



Technical Report

# E-Series and EF-Series Reference Architecture and Storage Best Practices with Veeam Backup & Replication v8

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## **Implementation Overview and Usage Considerations**

This document outlines the reference architecture and best practices when using NetApp<sup>®</sup> E-Series storage in a Veeam Backup & Replication v8 environment.

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# 1 Executive Summary

## The Challenge

With data growing at astounding rates, IT managers depend more and more on reliable data backup and recovery. High-growth businesses require a complete data protection solution that is reliable, flexible, and easy to use. Virtualizing an environment provides increased levels of data availability, but meeting aggressive recovery point objectives (RPOs) and recovery time objectives (RTOs) becomes increasingly difficult.

Traditional backup tools were not created for virtualized environments. That fact makes it hard for many organizations to take full advantage of their virtualized environment, and many IT managers struggle with:

- Unreliable backups
- Recovery that takes too long
- High costs associated with managing backup data and secondary storage
- Inability to provide reliable and true backups for compliance purposes
- Lost productivity because of management complexity
- The need to scale backup operations for growth

## The Solution

To meet these challenges, Veeam and NetApp collaborated to offer high-performance storage with reliable data protection designed for virtualized environments.

Veeam and NetApp help you modernize your data protection strategy with a solution designed to manage large data volumes and handle the increasing performance and availability demands of a 21st-century infrastructure.

Veeam Backup & Replication unifies backup and replication in a single solution, increasing the value of backup and reinventing data protection for VMware vSphere and Microsoft Hyper-V virtual environments. The Veeam agentless design provides multiple backup options to meet your needs. Features such as source-side deduplication and compression, change block tracking, parallel processing, and automatic load balancing provide the fastest, most efficient backups possible.

NetApp E-Series and EF-Series storage provides simple and reliable SAN storage that integrates seamlessly with most application environments. Its modular design helps decrease operating expenses while offering many options for connectivity, capacity, and performance that easily scale to meet the demands of a growing backup environment.

Together, Veeam and NetApp create the perfect staging area for backups—reducing backup ingest bottlenecks and providing faster backups through parallel processing.

In addition, Veeam Backup & Replication provides:

- Granular recovery of VMs and files, including Microsoft Exchange and SharePoint application items
- The ability to automatically verify every backup, VM, and replica—every time
- Self-service recovery of VMs and guest files without direct network connection to the VM, user permissions, or the need to deploy costly agents
- Instant VM recovery to recover a failed VM in less than two minutes
- A choice to back up and recover what you need, where you need it, and when you need it, whether it is on site, on tape, or in the cloud

Veeam and NetApp offer the right solution for performance, flexibility, and reliability, providing an impressive modern disaster recovery solution for your vSphere or Hyper-V environment.

This document is a reference architecture for enabling a collaborative backup and recovery solution on NetApp E-Series with Veeam Backup & Replication v8 data protection software.

## 1.1 Introduction

Veeam and NetApp jointly developed this reference architecture to guide successful Backup & Replication v8 deployments with E-Series storage to enable data and application availability.

NetApp E-Series and Veeam Backup & Replication v8 combine to offer a data protection and availability solution through this tested reference architecture from industry leaders NetApp and Veeam. This solution is optimized for virtual environments providing disk-to-disk backup and recovery on high-capacity, flexible, performance-oriented NetApp E-Series storage arrays. This solution provides customers with superior data management for virtual environments and high availability while making customers' data highly available as well.

NetApp E-Series arrays provide a high-performing backup repository to house Veeam-created backups. This capability enables the recovery technologies enabled through Veeam to satisfy stringent RTOs. Recovery technologies such as Instant VM Recovery, SureBackup, and On-Demand Sandbox can leverage backup repositories capable of high I/O to achieve their full potential. These technologies enable users to not only restore from their backups faster but also enable capabilities such as automated recovery verification. The technologies also are able to leverage backup data as an ad-hoc testing environment. This changes the way users used backups in the past because more benefits are associated with having backups. No longer do backups sit idle waiting for an emergency restore; you can apply your backups for many creative uses.

Features:

- Recovery of a failed VM in as little as two minutes
- Near-continuous data protection with built-in replication
- Fast, agentless item recovery and e-discovery for Microsoft Exchange, SharePoint, and Active Directory, along with transaction-level recovery of SQL databases
- Automatic recoverability testing of every backup and every replica, every time
- Off-site backups made up to 50 times faster than the speed of standard file copy with built-in WAN acceleration
- Fast and secure cloud backups with Veeam Cloud Connect
- Deduplication and compression to minimize storage consumption
- Off-site recovery with one-click site failover and support for facilitated data center migrations with zero data loss

## 1.2 About NetApp

NetApp creates innovative products: storage systems and software that help customers around the world store, manage, protect, and retain one of their most precious corporate assets: their data. We are recognized throughout the industry for continually pushing the limits of today's technology so that our customers never have to choose between saving money and acquiring the capabilities they need to be successful.

We always find ways to enable our customers to do things they couldn't do before at a speed they never thought possible. We partner with industry leaders to create the most efficient and cost-effective solutions optimized for their IT needs and to deliver to and support them worldwide. Leading organizations worldwide count on NetApp for software, systems and services to manage and store their data. Customers value our teamwork, expertise and passion for helping them succeed now and into the future.

<http://www.netapp.com>.

## 1.3 About Veeam

Veeam recognizes the new challenges that companies across the globe face in enabling the Always-On Business, a business that must operate 24/7/365. To address this challenge, Veeam delivers Availability

for the Modern Data Center by helping to ensure recovery time and point objectives (RTOs) of less than 15 minutes for all applications and data. Information about Veeam is available at [www.Veeam.com](http://www.Veeam.com). Veeam’s corporate headquarters are located in Baar, Switzerland; a main Americas office is located in Columbus, Ohio..

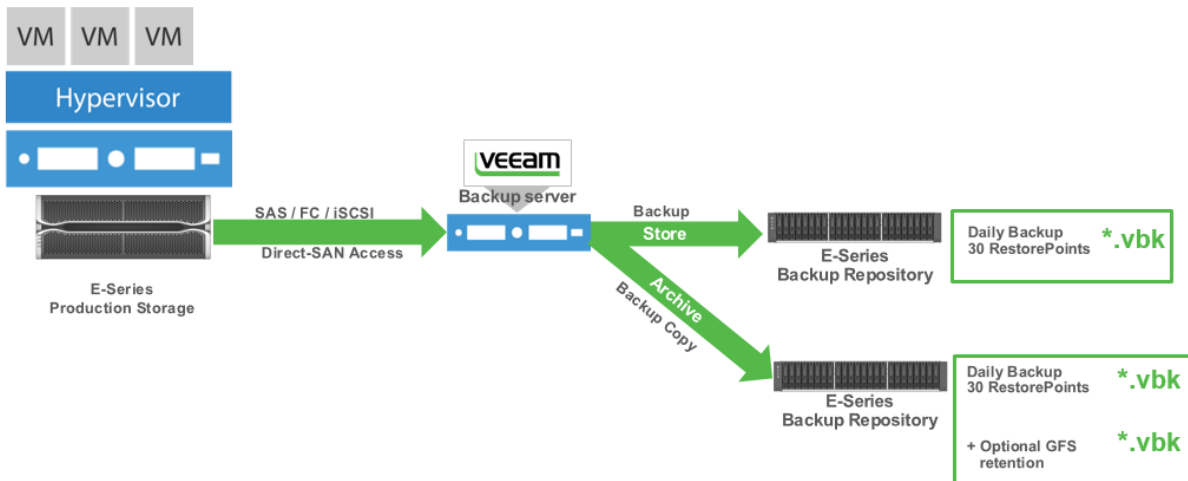
## 2 Reference Architecture Overview

This section details reference architectures ranging from those of small environments that protect a few terabytes of data to those in enterprise-size environments with petabytes of data under management.

### Solution Overview

#### 2.1 NetApp E-Series as Veeam Backup & Replication Repositories for Backup and Archive

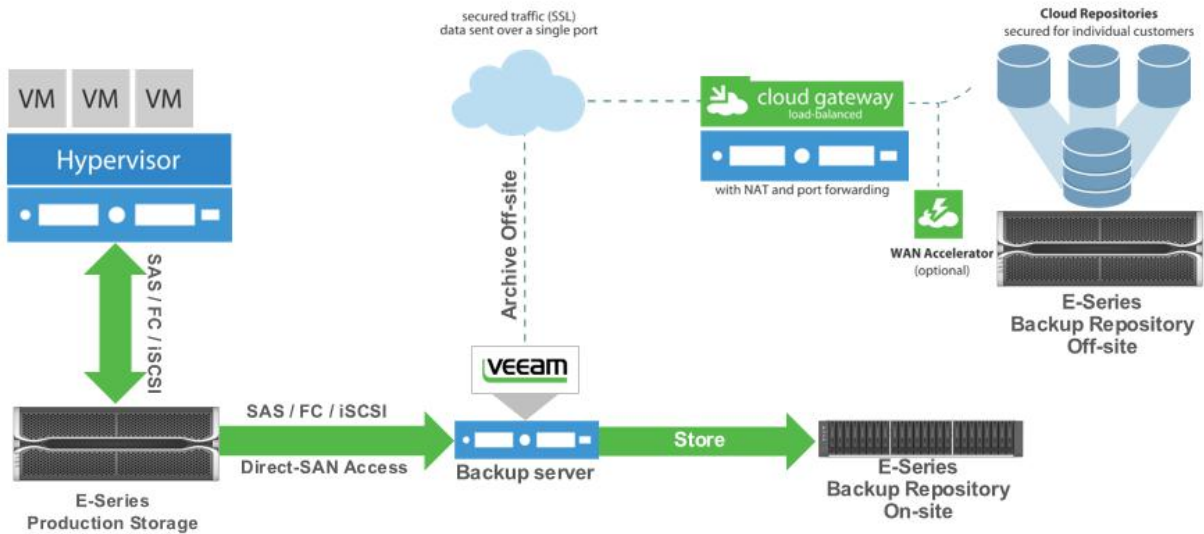
Figure 1) NetApp E-Series as Veeam Backup & Replication repositories for backup and archive.





## 2.2 NetApp E-Series as a Veeam Backup & Replication Backup Repository and Off-Site Cloud Repository

Figure 2) NetApp E-Series as a Veeam Backup & Replication backup repository and off-site cloud repository.



## 2.3 NetApp E-Series as a Veeam Backup & Replication Backup Repository for NetApp FAS Production Storage

Figure 3) NetApp E-Series as a Veeam Backup & Replication backup repository and off-premises backup repository for FAS production storage.

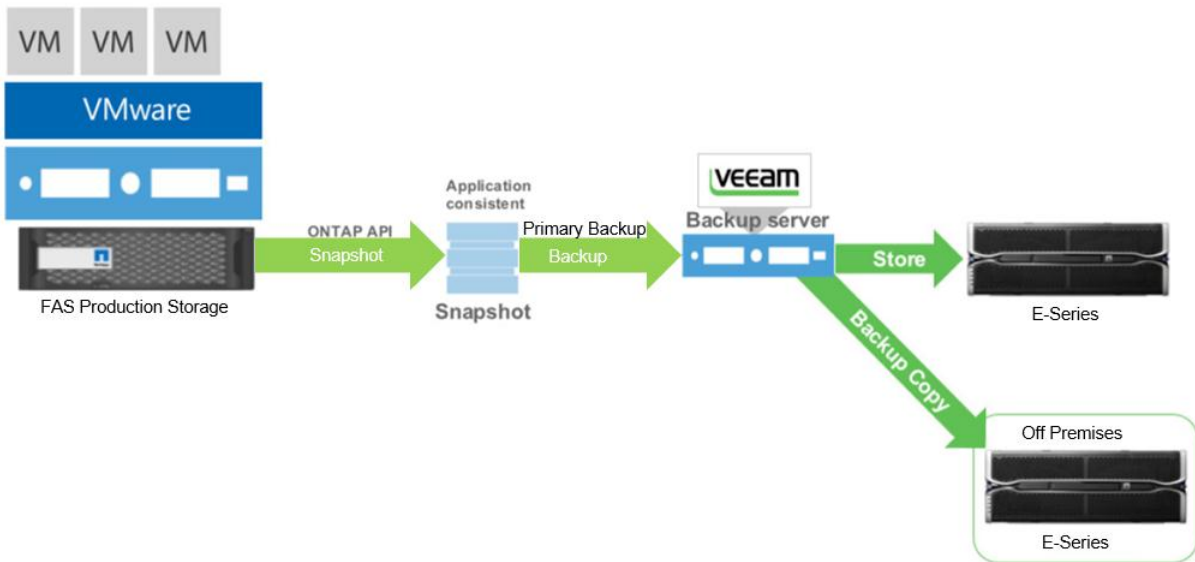


Figure 3 illustrates Veeam integration with a NetApp FAS series production storage array with newly created backups going to an E-Series array for storage. To provide disaster recovery, backups can also be sent off premises to another backup repository (another E-Series). Veeam provides a Backup Copy

Job for such scenarios; this job can be leveraged for backups off premises or for long-term archiving using Veeam’s built-in Grandfather-Father-Son–type retention.

Leveraging Veeam’s Backup Copy Job architecture is key to achieving that last level of protection. The off-site copy provides safeguards for an entire data center–level disaster. Veeam also provides an optional WAN acceleration component that can help reduce bandwidth utilization. This component can play a huge role in environments that have active-active sites or have low available bandwidth to start with. The forever-incremental nature of the Backup Copy Job enables only incremental change data to be transmitted off site after the initial copy. Preseeding options are available for the initial transfer of data for those that need it

## 2.4 Deployment Scenarios

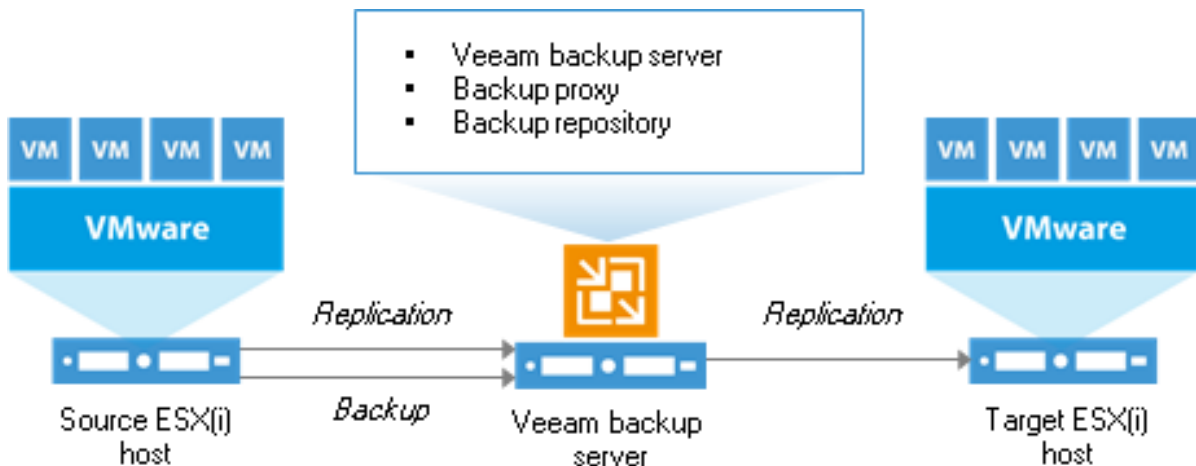
### Simple Deployment

In a simple deployment scenario, one instance of Veeam Backup & Replication is installed on a physical or virtual Windows-based machine. This installation is referred to as a Veeam backup server.

Simple deployment implies that the Veeam backup server fills three major roles:

- It functions as a management point, coordinates all jobs, controls their scheduling, and performs other administrative activities.
- It acts as the default backup proxy for handling job processing and transferring backup traffic. All services necessary for the backup proxy functionality are installed on the Veeam backup server locally.
- It is used as the default backup repository. During installation, Veeam Backup & Replication checks volumes of the machine on which you install the product and identifies a volume with the greatest amount of free disk space. On this volume, Veeam Backup & Replication creates the backup folder that is used as the default backup repository.

Figure 4) Simple deployment.



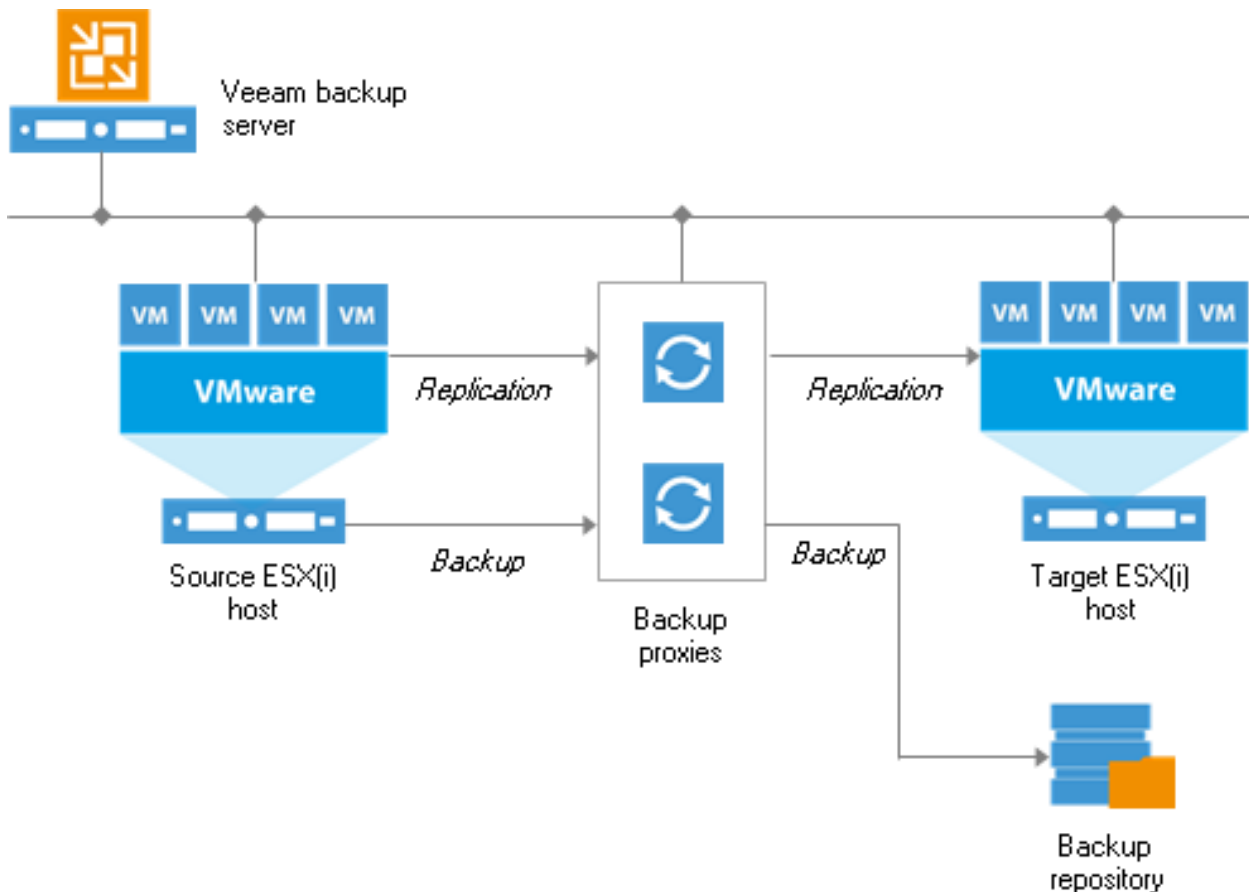
If you plan to back up and replicate only a small number of VMs or evaluate Veeam Backup & Replication, this configuration is enough to get you started. Veeam Backup & Replication is ready for use right out of the box—as soon as it is installed, you can start using the solution to perform backup and replication operations. To balance the load of backing up and replicating your VMs, you can schedule jobs at different times.

## Advanced Deployment

In large-scale virtual environments with a large number of jobs, the load on the Veeam Backup Server is heavy. In this case, NetApp recommends using the advanced deployment scenario that moves the backup workload to dedicated backup proxies and backup repositories.

The essence of the advanced deployment is that the backup proxy takes off part of Veeam backup server activities (namely, it collects and processes data and moves backup traffic from source to target). In addition, the Veeam backup server no longer acts as a storage location. The backup proxy transports VM data to a dedicated backup repository that keeps backup files, VM copies, metadata, and so on. The Veeam backup server in this scenario functions as a "manager" for deploying and maintaining backup proxies and repositories.

Figure 5) Advanced deployment.



To deploy a backup proxy and/or a backup repository, add a server to Veeam Backup & Replication and assign a proxy and/or repository role to it. Veeam Backup & Replication automatically installs lightweight components and services onto these servers. A backup proxy does not require a separate SQL database—all settings are stored centrally, within the SQL database used by the Veeam backup server.

With the advanced deployment scenario, you can easily meet your current and future data protection requirements. You can expand your backup infrastructure horizontally in a matter of minutes to match the amount of data you want to process and the available network throughput. Instead of growing the number of backup servers or constantly tuning job scheduling, you can install multiple backup proxies and

repositories and distribute the backup workload among them. The installation process is fully automated, which simplifies deploying and maintaining the backup infrastructure in your virtual environment.

In virtual environments with several proxies, Veeam Backup & Replication dynamically distributes backup traffic among those proxies. A job can be explicitly mapped to a specific proxy. Alternatively, you can let Veeam Backup & Replication choose the most suitable proxy. In this case, Veeam Backup & Replication will check settings of available proxies and select the most appropriate one for the job. The proxy server to be used should have access to the source and target hosts as well as to the backup repository to which files will be written.

The advanced deployment scenario can be a good choice for backing up and replicating off site. You can deploy a backup proxy in the production site and another one in the DR site, closer to the backup repository. When a job is performed, backup proxies on both sides establish a stable connection, so this architecture also allows efficient data transport over a slow network connection or WAN.

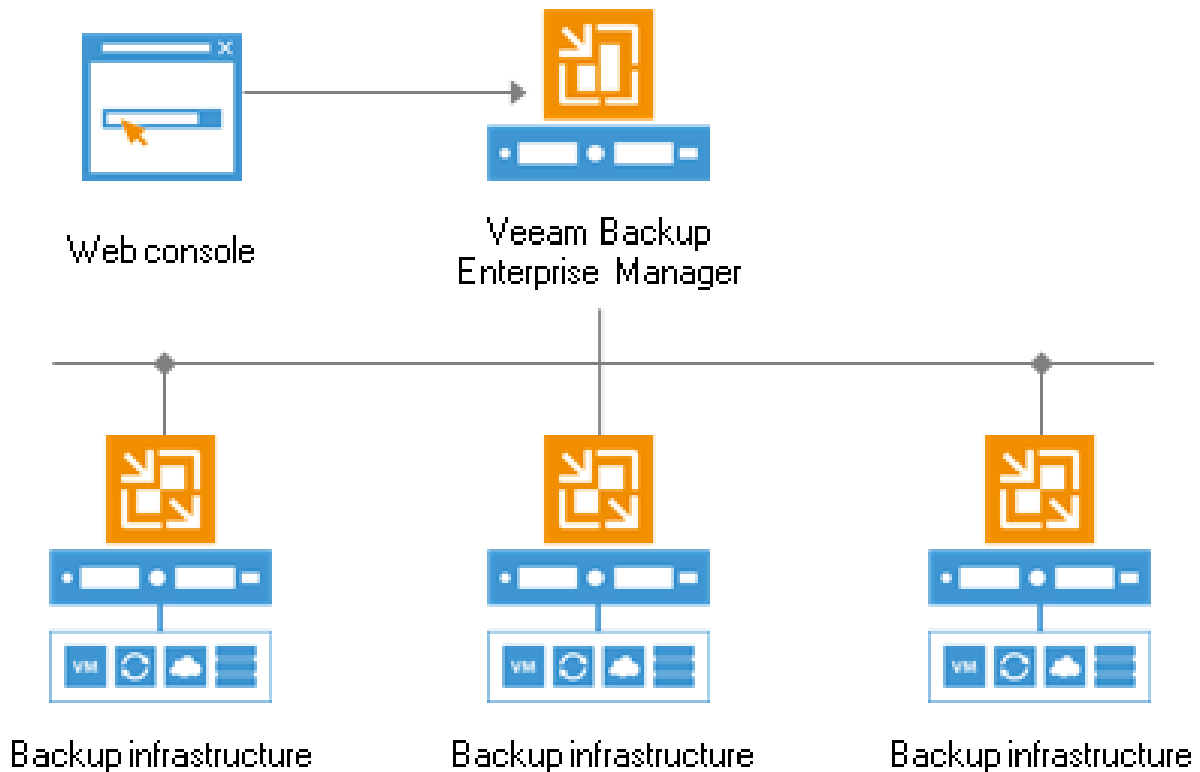
To regulate backup load, you can specify the maximum number of concurrent tasks per proxy and set up throttling rules to limit proxy bandwidth. The maximum number of concurrent tasks can also be specified for a backup repository in addition to the value of the combined data rate for it.

Another advantage of the advanced deployment scenario is that it contributes to high availability. Jobs can migrate between proxies if one of them becomes overloaded or unavailable.

## Distributed Deployment

NetApp recommends the distributed deployment scenario for large geographically dispersed virtual environments with multiple Veeam backup servers installed across different sites. These backup servers are federated under Veeam Backup Enterprise Manager, an optional component that provides centralized management and reporting for these servers through a web interface.

Figure 6) Distributed deployment.



Veeam Backup Enterprise Manager collects data from Veeam backup servers and enables you to run backup and replication jobs across the entire backup infrastructure through a single "pane of glass." You can also edit those jobs and clone jobs using a single job as a template. Enterprise Manager also provides reporting data for various areas (for example, all jobs performed within the last 24 hours or 7 days, all VMs engaged in these jobs and so on).

Using indexing data consolidated on one server, Veeam Backup Enterprise Manager provides advanced capabilities to search for VM guest OS files in VM backups created on all Veeam backup servers. It does so even if the files are stored in repositories on different sites and recovers them in a single click. Searching for VM guest OS files is enabled through Veeam Backup Enterprise Manager; to streamline the search process, you can optionally deploy a Veeam Backup Search server in your backup infrastructure.

With flexible delegation options and security roles, IT administrators can delegate the necessary file restore or VM restore rights to authorized personnel in the organization. For example, they can allow database administrators to restore Oracle or SQL Server VMs.

If you use Veeam Backup Enterprise Manager in your backup infrastructure, you do not need to install licenses on every Veeam backup server you deploy. Instead, you can install one license on the Veeam Backup Enterprise Manager server and it will be applied to all servers across your backup infrastructure. This approach simplifies tracking license usage and license updates across multiple Veeam backup servers.

In addition, VMware administrators will benefit from the Veeam plug-in for vSphere Web Client that can be installed using Veeam Backup Enterprise Manager. Administrators can analyze cumulative information about used and available storage space; view statistics on processed VMs; and review success, warning, and failure counts for all jobs. Administrators can also easily identify unprotected VMs and perform capacity planning for repositories, all directly from vSphere.

## 3 NetApp E-Series and NetApp EF-Series Arrays

### 3.1 NetApp E-Series E2700 Storage System

The NetApp E2700 delivers configurable, streamlined performance for midsize application-driven SAN storage environments.

The scalable E2700 provides application-driven storage for remote, branch, and midsize organizations. Configurable with the 2U/12- or 4U/60-drive shelf and three forms of connectivity—FC, iSCSI, or SAS—the E2700 integrates with key applications such as VMware, Exchange, SQL Server, and Oracle systems.

With the E2700, you can:

- Gain best-in-class performance efficiency for a wide range of database and other transactional applications.
- Reduce the cost and complexity of high-throughput data management through a configurable architecture that is easy to use and install.
- Attain streamlined high performance, with low latency and high bandwidth and IOPS.
- Achieve seamless operations with flexible application integration.
- Scale capacity as needed to support business growth.

Like all NetApp E-Series systems, the E2700 uses robust, easy-to-use, and lightweight NetApp SANtricity® storage management software. This software enables performance efficiency, dynamic drive rebalancing, RAID management, intelligent cache tiering, and extended data protection, including data replication and disaster recovery.

## 3.2 NetApp E-Series E5600 Storage System

The NetApp E5600 delivers configurable, streamlined performance for midsize application-driven SAN storage environments.

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Like all NetApp E-Series systems, the E5600 uses robust, easy-to-use, and lightweight SANtricity storage management software. This software enables performance efficiency, dynamic drive rebalancing, RAID management, intelligent cache tiering, and extended data protection, including data replication and disaster recovery.

## 3.3 NetApp EF-Series EF560 Storage System

The NetApp EF560 all-flash array provides a robust platform for delivering exceptional performance to mission-critical applications. The EF560 flash array leverages the latest in solid-state-disk (SSD) technologies and a strong heritage of handling diverse workloads and providing superior business value through accelerating latency-sensitive and high-I/O applications.

The NetApp EF560 flash array is designed for performance-driven applications with submillisecond latency requirements. Built on a storage architecture with more than 20 years of storage development and more than 750,000 systems in the field, the EF560 can deliver sustained performance with submillisecond response times. This capability enables business-critical applications to deliver faster results and improves the end-user experience.

The extensive configuration flexibility, custom performance-tuning capabilities, and complete control over data placement make the NetApp EF560 an ideal choice for mission-critical applications. Its GUI-based performance and management tools provide key information about storage input/output (I/O) from multiple viewpoints, enabling administrators to make informed decisions about configuration adjustments to further refine performance.

The NetApp EF560 can:

- Increase the speed of business with submillisecond response times.
- Eliminate overprovisioning and improve IT efficiency.
- Achieve the transactional performance of 1,000 15K-RPM drives in a 2-unit enclosure that requires just 5% of the available rack space, power, and cooling as compared to the storage systems that run on spinning disks.
- Detect and resolve issues quickly with advanced monitoring and proactive repair.
- Protect against data loss and downtime with NetApp point-in-time Snapshot<sup>®</sup> images, remote replication, data assurance, and drive security (encryption at the drive).
- Leverage the enterprise-proven SANtricity software platform to manage multiple EF-Series storage systems.

By combining extreme IOPS, submillisecond response times, scale-up capacity, and enterprise-grade reliability, the NetApp EF560 flash array helps IT shops to increase productivity and achieve faster business results.

The EF560, available with up to 38TB of raw SSD storage in a single 2U enclosure and expandable up to 192TB, provides capacity and superior reliability to meet the requirements of the most demanding organizations. This technical report provides details regarding the EF560 features and architecture, including an overview of workload characterizations performed on an EF560 across a wide variety of I/O types. Some installation and configuration best practices are provided, including observations based on test data. However, for detailed installation and configuration details, refer to the EF-Series and SANtricity technical publications located on the NetApp Support site in the documentation-by-product library.

### 3.4 Highlighted NetApp E-Series Features

- Highly scalable capacity and performance.
- Maximum density—optimal space utilization and reduced power and cooling requirements.
- Dynamic Disk Pools (DDP) enable dynamic rebalancing of drive count changes to easily expand storage capacity as backup needs grow while providing added data protection with faster rebuild times if a drive fails.
- Flexibility—Integrate with ease through multiple host interfaces, drive technologies, and disk shelf options for flexible deployment.
- Full disk encryption—Data Security SafeStore encryption services' AES 128-bit encryption and simplified key management protect data throughout the drive's lifecycle without sacrificing performance.
- No-cost application add-ins enable you to easily manage storage in a single pane of glass within the native application.
- Tighter economics provide:
  - Better price per gigabyte
  - Lower TCO
  - Supportability and reliability, availability, and serviceability minimize the cost of support calls

### 3.5 Enterprise Reliability and Availability

Field-proven technology protects your valuable data:

- It is the right choice for peace of mind:
  - Leverages knowledge from 1,000,000 systems
  - Is backed by a worldwide support organization
- It is architected for the highest reliability and availability:
  - Fully redundant I/O path with automated failover
  - Online configuration, expansion, maintenance
  - Advanced monitoring and diagnostic features enable timely problem resolution
  - Proactively tracks SSD wear life and sends alert messages
- Provides enterprise data protection:
  - Robust disaster recovery (sync and asynch)
  - Local protection with high-efficiency Snapshot copies

### 3.6 SANtricity Storage Manager 11.20

E-Series storage systems are managed by using the SANtricity Storage Manager application, which offers both GUI management and CLI management interfaces for out-of-band and in-band system

management. NetApp generally recommends out-of-band management. However, in-band management is useful for cases in which there is no IP network access to remote storage systems but there are in-band traffic connections to the storage system from a local host.

SANtricity Storage Manager is based on the Oracle Java framework and can be installed on a Microsoft Windows, Solaris, or Linux operating system (OS) platform. The NetApp best practices configuration for managing storage systems is to use an out-of-band management host that does not participate in the data delivery workload.

For additional management configuration options, refer to the “Initial Configuration and Software Installation Guide for SANtricity Storage Manager 11.20” in the [SANtricity Storage Manager](#) product documentation.

SANtricity Storage Manager 11.20 (sometimes referred to as *storage management software*) is supported on 64-bit OS platforms and enables storage administrators to perform the following tasks:

- Set up network connections.
- Commission new storage systems.
- Configure NetApp AutoSupport™ (ASUP®) settings and preferences.
- For ASUP to function, the persistent monitor service must be running on the management station.
- Provision volumes and map the storage to hosts.
- Set up and manage storage features such as NetApp Snapshot copies, volume copy, synchronous mirroring, asynchronous mirroring, and solid-state-drive (SSD) read cache.
- Perform hardware and software maintenance activities to manage E-Series storage systems.

When the SANtricity management client is installed on a desktop OS, the following limitations apply:

- Simultaneous user sessions are limited to eight sessions.
- Desktop systems cannot run the host agent and send I/O traffic to the E-Series storage system.

SANtricity Storage Manager software has two windows that provide management functionality and offer a graphical representation of the storage system:

- **Enterprise Management Window (EMW).** When SANtricity Storage Manager is initiated, the EMW appears first. The EMW is used to add the storage systems that will be managed and monitored through SANtricity Storage Manager.
- **Array Management Window (AMW).** From the EMW, the AMW can be launched to access summary views and detailed information about individual storage systems. The AMW is used to configure, maintain, and manage a storage system and its components.

**Figure 7** and **Figure 8** show the EMW and AMW, respectively. In addition, the script editor for a storage system can be opened from the EMW, and configuration of the system can be accomplished by using a saved configuration or a custom script.

- a. The storage system is referred to as the *storage array* in the SANtricity GUI.



Figure 7) SANtricity Storage Manager 11.20 EMW.

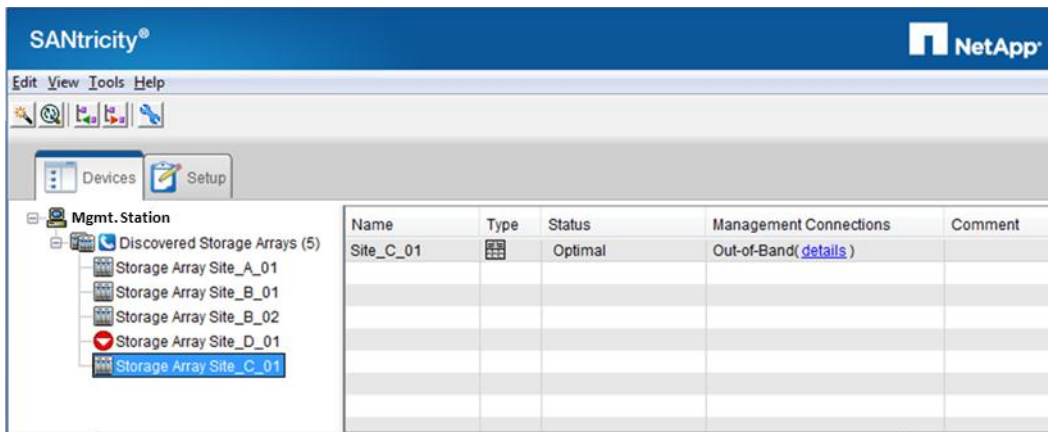
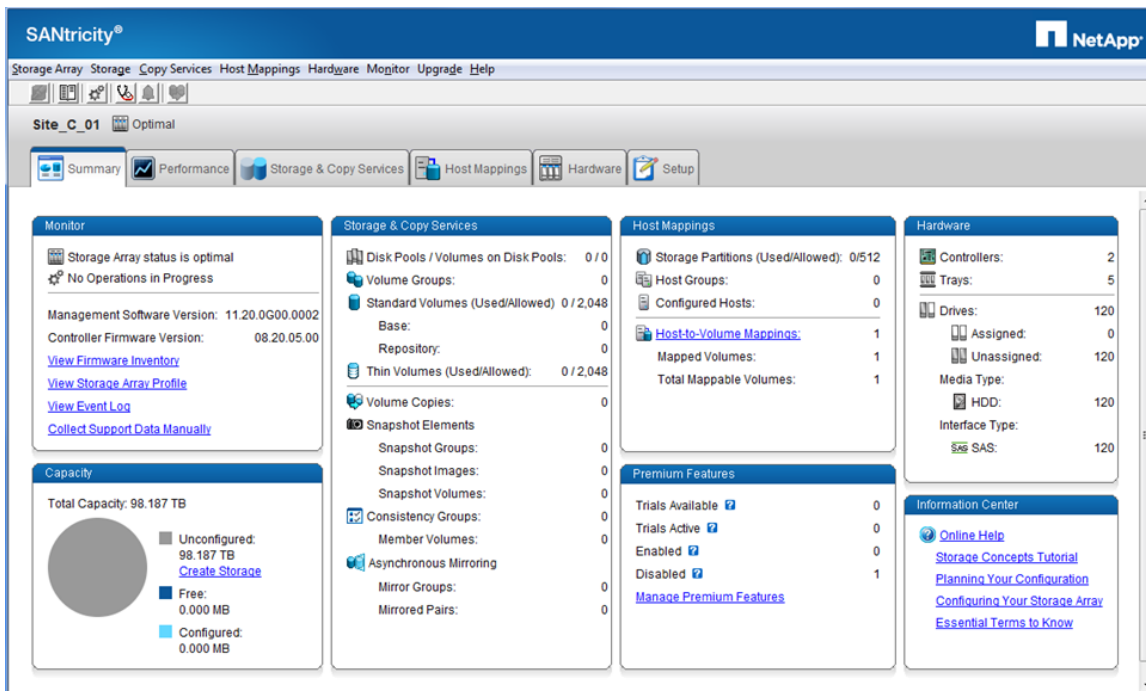


Figure 8) SANtricity Storage Manager 11.20 AMW storage system Summary tab view.



E-Series and EF-Series storage systems are shipped preloaded with SANtricity 11.20 OS software. SANtricity Storage Manager software, however, must be downloaded separately from the NetApp Support site and loaded on the management server before discovering storage systems running SANtricity 11.20 OS.

- b. The Support site registration process for first-time customers can take from three to five business days to complete. New customers should register for Support site access well ahead of the initial product installation date.

## 4 Veeam Backup & Replication v8

### 4.1 Overview

Veeam Backup & Replication is a data protection and disaster recovery solution for VMware vSphere and Hyper-V virtual environments of any size and complexity. Combining all of the necessary functions in one intuitive interface, Veeam Backup & Replication solves the most critical problems of virtualized infrastructure management. The solution also protects mission-critical virtual machines (VMs) from both hardware and software failures.

### 4.2 Solution Architecture

Veeam Backup & Replication is composed of the following elements.

### 4.3 Veeam Backup Server

The Veeam backup server is a Windows-based physical or virtual machine on which Veeam Backup & Replication is installed. It is the core component in the backup infrastructure that fills the role of the “configuration and control center.” The Veeam backup server performs all types of administrative activities:

- Coordinates backup, replication, recovery verification, and restore tasks
- Controls job scheduling and resource allocation
- Is used to set up and manage backup infrastructure components as well as specify global settings for the backup infrastructure

In addition to its primary functions, a newly deployed Veeam backup server also performs as a default backup proxy and the backup repository (it manages data handling and data storing tasks).

The Veeam backup server uses the following services and components:

- **Veeam Backup Service** is a Windows service that coordinates all operations performed by Veeam Backup & Replication, such as backup, replication, recovery verification, and restore tasks. The Veeam Backup Service runs under the Local System account or the account that has the Local Administrator permissions on the Veeam backup server.
- **Veeam Backup Shell** provides the application UI and enables user access to the application's functionality.
- **Veeam Backup Catalog Service** is a Windows service that manages guest OS file system indexing for VMs and replicates system index data files to enable search through guest OS files. Index data is stored in the Veeam Backup Catalog, a folder on the Veeam backup server. The Veeam Backup Catalog Service running on the Veeam backup server works with search components installed on Veeam Backup Enterprise Manager and (optionally) a dedicated Microsoft Search Server.
- **Veeam Backup SQL Database** is used by Veeam Backup Service, Veeam Backup Shell, and Veeam Backup Catalog Service to store data about the backup infrastructure, jobs, sessions, and so on. The database instance can be on a SQL Server installed either locally (on the same machine on which the Veeam backup server runs) or remotely.
- **Veeam Backup PowerShell Snap-In** is an extension for Microsoft Windows PowerShell 2.0. Veeam Backup PowerShell adds a set of cmdlets to allow users to perform backup, replication, and recovery tasks through the CLI of PowerShell or run custom scripts to automate operating Veeam Backup & Replication.
- **Backup Proxy Services.** In addition to dedicated services, the Veeam backup server runs a set of data mover services.

## 4.4 Backup Proxy

When Veeam Backup & Replication is initially installed, the Veeam backup server coordinates all job activities and handles data traffic. So, when you run a backup, replication, VM copy, or VM migration job or perform restore operations, VM data is moved from source to target through the Veeam backup server. This scenario is acceptable for virtual environments in which few backup jobs are performed. In large-scale environments, however, the workload on the Veeam backup server will be significant.

To take the workload off the Veeam backup server, Veeam Backup & Replication uses backup proxies. A backup proxy is an architecture component that sits between the data source and the target and is used to process jobs and deliver backup traffic. In particular, the backup proxy tasks include retrieving VM data from the production storage. The tasks also include compressing the data and sending it to the backup repository (for example, if you run a backup job) or another backup proxy (for example, if you run a replication job). As the data handling task is assigned to the backup proxy, the Veeam backup server becomes the “point of control” for dispatching jobs to proxy servers.

The role of a backup proxy can be assigned to a dedicated Windows server (physical or virtual) in your virtual environment. You can deploy backup proxies both in the primary site and in remote sites. To optimize the performance of several concurrent jobs, you can use a number of backup proxies. In this case, Veeam Backup & Replication distributes the backup workload between available backup proxies.

By using backup proxies, you can easily scale your backup infrastructure up and down based on your demands. Backup proxies run lightweight services that take a few seconds to deploy. Deployment is fully automated: Veeam Backup & Replication installs the necessary components on a Windows-based server when you add it to the product console. As soon as you assign the role of a backup proxy to the added server, Veeam Backup & Replication starts the required services on it.

The primary role of the backup proxy is to provide an optimal route for backup traffic and enable efficient data transfer. Therefore, when deploying a backup proxy, you need to analyze the connection between the backup proxy and the storage with which it is working. Depending on the type of connection, the backup proxy can be configured in one of the following ways (starting from the most efficient):

- A machine used as a backup proxy should have direct access to the storage on which VMs reside or the storage to which VM data is written. In this way, the backup proxy retrieves data directly from the datastore, bypassing the LAN.
- The backup proxy can be a VM with HotAdd access to VM disks on the datastore. This type of proxy also enables LAN-free data transfer.
- If neither of the above scenarios is possible, you can assign the role of the backup proxy to a machine on the network closer to the source or the target storage with which the proxy will work. In this case, VM data is transported over the LAN using the NBD protocol.

Depending on the type of backup proxy and your backup architecture, the backup proxy can use one of the following data transport modes: Direct SAN Access, Virtual Appliance, or Network. If the VM disks are on the SAN storage and the SAN storage is added to the Veeam Backup & Replication console, the backup proxy can also use the Backup from Storage Snapshots mode. You can select the transport mode or let Veeam Backup & Replication replication automatically choose it.

The backup proxy uses the following services and components:

- Veeam Installer Service is an auxiliary service that is installed and started on any Windows server once it is added to the list of managed servers in the Veeam Backup & Replication console. This service analyses the system and installs and upgrades necessary components and services depending on the role selected for the server.
- Veeam Transport is responsible for deploying and coordinating executable modules that act as "data movers" and perform main job activities on behalf of Veeam Backup & Replication. These activities include communicating with VMware Tools, copying VM files, performing data deduplication and compression, and so on.

### Backup Repository

A backup repository is a location used by Veeam Backup & Replication jobs to store backup files, copies of VMs, and metadata for replicated VMs. Technically, a backup repository is a folder on the backup storage. By assigning different repositories to jobs and limiting the number of parallel jobs for each one, you can balance the load across your backup infrastructure.

## 5 Veeam Backup & Replication v8 Requirements

### 5.1 VMware System Requirements

#### 5.1.1 Veeam Backup Server

Table 1) Veeam backup server.

Specification	Requirement
<b>CPU</b>	<ul style="list-style-type: none"> <li>Modern x86-64 processor (minimum 2 cores or vCPUs).</li> </ul>
<b>Memory</b>	<ul style="list-style-type: none"> <li>Memory: 4GB RAM plus 500MB RAM for each concurrent job.</li> </ul>
<b>Disk Space</b>	<ul style="list-style-type: none"> <li>2GB for product installation 10GB per 100 VMs for guest file system catalog folder (persistent data). Sufficient free disk space for Instant VM Recovery cache folder (nonpersistent data, at least 10GB is recommended).</li> </ul>
<b>Network</b>	<ul style="list-style-type: none"> <li>1Gbps LAN for on-site backup and replication and 1Mbps WAN for off-site backup and replication are recommended. High latency and reasonably unstable WAN links are supported.</li> </ul>
<b>OS</b>	<p>64-bit version of the following operating systems is supported:</p> <ul style="list-style-type: none"> <li>Microsoft Windows Server 2012 R2</li> <li>Microsoft Windows Server 2012</li> <li>Microsoft Windows Server 2008 R2 SP1</li> <li>Microsoft Windows Server 2008 SP2</li> <li>Microsoft Windows 8.x</li> <li>Microsoft Windows 7 SP1</li> </ul>
<b>Software</b>	<p>During setup, the installer performs a system configuration check to determine if all prerequisite software is available on the machine in which you plan to install Veeam Backup &amp; Replication. If some of the required software components are missing, the setup wizard offers to install the missing software automatically. This refers to:</p> <ul style="list-style-type: none"> <li>Microsoft .NET Framework 4.0</li> <li>Windows Installer 4.5</li> <li>Microsoft SQL Server Management Objects</li> <li>Microsoft SQL Server System CLR Types</li> <li>Microsoft Visual C++ 2010 Service Pack 1 redistributable package</li> </ul> <p>The following software must be installed manually:</p> <ul style="list-style-type: none"> <li>Microsoft PowerShell 2.0 (required for PowerShell snap-in)</li> <li>Internet Explorer 9.0 or later</li> </ul>

<b>SQL Database</b>	<p>Local or remote installation of the following versions of Microsoft SQL Server (both Full and Express Editions are supported):</p> <ul style="list-style-type: none"> <li>• Microsoft SQL Server 2014</li> <li>• Microsoft SQL Server 2012 (Microsoft SQL Server 2012 Express Edition is included in the setup)</li> <li>• Microsoft SQL Server 2008 R2</li> <li>• Microsoft SQL Server 2008</li> <li>• Microsoft SQL Server 2005</li> </ul>
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**Important**

1. If you plan to back up VMs running Microsoft Windows Server 2012 R2 and data deduplication is enabled for some VM volumes, NetApp recommends that you deploy Veeam Backup & Replication on a machine running Microsoft Windows Server 2012 R2 with data deduplication enabled. Otherwise, some types of restore operations for these VMs (such as Microsoft Windows File Level Recovery) might fail.
2. Because of its limitations, Microsoft SQL Server Express Edition can be used only for evaluation purposes or in case of a small-scale production environment. For environments with many VMs, it is necessary to install a fully functional commercial version of Microsoft SQL Server.

**5.1.2 VMware Backup Proxy Server**

Table 2) VMware backup proxy server.

Specification	Requirement
<b>CPU</b>	<ul style="list-style-type: none"> <li>• Modern x86 processor (minimum 2 cores or vCPUs). Using multicore processors improves data processing performance and enables more tasks to be processed concurrently by the backup proxy.</li> </ul>
<b>Memory</b>	<ul style="list-style-type: none"> <li>• 2GB RAM plus 200MB for each concurrent task. Using faster memory (DDR3) improves data processing performance.</li> </ul>
<b>Disk Space</b>	<ul style="list-style-type: none"> <li>• 300MB.</li> </ul>
<b>Network</b>	<ul style="list-style-type: none"> <li>• NetApp recommends 1Gbps LAN for on-site backup and replication and 1Mbps WAN for off-site backup and replication. High latency and reasonably unstable WAN links are supported.</li> </ul>
<b>OS</b>	<p>Both 32-bit and 64-bit versions of the following operating systems are supported:</p> <ul style="list-style-type: none"> <li>• Microsoft Windows Server 2012 R2</li> <li>• Microsoft Windows Server 2012</li> <li>• Microsoft Windows Server 2008 R2 SP1</li> <li>• Microsoft Windows Server 2008 SP2</li> <li>• Microsoft Windows Server 2003 SP2</li> <li>• Microsoft Windows 8.x</li> <li>• Microsoft Windows 7 SP1</li> <li>• Microsoft Windows Vista SP2</li> </ul>
<b>Software</b>	<p>For VMware vSphere 5.5 backup proxy server on Microsoft Windows Server 2008 or earlier: Microsoft Visual C++ 2008 SP1 redistributable package (x64). Installation package can be downloaded from <a href="http://vee.am/runtime">http://vee.am/runtime</a>.</p>

**Important:** To protect VMs running on ESXi 5.5 and newer, you must deploy backup proxies on machines running a 64-bit version of Microsoft Windows. VDDK 5.5 and newer do not support 32-bit versions of Microsoft Windows.

### 5.1.3 Backup Repository Server (VMware)

Table 3) Backup repository server (VMware).

Specification	Requirement
<b>CPU</b>	<ul style="list-style-type: none"> <li>Modern x86 processor (minimum 2 cores or vCPUs). Using multicore processors improves data processing performance and enables more tasks to be processed concurrently by the backup proxy.</li> </ul>
<b>Memory</b>	<ul style="list-style-type: none"> <li>4GB RAM plus 2GB RAM (32-bit OS) or 4GB RAM (64-bit OS) for each concurrent job. Using more memory improves data processing performance for long chains of large backup files on backup repositories running a 64-bit OS.</li> </ul>
<b>Disk Space</b>	<ul style="list-style-type: none"> <li>200MB for Veeam Backup &amp; Replication components and sufficient disk space to store backup files and replicas (NetApp recommends high-RPM drives and RAID 10 configuration).</li> </ul>
<b>Network</b>	<ul style="list-style-type: none"> <li>NetApp recommends 1Gbps LAN for on-site backup and replication and 1Mbps WAN for off-site backup and replication. High latency and reasonably unstable WAN links are supported.</li> </ul>
<b>OS</b>	<p>Both 32-bit and 64-bit versions of the following operating systems are supported:</p> <ul style="list-style-type: none"> <li>Microsoft Windows Server 2012 R2</li> <li>Microsoft Windows Server 2012</li> <li>Microsoft Windows Server 2008 R2 SP1</li> <li>Microsoft Windows Server 2008 SP2</li> <li>Microsoft Windows Server 2003 SP2</li> <li>Microsoft Windows 8.x</li> <li>Microsoft Windows 7 SP1</li> <li>Microsoft Windows Vista SP2</li> <li>Linux—SSH and Perl are required (check the full list of required Perl modules here: <a href="http://www.veeam.com/kb2007">www.veeam.com/kb2007</a>)</li> </ul> <p>64-bit edition of Linux must be able to run 32-bit programs; pure 64-bit Linux editions are not supported</p>
<b>Software</b>	<p>For VMware vSphere 5.5 backup proxy server on Microsoft Windows Server 2008 or earlier: Microsoft Visual C++ 2008 SP1 redistributable package (x64). Installation package can be downloaded from <a href="http://vee.am/runtime">http://vee.am/runtime</a>.</p>

## 5.2 Hyper-V System Requirements

### 5.3 Veeam Backup Server (Hyper-V)

Table 4) Veeam proxy server.

Specification	Requirement
<b>CPU</b>	<ul style="list-style-type: none"> <li>Modern x86 processor (minimum 2 cores or vCPUs).</li> </ul>
<b>Memory</b>	<ul style="list-style-type: none"> <li>4GB RAM plus 500MB RAM for each concurrent job.</li> </ul>
<b>Disk Space</b>	<ul style="list-style-type: none"> <li>2GB for product installation and 10GB per 100 VMs for guest file system catalog folder (persistent data).</li> </ul>

<b>Network</b>	<ul style="list-style-type: none"> <li>NetApp recommends 1Gbps LAN for on-site backup and replication and 1Mbps WAN for off-site backup and replication. High latency and reasonably unstable WAN links are supported.</li> </ul>
<b>OS</b>	<p>64-bit versions of the following operating systems are supported:</p> <ul style="list-style-type: none"> <li>Microsoft Windows Server 2012 R2</li> <li>Microsoft Windows Server 2012</li> <li>Microsoft Windows Server 2008 R2 SP1</li> <li>Microsoft Windows Server 2008 SP2</li> <li>Microsoft Windows 8.x</li> <li>Microsoft Windows 7 SP1</li> </ul>
<b>Software</b>	<ul style="list-style-type: none"> <li>Microsoft .NET Framework 4.0</li> <li>Windows Installer 4.5</li> <li>Microsoft SQL Server Management Objects</li> <li>Microsoft SQL Server System CLR Types</li> <li>Microsoft Visual C++ 2010 Service Pack 1 redistributable package</li> </ul> <p>The following software must be installed manually:</p> <ul style="list-style-type: none"> <li>Microsoft PowerShell 2.0 (required for PowerShell snap-in).</li> <li>Internet Explorer 9.0 or later.</li> <li>System Center Virtual Machine Manager 2012 R2/2012/2008 R2 Admin UI (optional, so you can register the System Center Virtual Machine Manager server with Veeam Backup &amp; Replication infrastructure).</li> <li>Remote Desktop Protocol (RDP) client version 7.0 and later installed on the Veeam backup server (required to open the VM console during SureBackup recovery verification of Hyper-V VMs). The RDP client is preinstalled on Microsoft Windows 7/Windows Server 2008R2 OS and later. You can download the RDP client from <a href="http://support.microsoft.com/kb/969084/en-us">http://support.microsoft.com/kb/969084/en-us</a>.</li> </ul>
<b>SQL Database</b>	<p>Local or remote installation of the following versions of Microsoft SQL Server (both Full and Express Editions are supported):</p> <ul style="list-style-type: none"> <li>Microsoft SQL Server 2014</li> <li>Microsoft SQL Server 2012 (Microsoft SQL Server 2012 Express Edition is included in the setup)</li> <li>Microsoft SQL Server 2008 R2</li> <li>Microsoft SQL Server 2008</li> <li>Microsoft SQL Server 2005</li> </ul>

### Important

1. If you plan to back up VMs running Microsoft Windows Server 2012 R2 and data deduplication is enabled for some VM volumes, NetApp recommends that you deploy Veeam Backup & Replication on a machine running Microsoft Windows Server 2012 R2 with data deduplication enabled. Otherwise, some types of restore operations for these VMs (such as Microsoft Windows File Level Recovery) might fail.
2. Because of its limitations, Microsoft SQL Server Express Edition can be used only for evaluation or in a small-scale production environment. For environments with many VMs, you need to install a fully functional commercial version of Microsoft SQL Server.

## 5.4 Off-Host Backup Proxy Server (Hyper-V)

Table 5) Off-host backup proxy server.

Specification	Requirement
<b>CPU</b>	<ul style="list-style-type: none"> <li>Modern x86 processor (minimum 2 cores or vCPUs). Using multicore processors improves data processing performance and enables more tasks to be processed concurrently by the backup proxy.</li> </ul>
<b>Memory</b>	<ul style="list-style-type: none"> <li>2GB RAM plus 200MB for each concurrent task. Using faster memory (DDR3) improves data processing performance.</li> </ul>
<b>Disk Space</b>	<ul style="list-style-type: none"> <li>300MB.</li> </ul>
<b>Network</b>	<ul style="list-style-type: none"> <li>NetApp recommends 1Gbps LAN for on-site backup and replication and 1Mbps WAN for off-site backup and replication. High latency and reasonably unstable WAN links are supported.</li> </ul>
<b>OS</b>	<ul style="list-style-type: none"> <li>Microsoft Windows Server 2012 R2 with Hyper-V role enabled</li> <li>Microsoft Windows Server 2012 with Hyper-V role enabled</li> <li>Microsoft Windows Server 2008 R2 SP1 with Hyper-V role enabled</li> </ul>
<b>Software</b>	VSS hardware provider that supports transportable shadow copies. The VSS hardware provider is typically distributed as part of client components supplied by the storage vendor.

## 5.5 Backup Repository Server (Hyper-V)

Table 6) Backup repository server.

Specification	Requirement
<b>CPU</b>	<ul style="list-style-type: none"> <li>x86 processor (NetApp recommends x86-64).</li> </ul>
<b>Memory</b>	<ul style="list-style-type: none"> <li>4GB RAM plus 2GB RAM (32-bit OS) or 4GB RAM (64-bit OS) for each concurrent job. Using more memory improves data processing performance for long chains of large backup files on backup repositories running 64-bit OS.</li> </ul>
<b>Disk Space</b>	<ul style="list-style-type: none"> <li>200MB for Veeam Backup &amp; Replication components and sufficient disk space to store backup files and replicas (NetApp recommends high-RPM drives and RAID 10 configuration).</li> </ul>
<b>Network</b>	<ul style="list-style-type: none"> <li>NetApp recommends 1Gbps LAN for on-site backup and replication and 1Mbps WAN for off-site backup and replication. High latency and reasonably unstable WAN links are supported.</li> </ul>



<b>OS</b>	<p>Both 32-bit and 64-bit (recommended) versions of the following operating systems are supported:</p> <ul style="list-style-type: none"> <li>• Microsoft Windows Server 2012 R2</li> <li>• Microsoft Windows Server 2012</li> <li>• Microsoft Windows Server 2008 R2 SP1</li> <li>• Microsoft Windows Server 2008 SP2</li> <li>• Microsoft Windows Server 2003 SP2</li> <li>• Microsoft Windows 8.x</li> <li>• Microsoft Windows 7 SP1</li> <li>• Microsoft Windows Vista SP2</li> <li>• Linux—SSH and Perl are required (check the full list of required Perl modules here: <a href="http://www.veeam.com/kb2007">www.veeam.com/kb2007</a>)</li> <li>• 64-bit edition of Linux must be able to run 32-bit programs; pure 64-bit Linux editions are not supported</li> </ul>
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## 5.6 Veeam Sizing Requirements

Table 7) Veeam sizing requirements.

Veeam Sizing Requirements		
<b>Veeam Backup Proxy</b>	Virtual: 1 vCPU for every 200 VMs (recommended minimum: 2 vCPUs), 4GB RAM, 300MB disk space for installed components, and VMXNET3 NIC. No CPU/memory reservations are required.	Physical: 1 CPU core for every 250 VMs, 2GB of RAM for each concurrent VMDK backup
<b>Veeam Backup Server</b>	4GB of RAM plus 500MB of RAM for each concurrent job. Disk space: 2GB for product, plus 10GB per 100 VMs for guest file system catalog and at least 10GB for VM recovery cache folder. No CPU/memory reservations required. Additional sizing considerations should be applied if the back-end SQL Server is deployed on this server. (See the Veeam documentation for additional guidance.)	
<b>Veeam Repository</b>	The Veeam Repository can be colocated with the backup server role for small deployments or on a dedicated server (physical or virtual Windows/Linux server, NAS device, or dedicated backup appliance). The repository requires sufficient free space to store all backup job data. If a virtual machine is used, NetApp recommends using the VMware PVSCSI controller for the disk(s) that will store backup data. The use of vSphere 5.5 enables the use of disks larger than 2TB, which might be advantageous for a repository server.	

## 6 Veeam Backup & Replication v8 Design Considerations

### 6.1 Direct SAN Access Mode

Veeam proxy servers directly connect to the storage fabric because that is the fastest way to perform backups with Backup & Replication. Doing so allows a LAN-free backup and provides the possibility to leverage storage Snapshot copies on supported storage systems such as NetApp FAS. Fast backup speed is critical for low RPOs.

An often-discussed point about direct SAN access for the Veeam proxy is the possibility that the Veeam proxy can mount VMFS LUNs and write a Windows signature onto the LUN. Doing so results in an inaccessible VMFS requiring VMware support to fix the issue. Veeam Knowledge Base KB article #1446 provides instructions on how to configure SAN access for use with Veeam Backup & Replication.

Although Microsoft Windows 2003 had “automount” enabled by default, the SAN policy in Windows Server 2008 R2 Enterprise and Datacenter editions is set to “Offline Shared” by default. But even if an administrator changed the policy to “Online All,” Veeam reverts the policy back to “Offline Shared,” as shown in Figure 2. The result is that Windows will not mount and resignature VMFS LUNs unless an administrator changes this setting again or manually mounts VMFS LUNs while ignoring Windows warnings. NetApp recommends the Direct SAN Access transport mode for VMs whose disks are on shared VMFS SAN LUNs that are connected to ESX(i) hosts through FC or iSCSI.

In the Direct SAN Access transport mode, Veeam Backup & Replication leverages VMware VADP to transport VM data directly from and to FC and iSCSI storage over the SAN. VM data travels over the SAN, bypassing ESX(i) hosts and the LAN. The Direct SAN Access transport method provides the fastest data transfer speed and produces no load on the production network.

You can use the Direct SAN Access transport mode for all operations in which the backup proxy is engaged:

#### Backup

- Replication
- Full VM restore
- VM disk restore
- Replica failback
- Quick migration

#### Requirements for the Direct SAN Access Transport Mode

To use the Direct SAN Access transport mode, you need to meet the following requirements:

1. The backup proxy using the Direct SAN Access transport mode must have direct access to the production storage through a hardware or software HBA. If a direct SAN connection is not configured or not available when a job or task starts, the job or task will fail.
2. For restore operations: The backup proxy must have write access to LUNs where the VM disks are located.

#### Limitations for the Direct SAN Access Transport Mode

1. The Direct SAN Access transport mode is not supported for VMs residing on a vSAN. You can use Virtual Appliance and Network transport modes to process such VMs. For details on vSAN restrictions, see the VDDK 5.5 Release Notes.
2. The Direct SAN Access mode cannot be used if at least one VM disk is on a VVol.
3. The Direct SAN Access transport mode can be used only for the initial run of the replication job. For subsequent replication job runs, Veeam Backup & Replication uses the Virtual Appliance or Network transport mode.

4. The Direct SAN Access transport mode can be used to restore only thick VM disks.
5. The Direct SAN Access transport mode cannot be used for incremental restore because of VMware limitations. Either disable CBT for VM virtual disks for the duration of the restore process or select another transport mode for incremental restore.

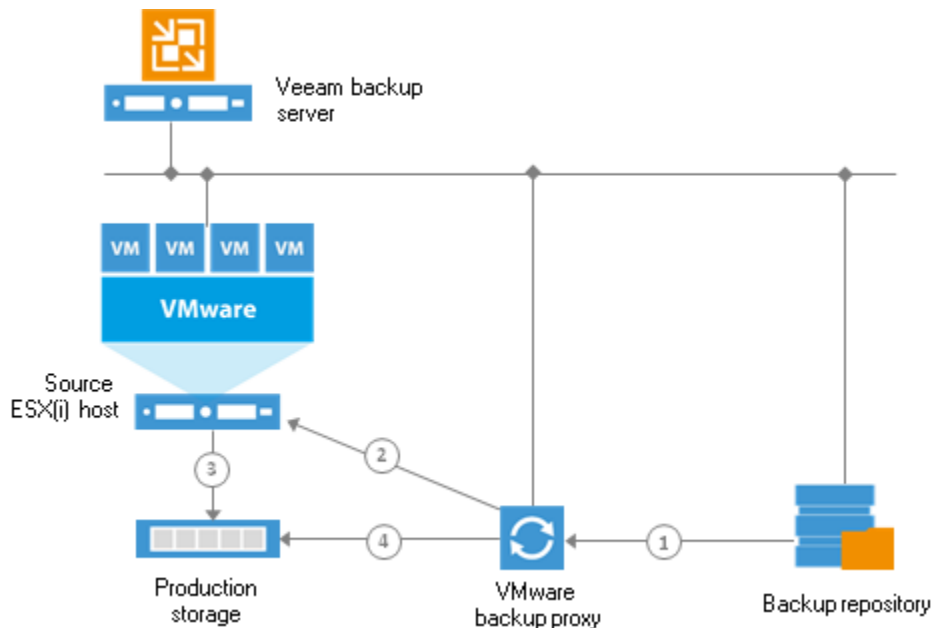
For VMware vSphere 5.5 and Later

## 6.2 Data Restore in Direct SAN Access Mode

Data restore in the Direct SAN Access transport mode includes the following steps:

1. The backup proxy retrieves data blocks from the backup repository or a datastore in the target site.
2. The backup proxy sends a request to the ESX(i) host in the source site to restore data to a necessary datastore.
3. The ESX(i) host in the source site allocates space on the datastore.
4. Data blocks obtained from the backup proxy are written to the datastore.

Figure 9) Data restore in Direct SAN Access mode.



The Direct SAN Access transport mode can be used to restore VMs only with thick disks. Before VM data is restored, the ESX(i) host needs to allocate space for the restored VM disk on the datastore:

- When thick disks are restored, the ESX(i) host allocates space on disk before writing VM data.
- When thin disks are restored, the ESX(i) host attempts to allocate space on the fly as requests for data block restores are received.

As a result, restoring thin disks involves extra allocation overhead when compared to restoring thick disks, which results in decreased performance.

To restore VMs with thin disks, you can use the Virtual Appliance mode or the Network mode. If you plan to process a VM that has both thin and thick disks, select the Direct SAN Access transport mode and choose to fail over to the Network mode if the SAN becomes inaccessible. In this case, Veeam Backup & Replication uses the Direct SAN Access transport mode to restore thick disks and the Network transport mode to restore thin disks. Alternatively, you can restore all VM disks as thick.

### 6.3 Off-Host Backup (Hyper-V)

In Off-Host Backup mode, backup processing is shifted from the source Hyper-V host to a dedicated machine—an off-host backup proxy. The off-host backup proxy acts as a “data mover”—the Veeam transport service running on it retrieves VM data from the source datastore, processes it, and transfers it to the destination. This type of backup does not impose load on the Hyper-V host; while resource-intensive backup operations are performed on the off-host backup proxy, production hosts remain unaffected.

To perform off-host backup, Veeam Backup & Replication uses transportable shadow copies. The transportable shadow copy technology enables you to create a snapshot of a data volume on one server and import, or mount, it onto another server within the same subsystem (SAN) for backup and other purposes. The transport process is accomplished in a few minutes, regardless of the amount of data. The process is performed at the SAN storage layer so it does not affect host CPU usage or network performance.

To perform off-host backup, you must meet the following requirements:

1. You must configure an off-host backup proxy. The role of an off-host backup proxy can be assigned only to a physical Microsoft Windows 2008 Server R2 machine with the Hyper-V role enabled, a Microsoft Windows Server 2012 machine with the Hyper-V role enabled, or a Microsoft Windows Server 2012 R2 machine with the Hyper-V role enabled.

The version of the Hyper-V host and off-host backup proxy must be the same. For example, if you use a Microsoft Windows 2008 Server R2 machine with the Hyper-V role enabled as a Hyper-V host, you should deploy the off-host backup proxy on a Microsoft Windows 2008 Server R2 machine with the Hyper-V role enabled.

2. In a backup or replication job's properties, you must select the off-host backup method. If necessary, you can point the job to a specific proxy.
3. The source Hyper-V host and the off-host backup proxy must be connected through a SAN configuration to the shared storage.
4. To create and manage volume shadow copies on the shared storage, you must install and properly configure a VSS hardware provider that supports transportable shadow copies on the off-host proxy and Hyper-V host. Typically, when configuring a VSS hardware provider, you need to specify a server controlling the LUN and disk array credentials to provide access to the array.

The VSS hardware provider is usually distributed as part of client components supplied by the storage vendor. Any VSS hardware provider certified by Microsoft is supported. Some storage vendors might require additional software and licensing to work with transportable shadow copies.

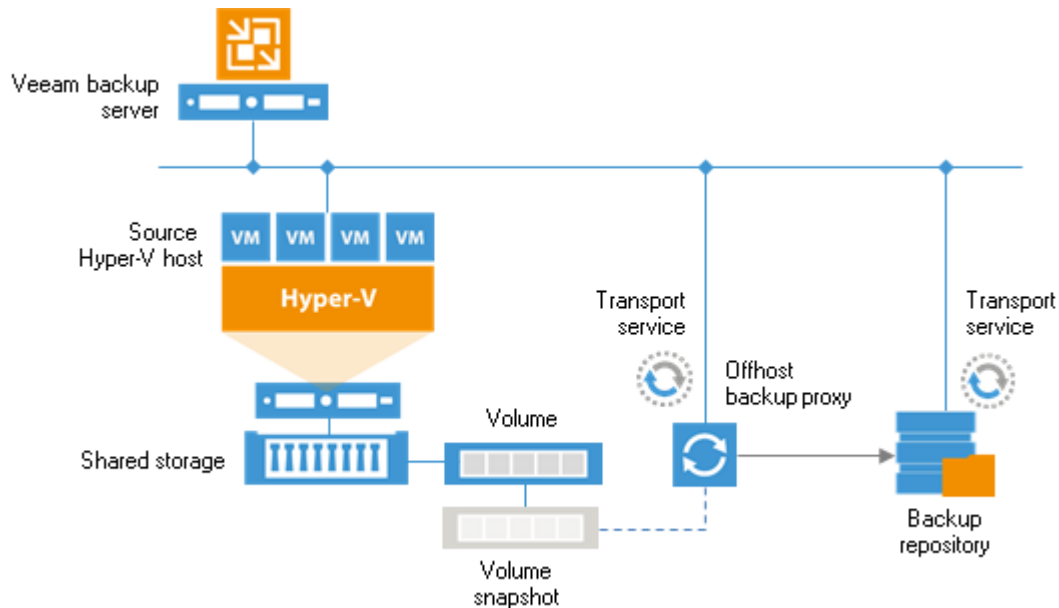
5. If you back up VMs whose disks reside on a CSV with data deduplication enabled, make sure that you use a Microsoft Windows 2012 R2 machine as an off-host backup proxy and enable data deduplication on this off-host backup proxy. Otherwise, off-host backup will fail.

The off-host backup process includes the following steps:

1. Veeam Backup & Replication triggers a snapshot of the necessary volume on the production Hyper-V host.

2. The created snapshot is split from the production Hyper-V server and mounted to the off-host backup proxy.
3. The Veeam transport service running on a backup proxy uses the mounted volume snapshot to retrieve VM data. The VM data is processed on the proxy server and copied to the destination.
4. Once the backup process is complete, the snapshot is dismounted from the off-host backup proxy and deleted on the SAN.

Figure 10) Process of Off-host Backup mode.



### Important

If you plan to perform off-host backup for a Hyper-V cluster with CSV, deploy an off-host backup proxy on a host that is NOT part of a Hyper-V cluster.

When a volume snapshot is created, this snapshot has the same LUN signature as the original volume. Microsoft Cluster Services do not support LUNs with duplicate signatures and partition layout. For this reason, volume snapshots must be transported to an off-host backup proxy outside the cluster. If the off-host backup proxy is deployed on a node of a Hyper-V cluster, a duplicate LUN signature will be generated and the cluster will fail during backup or replication.

### 6.3.2 Off-Host Backup Proxy

By default, when you perform backup, replication, or VM copy jobs in the Hyper-V environment, VM data is processed directly on the source Hyper-V host where VMs reside. The data is then moved to the target, bypassing the Veeam backup server.

VM data processing can produce unwanted overhead on the production Hyper-V host and affect the performance of the VMs running on this host. To take data processing off the production Hyper-V host, use the off-host backup mode.

The off-host mode shifts the backup and replication load to a dedicated machine—an off-host backup proxy. The off-host backup proxy functions as a “data mover” that retrieves VM data from the source datastore, processes it, and transfers it to the destination.

The machine performing the role of an off-host backup proxy must meet the following requirements:

- The role can be assigned only to a physical Microsoft Windows 2008 Server R2 machine with the Hyper-V role enabled, a Windows Server 2012 machine with the Hyper-V role enabled, or a Windows Server 2012 R2 machine with the Hyper-V role enabled.
- The off-host backup proxy must have access to the shared storage hosting VMs to be backed up, replicated, or copied.
- To create and manage volume shadow copies on the shared storage, you must install a VSS hardware provider that supports transportable shadow copies on the off-host proxy and the Hyper-V host. The VSS hardware provider is usually distributed as part of client components supplied by the storage vendor.

When you assign the role of an off-host backup proxy to the selected machine, Veeam Backup & Replication automatically installs on it lightweight components and services required for backup proxy functioning. Unlike the Veeam backup server, backup proxies do not require a dedicated SQL database; all settings are stored centrally, within the SQL database used by the Veeam backup server.

To enable a Hyper-V host or a Windows machine to act as an off-host backup proxy, Veeam Backup & Replication installs the following services on it:

- Veeam Installer Service is an auxiliary service installed and started on any Windows (or Hyper-V) server once it is added to the list of managed servers in the Veeam Backup & Replication console. This service analyzes the system and installs and upgrades necessary components and services.
- Veeam Transport is responsible for deploying and coordinating executable modules that act as "data movers" and perform main job activities on behalf of Veeam Backup & Replication. These activities include performing data deduplication, compression, and so on.
- Veeam Hyper-V Integration Service is responsible for communicating with the VSS framework during backup, replication, and other jobs and performing recovery tasks. The service also deploys a driver that handles changed block tracking for Hyper-V.

## 6.4 Veeam Backup & Replication v8 Components

Table 8) Veeam Backup & Replication v8 components and descriptions.

Component	Description
<b>Veeam Backup Server</b>	<p>The Veeam backup server is a Windows-based physical or virtual machine on which Veeam Backup &amp; Replication is installed. It is the core component in the backup infrastructure that fills the role of the "configuration and control center." The Veeam backup server performs all types of administrative activities:</p> <ul style="list-style-type: none"> <li>• Coordinates backup, replication, recovery verification, and restore tasks</li> <li>• Controls job scheduling and resource allocation</li> <li>• Is used to set up and manage backup infrastructure components as well as specify global settings for the backup infrastructure</li> <li>• In addition to its primary functions, a newly deployed Veeam backup server also performs the roles of the default backup proxy and the backup repository (it manages data handling and data storing tasks)</li> </ul>

Component	Description
<b>Veeam Backup Service</b>	This service is a Windows service that coordinates all operations performed by Veeam Backup & Replication, such as backup, replication, recovery verification, and restore tasks. The Veeam Backup Service runs under the Local System account or the account that has the Local Administrator permissions on the Veeam backup server.
<b>Veeam Backup Shell</b>	The Veeam Backup Shell provides the application UI and enables user access to the application's functionality.
<b>Veeam Backup Catalog Service</b>	This service is a Windows service that manages guest OS file system indexing for VMs and replicates system index data files to enable search through guest OS files. Index data is stored in the Veeam Backup Catalog, a folder on the Veeam backup server. The Veeam Backup Catalog Service running on the Veeam backup server works with search components installed on Veeam Backup Enterprise Manager and (optionally) a dedicated Microsoft Search Server.
<b>Veeam Backup SQL Database</b>	This database is used by Veeam Backup Service, Veeam Backup Shell, and Veeam Backup Catalog Service to store data about the backup infrastructure, jobs, sessions, and so on. The database instance can be on a SQL Server installed either locally (on the same machine where the Veeam backup server runs) or remotely.
<b>Veeam Backup PowerShell Snap-In</b>	This snap-in is an extension for Microsoft Windows PowerShell 2.0. Veeam Backup PowerShell adds a set of cmdlets to enable users to perform backup, replication, and recovery tasks through the PowerShell CLI or run custom scripts to fully automate Veeam Backup & Replication operation.
<b>Backup Proxy Services</b>	In addition to dedicated services, the Veeam backup server runs a set of data mover services (for details, see Backup Proxy).
<b>Backup Proxy</b>	A Backup Proxy is an architecture component that sits between the data source and the target and is used to process jobs and deliver backup traffic. The backup proxy tasks include retrieving VM data from the production storage and compressing and sending it to the backup repository (for example, if you run a backup job) or another backup proxy (for example, if you run a replication job). As the data handling task is assigned to the backup proxy, the Veeam backup server becomes the “point of control” for dispatching jobs to proxy servers.
<b>Backup Repository</b>	A Backup Repository is a location used by Veeam Backup & Replication jobs to store backup files, copies of VMs, and metadata for replicated VMs. Technically, a Backup Repository is a folder on the backup storage. By assigning different repositories to jobs and limiting the number of parallel jobs for each one, you can balance the load across your backup infrastructure.

## 7 NetApp E-Series and EF-Series Volume Configuration Guidelines

### 7.1 NetApp E-Series Storage Configuration Guidelines for Backup & Replication v8 Backup Repositories

Maximum Performance:

- NetApp recommends using RAID 10 volume groups for maximum performance.
- Create multiple volume groups, having an even number when possible to achieve balance between owning controllers.
- Have no hot spares.
- Create a single volume per volume group.
- When creating the volumes, select 512KB segment sizing to match the 512KB transfer size that Veeam Backup & Replication presents as a sequential write to the system after sequencing I/O.
- Run multiple backup jobs to each repository.

Typical Configuration:

- NetApp recommends using RAID 6 (8+2) volume groups for the best balance of performance and capacity usage.
- Create multiple volume groups, having an even number when possible to achieve balance between owning controllers.
- Have no hot spares.
- Create a single volume per volume group.
- When creating the volumes, select 512KB segment sizing to match the 512KB transfer size that Veeam Backup & Replication presents as a sequential write to the system after sequencing I/O.
- Run multiple backup jobs to each repository.

Large Configuration:

- NetApp recommends using Dynamic Disk Pools for the best ease of use and fast rebuild times.
- Create multiple Dynamic Disk Pools, having an even number when possible to achieve balance between owning controllers.
- Create a single volume per Dynamic Disk Pool.
- When creating the volumes with Dynamic Disk Pools, the default segment size is 128KB. No additional selection is required.
- Run multiple backup jobs to each repository.

### 7.2 NetApp EF-Series Storage Configuration Guidelines for Backup & Replication v8 Backup Repositories

Maximum Performance:

- NetApp recommends using RAID 10 volume groups for maximum performance.
- Create multiple volume groups, having an even number when possible to achieve balance between owning controllers.
- Have no hot spares.
- Create a single volume per volume group.
- When creating the volumes, select 512KB segment sizing to match the 512KB transfer size that Veeam Backup & Replication presents as a sequential write to the system after sequencing I/O.
- Run multiple backup jobs to each repository.



Typical Configuration:

- NetApp recommends using RAID 5 volume groups for the best balance of performance and capacity use.
- Create multiple volume groups, having an even number when possible to achieve balance between owning controllers.
- Have no hot spares.
- Create a single volume per volume group.
- When creating the volumes, select 512KB segment sizing to match the 512KB transfer size that Veeam Backup & Replication presents as a sequential write to the system after sequencing I/O.
- Run multiple backup jobs to each repository.

## 8 NetApp E-Series and EF-Series Host Configuration Guidelines

### 8.1 Host Connectivity

NetApp E-Series arrays provide multiple options for connectivity: 12Gb SAS, 16Gb Fibre Channel, 10Gb Ethernet (available as optical or copper), and 40Gb or 56Gb InfiniBand in higher models. Your optimal design is based on your existing environment and how the data will flow from primary storage through the Veeam server to its final destination on the E-Series array. One design approach is to leverage 12Gb SAS for connectivity from the Veeam server to the E-Series array. This would provide the target backup repository (E-Series) to Veeam as a direct connection. Having the direct connection to the E-Series array would prevent having to write the backup file across an existing network.

This configuration might not be ideal for larger environments in which Veeam's distributed architecture is implemented and there are multiple proxy server processing backup data. Having a dedicated network for backup targets might make more sense in those cases. Either way, the options are there for any environment, and Veeam provides a bottleneck detector to help optimize the backup data flow as you progress through your implementation.

### 8.2 NetApp E-Series Storage Host Mapping Configuration for Direct SAN Access

On the E-Series or EF-Series system that hosts the virtual environment's storage, verify that the Veeam backup server is associated with the same host group as the host of the virtual environment, as shown in SANtricity in Figure 11.

Figure 11) Host group mapping.

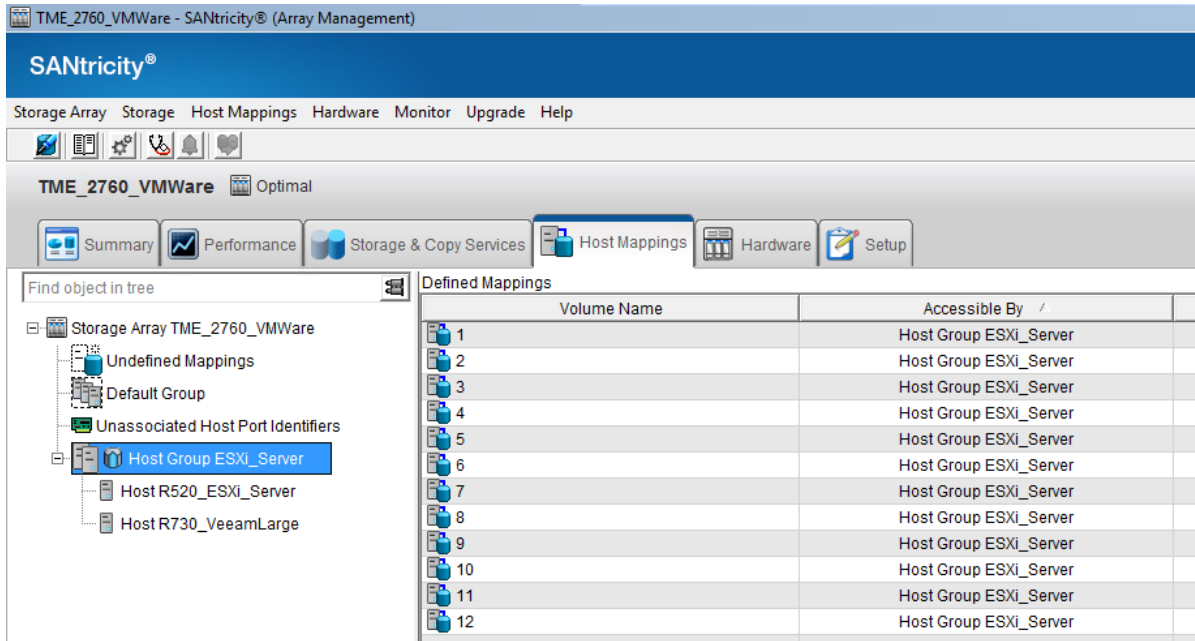


Figure 12) ESXi server mapping.

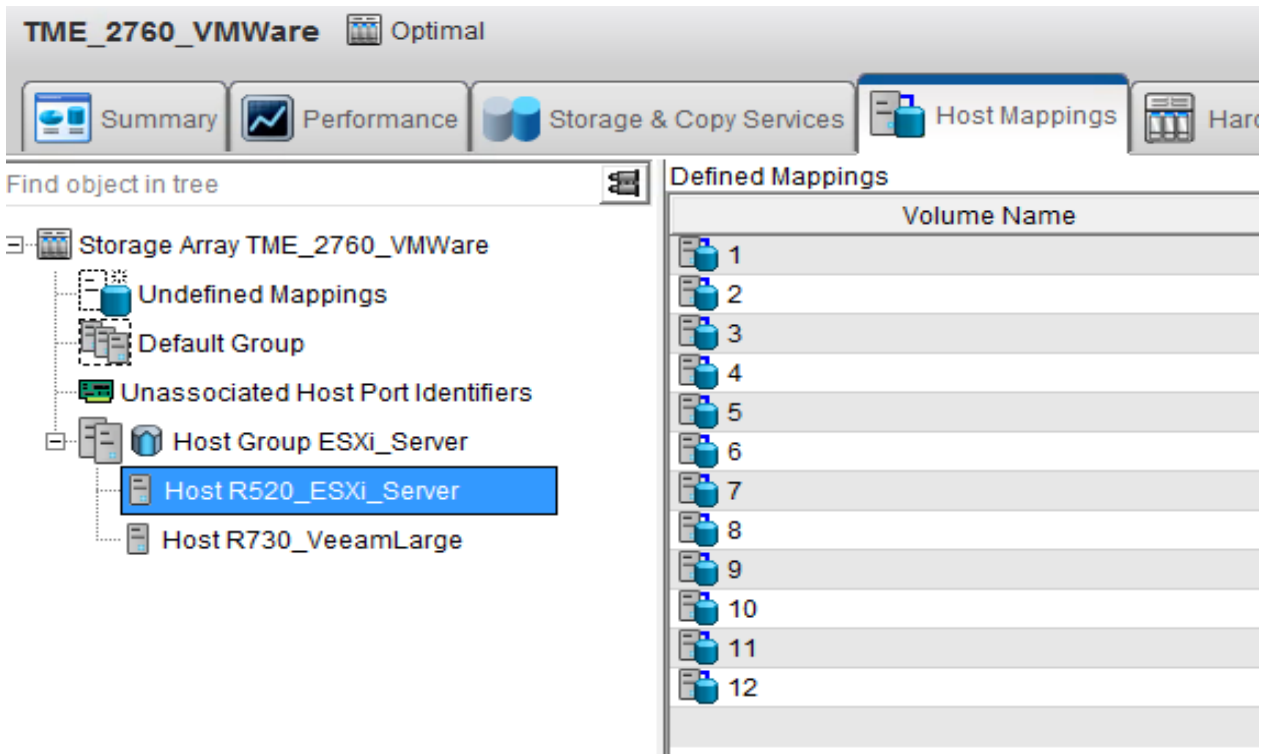
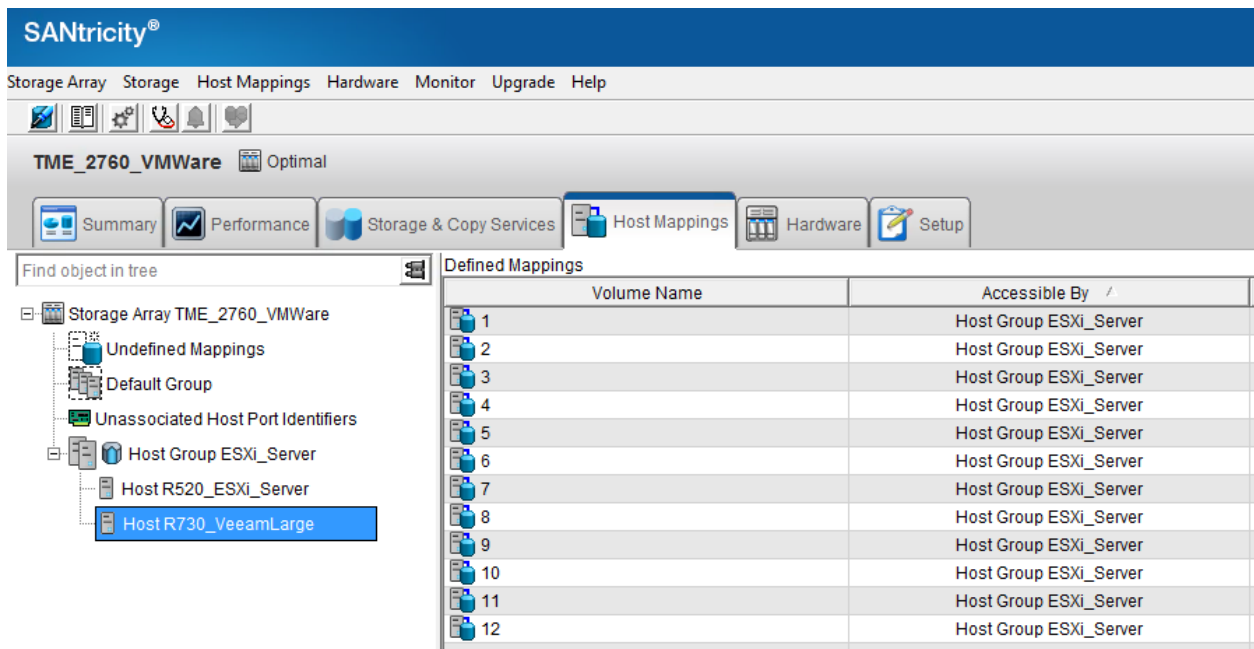


Figure 13) Backup server mapping.



As a result of hosting both the virtual environment and the backup repository on the E-Series and/or the EF-Series arrays, Veeam Backup & Replication has resource location awareness in the environment. The resulting data transfers will take place over the SAN network.

## 9 NetApp E-Series E2700 Hardware and Software Specifications

### 9.1 E2700 Hardware Using SANtricity 11.20

#### Overview

NetApp E2700 storage systems address wide-ranging requirements with balanced performance that is equally adept at handling throughput for sequential I/O applications and high-IOPS requirements for transactional databases. The E2700 brings together the following advantages:

- Modular host interface flexibility (SAS, FC, and iSCSI)
- Excellent storage density
- High reliability
- Intuitive management

Together, these features create an entry midrange storage system. The system is perfectly suited for data-intensive solutions, high bandwidth-intensive streaming applications, transaction-intensive workloads, and high-performance file system requirements without sacrificing simplicity and efficiency. In addition, its fully redundant I/O paths, advanced protection features, and extensive diagnostic capabilities deliver a high level of availability, integrity, and security.

#### E2700 System Options

The E2700 controller is available with three shelf options: E2760, E2724, and E2712. These options support both spinning media and solid-state drives (SSDs) to meet a wide range of customer performance and application requirements.

**Note:** SSDs are not supported in the E2712 shelf (DE1600). However, they are supported in mixed shelf systems when the E2712 is used as the controller-drive shelf and at least one expansion-drive shelf supports SSDs.

All three shelf types support dual controller packs, dual power supplies, and dual fan units for redundancy. The E2724 and E2712 systems can also be used in a simplex controller configuration. The shelves are sized to hold 60 drives, 24 drives, or 12 drives, respectively, as shown in

Figure 14.

**Note:** This document uses the following terms interchangeably with the terms used in the NetApp SANtricity management software and E-Series technical publications:

- Shelf = shelf enclosure
- Drive shelf = drive tray
- Drive = disk
- Module = canister

Figure 14) E2700 shelf options.

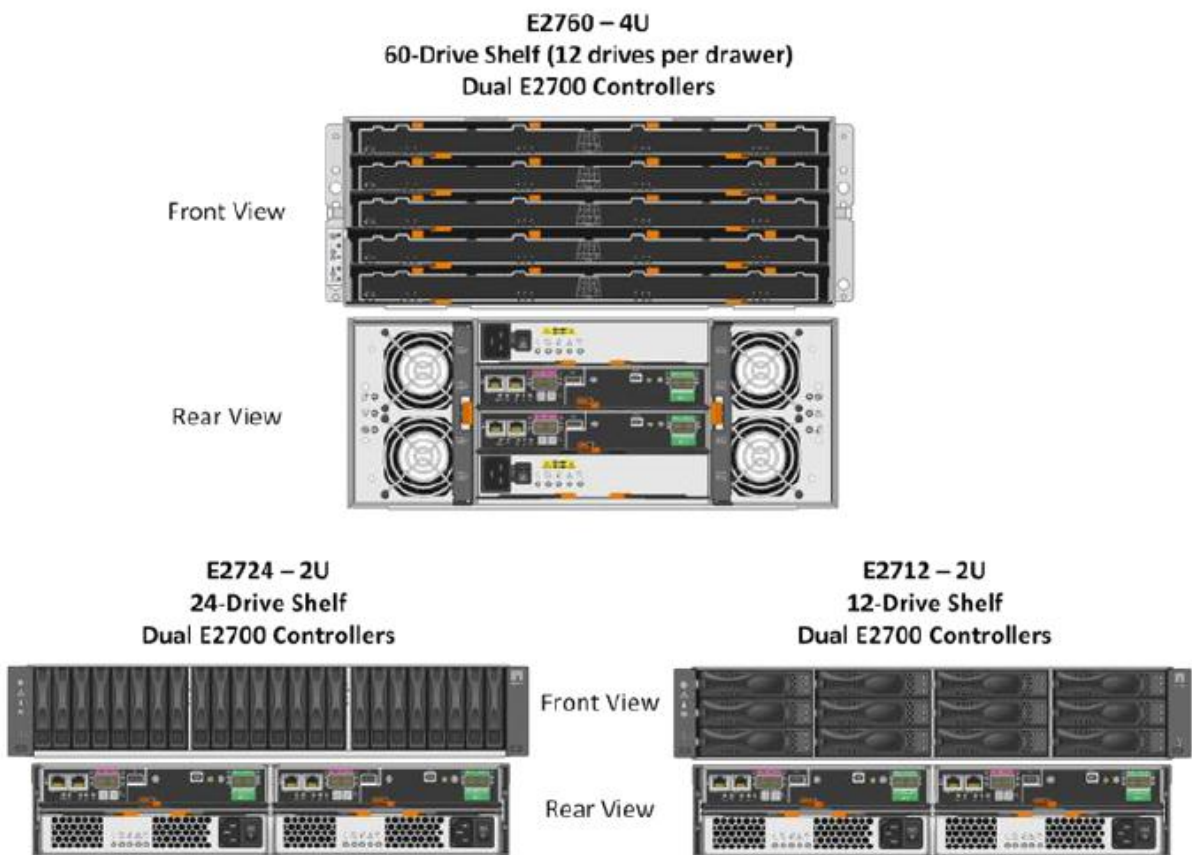
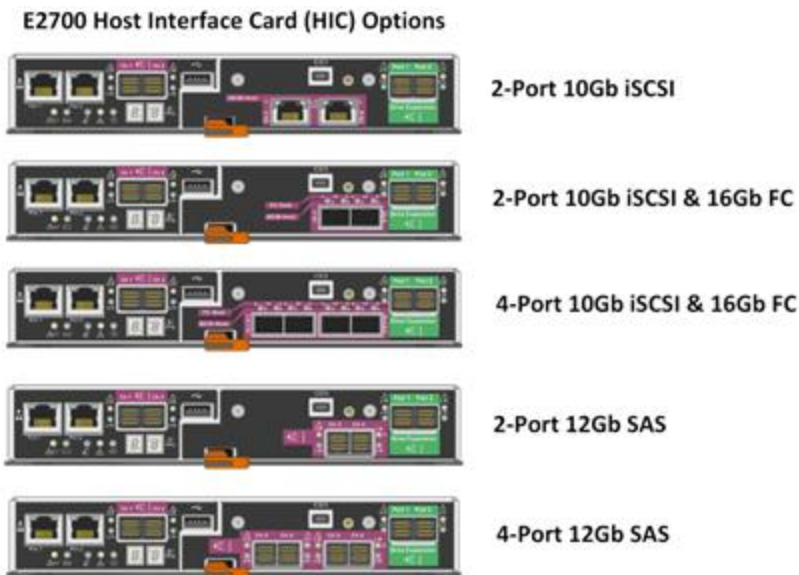


Figure 15) E2700 optional HICs.



## E2712 Controller-Drive Tray

The E2712 is a 2U tray that holds up to 12 3.5" drives. It features dual RAID controllers, dual power canisters, and dual fan canisters with two fans in each canister. An E2712-based storage system supports a maximum of 192 drives and a mix of expansion drive tray models.

Refer to [Table 9](#) for more details on the E2712 technical specifications.

The E2712 has a proven track record of reliability in remote dedicated environments.

[Figure 16](#) and [Figure 17](#) show the front and rear views of the E2712 controller-drive tray.

Figure 16) E2712 front view without bezel.



Figure 17) E2712 rear view.



## E2760 Controller-Drive Tray

The E2760 is a 4U tray that holds up to 60 3.5" or 2.5" drives in 5 horizontal drawers (12 drives per drawer). It features dual RAID controllers, dual power canisters, and dual fan canisters with two fans in each canister.

An E2760-based storage system supports a maximum of 180 drives by using only 60-drive trays or 192 drives by using a mix of expansion-drive tray models. A minimum of 20 drives must be installed in the E2760 controller-drive tray (and in each 60-drive expansion-drive tray that is added to the system). These drives must be installed in the four front drive slots in each drawer.

Operating the storage system without populating all four front drive slots in each drawer can lead to overheating. The bezel must be installed during normal operation.

Refer to Table 9 for more details on the E2760 technical specifications.

Figure 18 and Figure 19 show the front and rear views of the E2760 controller-drive tray.

Figure 18) E2760 front view without bezel.

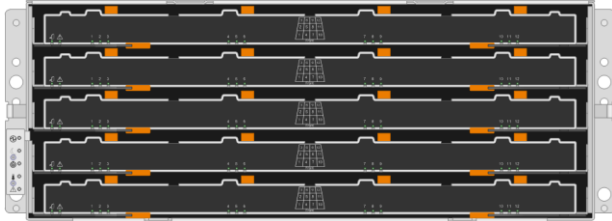
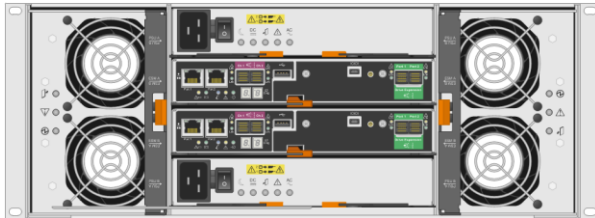


Figure 19) E2760 rear view.



## E2700 Hardware Specifications

The E2700 controller has the following base hardware features:

- Dual Ethernet ports for management-related activities
- SAS, FC, or iSCSI ports for host connection (one of the host I/O port options must be ordered when the controller is purchased.)

Table 9 lists the technical specifications of E2700-based storage systems.

Table 9) E2700 technical specifications.

Specification	E2712	E2724	E2760
<b>Maximum raw capacity</b>	1.2PB	1.1PB	1.2PB
<b>Maximum number of drives</b>	192	192	192
<b>Form factor</b>	2U—12 drives	2U—24 drives	4U—60 drives
<b>Drive types supported</b>	2/3/4/6TB NL-SAS 7.2K FDE/non-FDE	600/900GB, 1.2/1.8TB SAS 10K FDE/non-FDE	2/3/4/6TB NL-SAS 7.2K FDE/non-FDE
		400/800GB, 1.6TB SSD non-FDE	600/900GB, 1.2/1.8TB SAS 10K FDE/non-FDE
		800GB SSD FDE	400/800GB, 1.6TB SSD non-FDE
			800GB SSD FDE

Specification	E2712	E2724	E2760
<b>System memory</b>	8GB/16GB		
<b>Onboard I/O</b>	2-port 12Gb SAS per controller canister		
<b>Optional I/O</b>	2-port or 4-port 12Gb SAS per controller canister		
	2-port or 4-port 16Gb FC per controller canister		
	2-port 10Gb iSCSI per controller canister		
<b>Drive trays supported for expansion—drive offerings</b>	DE1600 (2U—12 drives): 16 trays max; supports the same drive types as the E2712		
	DE6600 (4U—60 drives): 3 trays max; supports the same drive types as the E2760		
<b>High-availability (HA) features</b>	Dual active controllers with automated I/O path failover		
	Support for RAID levels 0, 1 (10 for 4 drives or more), 5, 6, and DDP		
	Redundant, hot-swappable storage controllers, disk drives, power supplies, and cooling fans		
	SANtricity proactive drive health monitoring to identify problem drives before they create issues		
	Automatic drive fault detection, failover, and rebuild by using global hot spare drives		
	Mirrored data cache with battery backup and destage to flash		
	SANtricity Persistent Monitor, for making periodic copies of the storage system configuration		

For additional information, refer to the [NetApp E2700 Technical Specifications](#).

## SANtricity Software Specifications for E2700 Hardware

Table 10 lists the SANtricity software specifications for E2700-based storage systems.

Table 10) SANtricity software boundaries for E2700-based storage systems.

Components	Maximum
<b>Storage Hardware Components</b>	
Trays (system and expansion)	16
Drives	192
SSD cache capacity	5TB
<b>Logical Components</b>	
Partitions	128
Volumes	512

Components	Maximum
Volumes per consistency group	32
Thin volumes per system	512
Disk pools per system	20
<b>Snapshot Copies</b>	
Per Snapshot group	32
Per volume	128
Per storage system	512
<b>Snapshot Volumes</b>	
Per Snapshot copy	4
Per system	256
<b>Snapshot Groups</b>	
Per volume	4
Per system	256
<b>Mirrors</b>	
Legacy mirrors per system	16 (synchronous only)
Mirrors per system	32
Mirrors per volume	+1
Mirrors per asynchronous mirror group	32
Asynchronous mirror groups per system	4

## 10 NetApp E-Series E5600 Hardware and Software Specifications

### 10.1 E5600 Hardware Using SANtricity 11.20

NetApp E-Series E5600–based storage systems provide enterprise-class tier 1 SAN storage for small and medium-sized businesses and for Fortune 100 companies with branch locations around the world. The combination of ultradense capacity, host interface flexibility, and best-in-class quality makes the E5600 a natural choice for customers focused on minimizing their TCO while maximizing the use of their current footprint.

### 10.2 E5600 Primary Use Cases

The E-Series E5600 is an industry-leading storage system. The E5600 delivers high IOPS and bandwidth with consistently low latency to support the demanding performance and capacity needs of science and technology, simulation modeling, and decision support environments. But the E5600 is equally capable of supporting primary transactional databases, general mixed workloads, and dedicated workloads such as backup applications in a highly efficient footprint with extreme simplicity, reliability, and scalability. The E5600 provides the following benefits:

- Support for wide-ranging workloads and performance requirements



- Fully redundant I/O paths, advanced protection features, and proactive support monitoring and services for high levels of availability, integrity, and security
- Double the IOPS performance of the previous high-performance generation of E-Series products that support data-intensive applications
- A level of performance, density, and economics that leads the industry

### 10.3 E5600 Storage Systems

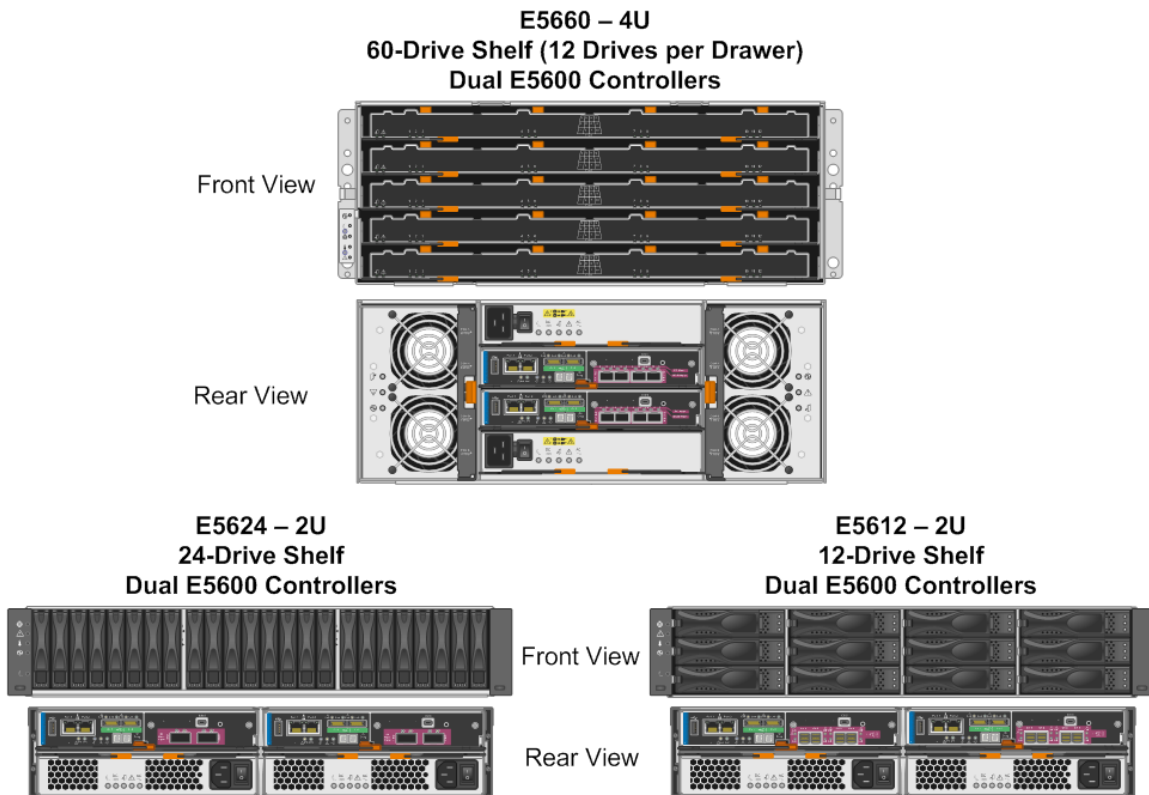
The E5600 is available with three shelf options: E5660 (DE6600), E5624 (DE5600), and E5612 (DE1600). These configuration options support both spinning media and solid-state drives (although SSDs are not supported in the E5612) to meet a wide range of customer performance and application requirements.

This document uses the following terms interchangeably with the terms used in NetApp SANtricity Storage Manager and product technical publications:

- Tray = shelf = enclosure.
- Drive tray = drive shelf.
- Drive = disk.
- Canister = module.
- The term drawer describes only the five drawers in the DE6600 shelf and does not apply to other shelf models.

All three shelf types support dual controller packs, dual power supplies, and dual fan units for redundancy (DE5600 and DE1600 shelves have integrated power and fan modules). The shelves are sized to hold 60 drives, 24 drives, or 12 drives, respectively, as shown in **Figure 20**.

Figure 20) E5600 controller-drive shelf options.



## 10.4 SANtricity Software Specifications for E5600 Hardware

Table 11 lists the SANtricity software specifications for E5600-based storage systems.

Table 11) SANtricity software boundaries for E5600-based storage systems.

Components	Maximum
<b>Storage Hardware Components</b>	
Shelves (system and expansion)	16
Drives	384
SSD cache capacity per system	5TB
<b>Logical Components</b>	
Partitions	512
Volumes	2,048
Volumes per consistency group	64
Consistency groups per system	32
Thin volumes per system	2,048
Disk pools per system	20
<b>Snapshot Copies</b>	
Per Snapshot group	32
Per volume	128
Per storage system	2,048
<b>Snapshot Volumes</b>	
Per Snapshot copy	4
Per system	2,048
<b>Snapshot Groups</b>	
Per volume	4
Per system	1,024
<b>Mirrors</b>	
Legacy mirrors per system	128
Mirrors per system	128
Mirrors per volume	1
Mirrors per asynchronous mirror group	64
Asynchronous mirror groups per system	4

# 11 NetApp EF560 Hardware and Software Specifications

## 11.1 EF560 Hardware Using SANtricity 11.20

### 11.1.1 EF560 Controller-Drive Shelf

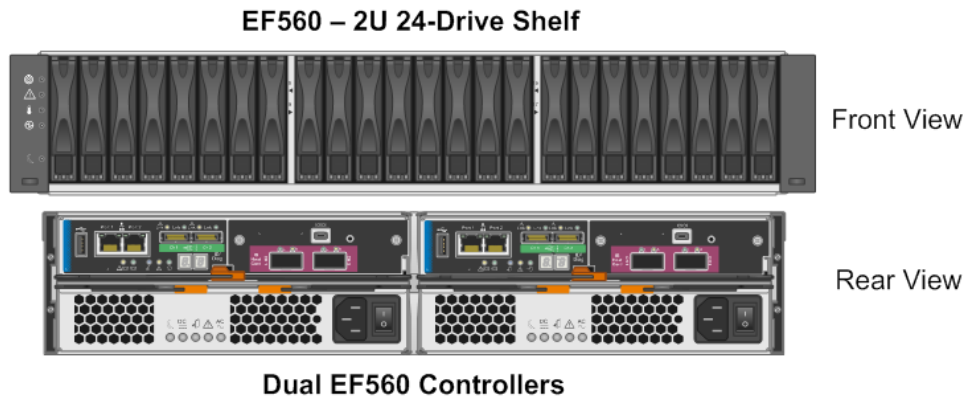
The EF560 is available in a 2U 24-drive shelf and can be expanded to a 5-shelf system by adding 4 additional expansion-drive shelves.

**Note:** This document uses the following terms interchangeably with the terms used in NetApp SANtricity Storage Manager and product technical publications:

- Tray = shelf = enclosure.
- Drive tray = drive shelf.
- Drive = disk.
- Canister = module.
- The term *drawer* describes only the five drawers in the DE6600 shelf and does not apply to other shelf models.

EF560 shelves support dual-active controller packs and dual power supplies with integrated fan units for redundancy, as shown in Figure 22.

Figure 21) EF560 controller-drive shelf.



### 11.1.2 EF560 Hardware Specifications

The EF560 controller has the following base hardware features:

- Dual Ethernet ports for management-related activities
- SAS, FC, iSCSI, or IB ports for host connection
- SAS drive expansion ports to attach expansion-drive shelves

Note: One of the host I/O port options must be ordered when the controller is purchased.

Table 12 lists the technical specifications for the EF560 storage system.

Table 12) EF560 technical specifications.

Specification	EF560
Maximum raw system capacity	192TB

Specification	EF560
Maximum number of drives per system	120
Shelf form factor	2U, 24 drives
Drive types supported	400GB, 800GB, or 1.6TB 2.5" SSD
Memory	24GB (12GB per controller)
Host I/O (one I/O type supported at a time; controllers must match)	8-port 12Gb SAS (4-port 12Gb SAS [wide-port] per EF560 controller)
	8-port 16Gb FC (4-port 16Gb FC [SMID = 246] per EF560 controller)
	8-port 10Gb iSCSI (4-port 10Gb iSCSI [SMID = 247] per EF560 controller)
	4-port 56Gb IB (2-port 56Gb IB per EF560 controller)
Expansion-drive shelves supported	DE6600 (2U, 24 drives): 4 expansion shelves max
High-availability (HA) features	Dual active controllers with automated I/O path failover
	Support for RAID levels 0, 1, 3 (10 for 4 drives or more), 5, and 6 or DDP
	Redundant, hot-swappable storage controllers, disk drives, power supplies, and cooling fans
	SANtricity proactive drive health monitoring with the new drive evacuator feature to identify problem drives and begin removing data before hard failures occur
	Automatic drive fault detection, failover, and rebuild by using global hot spare drives for standard RAID and spare pool capacity for DDP
	Mirrored data cache with battery backup and destage to flash
	Online controller firmware and NVSRAM upgrade
	Online Expansion Shelf Module (ESM) firmware and drive firmware upgrade (consult Customer Success Services for guidance before performing ESM or drive firmware upgrades)
SANtricity Persistent Monitor and AutoSupport, for making periodic copies of the storage system configuration	

**Note:** Usable capacity per drive depends on a number of factors, including system overhead (constant and established when the system is initialized), RAID level or DDP, and data protection features used. Use the [E-Series Performance Sizing Tool](#) to accurately determine the raw capacity required to meet a specific set of usable capacity requirements.

For additional information, refer to the [NetApp EF560 Flash Array Datasheet](#).

## 11.2 Controller Host Interface Features

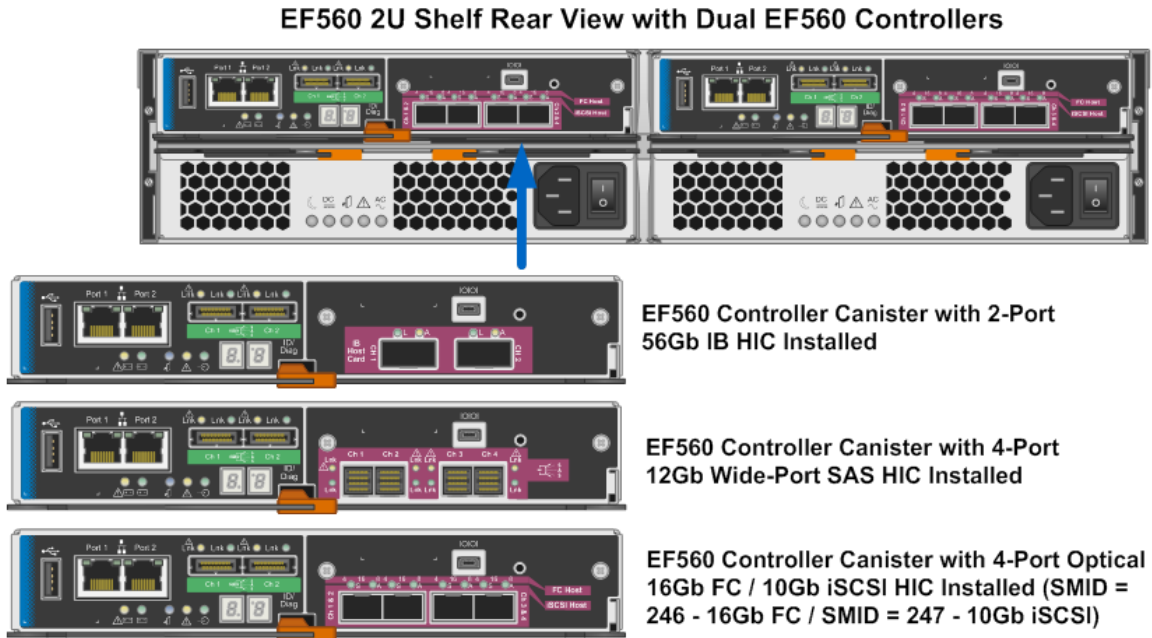
The EF560 controller by default includes two Ethernet management ports and two SAS drive expansion ports that provide out-of-band or in-band system management access and redundant drive expansion paths. EF560 controllers must be ordered with one of the supported HIC options per controller:

- 2-port 56Gb InfiniBand (IB) HIC
- 4-port 12Gb SAS HIC
- 4-port optical 16Gb FC or 10Gb iSCSI HIC

For optical connections, the appropriate SFPs must be ordered for the specific implementation. Consult the [Hardware Universe](#) for a full listing of available host interface equipment. Figure 22 provides a close-up view of the EF560 HIC options.

**Note:** Both controllers in a storage system must be configured identically.

Figure 22) EF560 HIC options.



### 11.3 SANtricity Software Specifications for EF560 Hardware

Table 11 lists the SANtricity software specifications for EF560-based storage systems.

Table 13) SANtricity software boundaries for EF560-based storage systems.

Components	Maximum
<b>Storage Hardware Components</b>	
Shelves (system and expansion)	5
Drives	120
<b>Logical Components</b>	
Partitions	512
Volumes	2,048
Volumes per consistency group	64
Consistency groups per system	32
Thin volumes per system	2,048
Disk pools per system	20
<b>Snapshot Copies</b>	

Components	Maximum
Per Snapshot group	32
Per volume	128
Per storage system	2,048
<b>Snapshot Volumes</b>	
Per Snapshot copy	4
Per system	2,048
<b>Snapshot Groups</b>	
Per volume	4
Per system	1,024
<b>Mirrors</b>	
Legacy mirrors per system	128
Mirrors per system	128
Mirrors per volume	1
Mirrors per asynchronous mirror group	64
Asynchronous mirror groups per system	4

## 12 NetApp SANtricity Plug-ins for VMware

### 12.1 NetApp SANtricity Plug-in for VMware vCenter

The NetApp SANtricity Plug-in for VMware vCenter is a VMware vCenter Server plug-in that provides integrated management of E-Series storage arrays and EF-Series flash arrays from within a VMware vSphere Web Client. The vSphere Web Client is a single management interface that you can use to manage the VMware infrastructure and all of your day-to-day storage needs.

The plug-in enables you to perform the following tasks:

- Configure ESXi hosts to NetApp SANtricity E-Series storage arrays and EF-Series flash arrays.
- Provision new and existing storage array volumes.
- Map storage array volumes to ESXi hosts and host groups.
- Manage synchronous and asynchronous mirroring and storage-array snapshots.
- View vCenter datastores located on E-Series and EF-Series storage volumes.

See [support.netapp.com](http://support.netapp.com) for the latest download and details.

### 12.2 NetApp Storage Replication Adapter for E-Series

NetApp Storage Replication Adapter for E-Series is a storage vendor–specific plug-in for VMware vCenter Site Recovery Manager. The adapter enables interaction between VMware vCenter Site Recovery Manager and the E-Series and EF-Series storage arrays at the interface level. The adapter

interacts with the storage arrays to discover replicated datastores. The adapter manages failover and test failover of the volumes containing the virtual machines' datastores.

See [support.netapp.com](http://support.netapp.com) for the latest download and details.

## 12.3 NetApp SANtricity VASA Provider

NetApp SANtricity VASA Provider is a software component that supports the VMware VASA (vStorage APIs for Storage Awareness) framework, first introduced in vSphere 5. The component acts as an information pipeline between NetApp E-Series and EF-Series storage systems and vCenter Server, enabling you to monitor relevant storage system status by collecting data such as the following:

- Storage system topology
- LUN and volume attributes
- Events and alarms

VMware vSphere Storage APIs for Storage Awareness enable unprecedented coordination between vSphere/vCenter and storage arrays. It provides built-in storage insight into vCenter to support intelligent VM storage provisioning, bolsters storage troubleshooting, and enables new Distributed Resource Scheduler–related use cases for storage.

See [support.netapp.com](http://support.netapp.com) for the latest download and details.

## 13 Architectural Tools and Sizing

### 13.1 E-Series Performance Sizing Tool

The E-Series Performance Sizing Tool provides performance and capacity results based on the performance and workload configuration requested. You can access the tool here: <https://eseries-sizer.netapp.com/sizer/main.php>.

### 13.2 E-Series Capacity Calculator

The E-Series Capacity Calculator provides information on E-Series storage capacity sizing and is available on the NetApp Field Portal under “Present a Customized Solution” for E-Series. You can access the calculator here: <https://fieldportal.netapp.com/e-series.aspx#/150496>.

## 14 Summary

Veeam Backup & Replication offers capabilities that are unprecedented in the data protection industry, but without a proper repository, backup windows and recoveries can be negatively affected. Veeam provides more recovery options and faster restoration capabilities, but to realize these benefits, the storage system must have the necessary performance profile. With technologies such as Instant VM Recovery, you can run an application directly from your backup file, but how is that application going to perform? NetApp E-Series arrays offer the performance needed when recovering an application or multiple applications and the confidence that the data backed up is protected and always available.

### 14.1 NetApp E-Series Documentation

Refer to the following link for NetApp E-Series documentation:

<https://mysupport.netapp.com/info/web/ECMP1658252.html>

## 14.2 Veeam Backup & Replication v8 Software Documentation

Refer to the following link for Veeam Backup & Replication v8 software documentation:

<http://www.veeam.com/documentation-guides-datasheets.html>



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