Dell EMC

Ready Stack – Architecture Guide

Design considerations for certified reference systems built from Dell EMC components

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May 2018

Document feedback can be sent to: docfeedback@vce.com

DELL EMC

Revision History

Date	Document Revision	Description of changes
May 2018	1.0	Initial version

Contents

Introduction

Technology is changing at a phenomenal rate. Capability is increasing by an order of magnitude (10x) every five years – that is 1000x in just 15 years. This is leading to incredible changes in our daily lives, and it is changing the expectations of those that use technology. The world is transforming and technology is being applied to every aspect of our daily lives to improve the human experience.

What does this mean for Information Technology (IT)? As more and more business processes are becoming automated and software takes over previously manual operations, the role of applications and software in business is becoming more widespread and far-reaching.

This means that application ecosystems are becoming more complex and intertwined with business operations. So IT is becoming more relevant to the business than ever.

However, this is a huge shift for many IT organizations, who are accustomed to a back office support function.

IT organizations need to re-examine how they undertake every facet of what they do, how they do it, and how they prioritize their business objectives. In particular, IT organizations need to transform to deliver greater efficiency, predictability, and business agility.

And most IT organizations agree. According to research by Enterprise Strategy Group (ESG) for Dell EMC, 71 percent agree that if they do not embrace IT transformation, their firm will no longer be competitive in the market (Source: Dell EMC 2017 IT Transformation Maturity Study).

The Modern Data Center

Converged Infrastructures (CI) bring together the disparate infrastructure elements that power IT: servers, data storage devices, networking functions, virtualization, and management software.

There are multiple technology pillars that underpin the modern data center (flash, scale-out architectures, software-defined Infrastructure, and cloud enabled systems, all wrapped in protection and trust). Converged infrastructure helps make the adoption of these new technologies faster, simpler, more agile, more efficient, less risky and less costly – which speeds overall IT transformation efforts.

Not all customer objectives are the same, so Dell EMC offers a continuum of Converged Infrastructure options. Customer preferences range from Do-It-Yourself (DIY) approaches, perfect for small and medium-sized systems, to fully engineered, factory-built, and enterprise-class architectures for global organizations with global data centers. Having a breadth of offerings is the key reason why Dell EMC continues to hold number one leadership position in the market, with a market share nearly double that of the next highest competitor.

Deployments Choices – Which is the right one?

Fundamentally there are three ways to deploy a modern data center architecture:

1. Fully engineered and factory assembled as a complete integrated infrastructure.
2. DIY with a mix of multivendor components, assembled in-house or channel partner resources

3. DIY with single vendor components, assembled in-house or through channel partner resources

The correct deployment methodology will depend on a customers identified business outcomes, and a number of other variables that any consultative channel partner will identify and work through when developing solutions. When the preferred acquisition model is option three, Ready Stack is the preferred Dell EMC offer. The remainder of this document focuses on the architecture and component options available to customers choosing to deploy a Ready Stack solution.

Ready Stack - Defined

Dell EMC Ready Stack is a new program exclusively for Dell EMC channel partners. It makes it easier than ever to build complete certified reference systems leveraging Dell EMC best-of-breed hardware and software technologies.

Ready Stack certified reference systems can be built from any combination of Dell EMC servers and Dell EMC storage, with Dell EMC as the preferred networking option.

Ready Stack is built from the industry's number one servers, number one storage arrays, and cost efficient disaggregated networking based on open standards.

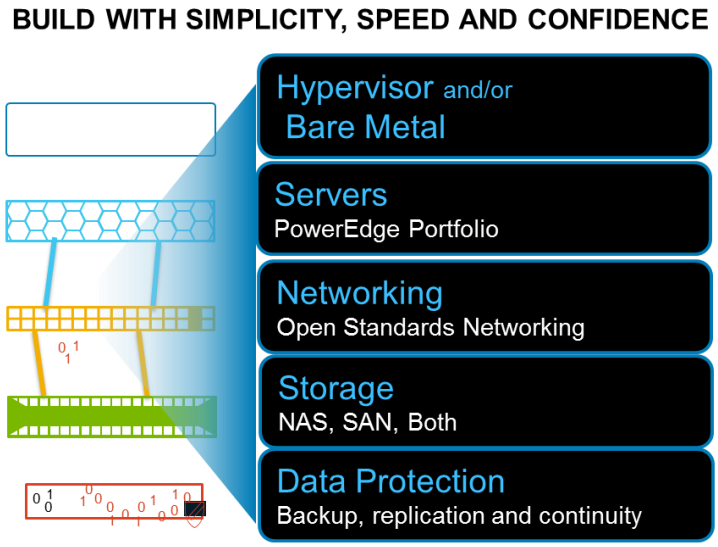
Ready Stack can be protected by the industry's number one data protection.

Ready Stack is compatible with industry-leading hypervisors and operating systems from VMware, Red Hat and Microsoft and can be managed by the Dell EMC portfolio of management products.

In addition to this architecture guide, Dell EMC will be rolling out validated architecture designs which include deeper technical details for specific hardware choices. The additional details are covered in two documents.

Design Guide: Technical whitepaper that describes best practices, standards and design principles of the Ready Stack architecture.

Deployment Guide: Step-by-step guidance on deploying VMware vSphere on a complete Dell EMC converged stack including system management tools and plugins.



Ready Stack certified reference systems:

- Built on Dell EMC best-of-breed products that are designed for virtualization across the entire ecosystem.

- Tested and validated, yet flexible enough to be tailored for any organization, removing risk, and accelerating time to value.

- Optimized and protected with investments Dell has made in software that makes our solutions easier to manage and deliver ongoing results.

- Delivered by Dell EMC trusted partners, who understand our joint customers' business needs and how to deliver comprehensive and low-risk solutions.

Benefits of a Certified Reference System

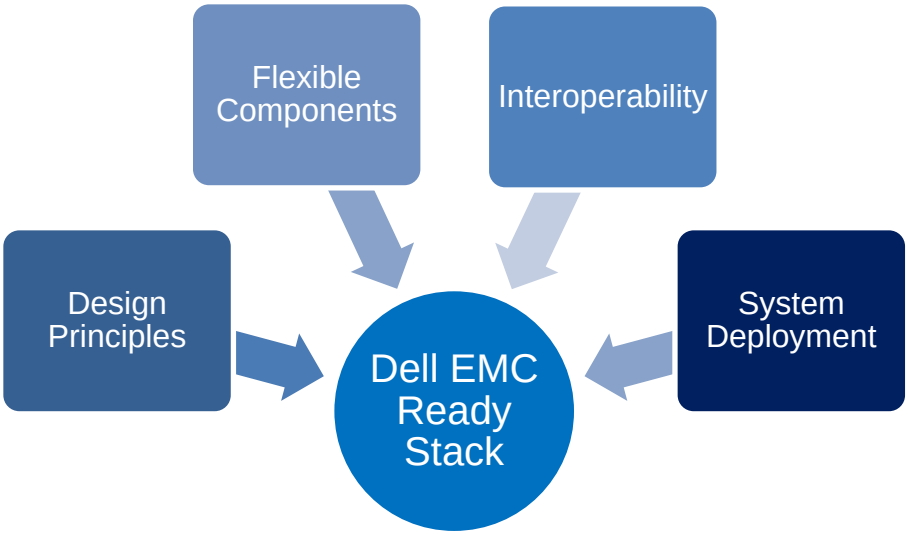
A Ready Stack solution removes a significant amount of both complexity and risk from the DIY approach by providing guidance on many aspects of a Modern Datacenter:

- Component interoperability and connectivity requirements
- Design redundancy throughout the entire system, to prevent Single-Points-of-Failure
- How to scale-up and scale-out as resource demands increase
- How to perform non-disruptive sustaining/upgrades
- Modern operational management considerations
- High performance networking and throughput optimization (SAN/LAN)
- Planning for degraded state performance in the event of any failure

Benefits of an "all Dell EMC" Solution

The Dell EMC strength is its broad *and complete* product portfolio that can be tailored to meet customer's requirements regardless of their size, scale, or business model.

The breadth of the Dell EMC family of products afford the freedom to focus on the "right size" elements of the complete system including compute, network and storage. There is a demonstrable value to building a better converged stack, having a better support experience from a single vendor for all hardware and software, and knowing that scalability considerations were considered in the architecture from the beginning.



Optimum simplicity

The Ready Stack solution leverages the industry's leading components to accommodate a wide variety of flexible system designs to address customer requirements:

- Dell EMC storage arrays
- Dell EMC PowerEdge servers
- Dell EMC networking
- VMware virtualization
- Dell EMC data protection options
- Sizing Guidance
- Deployment guidance

Ready Stack Target Customers

Current or possible "Build-Their-Own" customers who do the following:

- Considering a Dell EMC Unity, VMAX, XtremIO or Isilon refresh.
- Considering a storage or compute refresh, from any vendor.
- Want to simplify their IT operations and reduce costs and support risks by using fewer vendors.
- Have concerns about building a full infrastructure solution themselves (time, effort, complexity) and maintaining best-practice configurations.
- Need to move quickly to deploy new applications or pursue new business initiatives.

- Require a complete range of data protection options (backup, replication, business continuity) to protect data with various levels of business value/criticality.
- Have experienced “multi-vendor finger-pointing” or business-impacting delays as part of their support experience.
- Need a repeatable platform for general purpose virtualization.

Consider that in any scenario, where a proposed solution includes more than one of the Dell EMC portfolio items (including any components that the customer may already have deployed previously) - Ready Stack will deliver a predictable solution with the fastest time to value, and the best possible customer experience.

Ready Stack Design Overview

Designing, configuring, and running a production-ready, Converged Infrastructure involves multiple considerations, including:

- The appropriate operating system and virtualization software distributions
- Monitoring and management software
- Allocation of cluster services and data storage to physical nodes and arrays
- Selection of appropriate server hardware
- Design of the network fabric
- Sizing and scalability
- Performance

The Dell EMC Ready Stack specifies all the hardware, software, resources and services needed to run a scalable, highly-available converged infrastructure environment. This end-to-end solution approach means that a solution can be operational in a shorter time than is typically possible with build-your-own solutions.

This document provides an o*verview* of the many design points and technology decision criteria when proposing a Ready Stack solution, including suggested Dell EMC portfolio items. Highly prescriptive designs and configuration information can be found in the *Ready Stack Design Guide* and the *Ready Stack Deployment Guide* supporting documents.

Reference Document	Content Description
http://en.community.dell.com/techcenter/ready_solutions/	Ready Stack Design and Deployment Guides

Design Principles

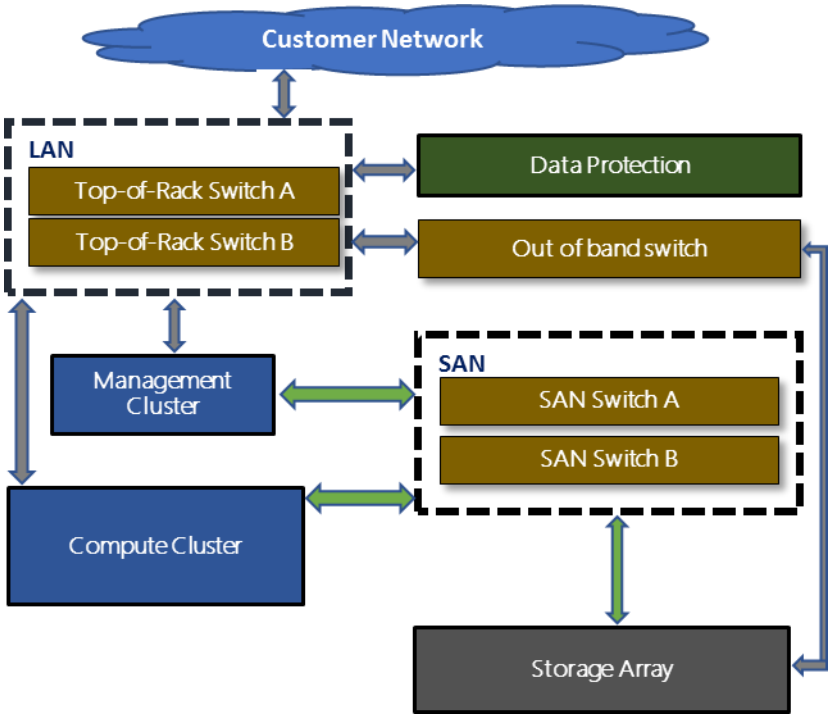
The following principles are central to the design and architecture of the Dell EMC Ready Stack:

- **No single point-of-failure**: Redundancy is incorporated in the critical aspects of the solution, including server high availability features, redundant networking, and multi-path storage.
- **Integrated Management**: Provide integrated management of the Ready Stack using OpenManage Integration for VMware vCenter and Virtual Storage Integrator, when VMware is the hypervisor deployed.
- **Hardware configuration for virtualization**: The Dell EMC Ready Stack is designed for general-purpose virtualized workloads. Each server is equipped with appropriate processor, memory, Fibre channel, and Ethernet network adapters as required for virtualization.
- **Best practices adherence**: Storage, networking and hypervisor best practices of the corresponding components are incorporated into the design to ensure availability, serviceability and optimal performance.
- **Flexible configurations**: The Dell EMC Ready Stack can be configured to suit customer needs for a virtualized infrastructure. The solution supports flexibility in form of various options, such as rack server model, number of compute servers, server

processor model, server memory capacity, type of storage array, and storage capacity based on customer needs.

Ready Stack Architecture Overview

The following figure provides a high-level overview of the architecture, including compute servers (showing flexible compute nodes), management servers, LAN switches, SAN switches, storage arrays and out-of-band switches that comprise the Dell EMC Ready Stack solution.



The following table aligns the core components and the product in the Dell EMC portfolio.

Core Component	Dell EMC Portfolio
Server Platforms	Dell EMC PowerEdge Rack Servers Dell EMC PowerEdge Modular
LAN Connectivity	Dell EMC Networking 25/40/50/100GbE Switches
SAN Connectivity	Dell EMC Connectrix16 Gbps Fiber Channel Switches
Out-of-band Connectivity (Management switch)	Dell EMC Networking 10/100/1000Mb Switch

Core Component	Dell EMC Portfolio
Storage Array Choices	Dell EMC Unity, SC Series, XtremIO, VMAX, Isilon
Management Server Platforms	Dell EMC PowerEdge R640, or Dell EMC PowerEdge R440
Management Software Components	VMware vCenter Server Appliance (VCSA) Dell EMC OpenManage Integration for VMware vCenter (OMIVV) Dell EMC Virtual Storage Integrator (VSI)
Data Protection	Avamar, Data Domain, RecoverPoint, VPLEX, and more. *See Data Protection section for details.*

Ready Stack Built on PowerEdge Servers

Dell EMC holds the number one position when it comes to servers. The portfolio includes the highly regarded PowerEdge Rack Servers and PowerEdge Blade servers

The Dell EMC PowerEdge servers are designed to optimize application performance and ensure a stable, worry-free environment with intuitive tools that simplify and automate throughout the entire server lifecycle. Every customer has unique requirements, and PowerEdge provides the flexibility needed to build the right scalable infrastructure that is tightly integrated with VMware vSphere.

Embedded in every PowerEdge server, iDRAC 9 provides secure and remote server access for a multitude of common management functions. The iDRAC with Lifecycle Controller operates regardless of operating system state or the presence of a hypervisor and offers a complete set of server management features including configuration, OS deployment, firmware updates, health monitoring and maintenance.

The following table provides links to related Dell EMC documents and an overview of the content.

Reference Document	Content Description
Brief: PowerEdge Server Solutions Brochure	Severs are the bedrock of the modern software-defined data center and the key to building a flexible, efficient and cloud enabled infrastructure. Dell EMC PowerEdge Servers deliver a worry-free infrastructure that is secure, and scalable with no compromises.
Brief: Is Your Data Secure Enough?	Every organization faces a daunting challenge: how to keep personal information, proprietary data and classified information safe
Brief: PowerEdge - Security in Server Design.	To protect, detect and recover from cyber-attacks, security is built into the PowerEdge server design, not bolted on after the fact.
Dell PowerEdge SATA SSD Performance Specifications	Dell EMC puts its enterprise hard drive (HDD) and solid state drive (SSD) offerings through a rigorous validation process before they are ever considered as additions to PowerEdge server portfolio.
iDrac9 Spec Sheet	Embedded in every PowerEdge server, iDRAC 9 provides secure and remote server access for a multitude of common management functions.

PowerEdge Server Options

The Dell EMC Ready Stack offers customers a selection of server platforms for their compute infrastructure. A single Ready Stack configuration can contain any combination of the servers with resource configurations appropriate for the customer workload and use case.

Rack or Blade Server Platform Selection

When it comes to building a converged stack, stand-alone tower servers are not typically considered an option because of capacity limitation and physical format. The choice is between Rack Server and Blade Enclosure. Both server types mount into standard data center racks, use floor space efficiently and can co-exist with other components within the same rack. Dell EMC offers both rack and blade servers providing flexibility to build the optimum converged stack.

Which server type is best for a particular situation depends on the system design criteria.

- Rack servers scale completely linearly. It is possible to add one server at a time, with a choice of 1, 2 or 4 CPU sockets per server.
- Rack servers can have a multiple disk drives (mechanical or solid state) onboard.
- Each Rack server fits in 1U - 4U of rack space.
- Each Rack server will have redundant power supplies (still runs if one supply fails)
- Blade Enclosures scale by adding blades (servers) until the blade enclosure is filled to capacity, then an additional Enclosure is added.
- A typical Blade Enclosure requires 10U of rack space.
- Blade enclosure will have n+1 power supplies (still runs if one supply fails).
- Blade servers provide greater processing power, take up less space and use less energy than rack servers.
- By selecting the right Dell EMC PowerEdge server, CPU socket-based licensing costs can be reduced, and greater VM density can be achieved.

Server Memory and Performance Considerations

Memory can be configured in various modes from within the BIOS. Optimizer Mode is the default mode and is recommended for most virtualization use cases to provide optimized memory performance. For improved reliability and resiliency, other modes such as mirror mode and spare mode are available.

Dell EMC PowerEdge servers support various BIOS configuration profiles that control the processor, memory, and other configuration options:

- Enable the Performance Optimized Virtualization profile
- Disable processor C-States and C1E to ensure the highest performance in a virtualized environment
- Enable Intel Hyper-threading and Virtualization features

Dell EMC PowerEdge rack servers help in building a modern infrastructure that minimizes IT challenges and drives business success. Choose from a complete portfolio of 1, 2 and 4 socket rack servers to deliver high core density for traditional applications, virtualization and cloud-native workloads. Enhanced memory speeds, faster NVMe storage options and BIOS tuning which allows match performance to the workload for ultimate efficiency. Take control of the entire IT lifecycle with intelligent automation, so the focus can be on moving the business forward. Integrated security will help protect the data center from unauthorized changes and cyber-attacks. Future-proof the data center with the worry-free PowerEdge rack portfolio.

The following table provides links to related Dell EMC documents and an overview of the content.

Reference Document	Content Description
PowerEdge Rack Servers Quick Reference Guide	Feature and capability comparison for the complete PowerEdge rackmount server portfolio.
PowerEdge R640 Spec Sheet	The PowerEdge R640 is the ideal dual-socket, 1U platform for dense scale-out data center computing
PowerEdge R740 Spec Sheet	The PowerEdge R740 was designed to accelerate application performance leveraging accelerator cards and storage scalability
PowerEdge R740xd Spec Sheet	The PowerEdge R740xd delivers a perfect balance between storage scalability and performance.
PowerEdge R940 Spec Sheet	The PowerEdge R940 is designed to power mission critical applications and real-time decisions.
PowerEdge R7425 Spec sheet	The PowerEdge R7425 platform delivers outstanding TCO for data analytics, HPC and scale up deployments.
PowerEdge C Series Quick Reference Guide	Dell EMC PowerEdge C series platforms deliver the latest high speed memory, fast NVMe storage and workload-based BIOS tuning

Dell EMC PowerEdge Modular Infrastructure (FX, VRTX, and PowerEdge blade servers) are built from the ground up for the software defined data center. The PowerEdge platform is designed to support the right balance of density, capacity, and flexibility. Customizable modules of compute, storage and networking are easily and rapidly scaled and managed. And the OpenManage portfolio delivers innovative systems management that makes administrators more efficient and the infrastructure more productive and reliable.

The following table provides links to related Dell EMC documents and an overview of the content.

Reference Document	Content Description
PowerEdge Modular Quick Reference Guide	Feature and capability comparison for the complete PowerEdge modular infrastructure portfolio.
PowerEdge FX2 Spec Sheet	The Dell PowerEdge FX2 enclosure is the uniquely small modular foundation for the PowerEdge FX architecture, an extremely flexible and efficient platform for building an IT infrastructure that precisely fits the computing needs
PowerEdge FC640 Spec Sheet	The PowerEdge FC640 delivers powerful performing processors, large memory capacity

Reference Document	Content Description
	and highly scalable I/O capability that meet virtualization, server consolidation, scale-out, private cloud or hybrid cloud needs.
PowerEdge 1000e Blade Chassis	The Dell™ PowerEdge™ M1000e Modular Blade Enclosure is the rock-solid foundation for the Dell EMC blade server architecture, providing an extremely reliable, flexible and efficient platform for building any IT infrastructure.

Storage array options

The Dell EMC storage array portfolio ensure that the most appropriate storage technology can be included as part of a Ready Stack solution to support a customers' desired outcomes. Multiple storage arrays can be configured both as part of the initial design but also added incremental as ongoing expansions once deployed.

The following table provides a summary of storage array options.

	VMAX	XtremIO	Dell EMC Unity	SC Series	Isilon
DESCRIPTION	Hybrid or all-Flash storage with enterprise data services for consolidation of mission critical workloads.	All-flash storage with extreme performance and inline data reduction.	Simple, unified all-flash or hybrid storage with hybrid cloud.	Affordable and efficient all-flash or hybrid storage provides lowest $/GB	Industry's #1 scale-out Network-Attached Storage (NAS) solution for any file workload.
USE CASE	Consolidation of enterprise applications and databases, open systems	Enterprise applications including virtual and database environments, integrated copy data management.	SAN, NAS, mixed workloads, storage and server consolidation, enterprise applications.	General-purpose SAN and NAS workload consolidation, VDI, high-volume OLTP.	General purpose file workloads, High Performance Computing (HPC), media & entertainment, active and deep archiving.
STORAGE TYPE	Block, file, open systems, mainframe	Block	Block and file	Block and file	File
CAPACITY	Multi-petabyte	Multi-petabyte	Multi-petabyte	Multi-petabyte	Over 90PB in a single namespace

Storage Design Considerations

Selecting the best storage array for the specific business demands requires choice. Only Dell EMC provides a complete portfolio of storage array technologies, all of which are suitable for deployment in a Ready Stack Architecture.

Key considerations when choosing the appropriate storage include:

- Storage type: Block and file, Block only, File only
- Performance throughput
- Cost
- Reliability

Dell EMC VMAX All Flash Storage Array

Get performance, scale, high availability, and advanced data services for all mission-critical applications with Dell EMC VMAX All Flash powered by Intel® Xeon® processors. Engineered to optimize flash drive technology, VMAX All Flash is built to take on all modern data center challenges.

- Consolidate open systems, mainframe, IBM i, and block and file storage.
- Protect mission-critical applications with 99.9999 percent availability.
- Simplify planning and deployment with packaging designed for modular scale-up and scale-out flexibility.

The following table provides links to related Dell EMC documents and an overview of the content.

Reference Document	Content Description
VMAX All Flash Array Family	Dell EMC VMAX All Flash arrays are architected to solve the CIO challenge of embracing a modernized flash-centric datacenter for mission-critical applications while simultaneously simplifying, automating, and consolidating IT operations.
VMAX All Flash Spec Sheet (250F/950F) VMAX All Flash Spec Sheet (450F/850F)	VMAX All Flash arrays extend the long tradition of VMAX Reliability, Availability and Serviceability that our customers have come to expect. Ranging from 1 to 8 VBricks packaged in dual VBrick racks along with their associated DAEs, the VMAX All Flash family offers unprecedented scale and footprint efficiency

DELL EMC XTREMIO

XtremIO delivers great efficiencies and business agility by maximizing inline deduplication and compression, application integrated efficient copy services and consistent Performance with Data Services. X2 has improvements across the board – Speed, efficiency and ease of use. X2 is an ideal platform for Virtual infrastructure use cases, especially VDI as well as large scale Copy data management use cases. XtremIO's software is ahead of the industry with architecture that makes the most of rapid in-memory computational mechanisms than moving and copying data on the storage media. The unique characteristics of XtremIO architecture is that it has a scaled out distributed key-value store identifying data with an unique fingerprint and associating data content with data location for efficient data storage, movement, replication and identification.

The following table provides links to related Dell EMC documents and an overview of the content.

Reference Document	Content Description
XTREMIO All Flash Data Sheet	The next-generation platform, XtremIO X2, builds upon unique features of XtremIO to provide even

	more agility and simplicity for the data center and business. Content-aware, in-memory metadata and inline, all-the-time data services have made XtremIO the ultimate platform for virtual server and desktop environments and workloads that benefit from efficient copy data management.
XTREMIO X2 Spec Sheet	XtremIO X2 scaling, capacity and performance details

Dell EMC Unity All-Flash Unified Storage

Dell EMC Unity, powered by Intel® Xeon® processors, is perfect for midsized deployments, Remote Office/Branch Office locations, and cost-sensitive mixed workload environments. It is designed for all-flash, delivers the best value, Unity is available in purpose-built (all flash or hybrid) arrays as well as software-defined virtual edition. With all-inclusive software, new differentiated features, internet-enabled management, and a modern design delivers simplicity and value, enabling organizations to speed deployment, streamline management and seamlessly tier unified storage workload to the cloud.

The following table provides links to related Dell EMC documents and an overview of the content.

Reference Document	Content Description
Unity All Flash Data Sheet	The Dell EMC Unity™ All Flash product line sets new standards for storage with compelling simplicity, modern design, flexible deployments and affordable prices to meet the needs of resource constrained IT professionals in large or small companies.
Unity All Flash Spec Sheet	Unity array scaling, capacity and performance details

DELL EMC SC SERIES

Intelligent All-Flash and hybrid storage solutions, powered by Intel® Xeon® processors, offer transformational performance, flexible tiered storage architecture and future-proof value.

End-to-end flash can take a business to new levels of productivity. SC All-Flash's active/active, performance-centric design keeps IOPS and throughput high as scale up and out occurs.

The following table provides links to related Dell EMC documents and an overview of the content.

Reference Document	Content Description
SC All Flash Spec Sheet	SC features, array scaling, capacity and performance details
SC Series SC7020 Spec Sheet	The SC7020 provides more capacity and greater flexibility to manage a variety of workloads. Realize rack space savings with a 3U, 30-drive

Reference Document	Content Description
	bay chassis that can expand up to 500 drives with 12Gb SAS expansion enclosures.
SC Series SC5020 Spec Sheet	The Dell EMC SC5020 makes storage cost savings automatic with a modern architecture that optimizes the data center for economics while delivering transformational SSD, HDD or hybrid performance.

Dell EMC Isilon Scale-Out Network Attached Storage (NAS)

Store, manage and protect unstructured data with efficiency and massive scalability. Dell EMC Isilon is the industry's number one family of scale-out network-attached storage systems, designed for demanding enterprise file workloads. Choose from all-flash, hybrid and archive NAS platforms powered by Intel® Xeon® processors.

- Simplify management no matter how large the data becomes
- Cut costs with over 80 percent utilization and automated tiering
- Scale from tens of terabytes to tens of petabytes
- Increase operational flexibility with multiprotocol support

The following table provides links to related Dell EMC documents and an overview of the content.

Reference Document	Content Description
Dell EMC Isilon Scale-Out NAS Product Family	Dell EMC Isilon scale-out storage solutions are designed for enterprises that want to manage their data, not their storage. Our storage systems are powerful yet simple to install, manage, and scale to virtually any size.
Dell EMC Isilon OneFS Operating System	The Dell EMC Isilon OneFS operating system provides the intelligence behind all Isilon scale-out storage systems. It combines the three layers of traditional storage architectures - file system, volume manager, and data protection - into one unified software layer, creating a single intelligent file system that spans all nodes within a cluster.
Dell EMC Isilon Scale-Out NAS All Flash Specifications	With a highly dense design that contains four nodes within a single 4U chassis, Isilon F800 delivers extreme performance and efficiency for the most demanding unstructured data applications and workloads
Dell EMC Isilon Scale-Out NAS Hybrid Specifications	Dell EMC Isilon hybrid storage is highly flexible and strikes the balance between large capacity and high-performance storage to provide support for a broad range of enterprise file workloads.
Dell EMC Isilon Scale-Out NAS Archive Specifications	Increasingly stringent compliance requirements is another factor driving the need for efficient data archiving solutions that can store and protect data for long-term retention. Organizations must also weigh the cost of storing archive data against the need for quick access. To address these challenges, Dell EMC Isilon offers highly efficient and massively scalable archive storage solution.

SAN switches

For Fibre Channel storage traffic, Dell EMC Ready Stack uses the Dell EMC Connectrix DS-6500B series switches. DS6500B switches deliver up to 16 Gbps Fibre channel performance and scale from 12 to 96 ports.

Brocade Web Tools is an embedded graphical user interface (GUI) on the Connectrix DS-6500B switches that enables administrators to monitor and manage single or small fabrics, switches, and ports. Web Tools are launched directly from a web browser, or from the Brocade Network Advisor.

The following table provides links to related Dell EMC documents and an overview of the content.

Reference Document	Content Description
Connectrix DS-6500B Switch Series - Spec Sheet	The Connectrix DS-6500B series switches deliver up to 16 Gigabits per second (16Gb/s) Fibre Channel (FC) performance. The DS-6500B switches scale from twelve to ninety-six ports

SAN Design Considerations

- For SAN arrays, always design for two FC fabrics to ensure high availability connectivity for the storage array.
- Number of port connections, whether SAN or IP should be based on throughput requirements and tolerance for degraded mode operation during a path failure.
- Multiple datastores within the VMware vSphere cluster enable the use of VMware vSphere HA Datastore Heartbeat. Enabling this ensures that partitioning, or isolated host networks, do not trigger VM movement within the cluster.
- VMware currently supports a maximum datastore size of 64 TB and 2048 powered on virtual machines per VMFS datastore. However, in most circumstances and environments, a target of 15-25 virtual machines per 500-750GB sized datastore is the conservative recommendation. LUNs and VMware vSphere datastores can easily be expanded to address future growth and by maintaining a smaller number of virtual machines per datastore, the potential for I/O contention is greatly reduced. This results in more consistent performance across the Ready Stack environment.
- Utilizing thin provisioning within VMware on virtual disks does not initially result in additional space efficiency when thin provisioning is enabled on the array. However, the ability to reclaim space from within a compatible guest OS requires thin provisioning be used on both the storage and the virtual disks.

The following table provides links to related Dell EMC documents and an overview of the content.

Reference Document	Content Description
Optimize for Storage Service Description	The Dell EMC Optimize for Storage service description outlines the scope of service, requisite service steps, optional services and other important terms and conditions relevant to the purchase of services from Dell EMC.

IP Network

This section provides an overview of the network architecture including compute and management server connectivity. The section also provides details about the Top-of-Rack (TOR) and virtual switch configuration approaches, as well as considering the implications of modern network design and implementation as part of a Ready Stack solution.

The following table provides links to related Dell EMC documents and an overview of the content.

Reference Document	Content Description
Brief: Perfect Your Network Modernization	Whether pondering a move to a different network vendor, ensuring the budget is being spent on features that really matter, or putting new equipment through its paces before signing the contract, gain useful tips for making the right buying decisions.
Dell EMC Networking Product Poster - Data Center	This Sales Aid provides information on Dell EMC Networking Data Center switches and solutions.
Network Automation with Dell Open Automation	The concept of a Software Defined Data Center (SDDC) has sparked a revolution that might be the most significant transformation in IT since the invention of the mainframe.

IP network Design Considerations

For Ethernet network traffic, the preferred choice for a Ready Stack is Dell EMC Networking switches. Using industry-leading hardware and a choice of the Dell EMC OS9 or select third-party network operating systems and tools, Dell EMC IP switches deliver non-blocking performance for workloads sensitive to packet loss.

Key features include scalable L2 and L3 Ethernet switching with QoS and a full complement of standards-based IPv4 and IPv6 features, including OSPF and BGP routing support. L2 multipath is supported via Virtual Link Trunking (VLT) and multiple VLT (mVLT) multi-chassis link aggregation technology.

Dell EMC Networking OS 9 has been tested and hardened to meet stringent requirements for reliability, scalability and serviceability. OS 9 supports the full portfolio of Dell EMC Networking data center switch products and enables building cost-effective, end-to-end networks while reducing operational complexity. A fully compliant, industry-standard CLI allows certified engineers to be productive from day one. It provides the primary method to configure, monitor and administer Dell OS 9 applications and Dell EMC Networking switches.

Dell EMC Networking Best Practice

The network architecture employs Virtual Link Trunking (VLT) connection between the two Top-of-Rack (TOR) switches. The inherent redundancy of a non-VLT environment requires standby equipment, which drives up infrastructure costs and increases risks. In a VLT environment, all paths are active, adding immediate value and throughput while still protecting against hardware failures. VLT technology allows a server or bridge to uplink a physical trunk into more than one

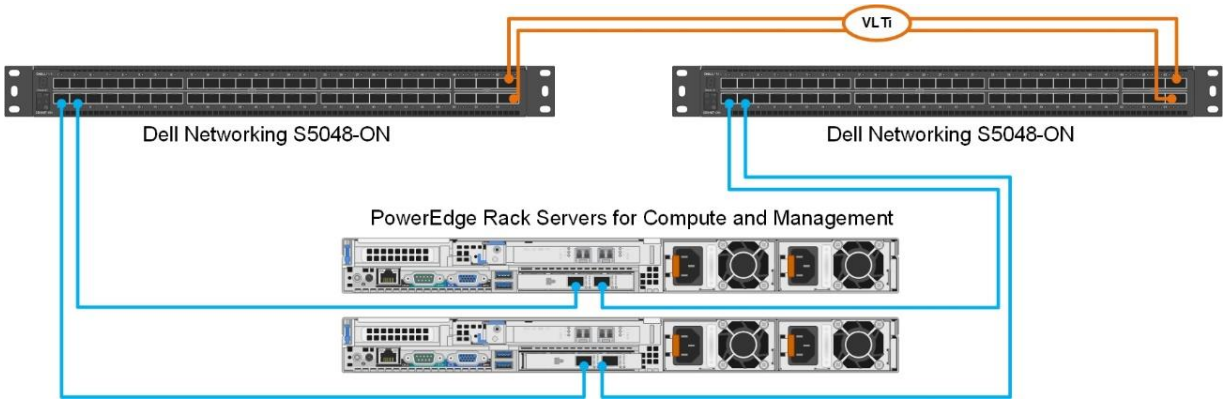
Dell EMC Networking switch by treating the uplink as one logical trunk. A VLT connected pair of switches acts as a single switch to a connecting bridge or server. Both links from the bridge network can actively forward and receive traffic. VLT provides a replacement for Spanning Tree Protocol (STP) based networks by providing both redundancy and full bandwidth utilization using multiple active paths. Major benefits of VLT technology include:

- Dual control plane for highly available resilient network services
- Full utilization of the active LAG interfaces
- Active / Active design for seamless operations during maintenance events

PowerEdge Rack Servers Network Configuration

The compute cluster consists of Dell EMC PowerEdge rack servers. This section describes the network connectivity if rack servers are used for compute servers, and the management servers. The following diagram is an example of the connectivity between the compute and management Dell EMC PowerEdge rack servers and Dell EMC Networking S5048-ON switches. The compute and management rack servers have two 10/25 GbE connections to S5048-ON switches through one Mellanox ConnectX-4 LX dual port 10/25 GbE network card.

The following diagram shows the PowerEdge Rack Server Connectivity.



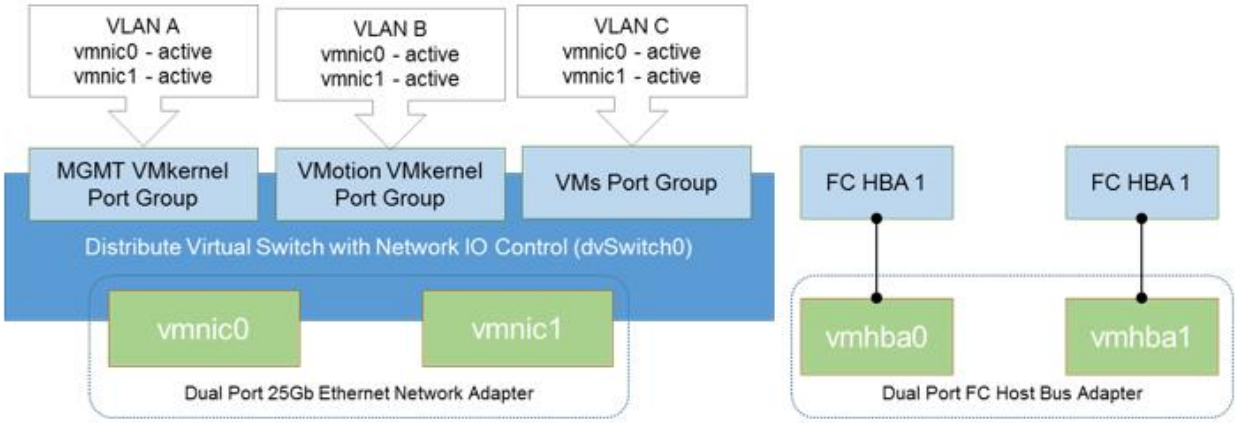
VMware vSphere Distributed Switch (vDS) LAN Traffic Network Configuration

This information applies when customers will use VMware as the hypervisor.

Customers can achieve bandwidth prioritization for different traffic classes such as host management, VMotion, and VM network using VMware Distributed Virtual Switches. The VMware vSphere Distributed Switch (vDS) can be configured, managed, and monitored from a central interface and provides:

- Simplified virtual machine network configuration
- Enhanced network monitoring and troubleshooting capabilities
- Support for network bandwidth partitioning when NPAR is not available

The following diagram shows the vDS configuration.

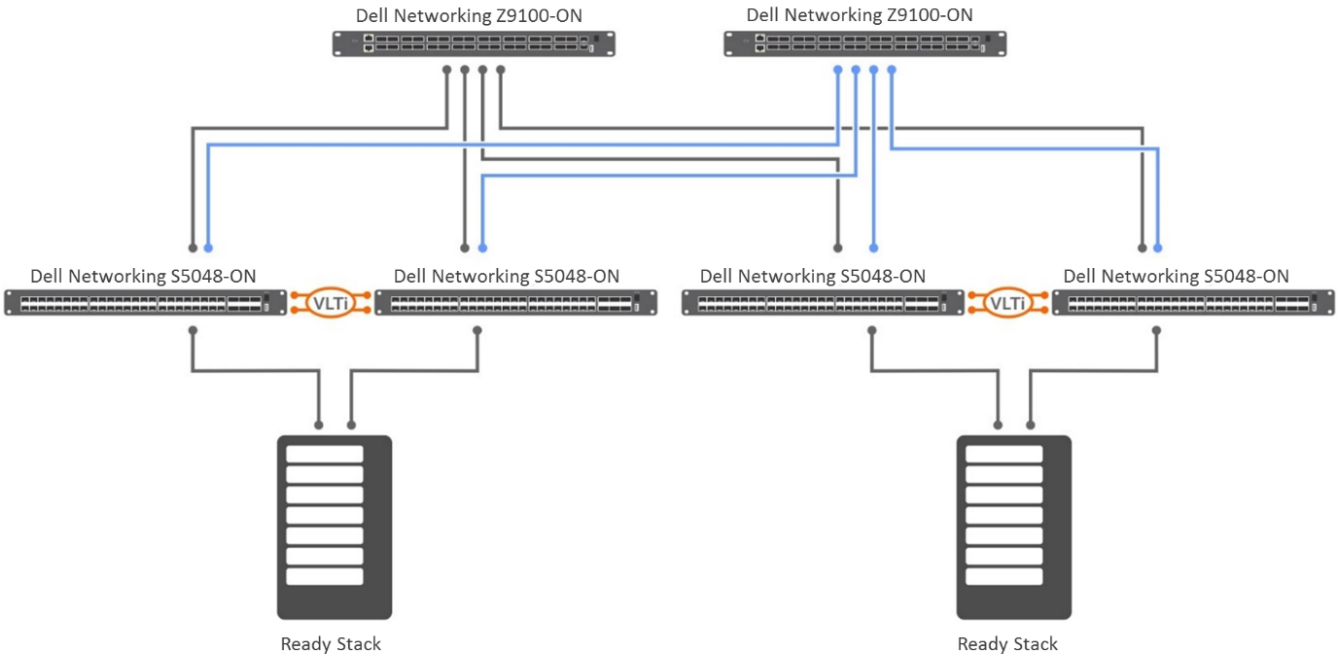


Network Design for Scaling Dell EMC Ready Stack

The solution can be scaled by adding multiple compute nodes (pods) in the customer data center. The Dell EMC Networking Z9100 switch can be used to create a simple yet scalable network. The Z9100 switches serve as the spine switches in the leaf-spine architecture. The Z9100 is a multi-line rate switch supporting 10/25/40/50/100 Gb Ethernet connectivity and can aggregate multiple racks with little or no oversubscription.

When connecting multiple racks, using the 40/100 GbE uplinks from the rack, it is possible to build a large fabric that supports multi-terabit clusters. The density of the Z9100 allows flattening the network tiers and creating an equal-cost fabric from any point to any other point in the network.

The following diagram shows the spine and leaf network used for scalability.



The following table provides links to related Dell EMC documents and an overview of the content.

Reference document	Content description
Dell Networking - Data Center Quick Reference	Data center switching Quick Reference Guide
Dell EMC Networking Z9100-ON Spec Sheet	The Dell Networking Z9100-ON is a 10/25/40/50/100GbE top-of-rack fixed switch purpose-built for applications in high-performance data center and environments.
Dell EMC Networking S5048F-ON Spec Sheet	Dell EMC S5048-ON switch is a future-ready top-of-rack open networking switch providing excellent capabilities and cost-effectiveness for the enterprise, mid-market, Tier2 cloud and NFV service providers.
Dell EMC Networking S4100-ON Spec Sheet	The S4100-ON 10GbE switches comprise, from Dell EMC, the latest disaggregated hardware and software data center networking solutions, providing state-of-the-art 100GbE uplinks, fibre channel connectivity and broad functionality.
Dell EMC Networking S4200-ON Spec Sheet	The Dell EMC Networking S4200-ON switch is the latest disaggregated hardware and software data center networking solution, providing broad functionality.
Dell EMC Networking S4048-ON Switch	The Dell EMC Networking S4048-ON switch empowers organizations to deploy workloads and applications designed for the open networking era.
Dell EMC Networking S4048T-ON Spec Sheet	The Dell EMC Networking S4048T-ON is a High-density, 1RU 48-port 100M/1G/10G BASE-T switch with six 40GbE up-links with non-blocking line-rate performance.
Dell EMC Networking N2000 Series Spec Sheet	The N2000 switch series offers a power-efficient Gigabit Ethernet (GbE) network-access switching solution with integrated 10GbE uplinks.
Dell EMC Networking N4000 Series Spec Sheet	The N4000 switch series offers a power-efficient and resilient 10 Gigabit Ethernet (10GbE) switching solution with support for 40GbE uplinks for advanced Layer 3 distribution for offices and campus networks.

Management Design

This section provides an overview of the Dell EMC Ready Stack's management infrastructure, and the software components that run on virtual machines within the management cluster.

Management Infrastructure

The management infrastructure would typically consist of two PowerEdge R440 or R640 servers that form a management cluster. Management components are virtualized to provide high availability. Redundant 10/25 Gb Ethernet uplinks to the network infrastructure, redundant 16Gbps Fibre channel uplinks to the storage array combined with vSphere High Availability ensure that management components stay online. A Dell EMC Networking S3048 switch is used for OOB connectivity. iDRAC ports in each management and compute cluster connect to this switch.

The management software components include:

- VMware vCenter Server Appliance (VCSA)
- Dell EMC OpenManage Integration for VMware vCenter (OMIVV)
- Dell EMC Virtual Storage Integrator (VSI)

The following table provides links to related Dell EMC documents and an overview of the content.

Reference Document	Content Description
OpenManage Integration for VMware vCenter Overview	Manage and update Dell™ PowerEdge™ servers in a virtualized environment with the Dell EMC Management Plug-in for the VMware® vCenter. This virtual appliance offers extensive functionality with an integrated, easy-to-use graphical user interface (GUI) provided to manage Dell EMC hardware from inside the VMware vCenter client.
OpenManage Integration for VMware vCenter Solutions Brief	The OpenManage Integration for VMware vCenter (OMIVV) is designed to streamline the management processes in the data center environment by allowing use of VMware vCenter to manage the entire server infrastructure - both physical and virtual.

Management Server

The management software components for the Dell EMC Ready Stack require a nominal amount of virtual server resources. There are no strict requirements that these components cannot reside on the compute server cluster, alongside the compute workload. However, many customers would choose to run these software components on dedicated physical server resources so that there is less resource contention with the compute workloads, and because it simplifies system recovery in various failure scenarios.

A typical management cluster, is shown here for illustration purposes. Exact sizing would be based on the specific workload to be run on the management cluster.

The following table has details about the management server components.

Components	Details
Server Platform Models	(2) Dell EMC PowerEdge R440 or (2) Dell EMC PowerEdge R640
Processors	(1 or 2) Intel® Xeon® SP Bronze, Silver, Gold, Platinum Skylake processors
Memory (depends on server model)	(1 – 24) 2666MT/s RDIMMs/LRDIMMs
Network Adapter	Mellanox CX4 LX 10/25Gb Ethernet Network Adapter
Host Bus Adapter	QLogic® 2692 Dual Port Fibre Channel Adapter
Boot Device	Internal Dual SD Module (IDSDM) or PERC H730p RAID Controller
Out-of-band Server Management	iDRAC9 Enterprise
Hypervisor	VMware ESXi 6.5

Management Software Integrations

OpenManage Essentials

For administrators looking to reduce the complexity of hardware management, OpenManage Essentials provides an easy-to-use, customizable console for managing Dell EMC hardware including servers, storage, and switches.

Basic, repetitive hardware management—updating enterprise servers, discovering/monitoring servers, storage, and networking—is a fact of life for IT organizations. Such tasks are often time-consuming, requiring cumbersome tools and a range of skill sets. The right tools help reduce management complexity and provide a comprehensive inventory of hardware assets and effective monitoring of the hardware's health.

To help simplify hardware management and streamline IT operations, the OpenManage Essentials systems management console allows administrators to perform basic hardware management tasks from a single easy-to-install and easy-to-use interface. OpenManage Essentials is designed to support a range of management functions for Dell EMC servers, storage, and switches, including discovering and inventorying Dell EMC hardware assets; monitoring the health and status of discovered assets; sending e-mail alerts for unattended monitoring; executing simple tasks such as powering a server on and off remotely; and managing and automating server updates.

OpenManage Integration for VMware vCenter

The OpenManage Integration for VMware vCenter (OMIVV) is designed to streamline the management processes in data center environments by allowing use of VMware vCenter to manage the entire server infrastructure - both physical and virtual. From monitoring system

level information, bubbling up system alerts for action in VMware vCenter, rolling out cluster level BIOS and firmware updates for an ESXi cluster, to bare metal deployment, the OpenManage Integration will expand and enrich the data center management experience with Dell EMC PowerEdge servers. OpenManage Integration provides deep level details for inventory, monitoring, and alerting of Dell EMC hosts within VMware vCenter and recommends or performs VMware vCenter actions based on Dell EMC hardware events.

Proactive HA is a vCenter feature that works with OMIVV. When enabled, Proactive HA, the feature safeguards workloads by proactively taking measures based on degradation of redundancy health of supported components in a host. When OMIVV detects a change in the redundancy health status of supported components (either through traps or polling), the health update notification for the component is sent to the VMware vCenter server. Polling runs every hour, and it is available as a fail-safe mechanism to cover the possibility of a trap loss. After assessing the redundancy health status of the supported host components, the OMIVV appliance updates the health status change to the VMware vCenter server.

Deployment templates contain a system profile, hardware profile, hypervisor profile, a combination of system profile and hypervisor profile, or a combination of the hardware profile and hypervisor profile. The OMIVV Deployment Wizard uses this template to provision server hardware and deploy hosts within the VMware vCenter. It is recommended to use the system profile type for fourteenth generation servers. For Internal Dual SD Module deployment, the IDSDM should be enabled from BIOS before deploying a hypervisor with OMIVV.

Management Software Resources

The management software components run on virtual machines that reside in the management cluster. The table below lists the management components in the bundle and the recommended VM sizing of those components:

Component	VMs	CPU Cores	RAM (GB)	OS (GB)	NIC
VMware vCenter Server Appliance	1	4	16	290	1
Dell EMC OpenManage Integration for VMware vCenter	1	2	8	44	1
Dell EMC Virtual Storage Integrator	1	2	8	11	1
Dell EMC Data Domain Virtual Edition	1	8	64	260	1
Dell EMC Avamar Virtual Edition	1	2	16	3150	1
Dell EMC Avamar Proxy	1	4	4	21	1

Hypervisor Deployment

VMware vSphere

VMware vSphere is a popular hypervisor choice for organizations hoping to achieve some degree of virtualization. VMware vSphere is highly configurable, which can make it an attractive choice for companies that are either going fully virtual or opting for a hybrid approach. Here are the key components and features of vSphere

- **VMware ESXi**: type 1 hypervisor responsible for abstracting processors, memory, storage and other resources into multiple virtual machines (VMs).
- **VMware vCenter Server**: This management tool is the central control point for data center services and provides a single pane of glass view across ESXi hosts.
- **VMware vSphere Client**: a new HTML5-based management interface that enables users to remotely connect to VMware vCenter Server.
- **VMware VMotion**: a feature that enables live migration for powered-on VMs in the same data center.
- **VMware Storage VMotion**: similar to standard VMotion, this enables the live migration of virtual disks or configuration files to a new data store while a VM is running.
- **VMware vSphere High Availability (HA)**: formerly known as VMware HA, this utility restarts failed VMs on other available servers.

Microsoft Hyper-V

Microsoft Hyper-V is designed to offer server virtualization for organizations with a data center or hybrid cloud. Hyper-V is built into Windows Server, or can be installed as a standalone server, known as Hyper-V Server, both of which can ease the learning curve for virtualization administrators who already have knowledge and background with Microsoft products. Hyper-V features include:

- **Computing Environment**: A Hyper-V virtual machine includes the same basic parts as a physical computer, such as memory, processor, storage, and networking. All these parts have features and options that can be configured different ways to meet different needs. Storage and networking can each be considered categories of their own, because of the many ways to configure them.
- **Disaster recovery and backup:** For disaster recovery, Hyper-V Replica creates copies of virtual machines, intended to be stored in another physical location, so the virtual machine can be restored from the copy. For backup, Hyper-V offers two types. One uses saved states and the other uses Volume Shadow Copy Service (VSS) to make application-consistent backups for programs that support VSS.
- **Optimization:** Each supported guest operating system has a customized set of services and drivers, called integration services, that make it easier to use the operating system in a Hyper-V virtual machine.
- **Portability**: Features such as live migration, storage migration, and import/export make it easier to move or distribute a virtual machine.
- **Remote connectivity**: Hyper-V includes Virtual Machine Connection, a remote connection tool for use with both Windows and Linux. Unlike Remote Desktop, this tool gives console access, so the administrator can see what is happening in the guest even when the operating system is not booted yet.
- **Security:** Secure boot and shielded virtual machines help protect against malware and other unauthorized access to a virtual machine and its data.

Other Hypervisor options

There are other hypervisors available based on customer technology preferences, workloads and budgetary constraints. The following is a list of other data center hypervisor that customers might want to use on a Ready Stack.

- **KVM**: Kernel-based Virtual Machine (KVM) is an open source virtualization technology built into Linux. Specifically, KVM turns Linux into a hypervisor that allows a host machine to run multiple, isolated virtual environments. KVM can be added to most Linux-based operating systems including Ubuntu, SUSE, CentOS and Red Hat Enterprise Linux (RHEL)
- **Xen**: The Xen hypervisor is an open-source hypervisor, which makes it possible to run many instances of an operating system in parallel on a single machine. Below are some of the Xen Project hypervisor's key features:
    - Small footprint and interface (around 1MB in size). Because it uses a microkernel design, with a small memory footprint and limited interface to the guest, it is more robust and secure than other hypervisors.
    - Operating system agnostic: Most installations run with Linux as the main control stack.
    - Driver Isolation: The Xen Project hypervisor has the capability to allow the main device driver for a system to run inside of a virtual machine. If the driver crashes, or is compromised, the VM containing the driver can be rebooted and the driver restarted without affecting the rest of the system.
    - Para virtualization: Fully Para virtualized guests have been optimized to run as a virtual machine. This allows the guests to run much faster than with hardware extensions (HVM). Additionally, the hypervisor can run on hardware that does not support virtualization extensions.
- **RHEV**: Red Hat Enterprise Virtualization (RHEV) is a commercial implementation of the KVM hypervisor. RHEV offers support the following advanced features:
    - Network bonding and VLAN
    - Live migration, policy-based workload balancing, high availability, power saving, cluster maintenance, image management, templating, thin-provisioning, and event monitoring
    - Self Service user portal
    - Reporting and monitoring, detailed historical reporting capabilities, monitor historical usage, trending, quality of service

Bare Metal

Certain applications require bare metal servers. Customers may choose to run applications that require bare metal servers in a completely isolated system. Alternately, they may desire to run the application on a dedicated server (rack server or a blade) but using shared storage and network resources.

Applications requiring bare metal server can co-exist on a Ready Stack running hypervisors.

Provisioning tools exist to save time and effort when deploying bare metal. Listed here are common tools for bare metal provisioning

- Razor: comes with policy centered provisioning and works well with Windows images. In addition, it does a pretty good job when handing off to various Configuration management tools.
- Foreman: an effective tool not only for provisioning but also for configuration and monitoring of both virtual and physical servers.
- Cobbler: versatile Linux provisioning tool which can efficiently facilitate and automate system installation that is network-based. Cobbler manages installation for multiple operating systems just from a focal point using such services as DNS, DHCP and TFTP.
- RackHD: technology stack for enabling automated hardware management and orchestration through cohesive APIs. RackHD's strong workflow engine is a major element worth highlighting as it can catalog intelligent PDUs, servers and switches both dynamically and passively.
- Ironic: used for OpenStack bare metal provisioning. Ironic allows OpenStack users to provision bare metal machines instead of virtual machines. The bare metal service manages hardware through both common (for example, PXE and IPMI) and vendor-specific remote management protocols. It provides the cloud operator with a unified interface to a heterogeneous fleet of servers while also providing the compute service with an interface that allows physical servers to be managed as though they were virtual machines.

Data Protection Considerations

One hundred percent of all data centers need one hundred percent of their applications and data protected. It is always a good idea to have a fresh look at data protection requirements when there is a technology refresh under consideration.

For a customer that values the simplicity and reduced risk of single vendor support, the combination of Avamar backup software and Data Domain backup target hardware is a great combination.

Daily backup, ensures the ability to recover from corruptions, human error, malware, ransomware, etc. Daily backup meet a 24 hour Recovery Point Objective (RPO). In other words, when trouble arises, total data loss is limited to one day or less, by restoring from the most recent backup.

Typically, businesses will need an additional tier of data protection for about 20 percent of their applications. For transactional data, zero data loss is the RPO. Synchronous local replication and asynchronous offsite replication are valuable tools to delivering a complete data protection solution. These requirements can be met with software specific to certain Dell EMC storage arrays, or they can be met with storage agnostic software: Dell EMC RecoverPoint, or Dell EMC RecoverPoint for VM.

Dell EMC Avamar Virtual Edition

Dell EMC Avamar Virtual Edition (AVE) provides powerful data protection, unified management and hypervisor integration. The hypervisor integration allows administrators to take advantage of self-service data protection while using the native vSphere hypervisor interface. AVE uses Avamar data protection technology to protect VMware virtual environments. AVE brings performance backup features such as: Change Block Tracking (CBT) for backup and recovery, High-speed image-level backup and recovery for bare metal protection of each VM, and Universal proxy load balancing.

Dell EMC Data Domain

The Dell EMC Data Domain portfolio consists of an array of software features and backup appliances that transform backup, archive and disaster recovery with protection storage for small, midsize and large enterprise environments. Data Domain includes features such as Data Domain Boost, Data Domain Encryption, Data Domain Replicator, and Data Domain Management Center. With these advanced options, organizations can benefit from advanced integration with backup and enterprise applications, simple and cost-effective tiering to the public, private, or hybrid cloud for long-term retention, and network-efficient replication. Avamar backup to Data Domain brings value through instant access to a virtual machine by booting the VM directly from Data Domain via an NFS datastore. With the instant access feature, there is no restore operation required. The following are Data Domain Portfolio of controllers:

Compare Data Domain	DD VE 16TB	DD VE 96TB	DD3300	DD6300	DD6800	DD9300	DD9800
Max Throughput	2.1 TB/hr.	4.0 TB/hr.	4.2 TB/hr.	8.5 TB/hr.	14 TB/hr.	20 TB/hr.	31 TB/hr.

Compare Data Domain	DD VE 16TB	DD VE 96TB	DD3300	DD6300	DD6800	DD9300	DD9800
Max Throughput with DD Boost	5.6 TB/hr.	11.2 TB/hr.	7.0 TB/hr.	24 TB/hr.	32 TB/hr.	41 TB/hr.	68 TB/hr.
Usable Capacity	16 TB	96 TB	4-32 TB	36-178 TB	56-288 TB	144-720 TB	200 TB-1 PB
Logical Capacity with Deduplication	800 TB	4.8 PB	1.6 PB	8.9 PB	14.4 PB	36 PB	50 PB

The Data Domain Boost feature provides integration between Avamar backup and Data Domain systems. With DD Boost, parts of the de-duplication process are distributed to the Avamar backup server enabling client-side deduplication so only unique data segments are sent to the Data Domain system. This enables 50 percent faster backups and reduces network bandwidth requirements by 80 to 98 percent. DD Boost provides advanced load balancing and failover, which further improves throughput and resiliency.

RecoverPoint for VM

Enable quick recovery of VMware virtual machines to any point in time. Dell EMC RecoverPoint for Virtual Machines provides continuous data protection (CDP) for operational recovery and disaster recovery. Result: manage VM protection simply and efficiently.

The vAdmins and enterprise application owners can set and manage their VM data protection through a plug-in to VMware vCenter. Automated provisioning and DR orchestration make it easier to meet recovery point objectives (RPOs) and recovery time objectives (RTOs).

RecoverPoint for Virtual Machines is hypervisor-based, software-only data replication that integrates with VMware vCenter (customer supplied).

The following are key features:

- Protect VMware virtual machines with granular recovery to the VM level.
- Use orchestration to enable test, failover, and failback to any point in time.
- Replicate VMs (VMDK and RDM) locally and remotely.
- Support replication policies over any distance: synchronous, asynchronous, or dynamic.
- Use consistency groups for fast, application-consistent recovery of VMs.
- Optimize WAN bandwidth use with data compression and deduplication.
- Support any storage array on the VMware hardware compatibility list (HCL).
- Manage data protection using the familiar vSphere Web Client user interface.

Dell EMC RecoverPoint

Dell EMC RecoverPoint provides continuous data protection for operational recovery and disaster recovery. It enables any-point-in-time recovery for diversified storage environments both within and across data centers.

Should data become compromised or lost, it is possible to go back in time and recover that data in a consistent state. RecoverPoint technology makes data loss reversible, ensuring

assured the data is safe. It extends VMware Site Recovery Manager (SRM) functionality with any point-in-time recovery capabilities.

Combining RecoverPoint 4.1 and Dell EMC VPLEX 5.4, MetroPoint topology enables data replication from a Dell EMC VPLEX Metro region of two data centers to a third site over distance and provides disaster recovery that can sustain two-site failures. It helps organization to achieve a new level of continuous availability, disaster recovery, and continuous data protection that can sustain multisite failures.

More Data Protection Options

Dell EMC has a deep portfolio of data protection options. This document has highlighted a few of the products most likely to be used with Ready Stack. Whatever the Recovery Point Objective (RPO) or Recovery Time Objective (RTO) is required by the business for each application or file to be protected, there is a Dell EMC product to meet the need. See link at bottom of the table for more details.

The following table provides links to related Dell EMC documents and an overview of the content.

Reference Document	Content Description
https://www.emc.com/collateral/software/data-sheet/h2568-emc-avamar-ds.pdf?isKoreaPage=false&domainUrlForCanonical=https%3A%2F%2Fwww.emc.com	Avamar Data sheet
https://www.emc.com/collateral/specification-sheet/h11340-datadomain-ss.pdf?isKoreaPage=false&domainUrlForCanonical=https%3A%2F%2Fwww.emc.com	Data Domain Spec sheet
https://www.emc.com/collateral/analyst-reports/esg-lab-validation-report-emc-data-domain-avamar.pdf?isKoreaPage=false&domainUrlForCanonical=https%3A%2F%2Fwww.emc.com	Avamar Virtual Edition with Data Domain- lab validation report
https://www.emc.com/collateral/data-sheet/h11802-recoverpoint-vms-ds.pdf	RecoverPoint for VM
https://www.emc.com/collateral/software/data-sheet/h2769-recoverpoint-ds.pdf	RecoverPoint Datasheet
https://www.emc.com/collateral/software/specification-sheet/h2770-recoverpoint-ss.pdf	RecoverPoint Spec sheet
NOTE: some of these components are available in bundled offerings referred to as EMC Data Protection Suites http://www.emc.com/collateral/data-sheet/h11800-emc-data-protection-suite-so.pdf	

This data protection information is not the complete list of offering. Dell EMC has a deep portfolio of data protection products. The information above is a sampling of some of the most common products used for a Ready Stack class of infrastructure. The complete portfolio can be found here:

https://shop.dellemc.com/en-us/Data-Protection/c/DellEMCDataProtection?q=%3Arelevance&grid=true&page=0

Summary and additional information

Dell EMC Ready Stack is the answer when customers desire a channel delivered Modern Infrastructure.

The strength of the complete Dell EMC portfolio allows channel partners to deliver the right solution, built from the industry's best components, and backed by the peace of mind of single call support.

Information on specific Ready Stack certified reference systems can be found in the TechCenter website:

Reference Document	Content Description
http://en.community.dell.com/techcenter/ready_solutions/	Ready Stack Certified Reference Systems

Document feedback can be sent to: docfeedback@vce.com