Abstract

The NetApp® Integrated EVO:RAIL solution combines the robust and feature-rich storage management capabilities of NetApp FAS systems with VMware industry-leading virtualization software for a best-in-class hyper-converged infrastructure offering.
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1 Solution Overview

The NetApp Integrated EVO:RAIL Solution (NetApp EVO) is NetApp’s most recent converged infrastructure offering. It brings the benefits of NetApp world-class storage expertise to the VMware hyper-converged infrastructure solution EVO:RAIL. NetApp EVO combines compute and storage resources in a single platform and enables NetApp’s vision of a Data Fabric for data management across any cloud. This easy-to-use system simplifies management and provides a scalable, software-based building block that customers can use to cloud-enable their departmental, remote, and satellite locations.

1.1 Solution Summary

The NetApp Integrated EVO:RAIL Solution provides a preintegrated virtualized platform for branch offices and departmental workgroups. It combines compute and storage resources in a single 4RU platform that is easy to deploy and operate by IT generalists at remote sites. This solution makes it easy to provide state-of-the-art virtualized storage capabilities, enterprise-class data management and recovery, cloud scalability, and full integration with an enterprise-wide Data Fabric—wherever businesses need them.

The NetApp Integrated EVO:RAIL Solution provides the following benefits:

- **Simplicity.** Fast configuration, a single management console, a reduced footprint, and single-vendor support speed to deployment.
- **Scalability to cloud.** A software-defined building block serves as a foundation for cloud computing, provides central management, and lets customers scale storage without adding more nodes.
- **Control.** With a Data Fabric powered by NetApp, including a set of software-based capabilities, customers can integrate and manage data across a hybrid cloud environment, improve efficiency, and accelerate innovation and IT responsiveness.
- **Proven platform.** Data protection, advanced storage efficiencies, and world-class support deliver a proven enterprise platform designed by industry leaders, allowing customers to deploy with confidence.

NetApp solutions are user-friendly, easy to manage, and quick to deploy, and they offer increased availability while consuming fewer IT resources. Therefore, they dramatically lower the total cost of ownership (TCO) over their lifetimes. While other companies manage complexity, NetApp eliminates it.

1.2 Solution Benefits

The NetApp EVO solution extends the ease-of-use and best-in-class integration that NetApp has been providing for VMware vSphere environments for years. It builds upon over a decade of collaboration and engineering between VMware and NetApp, resulting in over 50,000 joint customers. NetApp EVO is targeted at providing several key business enablers: speed to value, ease of consumption, mission-critical reliability, and unified management. These values are core to NetApp’s decades-long customer focus and echo the well-known message of “Fast. Simple. Reliable.”

**Fast**

The world is not slowing down: Businesses and individuals must consistently do more and do it faster than they did it yesterday. Customers need to have new solutions procured, deployed, and operational as quickly as possible, without introducing additional risk to the business. NetApp EVO helps customers meet this need with shorter ordering and shipping time frames and a rapid deployment process. A complete virtual infrastructure can be up, running, and able to begin provisioning virtual machines (VMs) within 30 minutes.

**Simple**

NetApp EVO provides simplicity throughout the entire solution lifecycle. Customers get a simple set of choices for quoting and ordering of the solution, easy automation for the solution deployment, and
simplified ongoing management integrated into the industry-standard vSphere Web Client interface. Beyond these features, the ability to extend a single NetApp EVO into a larger infrastructure and out to the cloud is superior.

Reliable

If the final solution doesn’t provide enterprise-grade reliability, getting an infrastructure deployed quickly and easily is only marginally helpful. NetApp FAS (included in NetApp EVO) has been demonstrated to provide five-9s or higher availability without sacrificing any of its rich data management and storage efficiencies.

Unified

NetApp pioneered the concept of unified storage by leading the industry in the integration of multiple NAS and SAN protocols in the same storage array system with NetApp FAS arrays. NetApp takes the concept of unification even further by using a single storage operating system (OS) for all FAS platforms. These platforms range from the low-end models aimed at small to medium-sized businesses or small enterprise departments, to the high-end models that run the most mission-critical workloads for enterprises, service providers, and government organizations.

Storage hardware is standardized as well. A FAS model that begins as a single-chassis, low-end system (with disks in the same chassis as the storage controllers) can be converted in place to a storage shelf. It can also be upgraded with external controllers, all the way up to the largest FAS systems. Each FAS system supports any media type (SATA/NL-SAS, SAS, or SSD) within the same system. Also, thanks to the NetApp clustered Data ONTAP® storage OS, this support extends across multiple controllers within the same storage cluster that is managed as a single storage array. Even the latest NetApp All Flash FAS systems might be included as part of the same storage cluster, running side by side with other All Flash FAS, hybrid FAS, or all hard-disk drive (HDD) FAS systems.

Other vendors introduce infrastructure islands for different targeted workloads or types of storage. NetApp, however, gives customers the ability to run all workloads, on any type of storage, by using a consistent management interface and enabling the customer’s data to exist in a seamless Data Fabric.

2 Solution Technology

NetApp has partnered with VMware to create a branch and departmental IT solution that combines the best of both worlds. The NetApp Integrated EVO:RAIL Solution provides simple, easy-to-use storage virtualization in a hyper-converged form factor, but with best-in-class NetApp storage capabilities that integrate into an enterprise-wide Data Fabric.

2.1 Solution Software

The NetApp EVO solution is a combination of tightly integrated VMware and NetApp software with inclusive licensing and is preinstalled on physical appliances.

Included Licensing

Simple and comprehensive feature licensing is a core tenent of NetApp EVO. With the inclusion of a full suite of premium software licensing, the customer knows that future business needs for advanced features will not require new or unexpected licensing costs. Table 1 lists the VMware and NetApp licenses that are included with the NetApp EVO.
Table 1) Licensing included with NetApp EVO.

<table>
<thead>
<tr>
<th>VMware Licenses (EVO:RAIL)</th>
<th>NetApp Licenses (Premium Software Bundle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMware vCenter Server Standard</td>
<td>All storage protocols (CIFS/SMB, NFS, iSCSI, and FC)</td>
</tr>
<tr>
<td>VMware Virtual SAN (VSAN) (eight CPUs)</td>
<td>NetApp FlexClone® technology</td>
</tr>
<tr>
<td>VMware vRealize Log Insight</td>
<td>NetApp SnapManager® Suite Note: Includes SnapManager for Oracle, Microsoft Exchange, Microsoft SQL Server, SAP, Microsoft SharePoint, and so on</td>
</tr>
<tr>
<td>VMware vSphere Enterprise Plus (eight CPUs)</td>
<td>NetApp SnapMirror® software</td>
</tr>
<tr>
<td></td>
<td>NetApp SnapRestore® software</td>
</tr>
<tr>
<td></td>
<td>NetApp SnapVault® software</td>
</tr>
</tbody>
</table>

And with the inclusion of the NetApp Virtual Storage Console (VSC) VM, NetApp has provided the Microsoft Windows Server 2012 R2 license that is used to run the VSC software. No additional Microsoft licenses are required. The certificate of authority sticker for this Microsoft Windows license is affixed to the top left of the compute appliance chassis.

**VMware EVO:RAIL vSphere Loyalty Program**

By default, an EVO:RAIL appliance includes as part of the purchased solution all the required VMware licensing that is listed in Table 1. Alternatively, customers can preserve an existing investment in VMware vSphere licenses through the VMware EVO:RAIL vSphere Loyalty Program and can reduce the overall cost of a new NetApp EVO appliance purchase.

Customers who have licenses that were obtained through enterprise licensing agreements, OEM partners, or distribution or other resale channels are eligible for the program. Customers are required to commit a minimum of eight CPU vSphere Enterprise Plus licenses to each NetApp EVO appliance.

The full terms and conditions of the loyalty program are available on the [VMware vSphere Loyalty Program](https://www.vmware.com) website.

**VMware Software**

EVO:RAIL delivers the first hyper-converged infrastructure appliance that is powered 100% by VMware’s proven suite of core products. The EVO:RAIL software bundle, preloaded onto the NetApp EVO compute hardware, includes the following VMware components:

- EVO:RAIL configuration and management engine
- vSphere Enterprise Plus for ESXi
- vCenter Server
- VSAN
- vRealize Log Insight

**VMware EVO:RAIL**

VMware EVO:RAIL is software that was specifically developed for the EVO:RAIL platform to provide the autodiscovery and simplified initialization of the virtual infrastructure. EVO:RAIL also enables easier and automated scaling of the compute cluster, automation of field-replaceable units in the event of hardware failures, and automated upgrades of the core VMware software that is included. The EVO:RAIL software
is preinstalled on the vCenter Server virtual appliance and launches automatically when the compute appliance powers on at the customer site.

**VMware vSphere**

VMware vSphere is a virtualization platform for holistically managing large collections of infrastructure resources—CPUs, storage, and networking—as a seamless, versatile, and dynamic operating environment. Unlike traditional OSs that manage an individual machine, VMware vSphere aggregates the infrastructure of an entire data center. This aggregation creates a single powerhouse with resources that can be allocated quickly and dynamically to any application in need.

VMware vSphere provides revolutionary benefits, but with a practical, nondisruptive evolutionary process for legacy applications. Existing applications can be deployed on VMware vSphere with no changes to the application or to the OS on which they run.

VMware vSphere provides a set of application services that enable applications to achieve superior levels of availability and scalability. VMware vSphere delivers the following core capabilities to meet numerous application and enterprise demands:

- **Availability:**
  - Workload mobility through vMotion
  - High availability (HA) through vSphere fault domain manager technology, offering VM resiliency in the event of physical server or guest OS failures

- **Automation:**
  - VMware Distributed Resource Scheduler (DRS) that offers dynamic workload distribution to align resource utilization with business priorities and compute capacity; DRS provides efficient use of compute resources and subsequently power consumption

- **Compute:**
  - VMware vSphere ESXi hypervisor providing efficient memory, storage, and compute abstraction through VMs

VMware vSphere delivers a robust application environment. For example, with VMware vSphere, all applications can be protected from downtime with VMware HA—without the complexity of conventional clustering. In addition, by using capabilities such as hot add and VMware DRS, applications can be scaled dynamically to meet changing loads.

**VMware vCenter Server**

VMware vCenter is a centralized management framework and UI. It is used to manage a virtual data center that runs VMware VMs and all other layers of the environment, such as storage, networking, and granular user access control. Traditionally, vCenter was a binary installation package for Windows, but starting with the release of vSphere 5.0, VMware added the VMware vCenter Server Appliance as a deployment option.

The vCenter Server Appliance is a prepackaged, Linux-based Open Virtualization Format template that can be deployed through the vSphere Web Client. In the case of NetApp EVO, vCenter is already deployed as a VM, and the EVO:RAIL automation software handles the customization and setup of the vCenter management services based on the customer’s information. Connection to the vCenter Server Appliance is established through the vSphere Web Client in the same manner as with a traditional Windows-based vCenter instance. Table 2 lists the vCenter Server VM configuration.

<table>
<thead>
<tr>
<th>VMware vCenter Server VM</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>vCPU</td>
<td>4 vCPUs</td>
</tr>
</tbody>
</table>
VMware Virtual SAN

VMware VSAN aggregates direct-attached storage from vSphere ESXi hosts into a datastore for VMs. In an EVO:RAIL context, VSAN provides bootstrap functionality for the environment and is the location for the service VMs that constitute the environment as shipped from the factory.

VMware vRealize Log Insight

VMware vRealize Log Insight is an advanced log analytics and management engine with an intuitive and low-friction UI. It can be used to provide high-performance log correlation across the NetApp EVO infrastructure and beyond to the complete enterprise infrastructure.

vRealize Log Insight is packaged as a virtual appliance and is preinstalled as part of NetApp EVO. It can be automatically deployed during EVO:RAIL configuration and can be used as the default log management application for the entire NetApp EVO solution. Table 3 lists the vRealize Log Insight VM configuration.

Table 3) VMware vRealize Log Insight VM configuration.

<table>
<thead>
<tr>
<th>VMware vRealize Log Insight VM</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>vCPU</td>
<td>4 vCPUs</td>
</tr>
<tr>
<td>Memory</td>
<td>8GB</td>
</tr>
<tr>
<td>Network adapter type</td>
<td>VMXNET3</td>
</tr>
<tr>
<td>Hard disk size</td>
<td>60GB</td>
</tr>
<tr>
<td>Hard disk type</td>
<td>Thick</td>
</tr>
</tbody>
</table>

NetApp Software

Although NetApp has traditionally been seen as a hardware company, and NetApp EVO is delivered to a customer as a hardware appliance, it is software that is the core of NetApp value. The NetApp EVO software bundle includes the following preloaded software on either the compute or the storage appliances, as appropriate:

- NetApp Integration Server for VMware EVO:RAIL
- NetApp VSC for VMware vSphere
- NetApp NFS Plug-in for VMware vSphere VAAI
- NetApp clustered Data ONTAP

NetApp Integration Server

The NetApp Integration Server software was developed specifically to automate the initial configuration of NetApp FAS and its integration into a VMware vSphere infrastructure. Its UI builds upon VMware’s EVO:RAIL configuration UI for its look and feel, while making it even easier by prepopulating.
configuration data from vCenter Server itself. It implements a new back-end engine for NetApp specific customizations in a converged infrastructure environment that include:

- Data ONTAP cluster creation and configuration
- Complete storage allocation and presentation to ESXi hosts
- Application of ESXi host best practices settings
- Deployment of NetApp VSC and integration with both the clustered Data ONTAP and the VMware vSphere environments

With the NetApp Integration Server, customers can get started quickly, even with an unconfigured storage system and an uncustomized vSphere environment. In less than 10 minutes, customers can start managing their NetApp FAS system within the vSphere Web Client and begin deploying VMs onto NetApp datastores. Table 4 lists the NetApp EVO:RAIL Integration Server VM configuration.

Table 4) NetApp EVO:RAIL Integration Server VM configuration.

<table>
<thead>
<tr>
<th>NetApp EVO:RAIL Integration Server VM</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>vCPU</td>
<td>4 vCPUs</td>
</tr>
<tr>
<td>Memory</td>
<td>8GB</td>
</tr>
<tr>
<td>Network adapter type</td>
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</tr>
<tr>
<td>Hard disk size</td>
<td>6GB</td>
</tr>
<tr>
<td>Hard disk type</td>
<td>Thick</td>
</tr>
</tbody>
</table>

**NetApp VSC**

The complexity of deploying and managing thousands of virtual desktops can be daunting without the right tools. NetApp VSC for VMware vSphere is tightly integrated with VMware vCenter for rapidly provisioning, managing, configuring, and backing up a VMware vSphere implementation. By simplifying the deployment and management process for thousands of virtual desktops, NetApp VSC significantly increases operational efficiency and agility.

The following plug-ins and software features simplify deployment and administration of virtual desktop environments:

- The NetApp VSC provisioning and cloning plug-in enables customers to rapidly provision, manage, import, and reclaim space of thinly provisioned VMs and redeploy thousands of VMs.
- The NetApp VSC backup and recovery plug-in integrates VMware snapshot functionality with NetApp Snapshot® functionality to protect VMware vSphere environments.

Figure 1 provides a NetApp VSC example summary.
Figure 1) NetApp VSC example summary.

The NetApp VSC software delivers storage configuration and monitoring, datastore provisioning, VM cloning, and backup and recovery of VMs and datastores. NetApp VSC also includes an API for automated control. NetApp VSC delivers a single VMware plug-in that provides end-to-end VM lifecycle management for VMware environments that use NetApp storage. NetApp VSC is delivered as a VMware vCenter Server plug-in. This plug-in is different from a client-side plug-in that must be installed on every VMware vSphere Client. Table 5 lists the NetApp VSC server VM configuration.

Table 5) NetApp VSC server VM configuration.

<table>
<thead>
<tr>
<th>NetApp VSC</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS</td>
<td>Microsoft Windows Server 2012 R2</td>
</tr>
<tr>
<td>vCPU</td>
<td>2 vCPUs</td>
</tr>
<tr>
<td>Memory</td>
<td>4GB</td>
</tr>
<tr>
<td>Network adapter type</td>
<td>VMXNET3</td>
</tr>
<tr>
<td>Hard disk size</td>
<td>60GB</td>
</tr>
<tr>
<td>Hard disk type</td>
<td>Thick</td>
</tr>
</tbody>
</table>

**NetApp NFS Plug-In for VMware vSphere VAAI**

The NetApp NFS Plug-in for VMware vStorage APIs – Array Integration (VAAI) runs on the ESXi host and takes advantage of the enhanced storage features that VMware vSphere 5.5 offers. The plug-in ships preinstalled on each of the ESXi nodes within a NetApp EVO appliance—no installation or configuration is required.
The plug-in performs NFS-like remote procedure calls to the server and uses the same credentials as the ESXi NFS client. This capability means that the plug-in requires no additional credentials and has the same access rights as the ESXi NFS client.

The NetApp NFS Plug-in for VMware VAAI includes the following features:

- **Copy offload.** This feature helps to reduce the traffic on the ESXi host and lower the amount of CPU utilization that is required to perform this function. As a result, the copy offload process takes seconds instead of the few minutes that it used to take.

- **Space reservation.** This feature enables the creation of thick virtual disk files on NAS. Through the VAAI Reserve Space primitive, space can be reserved for the file at the time that the file is created.

- **VM cloning.** This feature allows VMs to be cloned within a datastore by using NetApp FlexClone technology. VMs can be cloned within a datastore in seconds instead of the time that it normally takes to copy VM files.

**NetApp Clustered Data ONTAP**

With clustered Data ONTAP, NetApp provides enterprise-ready, unified scale-out storage. Developed from a solid foundation of proven Data ONTAP technology and innovation, clustered Data ONTAP is the basis for large virtualized shared storage infrastructures that are architected for nondisruptive operations over the system lifetime. Controller nodes are deployed in high-availability (HA) pairs, with these HA pairs participating in a single storage domain or cluster.

The use of scale-out means that as the storage environment grows, additional controllers are added seamlessly to the resource pool that resides on a shared storage infrastructure. Host and client connections as well as datastores can move seamlessly and nondisruptively anywhere in the resource pool. Therefore, existing workloads can be easily balanced over the available resources, and new workloads can be easily deployed. Technology refreshes (replacing disk shelves, or adding or completely replacing storage controllers) are accomplished while the environment remains online and continues serving data.

NetApp Data ONTAP is the first product to provide a complete scale-up and scale-out solution, and it offers an adaptable, always-available storage infrastructure for today’s highly virtualized environment.

The benefits of scale-out include the following:

- Nondisruptive operations
- Ability to keep adding thousands of users to the virtual infrastructure without downtime
- Operational simplicity and flexibility

The move to a shared infrastructure has made it nearly impossible to schedule downtime to accomplish routine maintenance. NetApp clustered Data ONTAP is designed to eliminate the planned downtime needed for maintenance operations and lifecycle operations, as well as the unplanned downtime that hardware and software failures can cause.

Three standard tools make this elimination of downtime possible:

- **NetApp DataMotion™ for Volumes** (vol move) allows data volumes to be moved from one aggregate to another on the same or a different cluster node.

- **Logical interface (LIF) migrate** allows the physical Ethernet interfaces in clustered Data ONTAP to be virtualized. LIF migrate also allows LIFs to be moved from one network port to another on the same or a different cluster node.

- **Aggregate relocate** allows complete aggregates to be transferred from one controller in an HA pair to the other without data movement.

Used individually and in combination, these tools offer the ability to nondisruptively perform a full range of operations. This range includes moving a volume from a faster to a slower disk all the way up to a complete controller and storage technology refresh.
Shared storage infrastructure provides services to thousands of virtual servers or virtual desktops. In such environments, downtime is not an option. The NetApp FAS solution eliminates sources of downtime and protects critical data against disaster through two key features:

- **HA pair.** A NetApp HA pair provides seamless failover to its partner in case of hardware failure. Each of the two identical storage controllers in the HA pair configuration serves data independently during normal operation. During an individual storage controller failure, the data service process is transferred from the failed storage controller to the surviving partner.

- **NetApp RAID DP® technology.** During any virtualized desktop deployment, data protection is critical because any RAID failure might disconnect hundreds to thousands of end users from their desktops, resulting in lost productivity. RAID DP provides performance comparable to that of RAID 10, yet it requires fewer disks to achieve equivalent protection. RAID DP provides protection against double disk failure, in contrast to RAID 5, which can protect against only one disk failure per RAID group. In effect, RAID DP provides RAID 10 performance and protection at a RAID 5 price point.

To offer multilevel storage efficiency across virtual desktop data, installed applications, and user data, the NetApp FAS solution includes built-in thin provisioning, data deduplication, compression, and zero-cost cloning with NetApp FlexClone. This comprehensive storage efficiency helps significantly reduce the storage footprint for virtualized desktop implementations, with a capacity reduction of up to 10:1, or 90% (based on existing customer deployments and NetApp solutions lab verification). Three features make this storage efficiency possible:

- **Thin provisioning** allows multiple applications to share a single pool of on-demand storage, eliminating the need to provision more storage for one application while another application still has plenty of allocated but unused storage.

- **Deduplication** saves space on primary storage by removing redundant copies of blocks in a volume that hosts hundreds of virtual desktops. This process is transparent to the application and the user, and it can be enabled and disabled dynamically.

- **FlexClone** offers hardware-assisted rapid creation of space-efficient, writable, point-in-time images of individual VM files, LUNs, or flexible volumes. It is fully integrated with VMware vSphere VAAI. Both file-level cloning and volume-level cloning are tightly integrated with the VMware vCenter Server through the NetApp VSC provisioning and cloning vCenter plug-in and through native VM cloning offload with VMware VAAI. The NetApp VSC provides the flexibility to rapidly provision and redeploy thousands of VMs with hundreds of VMs in each datastore.

NetApp Data ONTAP provides a number of additional features that can be leveraged in a virtual desktop environment, whether they are for the infrastructure supporting the desktops or the desktops themselves. Some of these features are:

- **NetApp Snapshot copies,** which are manual or automatically scheduled point-in-time copies that write only changed blocks, with no performance penalty. Snapshot copies consume minimal storage space because only changes to the active file system are written. Individual files and directories can easily be recovered from any Snapshot copy, and the entire volume can be restored back to any Snapshot state in seconds.

- **Compression** of data blocks on disk to provide space savings instead of or in addition to the savings that are obtained with deduplication.

- A **LIF** that is associated to a physical port, interface group (ifgrp), or VLAN interface. More than one LIF can be associated to a physical port at the same time. There are three types of LIFs:
  - NFS LIF
  - iSCSI LIF
  - FC LIF

LIFs are logical network entities that have the same characteristics as physical network devices but are not tied to physical objects. LIFs used for Ethernet traffic are assigned specific Ethernet-based details such as IP addresses and iSCSI-qualified names and are then associated with a specific physical port that is capable of supporting Ethernet. LIFs used for FC-based traffic are assigned...
specific FC-based details such as worldwide port names and are then associated with a specific physical port that is capable of supporting FC or FCoE. NAS LIFs can be nondisruptively migrated to any other physical network port throughout the entire cluster at any time, either manually or automatically (by using policies). SAN LIFs, however, rely on multipath input/output and asymmetric logical unit access to notify clients of any change in the network topology.

- **Storage virtual machine (SVM)**, a secure virtual storage server that contains data volumes and one or more LIFs through which it serves data to the clients. An SVM securely isolates the shared virtualized data storage and network and appears as a single dedicated server to its clients. Each SVM has a separate administrator authentication domain and can be managed independently by an SVM administrator. During NetApp EVO setup, a single SVM is created for the vSphere environment, but customers can choose to create additional SVMs for other or more granular use after initial setup.

Built on more than 20 years of innovation, Data ONTAP has evolved to meet the changing needs of customers and help drive their success. NetApp clustered Data ONTAP provides a rich set of data management features and clustering for scale-out, operational efficiency, and nondisruptive operations to offer customers one of the most compelling value propositions in the industry. The IT landscape is undergoing a fundamental shift to IT as a service (ITaaS). The ITaaS model requires a pool of compute, network, and storage to serve a wide range of applications and deliver a wide range of services. Innovations such as NetApp clustered Data ONTAP are fueling this revolution.

### 2.2 Solution Hardware

The NetApp Integrated EVO:RAIL Solution is composed of two 2U appliances, for a total rack space requirement of 4U. The appliances do not need to be racked adjacent to one another as long as the correct network connectivity is available. When the appliances are adjacently racked, the storage appliance should be racked on top of the compute appliance. The compute appliance is significantly longer than the storage appliance and can obstruct service access to the storage appliance if it is racked on top.

#### Compute Hardware

The compute model that is currently shipping is the NetApp Integrated EVO:RAIL Solution Model 4425. Each model 4425 compute appliance has four independent nodes in a shared chassis. Each node has the following specifications:

- Two Intel Xeon Processor E5-2620 v2 six-core CPUs
- 192GB of memory (twelve 16GB DIMMs)
- One SAS 15K RPM 300GB HDD for the ESXi boot device
- Three SAS 10K RPM 1.2TB HDD for local storage
- One 400GB SSD for local read/write cache
- One VSAN-certified pass-through disk controller
- Two 10GbE NIC ports
  
  **Note:** Customers must use SFP+ connections for use with either direct-attached cables or optical transceivers and cables.

- One 1GbE BMC port for remote (out-of-band) management
  
  **Note:** This port includes remote power; virtual keyboard, video, and mouse (KVM); and virtual media capabilities for advanced supportability.

The compute chassis midplane provides only shared power from the two fully redundant power supplies. There is no connectivity between the compute nodes for shared networking or storage.
Storage Hardware

The NetApp FAS2552A appliance has been designed with fault tolerance and HA in mind, with two active controller nodes within a shared-disk chassis. Each storage node provides active storage processing during normal operations and assumes all processing activities in the event of a failure of the partner node. The nodes have the following specifications:

- Twenty SAS 10K RPM 1.2TB HDD
- Four 400GB SSDs for read/write cache with NetApp Flash Pool™ caching
- Two fully redundant power supplies
- Four redundant 10GbE NIC ports (two per node) for data access

Note: SFP+ connections are necessary for use with either direct-attached cables or optical transceivers and cables, as selected at the time of order.

- Four redundant cluster interconnect ports (two per node) for back-end cluster traffic
- Two 1GbE ports (one per node) for in-band (e0M) and out-of-band (Service Processor) management

Note: These ports include remote power, diagnostics, and virtual console capabilities for advanced supportability.

Optimized Writes

The NetApp WAFL® (Write Anywhere File Layout) file system enables NetApp to process writes efficiently. When the Data ONTAP OS receives an I/O, it stores the I/O in battery-backed nonvolatile RAM (NVRAM) in both controllers of the HA pair. It also sends back an acknowledgment (or ACK) notifying the sender that the write is committed. Acknowledging the write before committing to disk provides a very low response time for write I/O and thus low write latency. This architecture also allows Data ONTAP to perform many functions to optimize the data layout for optimal write/write coalescing. Before being written to disk, I/Os are coalesced into larger blocks because larger sequential blocks require less CPU for each operation.

Note: Many other storage systems, including most hyper-converged systems, use SSDs to protect the write cache. The use of battery-backed NVRAM to protect the write cache, however, provides greater performance and lower write latency for NetApp FAS systems.

3 Solution Software Components

Table 6 lists the software components of the NetApp Integrated EVO:RAIL Solution per release.

Table 6) Component versions of the NetApp Integrated EVO:RAIL Solution software per release.

<table>
<thead>
<tr>
<th>Component</th>
<th>Release 1.0</th>
<th>Release 1.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMware EVO:RAIL</td>
<td>EVO:RAIL 1.1, including:</td>
<td>EVO:RAIL 1.2.1, including:</td>
</tr>
<tr>
<td></td>
<td>• VMware vSphere 5.5 Update 2b</td>
<td>• VMware vSphere 5.5 Update 2(e)</td>
</tr>
<tr>
<td></td>
<td>• VMware vCenter Server 5.5 Update 2b</td>
<td>• VMware vCenter Server 5.5 Update 2e</td>
</tr>
<tr>
<td></td>
<td>• VMware vRealize Log Insight 2.0.3</td>
<td>• VMware vRealize Log Insight 2.0.5</td>
</tr>
<tr>
<td></td>
<td>• VMware EVO:RAIL Engine 1.1</td>
<td>• VMware EVO:RAIL Engine 1.2.1</td>
</tr>
<tr>
<td>NetApp Integration Server</td>
<td>1.0.1</td>
<td>1.0.3</td>
</tr>
<tr>
<td>NetApp VSC for VMware vSphere</td>
<td>6.0</td>
<td>6.0</td>
</tr>
</tbody>
</table>
4 Solution Deployment and Configuration

A NetApp EVO solution deployment consists of just a few easy steps:

1. Gather environment information and prepare the networking infrastructure.
2. Unbox, rack, and cable the solution appliances.
4. Configure a deployment workstation.
5. Use the solution automation software to configure the new infrastructure.

Two guides from NetApp provide a significant amount of information to assist customers in performing each of these steps. The NetApp Integrated EVO:RAIL Solution 1.1 Quick Start Guide is shipped with the NetApp EVO solution, and the NetApp Integrated EVO:RAIL Solution 1.1 Installation and Setup Guide is available from the NetApp Support site. This technical report offers additional detail and background about the deployment process.

4.1 Deployment Considerations

The NetApp EVO solution has been designed to be easy to deploy with limited administrative overhead. A few simple considerations must be addressed as part of the deployment, and they are specific to the customer’s networking environment.

Deployment Workstation

To begin the deployment process, customers must use a web browser to access the EVO:RAIL configuration UI that runs on the vCenter Server appliance at a predefined IP address. This step requires that a workstation or a laptop be connected to the same management network as the one to which the NetApp EVO appliance is connected. If the same management network VLAN is not trunked to and configured on the switch to which the workstation is normally connected, a direct connection to the top-of-rack switch is required.

The predefined IP address of the EVO:RAIL appliance is 192.168.10.200/24, and the deployment workstation must be configured with an address on the same subnet. For example, the workstation could be configured with an IP address of 192.168.10.199 and with a subnet mask of 255.255.255.0.

As part of the configuration data entry, customers assign a new IP address to the vCenter Server from their production management network subnet. During the deployment, the EVO:RAIL automation changes the vCenter Server IP address from the 192.168.10.200 address to the customer-supplied IP address. Customers then must access the EVO:RAIL interface on the new IP address to continue the deployment process, which requires that the deployment workstation be reconfigured with an IP address on the production management network subnet. For example, if the production management subnet is 10.10.10.0/24 and the vCenter Server is assigned 10.10.10.200, the workstation could be configured with an IP address of 10.10.10.199 and with a subnet mask of 255.255.255.0.

Note: Customers must make sure that the production management network IP address that is assigned to the deployment workstation is not already in use on the network.

For a smoother deployment process, both the temporary IP address in the 192.168.10.0/24 subnet and the production management subnet can be assigned simultaneously on the deployment workstation.
before beginning the deployment process. In this example, the deployment workstation could be configured with an IP address of 192.168.199/24 and with a secondary address of 10.10.10.199/24.

For more information, see the “Configuring the Deployment Workstation Networking” section of the appendix.

Physical Switch Configurations

NetApp EVO uses both 10GbE and 1GbE switching for its network connectivity. The switching infrastructure in a NetApp EVO environment is frequently referred to as top-of-rack (TOR) switching. However, it should be noted that different network architectures, including more centralized models (end-of-row, direct connectivity into a multichassis core, and so on), are fully supported. Customers can choose either to use separate 10GbE and 1GbE switches, or to use 1GbE transceivers on their 10GbE switches for the 1GbE NetApp EVO interfaces. NetApp recommends using separate 10GbE and 1GbE switches where possible.

Customers can use their networking vendor of choice because the features required for NetApp EVO are standardly available in managed switches: 802.1Q VLAN tagging and multicast support. Link aggregation technologies, such as EtherChannel and the Link Aggregation Control Protocol (LACP), can be used for upstream or Inter-Switch Link (ISL) connectivity. However, these technologies are not necessary for or supported on ports connected to either of the NetApp EVO appliances.

For production environments, NetApp strongly recommends two or more switches for HA and redundancy. In a multioswitch configuration, all VLANS used for the NetApp EVO environment must be allowed on all ISLs.

Multicast Traffic

IPv4 multicast support and IPv6 multicast support are required on the connected 10GbE TOR switch. Multicast is not required on the entire customer network, but only on the ports that are connected to the NetApp EVO compute appliance. Multicast is not required for the NetApp EVO storage appliance.

Customers should implement one of two supported multicast configurations:

- Enable IGMP Snooping (typically on by default) and IGMP Querier
- Disable IGMP Snooping and IGMP Querier

  **Note:** Disabling IGMP Snooping might lead to additional multicast traffic on the customer network.

VLAN Configurations

NetApp highly recommends using unique VLANS for each required service network: management, vMotion, VSAN, NFS, and VM networks. At a minimum, there must be at least two VLANS: one for NFS and one for all other service networks.

The management VLANS must be configured as an untagged VLAN on all ports that are connected to the NetApp EVO appliances. The switchports that are connected to the 10GbE interfaces on both the compute and the storage appliances must be configured as trunk (or VLAN-tagged) ports, with the management network as the single untagged VLANS. Some switch vendors refer to it as the native VLAN of the switchport. The switchports that are connected to the 1GbE interfaces on both the compute and the storage appliances can be configured as access ports (no VLAN tagging). They can also be configured as trunk ports, with the management network as the single untagged VLAN.

Two VM networks are included by default during the EVO:RAIL initial configuration. These networks do not necessarily need to be on different VLANS, but they do need to be named uniquely. Multiple customer network requirements can be accommodated by adding or removing VM networks during this initial configuration process.
For simplicity of management and ease of physical cabling, the same VLAN configuration can be applied to all ports that are connected to either of the NetApp EVO appliances. This feature eliminates the need to connect specific switchports to specific interfaces on the appliances, because any configured switchport will work.

In the EVO:RAIL configuration interface, VLAN IDs cannot be entered for management (being untagged) but must be specified for vMotion and VSAN. Default VLAN IDs are provided in these fields, but customers must change these values during the configuration process to properly match their environment.

**Note:** If invalid VLANs that do not match the actual switchport configuration are specified in the EVO:RAIL interface, the EVO:RAIL configuration process might fail to complete. This failure might require support assistance or manual intervention to recover or reset the appliance.

**Subnet Configurations**

Separate subnets are required for each configured VLAN. NetApp recommends using distinct, nonroutable subnets for all service networks, including vMotion, VSAN, and NFS data networking. Only management network traffic requires routing in a normal production environment (routing management is not necessary in a completely isolated environment).

Contiguous IP address ranges must be available within each subnet. For vMotion, VSAN, and NFS networks, the required number of addresses (see Table 7) must be in a single contiguous range. For management networking, in addition to the specific addresses that are assigned to the vCenter Server, NetApp Integration Server, and vRealize Log Insight VMs, IP addresses must be available in two contiguous ranges. These ranges include four addresses for ESXi management and eight addresses for NetApp management. NetApp highly recommends assigning four more management addresses for the compute BMC ports.

<table>
<thead>
<tr>
<th>Network</th>
<th>IP Address Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management network</td>
<td>14 addresses minimum; 19 addresses recommended</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> During deployment, one additional management IP address is required for the deployment workstation.</td>
</tr>
<tr>
<td>vSphere vMotion</td>
<td>4 addresses required</td>
</tr>
<tr>
<td>VSAN</td>
<td>4 addresses required</td>
</tr>
<tr>
<td>Data network (NFS)</td>
<td>6 addresses required</td>
</tr>
</tbody>
</table>

**Host Names**

Host names are entered for vCenter Server and for each ESXi host during the EVO:RAIL initial configuration process. For customer convenience, the EVO:RAIL UI prepopulates the host name fields, but NetApp recommends that customers specify these host names to better suit their environment.

ESXi host names are defined by a naming scheme that comprises an ESXi host name prefix, a separator, an iterator, and a top-level domain. The first three items are specific to the ESXi host names, and the top-level domain is applied to all other component names within the NetApp EVO environment.

The Preview field in the EVO:RAIL UI shows an example of the result for the first ESXi host. For example, if the prefix is evoesxi, the separator is None, the iterator is Num 0X, and the top-level domain is customer.local, the first ESXi host name would be evoesxi01.customer.local.
The vCenter Server host name is a single field. The top-level domain is automatically applied to the vCenter Server host name (for example, vcenter.customer.local). Table 8 lists the EVO:RAIL host name fields.

Table 8) EVO:RAIL host name fields.

<table>
<thead>
<tr>
<th>Data Entry Field</th>
<th>Data Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top-level domain</td>
<td>Alphanumeric string</td>
</tr>
<tr>
<td>ESXi host name prefix</td>
<td>Alphanumeric string</td>
</tr>
<tr>
<td>ESXi host name separator</td>
<td>None or a dash, “-”</td>
</tr>
<tr>
<td>ESXi host name iterator</td>
<td>Alpha, Num X, or Num 0X</td>
</tr>
<tr>
<td>vCenter Server host name</td>
<td>Alphanumeric string</td>
</tr>
</tbody>
</table>

For proper client name resolution, the NetApp EVO ESXi host names must be configured in the customer's DNS server. Alternatively, in a totally isolated environment, the workstation can be configured to use the vCenter Server as its DNS server. Without properly functioning name resolution, customers will see errors after deployment when they try to access VM consoles, upload or download from VMware datastores, and so on.

During the NetApp integration process, the storage cluster and node names are automatically assigned based on the appliance ID of the compute appliance. This Appliance ID is the same as the one discussed in the “Physical Labels” section of the appendix. The Data ONTAP cluster name is identical to the compute Appliance ID, but each node has a unique numeric suffix. For example, a compute Appliance ID of NTP62JD5Y04 results in a cluster name of NTP62JD5Y04 and storage node names of NTP62JD5Y04-01 and NTP62JD5Y04-02.

Passwords

The default factory password for all NetApp EVO components is Passw0rd!. During the configuration process, the password for each component is set to a user-supplied password.

Passwords are required for ESXi host and vCenter Server administrative access. These passwords must contain between 8 and 20 characters, with at least one uppercase, one lowercase, and one special character. No character can be repeated three times consecutively. The same password can be used for both the ESXi hosts and vCenter, or a different password can be used for vCenter; however, all ESXi hosts must be configured to use the same password. If vRealize Log Insight is chosen during EVO:RAIL deployment, its administrative password is set to match the vCenter Server password.

Passwords are required for all NetApp software components, including the NetApp Integration Server, NetApp VSC server, and NetApp clustered Data ONTAP. The same password is applied to all NetApp components during the configuration process; unique passwords per component are not supported during configuration but can be applied after the fact.

Note: All passwords are case-sensitive.

Table 9 lists the NetApp EVO components and administrator accounts.

Table 9) NetApp EVO components and administrator accounts.

<table>
<thead>
<tr>
<th>Component</th>
<th>Administrator Account</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMware ESXi</td>
<td>root</td>
</tr>
<tr>
<td>VMware vCenter Server (OS)</td>
<td>root</td>
</tr>
<tr>
<td>Component</td>
<td>Administrator Account</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>VMware vCenter Server (application)</td>
<td><a href="mailto:administrator@vsphere.local">administrator@vsphere.local</a></td>
</tr>
<tr>
<td>VMware vRealize Log Insight (OS)</td>
<td>root</td>
</tr>
<tr>
<td>VMware vRealize Log Insight (application)</td>
<td>admin</td>
</tr>
<tr>
<td>NetApp Integration Server</td>
<td>root</td>
</tr>
<tr>
<td>NetApp VSC server</td>
<td>administrator</td>
</tr>
<tr>
<td>NetApp clustered Data ONTAP</td>
<td>admin</td>
</tr>
<tr>
<td>NetApp compute BMC</td>
<td>UserId</td>
</tr>
</tbody>
</table>

**Network Services**

The NetApp Integrated EVO:RAIL Solution integrates with and, in some cases, relies upon existing networking services in the customer’s environment.

**Active Directory**

Active Directory is an optional configuration item for providing authentication to the vCenter Server. To enable this feature, during the EVO:RAIL initial configuration, customers must supply the Active Directory domain and an Active Directory user name and password with privileges that allow the user to join that domain. By using this information, EVO:RAIL configures the vCenter Server VM but does not automate the configuration of vSphere Single Sign-On. To complete the Active Directory configuration, customers must use the vSphere Web Client to add the appropriate Single Sign-On identity source.

For more information, see the Add a vCenter Sign-On Identity Source online publication.

**DHCP Server**

NetApp recommends Dynamic Host Configuration Protocol (DHCP) services for the VLANs and subnets that are used for the guest VM networks but DHCP will not be used for vMotion, VSAN, or NFS network configuration. Because all required management IP addresses are assigned statically, DHCP is not necessary on the management VLAN or subnet. There are two places where DHCP services on the management network might have an effect:

- BMC ports on the compute appliance (enabled for DHCP by default)
  
  **Note:** NetApp recommends that customers set the network configuration of the BMC ports to use static IP addresses instead. For detailed steps, see the “Out-of-Band Management” section.

- The initial management network VMkernel port (vmk0) of each ESXi host (enabled for DHCP)
  
  **Note:** Neither a DHCP-assigned nor a static IP address is required on the vmk0 interface. Self-assigned or Automatic Private IP Addressing addresses are perfectly acceptable for this interface.
  
  **Note:** Although NetApp has successfully performed extensive testing of EVO:RAIL environments where DHCP services are enabled on the management network, VMware does not recommend this configuration. For more information, see the VMware Knowledge Base online article.

**DNS Servers**

At least one DNS server is required for production use and is strongly recommended even for demonstration, proof-of-concept, or laboratory environments. DNS server IP addresses are entered during initial EVO:RAIL configuration and are prepopulated as the default values during the NetApp
integration process. If a DNS server is not specified, the NetApp EVO environment uses the internal DNS hosted on the vCenter Server itself.

Because EVO:RAIL registers the ESXi hosts to vCenter by using fully qualified domain names, customers must create matching host records on their DNS servers for all ESXi hosts. Clients connecting to the NetApp EVO environment must be able to resolve ESXi host names. If they cannot resolve these names, the clients are unable to perform many basic administrative tasks, including accessing VM consoles, and uploading and downloading from datastores.

For administrative ease and consistency, customers should also create records for all other components of NetApp EVO, including vCenter, Log Insight, NetApp VSC, clustered Data ONTAP management, and so on.

**NTP Servers**

Consistent and accurate timekeeping is critical for a well-functioning infrastructure, and particularly so for cross-host event correlation. Although a Network Time Protocol (NTP) server is not a requirement, NetApp strongly recommends it. If an NTP server is not provided, EVO:RAIL uses the clock time that is configured on ESXi node 1 for the rest of the environment (without being able to validate its accuracy). NTP server settings are applied to all compute and storage nodes, and to all VMs that are deployed during NetApp EVO initial setup. The time zone setting is configured for the VMware environment during EVO:RAIL initial configuration and for the storage environment during the NetApp integration phase. If it is not modified during setup, the default time zone is UTC.

NetApp strongly recommends that customers keep the time settings, for both NTP server and time zone, consistent across all components of the NetApp EVO environment.

**Proxy Server**

A proxy server is an optional configuration setting for the NetApp Integrated EVO:RAIL Solution. If the customer’s environment does not require a proxy server, this setting can be ignored. In some customer environments, a proxy server is necessary for vCenter Server to access services outside of the local network. In that case, the customer must enter into the EVO:RAIL configuration interface the host name or IP address of the proxy server, the required TCP port, the user name, and the password.

The proxy server settings are not used by the NetApp Integration Server when configuring the NetApp storage.

**Logging**

NetApp EVO ships with a deployed and licensed vRealize Log Insight instance for advanced log management. To use vRealize Log Insight, customers point their browser to the IP address specified for the VM during the configuration process. As noted in Table 9, the application user name is “admin,” with the same password as for vCenter.

Customers can also choose to use their own third-party syslog servers and can simply specify the destination syslog server instead of Log Insight during EVO:RAIL configuration. The NetApp integration process does not prompt for a syslog server but uses the settings obtained from vCenter.

**Out-of-Band Management**

Out-of-band (also known as remote or lights-out) management is available on each compute node through a dedicated BMC port. To use out-of-band management, customers connect the BMC port on each node to a 10/100/1000 Ethernet switch.

The default factory settings for the BMC ports are for DHCP. If DHCP is available in the customer’s environment, the BMC ports appear in the DHCP database, as shown in Table 10.
Table 10) NetApp EVO BMC host names.

<table>
<thead>
<tr>
<th>BMC Ports</th>
<th>DHCP Host Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node 1</td>
<td>ApplianceID-01</td>
</tr>
<tr>
<td>Node 2</td>
<td>ApplianceID-02</td>
</tr>
<tr>
<td>Node 3</td>
<td>ApplianceID-03</td>
</tr>
<tr>
<td>Node 4</td>
<td>ApplianceID-04</td>
</tr>
</tbody>
</table>

**Note:** The appliance ID can be found on the right ear of the chassis as described in the “Physical Labels” section of the appendix.

The BMC port IP addresses can also be assigned manually instead, which is the standard recommendation. To configure a BMC for a static IP address, complete the following steps:

1. Boot or reboot the compute node while connected to it with a physical keyboard, video, and mouse (KVM).
2. On the BIOS home page, press F2 to enter setup.
3. After entering the NetApp BIOS utility, click TAB three times to navigate to the Server Information pane.
4. Arrow down once to select the Set BMC LAN Configuration option and press Enter.
5. On the next configuration screen, arrow down to BMC NIC IP Source, press Enter, select Static, and press Enter again.
6. By using the arrow keys and keyboard, set the IP Address, Subnet Mask, and GateWay Address fields.
7. Press F10 to Save and Exit the BIOS utility. The node reboots with the entered settings, and the BMC web interface is now accessible for remote power, management, and virtual KVM.

As previously described, the default user name and password for the BMC ports is UserId and Passw0rd!, respectively. They can be modified before or after NetApp EVO configuration has been completed.

Out-of-band management for the NetApp FAS cluster is provided by using the same 1GbE interfaces that are used for in-band management. Internally to the storage controllers, a separate Service Processor is able to provide full lights-out capability over the same single Ethernet cable. Both in-band and out-of-band IP addresses are automatically assigned to the storage nodes during NetApp integration. The appendix explains how IP addresses are assigned.

**Note:** Although in-band management uses the 1GbE interfaces by default, the cluster and node management LIFs fail over to the 10GbE interfaces when necessary. The out-of-band Service Processor is accessible only through the 1GbE interface.

**Licensing**

The NetApp Integrated EVO:RAIL Solution is delivered with all required licenses (for more details about the option to use existing customer-owned vSphere Enterprise Plus licenses, see the “VMware EVO:RAIL vSphere Loyalty Program” section). NetApp recommends that customers apply all licenses during initial solution deployment. VMware EVO:RAIL licenses can be entered upon first login after configuration, and NetApp licensing is a required data entry field during the NetApp integration process.

Before beginning a deployment, customers should ensure that they have received e-mail with information about their VMware product activation code (PAC) and NetApp licenses. Customers must also have followed the steps described in the NetApp Integrated EVO:RAIL Solution 1.1 Installation and Setup Guide for obtaining their production licenses.
4.2 Configuration Process

The NetApp EVO configuration process is broken into four basic tasks:

- Data entry for VMware EVO:RAIL
- Automated configuration of VMware EVO:RAIL
- Data entry for NetApp storage integration
- Automated configuration for NetApp storage integration

Data Entry for VMware EVO:RAIL

The NetApp EVO configuration process begins by launching a web browser on the deployment workstation and connecting to the default initial URL: https://192.168.10.200:7443. Because the application uses a self-signed SSL certificate, the browser displays a warning about an unverified certificate. This warning can be safely ignored to access the EVO:RAIL configuration UI.

The configuration UI, as shown in Figure 2, is designed to be intuitive and simple to use for data entry. Fields can be navigated by using either the Tab key or the mouse, and field contents are validated live as the focus moves between fields throughout the interface. This validation status can be seen in the color of the top bar as it briefly flashes from blue to green when data entry validates successfully. The presence of red warning bars beneath particular fields indicates that validation has detected a possible problem. Throughout a typical installation, red warnings appear and disappear as items such as subnet mismatches are addressed during the data entry process.

Data entry is best performed by moving consistently from top to bottom within each window, and from top to bottom in the navigation panes on the left. Red dots are visible next to sections in the navigation pane where no default values have been provided. NetApp strongly recommends that customers navigate through all configuration panes to confirm that all values are correct and match the customer environment before attempting to build the appliance configuration.
After customers have entered all the data, they click the Validate button to initiate a more comprehensive validation of both the user-supplied data and the EVO:RAIL environment. It is at this point that the configuration engine verifies that all four ESXi nodes are online and communicating properly, that all 10GbE interfaces are connected, and so on. If an error is found during this validation process, an explanatory message is displayed to assist the user in remediating the issue.

When all errors have been addressed, a green checkmark is displayed and the user is presented with a Build Appliance button. Clicking the button begins the automated appliance configuration process.

Automated Configuration of VMware EVO:RAIL

The EVO:RAIL automation handles the initial VMware deployment and configuration, including:

- vCenter networking and service initialization and configuration
- All ESXi networking for management, vMotion, and VSAN
- Powering on and configuring the networking for the vRealize Log Insight and NetApp Integration Server VMs
- vSphere cluster and host settings
- Setting new passwords on vCenter, Log Insight, and ESXi nodes

The first task is to set the vCenter IP address to the newly specified address and display a link in the web browser to redirect to that IP address and continue with the appliance build. If the deployment workstation was not previously configured with the new management networking, as described in the "Configuring the Deployment Workstation Networking" section of the appendix, it must be configured at this point. Until the deployment workstation successfully connects to the EVO:RAIL interface at the new IP address, further configuration is not performed. If the deployment workstation does not connect within 20 minutes of the change, the EVO:RAIL configuration process halts and the vCenter IP address is reverted to the default 192.168.10.200.

Figure 3 shows the EVO:RAIL configuration interface after the vCenter IP address has been changed.

Figure 3) EVO:RAIL configuration interface after changing the vCenter IP address.
When the EVO:RAIL interface has successfully been reached at the new IP address, the automation proceeds without further user intervention, unless an error is encountered. The most common errors are improperly configured networking: for example, incorrectly specified or unreachable DNS servers, incorrectly specified or unconfigured VLANs, and so on. If the networking requirements previously discussed have been properly planned and implemented, the EVO:RAIL configuration should proceed smoothly and successfully.

The configuration process typically completes in 12 to 15 minutes. When the Hooray screen appears indicating successful completion, the customer must click the displayed URL to be taken to the EVO:RAIL login screen. Upon logging in, the customer is presented with the EVO:RAIL management interface, as shown in Figure 4, to enter the permanent license key and to begin data entry for the NetApp integration process. For further details, see the NetApp Integrated EVO:RAIL Solution 1.1 Installation and Setup Guide.

**Figure 4** EVO:RAIL management interface at initial login.

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**Data Entry for NetApp Storage Integration**

The NetApp EVO configuration process begins by navigating to the NetApp item in the left-hand navigation pane, and then clicking the NetApp Integrated EVO:RAIL Solution button that appears on the bottom right. A new tab opens in the web browser to connect to the IP address that was set for the NetApp Integration Server during the EVO:RAIL configuration. Because the application is using a self-signed SSL certificate, the browser displays a warning about an unverified certificate. This warning can be safely ignored to access the NetApp configuration UI.

The configuration UI for NetApp integration is almost identical to the EVO:RAIL data entry UI. It is designed to be intuitive and simple to use for data entry, and to provide a consistent user experience during a NetApp EVO deployment. Customers can navigate the fields by using either the Tab key or the mouse, and field contents are validated live as the focus moves between fields throughout the interface.

The major difference in the user experience is in the initial information requested: the vCenter Server IP address and credentials for the NetApp EVO appliance. With this information, the NetApp Integration Server can verify connectivity with the virtual environment, validate the ability to perform necessary additional customization, and prepopulate information to reduce the amount of manual data entry. The
prepopulated data includes the management network subnet and gateway, DNS server IP address, and NTP server IP address.

Data entry is best performed by moving consistently from top to bottom within each window, and from top to bottom in the navigation panes on the left. NetApp strongly recommends that customers navigate through all configuration panes to confirm that all values are correct and match the customer environment before attempting to finalize the configuration.

After all data is entered, customers click the Validate button to initiate a fuller validation of both the user-supplied data and the NetApp EVO environment. If an error is found during this validation, red dots in the navigation pane note the section where the error occurred. An explanatory message is also displayed to assist the user in remediating the issue, as shown in Figure 5.

Figure 5) NetApp configuration validation error example.

![Configuration analysis found the following issues:](image)

Data network IP address range is too small (2), must be at least 6 addresses

After all errors have been addressed, a green checkmark is displayed and the user is presented with a Configure button. Clicking the button begins the automated storage configuration and integration process.

**Automation Configuration of NetApp Storage Integration**

The NetApp EVO automation handles the initial storage configuration into the VMware environment, including:

- Data ONTAP cluster creation and physical configuration, including Flash Pool caching
- Application of all licenses entered during data entry
- Powering on and configuring the networking for the NetApp VSC server VM
- SVM creation and configuration
- Data volume creation and presentation to ESXi hosts as NFS datastores
- Modification of ESXi networking, including creation of VMkernel ports for NFS
- Creation of a Storage DRS (SDRS) cluster named NetApp and mounting of the NetApp datastores to all hosts as part of this SDRS cluster
- Registering of the VSC with vCenter and of the Data ONTAP cluster with VSC
The configuration process typically completes in 6 to 10 minutes. After the System Setup Is Complete message appears, click OK to redirect the browser to the NetApp Integration Server postconfiguration page.

5 Solution Operations and Management

One of the core strengths of the NetApp Integrated EVO:RAIL Solution is that it applies existing management skills rather than requiring new applications and interfaces to provide standard management capabilities. By using the VMware and NetApp core products, administrators can apply existing knowledge, best practices, and processes.

With the preinstallation and integration of the NetApp VSC for VMware vSphere, administrators should be able to perform almost all daily infrastructure management through a single interface: the vSphere Web Client. Administrators should need to use the VMware EVO:RAIL or NetApp OnCommand® System Manager interfaces only for more occasional operations such as software upgrades, cluster expansions, and so on.

5.1 Daily Operations

Many standard storage operations (applying vendor best practices, system initialization, and storage provisioning) are performed automatically during the initial NetApp EVO configuration, which means that no further work is required from customers. Daily operations generally fall into two categories: VM provisioning and VM data protection.

Virtual Machine Deployment

To provide the necessary levels of customization and specification that customers and application vendors require, VMs are best deployed by using the vSphere Web Client. The New Virtual Machine wizard walks customers through the creation process and allows them to specify the amount of CPU, RAM, storage, virtual network adapters, and other virtualized hardware to meet their exact requirements.

When customers are deciding where to deploy a VM, NetApp recommends the following:

- VMs that matching any of the following criteria should be placed on the NetApp datastores:
  - Workload requires advanced local data protection, such as frequent or long-lasting recovery points (Snapshot copies)
  - Workload requires integrated off-site backups
  - Workload requires advanced disaster recovery capabilities
  - Workload requires application-consistent backups, particularly in combination with any of the preceding requirements

- VMs that matching any of the following criteria might be suitable for the VSAN datastore:
  - Workload is providing its own application-level HA (across sites)
  - Workload consists of utility servers without backup requirements
  - Workload consists of temporary VMs, such as testing and development
  - Workload consists of stateless VMs, such as in a DevOps context

- VMs that matching either of the following criteria might be suitable for deploying across both NetApp and VSAN datastores:
  - Workload consists of shared-nothing application pairs; place one instance on VSAN and one instance on FAS
  - Workload is providing its own application-level HA (within the site); place one instance on VSAN and one instance on FAS
If the VM storage requirements are not known at the time of deployment, NetApp recommends provisioning onto the NetApp Storage DRS (SDRS) cluster as the default location. If a VM has been deployed to the wrong location, customers can choose to relocate VMs between the NetApp and VSAN datstores. With Storage vMotion, this process is completely online and nondisruptive.

Backup and Recovery

The NetApp VSC backup and recovery plug-in is an innovative, scalable, integrated data protection solution for VMware environments. The backup and recovery plug-in allows customers to leverage VMware snapshot functionality with NetApp array-based block-level Snapshot copies to provide consistent backups for their virtual servers and desktops. By using the NetApp VSC contextual menu in the vSphere Web Client, the creation, modification, or deletion of a backup schedule or job, or the initiation of a recovery job, is a simple task. A point-and-click wizard guides the customer through the few steps that are required for each operation.

The backup and recovery plug-in is integrated with NetApp SnapMirror replication technology, which preserves the deduplicated storage savings from the source to the destination storage array. It is then not necessary to rerun deduplication on the destination storage array. SnapMirror can be used to replicate between any disk type or between tiers of NetApp FAS systems. Customers can replicate from SSD to SAS, from SAS to SATA, from SATA to SSD, or any other combination, including cascading mirrors on different tiers of storage. A NetApp EVO can replicate to another NetApp EVO, to a hybrid FAS, to a NetApp All Flash FAS, to a hard-drive-only FAS, or even to a NetApp Cloud ONTAP® system. This feature provides customers with cost-effective performance options for business requirements for data protection and DR.

When a NetApp EVO environment is replicated with SnapMirror, the replicated data can quickly be brought online to provide production access during a site or a data center outage. In addition, SnapMirror is fully integrated with VMware Site Recovery Manager and NetApp FlexClone technology. Customers can instantly create zero-cost writable copies of the replicated VMs at the remote site that can be used for DR testing or for testing and development work.

**Note:** VSC can natively use existing SnapMirror relationships on a granular backup job basis. The underlying SnapMirror configuration must first be created by using standard NetApp tools such as OnCommand System Manager before VSC can take advantage of it. The creation of replication destinations, schedules, and relationships is not fully automated in the current NetApp EVO releases.

5.2 Additional Operations

Because NetApp EVO does not place any artificial limitations on customers’ use of their equipment, customers can take advantage of many advanced data management features beyond a standard hyper-converged solution. With the Premium software bundle that is included with every NetApp Integrated EVO:RAIL Solution, the system is fully licensed to use any storage protocols for any workload necessary. Customers can choose to begin hosting native Windows file shares off the system (for personal drives, department shares, profile redirection, and so on). Or they can create new volumes and LUNs for direct in-guest iSCSI connections (by using the simple NetApp SnapDrive® UI).

Business-critical applications can take advantage of zero-space cloning and application-consistent data protection and integration with the included SnapManager suite of products for Oracle, Microsoft Exchange, Microsoft SharePoint, Microsoft SQL Server, and SAP.

From a hardware perspective, the system allows scaling up or out as needed or desired. Additional disk shelves of any type can be added to the NetApp FAS systems to provide greater capacity and different tiers of storage performance. More NetApp FAS systems can be added into the same storage cluster to scale out both capacity and performance. With NetApp EVO, customers can take advantage of the independent scaling of storage and compute—a key differentiator from other hyper-converged solutions.
Note: These additional operations are not fully automated in the current NetApp EVO releases. Customers are fully supported to modify the configuration of the environment as described previously. However, these modifications must be performed manually by using standard NetApp management tools (VSC, OnCommand System Manager, Data ONTAP command-line interface, and so on).

6 Best Practices

Table 11 summarizes the recommended NetApp best practices for designing or implementing a NetApp Integrated EVO:RAIL Solution.

Table 11) NetApp EVO best practices for customers.

<table>
<thead>
<tr>
<th>Best Practices Area</th>
<th>Best Practices Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployment preparation</td>
<td>• Register your NetApp EVO on the NetApp Support site:</td>
</tr>
<tr>
<td></td>
<td>– If you do not already have a NetApp Support site account, first create one by using your NetApp EVO FAS serial number.</td>
</tr>
<tr>
<td></td>
<td>• Register your EVO:RAIL PAC to receive your production EVO:RAIL license.</td>
</tr>
<tr>
<td></td>
<td>• Verify that all the required, and correct, configuration information is available before beginning the deployment:</td>
</tr>
<tr>
<td></td>
<td>– This information includes your NetApp FAS cluster base license key and all 18 feature license keys.</td>
</tr>
<tr>
<td></td>
<td>• Configure the deployment workstation with IP addresses in both the temporary 192.168.10.0/24 subnet and in the production management subnet.</td>
</tr>
<tr>
<td></td>
<td>• For even faster setup and to reduce manual data entry error, prepare a configuration (JSON) file.</td>
</tr>
<tr>
<td></td>
<td>• If deploying multiple appliances, make sure that each appliance has been allocated its own set of VLANs and subnets.</td>
</tr>
<tr>
<td>Network services</td>
<td>• Make sure that a production DNS server is available, is reachable from the management network, and is configured with zones for the management network.</td>
</tr>
<tr>
<td></td>
<td>• Precreate DNS host entries for the ESXi hosts and vCenter Server in the appropriate DNS zone.</td>
</tr>
<tr>
<td></td>
<td>• Verify that a production NTP server is available and reachable from the management network.</td>
</tr>
<tr>
<td></td>
<td>• Make sure that DHCP is not enabled on the management network.</td>
</tr>
<tr>
<td>Physical networking</td>
<td>• Make sure that twelve 10GbE switchports and six 1GbE switchports are available for NetApp EVO connectivity.</td>
</tr>
<tr>
<td></td>
<td>• If using optical cables and transceivers in the NetApp EVO appliances, make sure that the available 10GbE switchports have corresponding transceivers installed.</td>
</tr>
<tr>
<td></td>
<td>• Connect the NetApp EVO appliances to multiple 10GbE switches for redundancy with one NIC port from each compute and storage node to different switches.</td>
</tr>
<tr>
<td></td>
<td>• Connect the NetApp EVO appliances to a 1GbE switch separate from the 10GbE switches.</td>
</tr>
<tr>
<td></td>
<td>• Connect the NetApp EVO compute appliance BMC ports for out-of-band management and supportability.</td>
</tr>
<tr>
<td></td>
<td>• Configure the connected switches either to enable both IGMP Querier and IGMP Snooping, or to disable IGMP Querier (the latter might result in higher multicast traffic on the network).</td>
</tr>
<tr>
<td>Best Practices Area</td>
<td>Best Practices Details</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------------</td>
</tr>
</tbody>
</table>
| Logical networking  | - Use a dedicated and distinct VLAN for each service network:  
|                     |  - Management  
|                     |  - vMotion  
|                     |  - VSAN  
|                     |  - NFS  
|                     |  - VM  
|                     |  - Use unique, nonoverlapping subnets for each service network, mapping one subnet for each VLAN.  
|                     |  - Make sure that all VLANs that are used for the NetApp EVO configuration are properly trunked on each connected port and across all switch uplinks or ISLs.  
|                     |  - Reserve contiguous blocks of additional IP addresses in each service network to make it easier to add more appliances for cluster expansion.  
|                     |  - For simplicity and administrative clarity, consider using the same last octet for the different IP ranges that are provided for ESXi management, vMotion, and VSAN.  
|                     |  - Configure the BMC ports with static IP addresses for greater predictability and reliability or use DHCP reservations. |
| Postdeployment       | - Assign the production license key to the EVO:RAIL appliance immediately upon deployment completion.  
|                     |  - Leave the NetApp Integration Server VM running to provide access to configuration logs and information, and to management and support shortcuts.  
|                     |  - Deploy onto the NetApp SDRS cluster any VMs that require replication or off-site backups, many on-disk recovery points, or deep application integration and protection, or that contain critical business data.  
|                     |  - Deploy onto the VSAN datastore VMs that are transient in nature or that do not require advanced data protection capabilities (or whose data protection is handled by the application itself). |
| Data protection      | - Upon VM deployment, create backup jobs and schedules in the NetApp VSC that match the desired Snapshot copy frequency and retention period.  
|                     |  - Create SnapMirror or SnapVault jobs to integrate NetApp EVO into your Data Fabric that is enabled by NetApp. |

## 7 Conclusion

The NetApp Integrated EVO:RAIL Solution provides an easy-to-consume infrastructure building block with rich data management capabilities that are superior to competing hyper-converged offerings. Customers can extend their Data Fabric powered by NetApp from the central data center to the enterprise edge in a simple, rapidly deployable, and easily repeatable manner. NetApp EVO proves that a customer does not need to compromise on reliability, features, or enterprise-class support to enjoy the benefits of a hyper-converged solution.

## Appendix

### Physical Labels

The NetApp EVO appliances are affixed with several labels that provide serial numbers, licenses, or other identifying notations. Table 12 lists the NetApp EVO labels.
### Table 12) NetApp EVO labels.

<table>
<thead>
<tr>
<th>Label</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft Certificate of Authority</td>
<td>Top of chassis on the front left</td>
</tr>
<tr>
<td>Compute Appliance ID (App ID)</td>
<td>Right side of right appliance ear</td>
</tr>
<tr>
<td>Compute Appliance/Chassis Serial Number</td>
<td>Right side of right appliance ear</td>
</tr>
<tr>
<td>Compute Node Serial Numbers</td>
<td>Rear left and right sides of chassis</td>
</tr>
<tr>
<td></td>
<td>(physically proximate to each node)</td>
</tr>
<tr>
<td>Storage Node Serial Numbers</td>
<td>Rear of each storage node</td>
</tr>
</tbody>
</table>

### Configuring the Deployment Workstation Networking

The customer workstation that is used during deployment must use a static IP address configuration, and two different IP addresses and subnets are used for this management network during the configuration process. The remainder of this section provides guidance on configuring multiple IP addresses on a single interface under Microsoft Windows, Mac OS X, and Linux.

Specific configuration steps might vary slightly depending on the version of the operating system that is installed on the deployment workstation.

#### Microsoft Windows

To configure multiple IP addresses on a single interface by using the Microsoft Windows GUI, users should complete the following steps:

1. Open the Control Panel, select Network and Internet, and then select Network Connections.
2. Right-click the appropriate network connection (frequently Local Area Connection) and select Properties.
4. Configure the first IP address by using the Use the Following IP Address option.
5. Click Advanced.
6. From the IP Settings tab, under IP Address, click Add.
7. Enter the second IP address and subnet mask.
8. Click Add and then click OK for the next three screens.

#### Mac OS X

To configure multiple IP addresses on a single interface by using the Mac OS X GUI, users should complete the following steps:

1. Open System Preferences and select Network.
2. In the left pane, select the connected network interface.
3. In the right pane, set the Configure IPv4 drop-down field to Manually.
4. Enter the first IP address and subnet mask.
5. In the left pane, select the connected network interface and click the gear icon at the bottom left pane.
7. Enter a desired name and click Duplicate.
8. Set the Configure IPv4 drop-down field to Manually.
9. Enter the second IP address and subnet.
10. Click Apply.

**Linux**

To configure multiple IP addresses on a single interface by using the Linux command-line interface, complete the following steps:

1. Open a terminal shell.
2. Display the current network interfaces and configuration by running the `sudo ifconfig -a` command.
3. Set the primary IP address by running the following command:

```
sudo ifconfig <interface> <ip_address> netmask <subnet_mask>
```

   For example:

```
sudo ifconfig eth0 192.168.10.199 netmask 255.255.255.0
```

4. Set the secondary IP address by running the following command:

```
sudo ifconfig <interface>:0 <ip_address> netmask <subnet_mask>
```

   For example:

```
sudo ifconfig eth0:0 10.10.10.199 netmask 255.255.255.0
```

5. Verify the new network configuration by running the `sudo ifconfig -a` command.

**Preconfiguration IP Addresses**

The NetApp Integrated EVO:RAIL Solution ships in a factory default state with a few temporary, predefined static IP addresses to assist with the initial bootstrapping of the environment. During the EVO:RAIL and NetApp integration automation, these IP addresses are changed in accordance with the values chosen by the customer. Table 13 lists the IP addresses that are used by the NetApp EVO solution in a preconfigured state.

Table 13) IP addresses used by the NetApp EVO solution in a preconfigured state.

<table>
<thead>
<tr>
<th>Component</th>
<th>IP Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>NetApp Integration Server</td>
<td>192.168.10.100</td>
</tr>
<tr>
<td>NetApp FAS NodeA</td>
<td>192.168.10.101</td>
</tr>
<tr>
<td>NetApp FAS NodeB</td>
<td>192.168.10.102</td>
</tr>
<tr>
<td>VMware vCenter Server</td>
<td>192.168.10.200</td>
</tr>
</tbody>
</table>

**New IP Address Assignment**

IP addresses are assigned in a predictable and consistent manner by both the EVO:RAIL and the NetApp Integration Server deployment processes. This feature is helpful in general and is particularly useful for precreating DNS host records for the management addresses that the NetApp EVO appliances use.

The EVO:RAIL deployment process assigns IP addresses sequentially to each ESXi node for each defined network (management, vMotion, and VSAN). Table 14 illustrates the following example: If the IP address range of 192.168.10.111 to 192.168.10.114 is used, the first ESXi node is assigned 192.168.10.111, the second is assigned 192.168.10.112, and so on.
Table 14) EVO:RAIL IP address example assignment.

<table>
<thead>
<tr>
<th>Entered IP Address Range: 192.168.10.111 to 192.168.10.114</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ESXi Node</strong></td>
</tr>
<tr>
<td>Node 1</td>
</tr>
<tr>
<td>Node 2</td>
</tr>
<tr>
<td>Node 3</td>
</tr>
<tr>
<td>Node 4</td>
</tr>
</tbody>
</table>

The NetApp integration process assigns IP addresses sequentially as well. Table 15 illustrates the following example: If the IP address range of 192.168.10.150 to 192.168.10.157 is used for storage management, the cluster management interface is assigned 192.168.10.150, the NodeA management interface is assigned 192.168.10.151, the NodeA intercluster interface (referred to as NodeA intercluster link in the GUI) is assigned 192.168.10.152, the NodeA Service Processor is assigned 192.168.10.153, and so on.

Table 15) NetApp storage management IP address example assignment.

<table>
<thead>
<tr>
<th>Entered IP Address Range: 192.168.10.150 to 192.168.10.157</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NetApp Interface</strong></td>
</tr>
<tr>
<td>Cluster management</td>
</tr>
<tr>
<td>NodeA: node management</td>
</tr>
<tr>
<td>NodeA: intercluster link</td>
</tr>
<tr>
<td>NodeA: Service Processor</td>
</tr>
<tr>
<td>NodeB: node management</td>
</tr>
<tr>
<td>NodeB: intercluster link</td>
</tr>
<tr>
<td>NodeB: Service Processor</td>
</tr>
<tr>
<td>VSC server</td>
</tr>
</tbody>
</table>

For the data network (NFS), the NetApp integration process assigns IP addresses sequentially to both the clustered Data ONTAP nodes and the ESXi compute nodes. Table 16 illustrates the following example: If the IP address range of 192.168.40.211 to 192.168.40.216 is used for the data network, the storage NodeA NFS interface is assigned 192.168.40.211, the storage NodeB NFS interface is assigned 192.168.40.212, the compute Node1 NFS interface is assigned 192.168.40.213, and so on.

Table 16) NFS IP address example assignment.

<table>
<thead>
<tr>
<th>Entered IP Address Range: 192.168.40.211 to 192.168.40.216</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Node Interface</strong></td>
</tr>
<tr>
<td>Storage NodeA</td>
</tr>
<tr>
<td>Storage NodeB</td>
</tr>
<tr>
<td>Compute Node1</td>
</tr>
</tbody>
</table>
For the VMware vCenter Server VM, VMware vRealize Log Insight VM, and NetApp Integration Server VM, each IP address is entered into the UI explicitly. The assignment is not determined by the automation software itself.

**Postconfiguration Management and Support Options**

The NetApp Integration Server displays helpful postsetup information in a three-tabbed interface that captures the configuration state of the NetApp EVO system and provides helpful links to support sites and management interfaces.

**Management Tab**

The Management tab provides convenient access to management tools that are both external and provisioned as part of the NetApp EVO deployment process:

- VMware EVO:RAIL License Activation:
  - VMware site to register PACs and obtain license keys
- NetApp System Manager:
  - Web browser–based local on-box management of clustered Data ONTAP through a cluster management IP address
- vSphere Web Client:
  - Web browser–based local vSphere management by using a vCenter Server IP address
- NetApp VSC:
  - Direct VSC page integrated within the vSphere Web Client

**Configuration Tab**

The Configuration tab captures the following environmental information that results from the completion of NetApp integration:

- Storage cluster:
  - Cluster name
  
  **Note:** This name is set to match the Appliance ID of the first compute appliance.
  - Cluster serial number
  - Cluster management IP address
- Storage node:
  - Names
  - Serial numbers
  - System IDs
  - IP addresses (management, intercluster LIF, Service Processor, and NFS data LIF)
- Cluster and feature licenses
- Compute nodes:
  - Names
- NFS IP addresses
- Serial numbers

**Support Tab**

The Support tab provides convenient access to support and documentation tools that are hosted on NetApp.com so that customers can:

- Access the main NetApp Support site
- Open a new support case
- Check an existing support case
- Access the NetApp My AutoSupport® system
- Access the NetApp EVO Resources page

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**References**

The following materials provide additional information about the subjects in this technical report:

- NetApp Integrated EVO:RAIL Solution resources page
  [https://mysupport.netapp.com/evorail/resources](https://mysupport.netapp.com/evorail/resources)
- VMware EVO:RAIL resources page
  [https://www.vmware.com/products/evorail/resources.html](https://www.vmware.com/products/evorail/resources.html)
- NetApp Tech OnTap® podcast on the NetApp Integrated EVO:RAIL Solution
- VMworld 2015 deep-dive session recording (requires login)
  [http://vmware.mediasite.com/mediasite/Play/fb902fbab4764cd2a1decbd2d857c6651d?catalog=1c95c1d4-0353-4ae1-b3ed-a5067af5b57aa](http://vmware.mediasite.com/mediasite/Play/fb902fbab4764cd2a1decbd2d857c6651d?catalog=1c95c1d4-0353-4ae1-b3ed-a5067af5b57aa)

**Version History**

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Document Version History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version 1.0</td>
<td>November 2015</td>
<td>First version of NetApp EVO for releases 1.0 and 1.1</td>
</tr>
</tbody>
</table>
Refer to the Interoperability Matrix Tool (IMT) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer’s installation in accordance with published specifications.

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