VxRail.)
- **Predictable costs, performance, and scalability to support a growing workforce**—The cost to deploy applications and desktops is dramatically simpler when deploying from a data center.
- **Rapid deployments**—Ready Architectures for VDI offer rapid automated deployment. (This feature is a standard offering on VxRail with optional services available for vSAN Ready Nodes.)

- **Rapid scaling to serve enterprises of any size**—Scale rapidly with workload-specific configurations per platform. The solution is scalable up to 64 nodes per cluster, supporting thousands of virtual machines (VMs). Continue scaling with pod architecture and by combining multiple clusters. The VxRail Manager (available only with VxRail appliances) makes it easy to insert or remove nodes from your cluster to meet your business needs.
- **Dell EMC support**—Dell EMC Ready Architectures for VDI are tested and validated Engineering Systems for VDI and its related tools. Deployment Services provide installation of this turn-key VDI appliance to ensure a rapid deployment with linear and predictable scalability.

Document purpose

This document introduces the architecture, components, design options, best practices, and configuration details for successful VDI deployments for VxRail appliances and vSAN Ready Nodes with Citrix Virtual Apps and Desktops.

Audience

This guide is for decision makers, managers, architects, developers, and technical administrators of IT environments who want an in-depth understanding of the value of the Ready Architectures for VDI that deliver Microsoft Windows virtual desktops to users using Citrix Virtual Apps and Desktops VDI components on VxRail appliances or vSAN Ready Nodes.

We value your feedback

Dell EMC and the authors of this document welcome your feedback on the solution and the solution documentation. Contact the Dell EMC Solutions team by [email](#) or provide your comments by completing our [documentation survey](#).

Authors: Dell EMC Ready Architectures for VDI team, Donna Renfro

 **Note:** The following page on the Dell EMC Communities website provides links to additional documentation for VDI Ready Solutions: [VDI Info Hub for Ready Solutions](#).

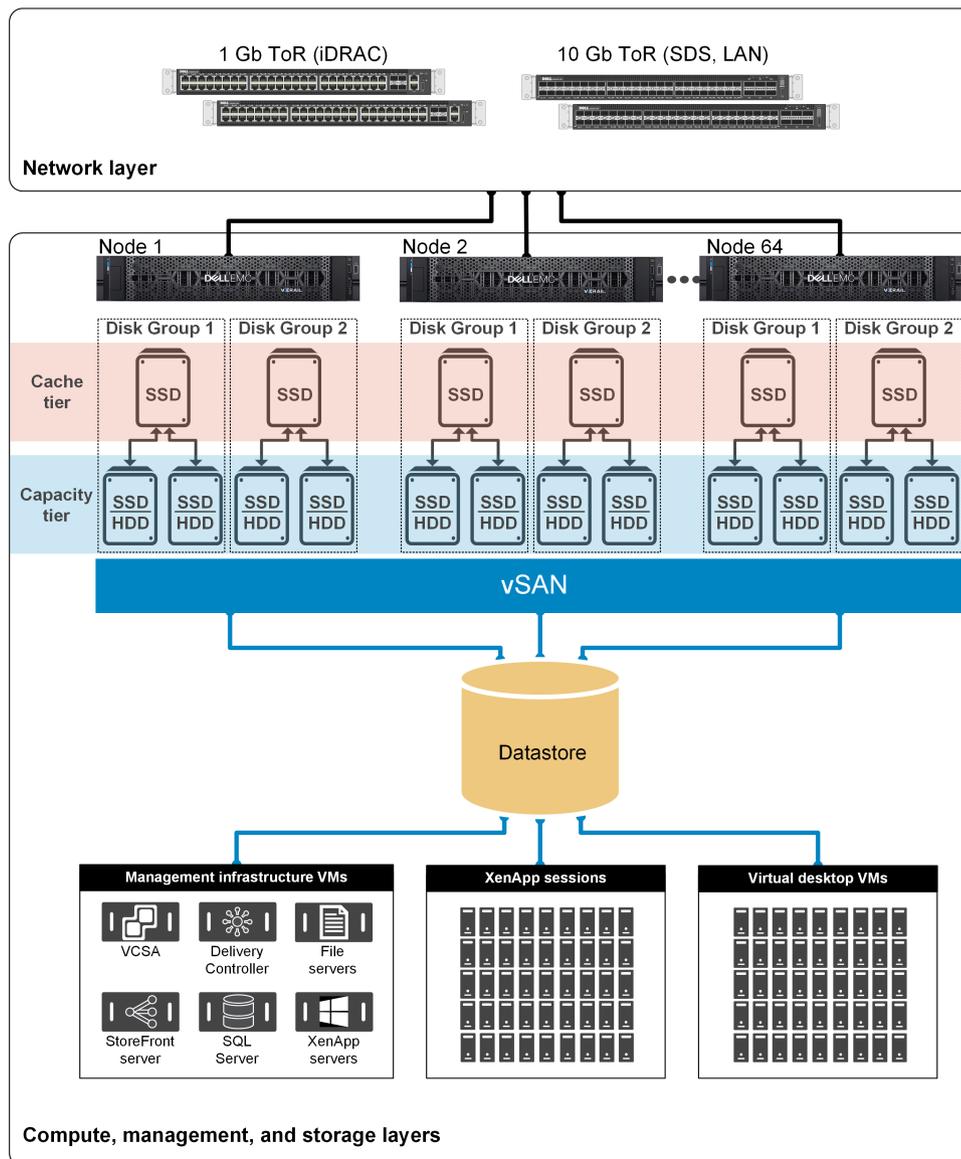
Solution architecture

This section provides an architecture overview and guidance on managing and scaling a Citrix Virtual Apps and Desktops environment on Dell EMC VxRail appliances.

Architecture overview

The following figure depicts the architecture of the validated solution, including the network, compute, management, and storage layers.

Figure 1 VxRail appliances or vSAN Ready Nodes with Citrix Virtual Apps and Desktops



The deployment option for this Dell EMC Ready System for VDI uses Citrix Machine Creation Services (MCS) with a random or non-persistent desktop—that is, virtual desktops are assigned randomly as users connect. When users log off, changes they made are discarded. The desktop is reset to its original state and is available for another user to log in and use.

Scaling the solution

vSAN-based appliances solutions provide flexibility as you scale, reducing the initial and future cost of ownership. Add additional physical and virtual servers to the server pools to scale horizontally. Add virtual resources to the infrastructure to scale vertically.

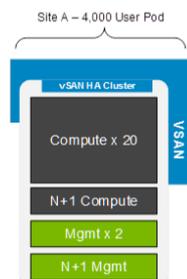
Scaling out

Each component of the solution architecture scales independently depending on the required number of supported users. You can add appliance nodes at any time to expand the vSAN SDS pool in a modular fashion. The scaling limit for vSAN is restricted by the limits of the hypervisor at 64 nodes per block.

The recommended limit of linked clones per cluster is 4,000.

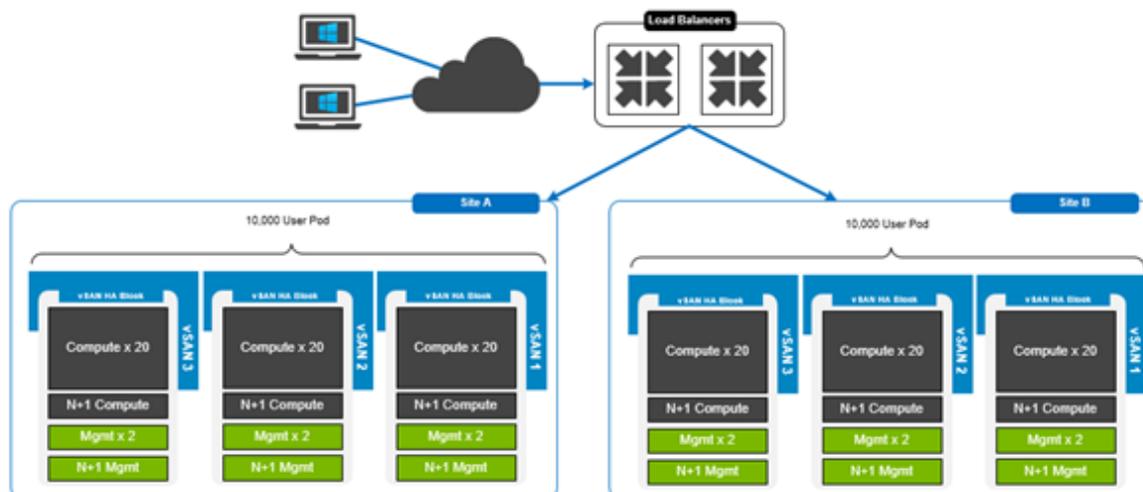
Each instance of VMware vCenter can service a maximum of 4,000 linked or full clone virtual machines. A Citrix "pod architecture" consists of a virtual desktop "site" and one or more "zones" at each site. The following figure shows a 4,000-user MCS linked clone/vSAN configuration, which equates to a single zone within a site.

Figure 2 Single 4,000-user pod



The following figure shows a scale-out of 20,000 MCS linked-clone VMs with vSAN. The recommended limit for a zone is 10,000 sessions. In this example, there are two sites with three zones each. The sites are load-balanced and presented to the users as a single entity.

Figure 3 Scaleout for 20,000 users



Scaling up

Dell EMC recommends a validated disk configuration for general purpose VDI. These configurations leave drive slots available for future vertical expansion and ensure that you protect your investment as new technology transforms your organization.

 **Note:** These configurations can accept additional or faster processors or memory than the guidance provided here.

[Citrix VDI Handbook and Best Practices](#) provides more information about Citrix best practices for scaling.

Enterprise solution pods

The compute, management, and storage layers are converged into a single VxRail Appliance or vSAN Ready Nodes block, hosting VMware vSphere. The number of nodes that are supported for vSphere 6.5 or 6.7, which is 64, determines the recommended boundaries of an individual vSphere cluster.

Dell EMC recommends that the VDI management infrastructure nodes be separated from the compute resources. Because our test environment was small, both management and compute are in the same vSphere HA cluster. Optionally, the management node can also be used for VDI VMs with an expected reduction of 30 percent of host resources for these nodes only. The 30 percent accounts for management VM resource reservations and should be factored in when sizing.

Compute hosts can be used interchangeably for Citrix Virtual Apps hosted applications and desktops, as required.

Key components

This section describes the key hardware and software components of the solution.

VxRail Appliance

The Dell EMC VxRail is a powerful Hyper-converged Infrastructure Appliance (HCIA) that is available in 1U or 2U rack building blocks. It is built on VMware vSAN technology and further enabled with Dell EMC software.

The following figure shows the components of the VxRail appliance.

Figure 4 Dell EMC VxRail appliance



VxRail appliance platforms are equipped with Intel Xeon Scalable Processors. You can deploy a cluster with as few as three nodes, providing an ideal environment for small deployments. To achieve full vSAN high availability (HA), the recommended starting block is four nodes. The VxRail Appliance can support storage-heavy workloads with storage-dense nodes, graphics-heavy VDI workloads with GPU hardware, and entry-level nodes for remote and branch office environments.

The VxRail appliance enables you to start small and scale as your requirements increase. Single-node scaling and low-cost entry point options give you the freedom to buy just the right amount of storage and compute resources to start, and then add capacity to support growth. A single-node VxRail V Series appliance can be configured with 16 to 56 CPU cores per node and support a maximum of 40 TB raw storage with a hybrid configuration of 76 TB with the all-flash option. A 64-node all-flash cluster delivers a maximum of 3,584 cores and 4,864 TB of raw storage. The following table shows the available platforms.

Table 1 Available Dell EMC VxRail platforms

Platform	Description	Configurations	Form Factor
E Series	Entry level	All-flash and hybrid	1U1N
V Series	VDI optimized	All-flash and hybrid	2U1N
P Series	Performance optimized	All-flash and hybrid	2U1N
S Series	Storage dense	Hybrid	2U1N

VxRail Manager

VxRail Manager, which is available on VxRail appliances only, is the primary deployment and element manager interface of the appliance. VxRail Manager simplifies the entire lifecycle from

deployment through management, scaling, and maintenance. It also enables single-click upgrades and dashboard monitoring for health, events, and physical views.

vSAN Ready Nodes

vSAN Ready Nodes are pre-validated Dell EMC Server configurations that reduce the complexity of deploying vSAN technology. vSAN Ready Nodes configurations are listed in the [vSAN Ready Node compatibility guide](#) on the VMware website. vSAN Ready Nodes provide more customized hardware and platforms to meet your data center needs.

Because vSAN Ready Nodes do not offer lifecycle management and additional bundled software, Dell EMC recommends customized deployment services and at least three years of ProSupport Plus. Add Citrix Virtual Apps and Desktops to license your Dell EMC vSAN Ready Nodes for a full VDI deployment.

Dell EMC Ready Architectures VDI-optimized configurations

For graphics-intensive desktop deployments, we recommend the VDI-optimized 2U/1 Node appliances that support GPU hardware.

The VxRail V Series and vSAN Ready Nodes R740XD can be configured with or without GPUs. Dell EMC also offers similar configurations in a 1U/1 Node appliance, although graphics configurations are not available on these platforms.

We have designated common configurations as *A3*, *B5*, and *C7*. These designations are referenced throughout the documentation.

Configuration	CPU	RAM	Disk	GPU (optional)	Description
A3	2x 10-core	192 GB (12x 16 GB @ 2400 MHz)	4 TB + (Capacity)	Up to 3x full length, dual width (FLDW) Up to 6x full length single width (FLSW) ^a	For small-scale, POC, or low-density, cost-conscious environments
B5	2x 14-core	384 GB (12x 32 GB @ 2400 MHz)	6 TB + (Capacity)	Up to 3x FLDW Up to 6x full length single width (FLSW) ^a	Geared toward larger-scale general-purpose workloads; balances performance and cost-effectiveness
C7	2x 20-core	768 GB (24x 32 GB @ 2667 MHz)	8 TB + (Capacity)	Up to 3x FLDW Up to 6x full length single width (FLSW) ^a	Offers an abundance of high-performance features and tiered capacity that maximizes user density

- a. Only available with vSAN Ready Nodes based on the R740xd platform. NVIDIA Pascal P4 is the only FLSW card available at this time.

vSAN software-defined storage

vSAN is available in hybrid or all-flash configurations.

After vSAN is enabled on a cluster, all disk devices presented to the hosts are pooled together to create a shared data store that is accessible by all hosts in the VMware vSAN cluster. VMs can then be created with storage policies assigned to them. The storage policy dictates availability, performance, and sizing.

vSAN provides the following configuration options:

- **Hybrid configuration**—Uses flash-based devices for the cache tier and magnetic disks for the capacity tier. Hybrid configurations are ideal for clients looking for higher volume in the capacity tier. The performance of SSD and magnetic spinning disks is comparable in VDI applications.
- **All-flash configuration**—Uses flash for both the cache tier and capacity tier to deliver enterprise performance and a resilient storage platform. In this configuration, the cache tier is fully dedicated to writes, allowing all reads to come directly from the capacity tier. This model allows the cache device to protect the endurance of the capacity tier. All-flash configured solutions enable data deduplication features to extend the capacity tier.

NVIDIA GPU

NVIDIA GPU accelerators provide high performance for demanding enterprise data center workloads.

In applications ranging from energy exploration to deep learning, scientists can now process petabytes of data up to ten times faster than with CPUs. NVIDIA accelerators deliver the horsepower that is required to run large simulations faster than ever before. For enterprises deploying VDI, NVIDIA accelerators are perfect for accelerating virtual desktops. GPUs can be used in the V570 or V570F appliance configurations or on vSAN Ready Nodes that are built on the PowerEdge R740xd chassis.

Physical network components

Ready Architectures for VDI for appliances allow for flexibility in networking selections. VDI validations have been successfully performed with the following hardware, although several other choices are available.

- **Dell EMC Networking S3048 (1 GbE ToR switch)**—The S3048 switch accelerates applications in high-performance environments with a low-latency top-of-rack (ToR) switch that features 48 x 1 GbE and 4 x 10 GbE ports, a dense 1U design, and up to 260 Gbps performance. The S3048-ON also supports Open Network Installation Environment (ONIE) for zero-touch installation of alternate network operating systems.
- **Dell EMC Networking S4048 (10 GbE ToR switch)**—The S4048 switch optimizes your network for virtualization with a high-density, ultra-low-latency ToR switch that features 48 x 10 GbE SFP+ and 6 x 40 GbE ports (or 72 x 10 GbE ports in breakout mode) and up to 720 Gbps performance. The S4048-ON also supports ONIE for zero-touch installation of alternate network operating systems.

[Dell EMC Networking S-Series 10GbE switches](#) on the Dell EMC website provides more information about these switches.

Note: Ensure that you comply with the switch requirements in the [VxRail Networking Guide](#), which provides important information, recommendations, and best practices for VxRail. Consider the same recommendations for vSAN Ready Nodes.

Networking

Designed for true linear scaling, VxRail appliances use a leaf-spine network architecture, which consists of two network tiers: an L2 Leaf and an L3 Spine that is based on 40 GbE and non-blocking switches. This architecture maintains consistent performance without any throughput reduction.

VMware vSphere

VMware vSphere provides a powerful, flexible, and secure foundation for business agility that accelerates the digital transformation to cloud computing and promotes success in the digital economy.

vSphere provides the following benefits for VDI applications:

- **Improved Appliance Management**—The vCenter Server Appliance Management interface provides CPU and memory statistics, network and database statistics, disk space usage, and health data. These features reduce reliance on a command-line interface for simple monitoring and operational tasks.
- **VMware vCenter Server native high availability**—This solution for vCenter Server Appliance consists of active, passive, and witness nodes that are cloned from the existing vCenter Server instance. The vCenter HA cluster can be enabled, disabled, or destroyed at any time. Maintenance mode prevents planned maintenance from causing an unwanted failover. The vCenter Server database uses Native PostgreSQL synchronous replication, while key data outside the database uses a separate asynchronous file system replication.
- **Backup and Restore**—Native backup and restore for the vCenter Server Appliance enables users to back up vCenter Server and Platform Services Controller appliances directly from the VAMI or API. The backup consists of a set of files that is streamed to a selected storage device using SCP, HTTP(S), or FTP(S) protocols. This backup fully supports VCSA instances with both embedded and external Platform Services Controller instances.
- **VMware vSphere HA Support for NVIDIA GRID vGPU-configured VMs**—vSphere HA protects VMs with the NVIDIA GRID vGPU shared pass-through device. In the event of a failure, vSphere HA tries to restart the VMs on another host that has an identical NVIDIA GRID vGPU profile. If no available healthy host meets this criterion, the VM fails to power on.
- **VMware vSAN Enterprise Edition**—Includes all-flash space-efficiency features (deduplication, compression, and erasure coding), software-defined, data-at-rest encryption, and stretched clusters for cost-efficient performance and greater hardware choice.
- **VMware Log Insight**—Provides log management, actionable dashboards, and refined analytics, which enable deep operational visibility and faster troubleshooting.

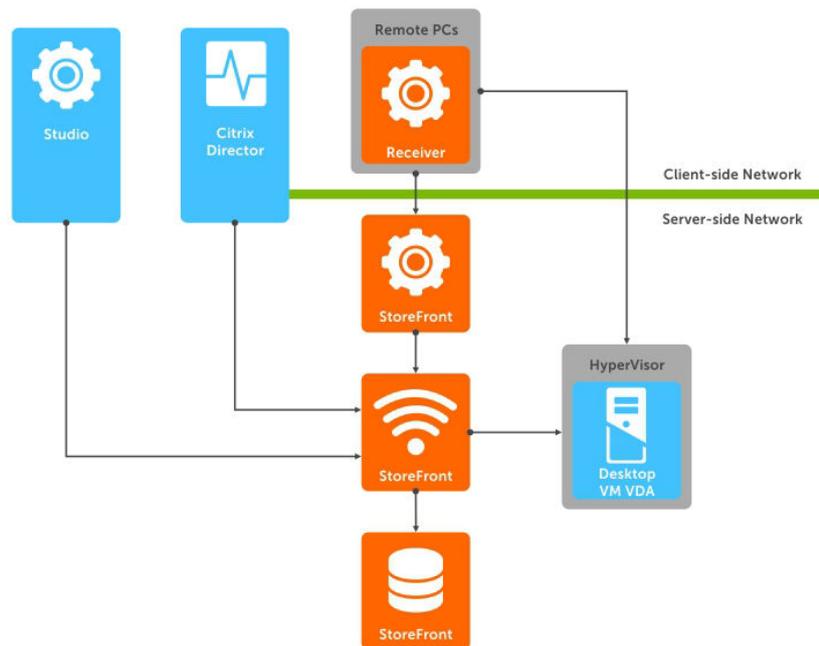
 **Note:** vSphere Enterprise Edition (or vSphere Desktop) is required to support NVIDIA graphics cards.

Citrix Virtual Apps and Desktops

The architecture that this guide describes is based on Citrix Virtual Apps and Desktops, which provides a complete end-to-end solution delivering Microsoft Windows virtual desktops to users on a wide variety of endpoint devices. Virtual desktops are dynamically assembled on demand, providing users with pristine, yet personalized, desktops each time they log in.

Citrix Virtual Apps and Desktops provides a complete virtual desktop delivery system by integrating several distributed components with advanced configuration tools that simplify the creation and real-time management of the virtual desktop infrastructure.

Figure 5 Citrix Virtual Apps and Desktops architecture



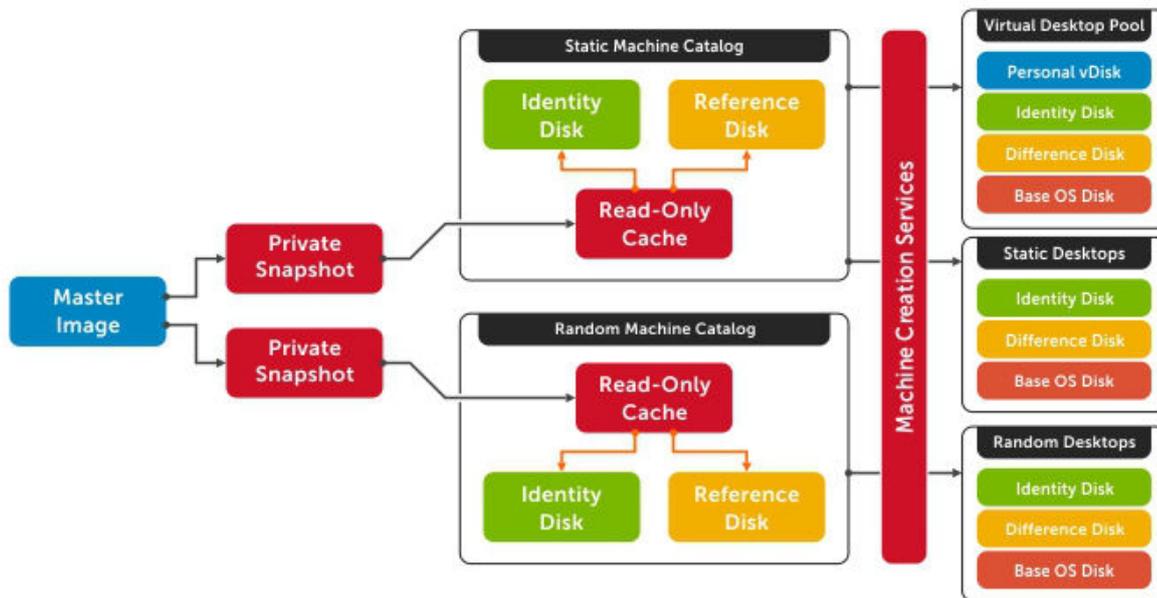
The core Citrix Virtual Apps and Desktops components include:

- **Studio**—Studio is the management console that enables you to configure and manage your deployment, eliminating the need for separate management consoles for managing delivery of applications and desktops. Studio provides various wizards to guide you through the process of setting up your environment, creating your workloads to host applications and desktops, and assigning applications and desktops to users.
- **Delivery Controller (DC)**—Installed on servers in the data center, the controller authenticates users, manages the assembly of users' virtual desktop environments, and brokers connections between users and their virtual desktops. DC also manages the state of desktops, starting and stopping them based on demand and administrative configuration.
- **Database**—At least one Microsoft SQL Server database is required for every virtual application or desktop Site to store configuration and session information. DC must have a persistent connection to the database as it stores data that is collected and managed by the Controller services.
- **Director**—Director is a web-based tool that enables IT support teams to monitor an environment, troubleshoot issues before they become system-critical, and perform support tasks for end users. You can also view and interact with a user's sessions using Microsoft Remote Assistance. Starting in version 7.12, Director now includes detailed descriptions for connection and computer failures, one-month historical data (Enterprise edition), custom reporting, and notifications via SNMP traps.
- **Receiver**—Installed on user devices, Citrix Receiver provides users with quick, secure, self-service access to documents, applications, and desktops from any of the user's devices including smart phones, tablets, and PCs. Receiver provides on-demand access to Windows, web, and Software as a Service (SaaS) applications. For devices that cannot install the Receiver software, Citrix Receiver for HTML5 provides connectivity through a HTML5-compatible web browser.
- **StoreFront**—StoreFront authenticates users to sites hosting resources and manages stores of desktops and applications that users access. StoreFront version 3.8 (released with

XenDesktop 7.12) and above includes the ability to create and use multiple IIS websites each having its own domain name.

- **License Server**—The Citrix License Server is an essential component of any Citrix-based solution. Every Citrix product environment must have at least one shared or dedicated license server. License servers are computers that are either partly or completely dedicated to storing and managing licenses. Citrix products request licenses from a license server when users try to connect.
- **Machine Creation Services (MCS)**—A collection of services that work together to create virtual servers and desktops on demand from a master image, optimizing storage utilization, and providing a pristine virtual machine to users every time they log in. Machine Creation Services is fully integrated and administered in Citrix Studio.

Figure 6 Machine Creation Services architecture



- **Virtual Delivery Agent (VDA)**—A transparent plugin that is installed on every virtual desktop or application host (RDSH). VDA enables the direct connection between the virtual desktop and users' endpoint devices. Windows and Linux VDAs are available.

Client components

End users can use a variety of client components to access the virtual desktops.

The following table lists the client components that Dell EMC recommends.

Table 2 Recommended clients

Component	Description	Recommended use	More information
Dell Wyse 3040 thin client	Dell's lightest, smallest, and most power-efficient thin client	Task and basic productivity	http://www.dell.com/us/business/p/wyse-3040-thin-client/pd
Dell Wyse 5070 thin client	A single thin client platform that meets every need, the Dell Wyse 5070 has multiple OS and connectivity options and can be	Knowledge workers who need powerful virtual desktop performance and support for unified	https://thinclientbenefits.com/products/wyse-5070

Table 2 Recommended clients (continued)

Component	Description	Recommended use	More information
	monitored, maintained, and serviced remotely.	communications solutions like Skype for Business	
Dell Wyse 5070 Extended thin client	Offers an on-board graphics card for offloading and supporting up to four 4K monitors plus two 2K monitors (total of 6)	Knowledge workers who need powerful virtual desktop performance and support for several monitors	https://thinclientbenefits.com/products/wyse-5070

Design sizing and guidelines

This section provides recommendations and guidelines for designing your VDI environment.

Platform configurations

With several options to choose from, consider these basic differences.

- Select the base B5 configuration when designing smaller deployments to meet minimum node requirements. B5 configurations scale well and can also effectively serve the maximum number of VMs for a block.
- C7 configurations are denser configurations that are intended for a higher scale and to reduce the number of nodes to maintain.

 **Note:** In the event of a node outage, the C7 configuration impacts more users.

CPU

User density and graphics considerations:

- Dell EMC Ready Architectures for VDI validation test results suggest that you can use CPU oversubscription to effectively size VDI user density. To use a CPU configuration other than those that have been validated, consider the following guidance to achieve comparable results:
 - **Task workers**—4.25 users per core. For example, 68 task users with dual eight-core processors.
 - **Knowledge workers**—3.75 users per core. For example, 60 knowledge users with dual eight-core processors.
 - **Power workers**—2.75 users per core. For example, 44 power users with dual eight-core processors.
- For graphics configurations consider the following:
 - For high-end graphics configurations with NVIDIA Quadro Virtual Data Center Workstation graphics enabled, consider choosing higher clock speeds over higher core counts. Many applications that benefit from high-end graphics are engineered with single-threaded CPU components. Higher clock speeds benefit users more in these workloads.
 - For NVIDIA Virtual PC configurations, consider higher core counts over faster clock speeds to reduce oversubscription.
 - Most graphics configurations do not experience high CPU oversubscription, because vGPU resources are likely to be the resource constraint in the appliance.

Memory

Best practices for memory allocation and configuration:

- Do not overcommit memory when sizing, because memory is often not the constraining resource. Overcommitting memory increases the possibility of performance degradation if contention for memory resources occurs (for example, swapping and ballooning of memory). Overcommitted memory can also impact storage performance when swap-files are created.
- Memory must be populated in units of six per CPU to yield highest performance. Dell EMC 14th generation servers using Intel Skylake Processors have six memory channels per CPU, which are controlled by two internal memory controllers, each handling three memory channels. To ensure that your environment has the optimal memory configuration, use a balanced

configuration, where each CPU supports a maximum of 12 DIMMs (or 24 DIMMs for a dual-CPU server). The most effective configuration is 12 DIMMs (6 DIMMs per CPU) or 24 DIMMs (12 DIMMs per CPU).

GPU

Consider these options when choosing GPU cards:

- Dell EMC strongly recommends NVIDIA M10 graphics options only for Virtual PC workloads. Quadro Virtual Data Center Workstation licenses do support the M10 card, but the card performance is less aligned with the features available in that license.
- For graphically intense workloads like CAD, instead of a single P40 card, it might be more effective to use several P4 cards, which provide more dedicated GPU resources per VM.
 **Note:** P4 cards are not available in VxRail configurations.
- For workloads performing large computations or running mixed workloads, a P40 card would better meet the needs of the system.

External vCenter considerations

The VxRail Manager can upgrade appliances that are contained inside the cluster. Using an external vCenter instance disables the upgrade features available with the VxRail one-click upgrade process, and each appliance requires a separate upgrade.

Sizing considerations

This section provides various general best practices for sizing your deployment.

- **User density**—If concurrency is a concern, be sure to calculate how many users will be using the environment at the peak of utilization. For example, if only 80 percent are using the environment at any time, the environment must support only that number of users (plus a failure capacity).
- **Disaster recovery**—When planning for DR, Dell EMC recommends implementing a dual/multi-site solution. The goal is to keep the customer's environment online and, in case of an outage, to perform an environment recovery with minimum disruption to the business.
- **Management and compute clusters**—For our small test environment, we used a combined management and compute cluster. For environments deployed at a larger scale, we recommend that you separate the management and compute layers. When creating a management cluster for a large scale deployment, consider using the E-Series VxRail or the R640 platform to reduce the data center footprint. With a more easily configured platform, the V-Series VxRail or R740XD platforms are preferred for compute clusters.
- **Network isolation**—This design illustrates a two-NIC configuration per appliance with all the traffic separated logically via VLAN. When designing for larger-scale deployments, consider physically separating the management and VDI traffic from the vSAN traffic for traffic isolation and to improve network performance and scalability.

User density recommendations

Test results provided recommended user densities.

The user densities in the following table were achieved by following the VMware best practices of FTT = 1 and a reserved slack space of 30 percent. All configurations were tested with Microsoft Windows 10 and Microsoft Office 2016.

Table 3 User density recommendations for VMware vSphere ESXi 6.5 or 6.7 with Citrix Virtual Apps and Desktops

Server configuration	Workload	User density
B5	Knowledge worker	105
B5	Power worker	80

Design assessment

Before deployment, be sure to perform an assessment of your environment to validate design considerations and ensure that you are designing your architecture to meet or exceed the performance of your current environment. Dell EMC Professional Services offers an assessment service for all VDI needs.

Design enhancements

File workload guidance

The increased growth in the amount of data that is stored in file shares and user home directories across corporate IT environments in recent years has resulted in an increased focus on the need to better manage this unstructured data. As a result, many organizations are choosing to deploy dedicated file workload solutions with capabilities such as cloud file tiering and single file system namespaces across their IT infrastructure, including for file workloads in a VDI environment.

Dell EMC provides a number of file workload solutions for different types of file workloads.

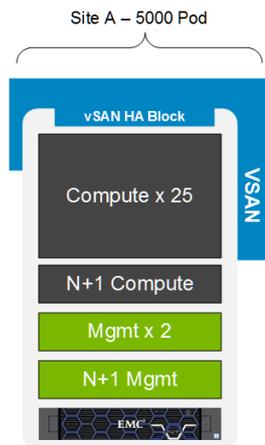
Dell EMC Unity

Dell EMC Unity storage is simple, unified all-flash and hybrid storage with hybrid cloud capabilities.

Unity is ideal for general purpose NAS/SAN mixed workload consolidation, smaller file workloads (including small to mid-sized VDI environments), and transactional databases.

The following figure shows an example of a 5,000-user VDI deployment using Unity storage for file shares.

Figure 7 5,000-user pod on Unity



When deploying Dell EMC Unity in a VDI environment, Dell EMC recommends that you deploy a separate Dell EMC Unity storage system with a vSphere HA cluster or Block. This structure provides the greatest scalability, resiliency, and flexibility when deploying and maintaining file services for the overall user pod. As unstructured data storage needs grow over time, the capacity of each Dell EMC Unity storage system can be scaled up independently with minimal user impact. You have the choice to deploy alternative architectures to the one suggested here, but you should carefully consider the tradeoffs.

The [Dell EMC Unity All-Flash Unified Storage](#) web page provides guidance about selecting an appropriate Dell EMC Unity storage solution for your file workload requirements.

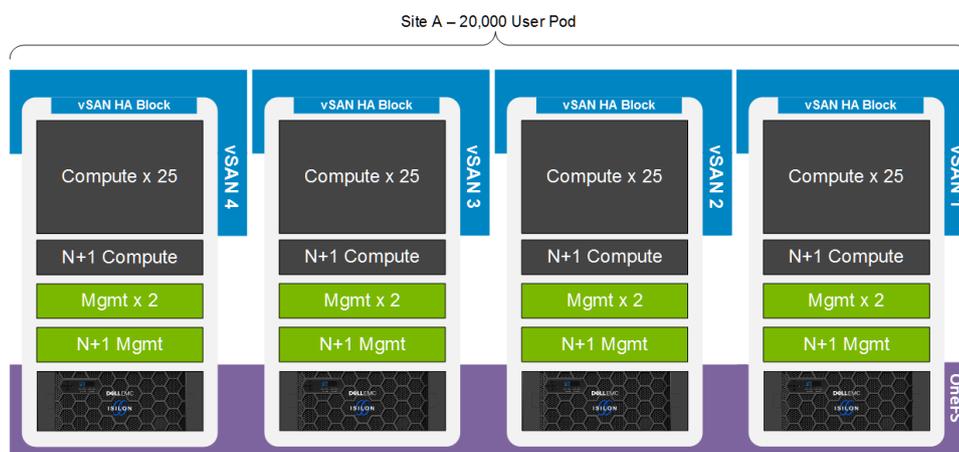
Dell EMC Isilon file storage

Dell EMC Isilon storage is the industry's number one scale-out NAS solution for any file workload.

Isilon is ideal for a wide range of file workloads (including large-scale enterprise VDI environments requiring a single file system namespace), high performance computing (HPC), archiving, and infrastructure consolidation.

The following figure shows an example of a 20,000-user VDI deployment using Dell EMC Isilon scale-out storage with a single namespace.

Figure 8 20,000-user pod on Isilon



When deploying Dell EMC Isilon in a VDI environment, Dell EMC recommends that you deploy a separate Dell EMC Isilon storage system with a vSphere HA cluster or Block. This structure provides the greatest scalability, resiliency, and flexibility when deploying and maintaining file services for the overall user pod. As unstructured data-storage needs grow over time, the capacity of each Dell EMC Isilon storage system can be scaled up independently with minimal user impact. In addition to scaling up each Isilon chassis, Isilon can also be scaled out using the OneFS operating system. This ability means that additional Isilon systems can be added to provide a single volume and namespace that all user pods in a datacenter can access.

As shown in the previous figure, Isilon OneFS can be scaled out in unison with vSAN HA blocks as the VDI environment grows. You can choose to deploy alternative architectures to the one suggested here, but you should carefully consider the tradeoffs.

The [Dell EMC Isilon](#) web page provides guidance about selecting an appropriate Dell EMC Isilon storage solution for your file workload requirements.

Conclusion

Summary

This design guide has described the integration of vSAN-based appliances from Dell EMC and Citrix Virtual Apps and Desktops brokering software to create virtual application and desktop environments. This architecture provides exceptional scalability and an excellent user experience and empowers IT teams to play a proactive strategic role in the organization.

Dell EMC offers comprehensive, flexible, and efficient VDI solutions that are designed and optimized for the organization's needs. These VDI solutions are easy to plan, deploy, and run.

Dell EMC Ready Architectures for VDI offer several key benefits to clients:

- Predictable costs, performance, and scalability to support a growing workforce
- Rapid deployments
- Rapid scaling, ready to serve enterprises of any size
- Dell EMC support

All the Dell EMC Ready architectures for VDI are configured to produce similar results. You can be sure that whichever vSAN-based appliances you choose has been designed and optimized for your organization's needs.

Next steps

Dell EMC has a configuration to fit the needs of any size organization:

- VxRail E560 or E560F(E Series)—Select this device if graphics are not required or for small deployments where energy concerns exist or space is limited.
- VxRail V570 or V570F (V Series)—This configuration is VDI-optimized and offers the highest processor speeds and graphics capability.
- vSAN Ready Nodes R640—This device is a powerful pre-validated configuration in a dense rack platform. Occupying only 1U in the rack, this powerful server supports A3, B5, or C7 non-graphics configurations for VDI.

To explore more about this solution, its design, and testing, see the Validation Guide for this architecture. Your Dell EMC solutions representative can assist with further information and resources.

The [Virtual Desktop Infrastructure](#) page on the Dell EMC website provides additional resources and other VDI designs to help make IT groups a strategic asset.

References

The documentation in this section provides additional information.

Dell EMC documentation

The following Dell EMC documentation provides additional and relevant information. Access to these documents depends on your login credentials. If you do not have access to a document, contact your Dell EMC representative. Also see the [VDI Info Hub for Ready Solutions](#) for a complete list of VDI resources.

- [Dell EMC VxRail Appliance documentation](#)
- [Dell EMC Virtual Desktop Infrastructure](#)

This document is part of the documentation set for this architecture, which includes the following:

- [Dell EMC Ready Architectures for VDI: Designs for Citrix Virtual Apps and Desktops on VxRail and vSAN Ready Nodes Design Guide](#)
- [Dell EMC Ready Architectures for VDI: Designs for Citrix Virtual Apps and Desktops on VxRail and vSAN Ready Nodes Validation Guide](#)
- [Dell EMC Ready Architectures for VDI: Designs for Citrix XenDesktop and XenApp on VxRail and vSAN Ready Nodes Deployment Guide](#)

VMware documentation

The following VMware documentation provides additional and relevant information:

- [VMware vSphere documentation](#)
- [vSAN Ready Node Configurator](#)
- [VMware Compatibility Guide](#)
- [vSAN Hardware Quick Reference Guide](#)

NVIDIA documentation

The following NVIDIA documentation provides additional and relevant information:

- [NVIDIA Virtual GPU Software Quick Start Guide](#)

