

Dell EMC Avamar[®] Data Store Gen4T

Comprehensive Reference Guide

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CHAPTER 1

Introduction

The following topics introduce Avamar and the Avamar Data Store (ADS) Gen4T family of hardware components:

- [Important Avamar terms and concepts](#)..... 6
- [Information for customers](#)..... 12
- [Avamar installation features overview](#).....12

Important Avamar terms and concepts

Avamar solves the challenges associated with traditional backup, enabling fast, reliable backup and recovery for remote offices, data center LANs, and VMware environments.

Avamar is backup and recovery software that uses patented global data deduplication technology to identify redundant sub-file data segments at the source, reducing daily backup data by up to 500x - before it is transferred across the network and stored to disk. This enables companies to perform daily full backups even across congested networks and limited WAN links.

Key Avamar differentiators are:

- Deduplication of backup data at the source - before transfer across the network
- Enabling of fast, daily full backups across existing networks and infrastructure
- Reduction of required daily network bandwidth by up to 500x
- Up to 10x faster backups
- Encryption of data in flight and at rest
- Patented RAIN technology that provides fault tolerance across nodes and eliminates single points of failure
- Scalable grid architecture
- Reduction of total backup storage by up to 50x due to global data deduplication
- Daily verification of recoverability - no surprises
- Centralized web-based management
- Simple one-step recovery
- Flexible deployment options, including the Avamar Data Store package

The remainder of this section provides descriptions of key terms used in this guide and other Avamar core software guides.

Nodes

A node is the primary building block in any Avamar configuration. Each node is a self-contained, rack-mountable, network-addressable server that runs Avamar software on the Linux operating system. All Avamar nodes are Domain Name System (DNS) clients.

Note

The term "server" in the previous definition is used in the typical industry context (that is, a computer that provides services to other computers or devices). However, for the remainder of this guide, unless otherwise specified, the term "server" refers to a single-node or multi-node Avamar system. The term "node" refers to the individual computer/storage platforms that make up an Avamar server.

All nodes run the Linux operating system and use RAID data protection. Nodes have 2, 4, 6, 8, or 12 hard drives, depending on node type and storage capacity. The primary differences between node types are:

- The amount of internal data storage (if any)
- The configuration and allocation of internal data storage (that is, RAID level, number of logical units [LUNs] and so forth)

- The installed Avamar application software

[Hardware specifications](#) on page 17 provides additional information.

Utility node

In scalable multi-node servers, a single utility node provides essential internal services for the server (for example, administrator server, replication, external authentication, network time protocol [NTP], and web access). Utility nodes are dedicated to running these essential services and do not store backups.

Storage nodes

Storage nodes, which store the actual backups, form the remainder of scalable multi-node servers. There are three storage node models, the primary difference being the amount of usable storage available: the M600, M1200, and M2400. Each model is also offered as a single-node server.

Single-node servers

Single-node servers combine all the features and functions of utility and storage nodes on a single node. There are four single-node server models: the M600, M1200, M2400, and S2400. The S2400 (the Avamar Business Edition) is offered only as a single-node server and features no requirement for replication.

NDMP accelerator node

An NDMP accelerator node is a dedicated single-node Avamar client that provides a complete backup and recovery solution for supported Isilon, Unity, VNX, VNXe, and Celerra systems, Oracle NAS systems, and NetApp filers by using Network Data Management Protocol (NDMP) to communicate with these storage devices. The NDMP accelerator node is not part of the Avamar server.

The *Avamar NDMP Accelerator for NAS Systems User Guide* provides more information about installation instructions.

Node resource database (probe.xml)

An XML file that stores the types and IP addresses of Avamar server nodes. In addition, `probe.xml` stores the types and IP addresses of optional nodes, and supports both Network Address Translation (NAT) and multiple network interfaces.

Avamar Downloader Service

A Windows-based file distribution system that delivers software installation packages to target Avamar systems. [Avamar Downloader Service](#) on page 15 provides more information.

Local downloader service

A component that is integrated into the Avamar Installation Manager. The local downloader service (LDLS) allows administrators to check the Dell EMC repository for updated software packages by using the Avamar Installation Manager web interface. The LDLS supports environments where local Windows hosts are unavailable and removes the requirement to copy files directly to the local repository.

Avamar FTP site

This site provides anonymous access to download Avamar hotfixes and operating system (OS) patches. The FTP site is <ftp://ftp.avamar.com>. Typically, access to this site is for Dell EMC personnel and authorized service partners (there may be exceptions). The contents of the FTP site are not browsable.

Avamar Installation Manager

A web interface that manages installation, upgrade, and maintenance packages. [Avamar Installation Manager](#) on page 13 provides more information.

Avamar login manager

A process that provides access to an external authentication database, which enables the Avamar system to use existing username and password information for Avamar authentication. Without the login manager, Avamar can only use its internal authentication mechanism. An Avamar server installation or upgrade installs the login manager, and then starts it. The login manager uses the domains configuration file to identify the supported domains.

Packages

Packages are Avamar software installation files, hotfix patches, and operating system (OS) patches that are available from the Dell EMC repository. Packages comprise three types:

- Client - A release of Avamar file system or application backup software
- Server - A new release of Avamar server software, a service pack, or a patch for the operating system, management console, or Avamar software
- Workflow - A package that runs operations such as replacing a node or changing the session security configuration

Packages use the extension `.avp`.

Dell EMC repository

A repository that contains server installation packages, client installation packages, and manifest files. The repository currently spans two locations: <ftp://ftp.avamar.com> and Dell EMC Subscribenet:

- High urgency packages such as hot fixes and OS patches are available from <ftp://ftp.avamar.com>
- Low urgency packages that have security and entitlement considerations are available from Dell EMC Subscribenet

The actual source location of a package is transparent to the user.

The repository is located on the Dell EMC network, where each customer has a download center that contains all of the available files. The Dell EMC Subscribenet team maintains these files. SSL encryption protects outgoing HTTP communication from the Avamar Downloader Service and the LDLS to the repository.

Local repository

The `/data01/avamar/repo/packages` directory on the utility node or single-node server contains the most current manifest file from the Dell EMC repository, installation packages, and workflow packages. The Avamar Downloader Service and

LDLS push packages from the Dell EMC repository to the local repository. If a customer site does not allow Internet access, you can manually copy packages into the local repository.

Manifest file

An XML file that lists all of the packages that are currently available for download from the Dell EMC repository. When the Dell EMC Subscribernet team adds a package to the repository, a corresponding manifest file entry describes the package. When the Dell EMC Subscribernet team removes a package from the repository, the team then removes the entry for the package from the manifest file.

The Avamar Downloader Service automatically downloads the manifest file from the Dell EMC repository once a day and determines whether there are new packages available for download. The Avamar Downloader Service sends the new manifest file to the local repository for each Avamar server. The LDLS manages changes to the manifest file in a similar way. However, the LDLS downloads the manifest file directly to each Avamar server without the requirement for an intermediate host.

Segregated networks

In multi-node servers, an internal network carries inter-node traffic over dual dedicated switches with specific utility node and storage node ports. All other data traffic is carried directly to external customer switches for access to backup, replication, and management sources or targets. Both internal and external networks provide protection against single points of failure.

[Bonded network interfaces](#) on page 9 and [Networking](#) on page 25 provide more information.

Bonded network interfaces

High-availability (HA) configurations use bonded network interfaces to eliminate node ports and switches as single points of failure. HA configurations require two separate customer network switches: one switch connected to each of a node's two physical interfaces. Outgoing replication and management networks can be configured for bonding through the additional ports on the utility node or single-node server.

[Networking](#) on page 25 provides more information.

High-availability network

An HA configuration provides for continued operation in the event of a single point of failure between network components. The primary objective is to provide multiple paths so that the server can recover from an individual device or link failure. To do this, HA configuration employs bonded network interfaces and dual dedicated internal switches that connect to one of two physical interfaces of a node.

[Networking](#) on page 25 provides more information.

ConnectEMC

A Linux-based program that transfers event data from an Avamar server to Customer Support. Installation of the Avamar software automatically initializes ConnectEMC by passing values from the workflow to the ConnectEMC configuration files.

The server software installation requires you to set the following ConnectEMC attributes:

Table 1 ConnectEMC attributes

Attribute	Example setting
Site name	ABC Company, Site ID: 123456
	Address: 123 Main Street, Anytown, CA 92618 US
Email server	mail.example.com
Email sender address	bob@example.com

Avamar Administrator allows you to set other ConnectEMC attributes after the installation. The following resources provide additional information about ConnectEMC:

- *Avamar Administration Guide*
- *ConnectEMC for Linux 3.0 Reference Guide*

Email home

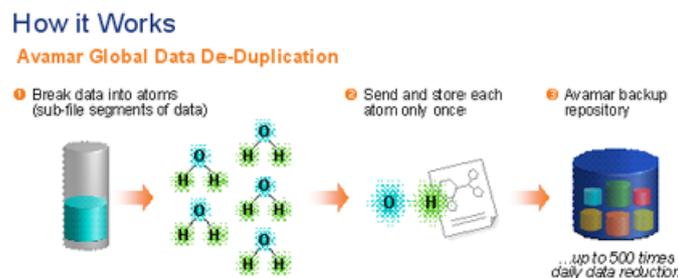
An Avamar feature that automatically emails configuration, capacity, and general system information to Customer Support once daily, and critical alerts in near-real time on an as-needed basis. Email home uses the same email server that you configure for ConnectEMC.

Data deduplication

Data deduplication is a key feature of the Avamar software. Data deduplication ensures that each unique sub-file object is stored only once across sites and servers.

During backups, the Avamar client software examines the client file system, applies a data deduplication algorithm that identifies redundant data sequences and breaks the client file system into sub-file data segments. Each data segment is assigned a unique ID. The client software then determines whether the Avamar server already stores this unique ID.

If this object resides on the Avamar server, the backup references a link to the stored object. Once an object has been stored on the server, it never has to be re-sent over the network, no matter how many times it is encountered on any number of clients. This feature significantly reduces network traffic and provides for greatly enhanced storage efficiency on the server.

Figure 1 Avamar global data deduplication

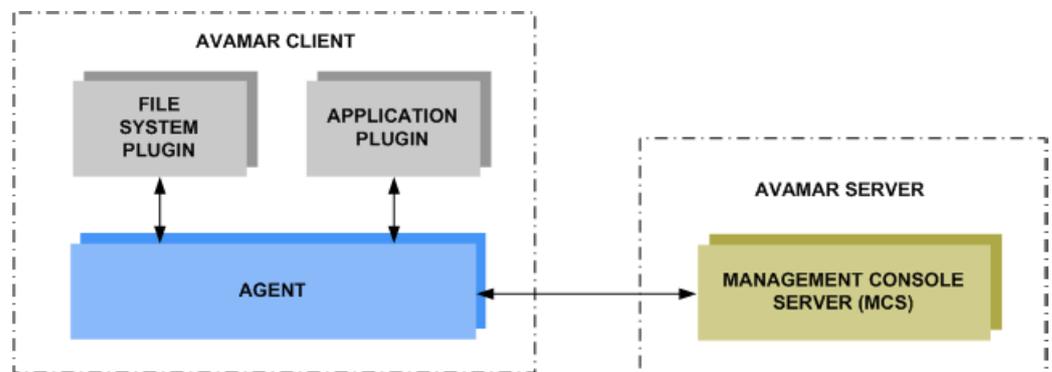
Replication

A feature that enables efficient, encrypted, and asynchronous exchange of data from one Avamar server to another Avamar server that is deployed in a remote location, without the requirement to ship tapes. Replication is a scheduled process between two independent Avamar servers that provides a higher level of reliability for stored backups. You can schedule replication to run at off-peak hours to minimize bandwidth impact.

Avamar clients

Avamar provides client software for various computing platforms. Each client comprises a client agent and one or more plug-ins.

Figure 2 Avamar client operation



Agents

Avamar agents are platform-specific software processes that run on the client and communicate with the Management Console Server (MCS) and any plug-ins installed on that client.

Plug-ins

Avamar provides two types of plug-ins:

- File system – used to browse, back up, and restore files or directories on a specific client file system (such as Linux, Mac OS, Microsoft Windows, and Sun Solaris).
- Application – support backup and restore of databases or other special applications (such as Microsoft Exchange or SQL Server, Oracle, and NDMP for NAS devices).

Encryption

To provide enhanced security during client/server data transfers, Avamar can encrypt all data that is sent between clients and the server “in flight.” You can set the encryption level on a client-by-client basis in client properties, or for an entire group of clients in group properties. You also can disable “in-flight” encryption entirely.

You can also configure each Avamar server to encrypt the stored data on the server (“at rest”). The decision to encrypt all data that is stored in an Avamar server is typically a one-time decision that is made when the server is initially deployed at a customer site.

Additional security features use encryption during authentication of both the server and client. The *Avamar Product Security Guide* provides more information.

Information for customers

The following is a collection of information about Avamar and the ADS that can guide you when installing and using this product:

The Online Support site is a great resource for information and links: <https://support.emc.com/products/>

The Avamar FTP site hosts Avamar software downloads: <ftp://ftp.avamar.com>

Obtaining an Avamar license key file requires an account for the Software Licensing Central (SLC) portal on the Online Support site.

For information about cross-version and cross-equipment compatibility, the *Avamar Compatibility and Interoperability Matrix* on the Online Support site provides additional information.

For best-practice tips about installing, configuring, upgrading, and using Avamar, refer to the *Avamar Operational Best Practices Guide*.

Technical notes provide supplemental information about rare, unique, or version-specific installation, implementation, and configuration scenarios. You can find technical notes by title on the Online Support site. For instance, one technical note, *Avamar Client Downloads and Client Manager Installer Upgrades Technical Note*, describes how to upgrade client downloads and Avamar Client Manager client installers.

Note

Starting in Avamar 7.2.x, Avamar Enterprise Manager is no longer available. The technical note *Avamar Enterprise Manager Transition to Backup and Recovery Manager* provides more information.

Fundamental Avamar principles

When working with Avamar, always consider the following:

- All nodes in an Avamar server must run the same version of the Avamar software.
- All storage nodes in a multi-node Avamar server must be the same size (capacity).
- The best practice for replication is to move data from an older generation Avamar server to a newer one and not the reverse. This scenario is typically used to replicate data from the old server as a first step before upgrading it to the latest version of Avamar software, after which the data can be replicated back.
- All non-RAIN systems must be replicated, except the S2400 (Avamar Business Edition, see [Hardware specifications](#) on page 17).

Avamar installation features overview

Avamar uses the Avamar Installation Manager user interface to automate the server software installation process. The Avamar Installation Manager runs on single-node servers and on the utility node of multi-node systems. Customer Support uses this utility during implementation.

Avamar also includes the Avamar Downloader Service, a Microsoft Windows-based application that automates package installation, and the LDLS, for direct download of packages.

How long will the Avamar software installation take?

Completing the Avamar server software installation takes about two hours, plus the amount of time it takes to upload the Avamar software installation packages to the server.

Note

Uploading the installation package can take a significant amount of time, depending on the method used. Installing and configuring the Avamar Downloader Service and LDLS are considered post-installation tasks because they are not required to perform Avamar software installation.

Avamar Installation Manager

The server software installation process installs the Avamar Installation Manager user interface on the utility node or single-node server. The Avamar Installation Manager user interface enables Dell EMC personnel to:

- Install or upgrade the Avamar software
- Install OS, Avamar software, or other hotfix patches after the initial Avamar software installation

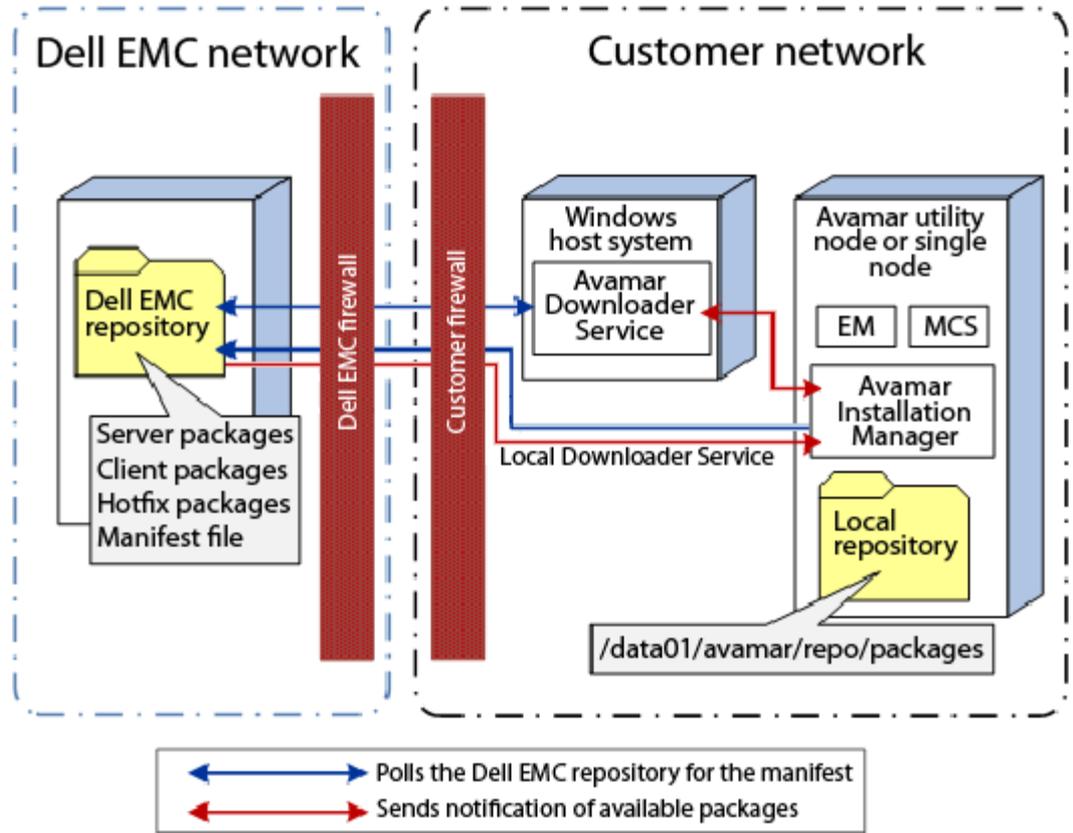
Avamar Installation Manager controls the following:

- The Dell EMC repository manifest file
- Downloading of packages from the Avamar Downloader Service and LDLS
- Monitoring the local repository for any software packages manually added to the server
- Dependency and version checks of the downloaded packages
- Management of the temporary directory that is used to extract the packages
- Deletion of software packages after a successful installation or upgrade

Process flow

The following diagram shows how the Avamar Downloader Service, LDLS, and Avamar Installation Manager work together with other components to automatically provide installation, upgrade, and hot fix packages.

Figure 3 Process flow for packages



Process flow tasks:

1. The Avamar Downloader Service and LDLS check with the Dell EMC repository for new manifest files, automatically every 24 hours.
 - The Avamar Downloader Service downloads the manifest from the Dell EMC repository and pushes it to the Avamar Installation Manager, or
 - The LDLS downloads the manifest from the Dell EMC repository directly to the Avamar Installation Manager.

Note

During the first communication handshake between the Avamar Downloader Service and Avamar Installation Manager, the Avamar Downloader Service passes information such as its version, its host and IP address, and so forth, to the Avamar Installation Manager.

2. The Avamar Installation Manager processes the manifest file and notifies the user of new packages.
3. The user requests the package by clicking the **Download** button in the Avamar Installation Manager.
 - The Avamar Downloader Service then downloads the package and pushes it to the Avamar Installation Manager, or
 - The Avamar Installation Manager downloads the package directly using the LDLS.

- The user installs the package by clicking the **Install** button in the Avamar Installation Manager.

Log files

The Avamar Installation Manager provides log file information through the web interface. The log information can be exported to a file (.xls or .pdf).

The Avamar Installation Manager also provides the **Download all system logs** icon , which enables you to download all system log files for troubleshooting issues, for example.

You must log in to the Customer Support account to use the **Download all system logs** icon.

In-flight encryption

A new installation of Avamar sets in-flight encryption to High as the default setting. An upgrade does not change the current in-flight encryption setting. The *Avamar Administration Guide* provides more information about in-flight encryption.

Avamar Downloader Service

The Avamar Downloader Service is a file distribution system that delivers software installation packages to target Avamar systems. The distribution process uses minimal bandwidth by downloading only files that you request through the Avamar Installation Manager.

The Avamar Downloader Service uses a local file cache to ensure that a file is fetched only once from the Dell EMC repository, no matter how many times an Avamar system requests the file. You can remove old files from the local repository to free disk space.

The Avamar Downloader Service software runs on a stand-alone Microsoft Windows server and installs as an automatic-startup service. The Windows server must have network access to the Dell EMC repository and the Avamar server. You can view the Avamar Downloader Service from the Microsoft Management Console. After you install the Avamar Downloader Service, use the Avamar Downloader Service application to configure it.

The installation of the Avamar Downloader Service installs these components:

Table 2 Avamar Downloader Service components

Component	Description		
Avamar Downloader Service Windows service	Monitors the Dell EMC repository. When a package is available for the Avamar system, the Avamar Downloader Service service automatically downloads the package and pushes it to the local repository on the Avamar utility node or single-node server.		
Avamar Downloader Service monitor	A process that provides status message about the Avamar Downloader Service.		
	Moving the mouse over the  tray icon displays status messages from the Avamar Downloader Service monitor.		
	Right-clicking the icon displays these options:		
	<table border="1"> <tr> <td>Configure Service</td> <td>Opens the Avamar Downloader Service configuration application.</td> </tr> </table>	Configure Service	Opens the Avamar Downloader Service configuration application.
Configure Service	Opens the Avamar Downloader Service configuration application.		

Table 2 Avamar Downloader Service components (continued)

Component	Description	
	Open Repository	Opens the local file cache directory on the Windows server (C:\Program Files\EMC\Avamar Downloader Service\repository).
	Run Diagnosis	Runs a test of packages in the local manifest file and for network connectivity to the Dell EMC repository.
	Check for New Packages	Queries the Dell EMC repository for a new manifest file.
	Show Advanced Settings	Allows the input of new Dell EMC repository credentials or the restoration of Avamar Downloader Service to default settings.
	Check for Updates	Checks for an updated version of the Avamar Downloader Service software.
	About	Shows the version of the Avamar Downloader Service.
	Exit	Closes the Avamar Downloader Service.

The Avamar Downloader Service installation also creates:

- A local repository in the installation directory.
This directory is where the Avamar Downloader Service puts packages it fetches from the Dell EMC repository.
- A Start menu program group: **Avamar Downloader Service <version>**, where <version> is the version of the Avamar system software that is installed on the server. The program group contains:
 - Avamar Downloader Service Configuration
 - Avamar Downloader Service Monitor
- A desktop shortcut to the Avamar Downloader Service configuration application.

CHAPTER 2

Hardware specifications

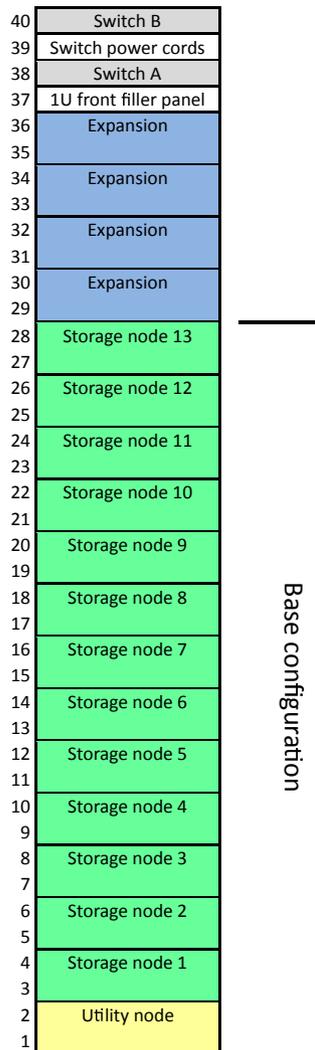
The following topics describe the set of Gen4T hardware:

- [Multi-node server component locations](#)..... 18
- [Hardware specifications](#)..... 19
- [Service port connectivity](#)..... 20
- [Node components](#)..... 21

Multi-node server component locations

A 14-node example (1 utility node and 13 active storage nodes) of the initial configuration of a standard ADS multi-node server is shown here. Initial configurations range from 4 to 18 nodes (one utility node plus a maximum of 16 active storage nodes and one optional spare storage node).

Figure 4 Multi-node layout



Previous component replacement might have changed the arrangement of nodes in your rack. Since a spare can replace any defective storage node, and because a replacement node can become the new spare, the location of any specific storage node can vary over time.

Each rack configuration has 40U capacity, and all nodes take up 2U increments. The utility node is at the bottom of a multi-node configuration, with active storage nodes and an optional spare storage node stacked above it. Additional nodes can be added in expansion slots starting with the lowest available slot.

Switches A and B at the top are ADS internal network switches. Switch A is the bottom one.

The minimum ADS multi-node configuration is one utility node and three storage nodes. The maximum is 1 utility node, 16 active storage nodes, and an optional spare storage node.

Hardware specifications

Each node runs the SuSE Linux Enterprise Server 11 SP3 or SP4 operating system, and features a service port. See [Service port connectivity](#) on page 20 for more information.

Note

Some versions of the Avamar software may upgrade the operating system to SLES 11 SP4.

The M600, M1200, and M2400 can be used as single-node servers or as storage nodes within a multi-node server. The S2400 (Avamar Business Edition) is available only as a single-node server and does not require replication.

The NDMP accelerator node is an optional node that is associated with, but not part of, the Avamar server.

Utility node

- Two 3.5" hard drives
- Dual 1100W power supplies
- Two SLICs, each containing four 10GbE network ports:
 - Bay 0: 10GBase-T or 10GbE Twinax/Optical
 - Bay 1: 10GBase-T
- RMC shared and dedicated management ports

M600 (2.0 TB licensed capacity)

- Four 3.5" hard drives
- Dual 1100W power supplies
- Two SLICs, each containing four 10GbE network ports:
 - Bay 0: 10GBase-T or 10GbE Twinax/Optical
 - Bay 1: 10GBase-T
- RMC shared and dedicated management ports

M1200 (3.9 TB licensed capacity)

- Six 3.5" hard drives
- Dual 1100W power supplies
- Two SLICs, each containing four 10GbE network ports:
 - Bay 0: 10GBase-T or 10GbE Twinax/Optical
 - Bay 1: 10GBase-T
- RMC shared and dedicated management ports

M2400 (7.8 TB licensed capacity)

- Twelve 3.5" hard drives
- One 2.5" SSD drive
- Dual 1100W power supplies
- Two SLICs, each containing four 10GbE network ports:
 - Bay 0: 10GBase-T or 10GbE Twinax/Optical
 - Bay 1: 10GBase-T
- RMC shared and dedicated management ports

Avamar Business Edition/S2400 node (7.8 TB licensed capacity)

- Eight 3.5" hard drives
- One 2.5" SSD drive
- Dual 1100W power supplies
- Two SLICs, each containing four 10GbE network ports:
 - Bay 0: 10GBase-T
 - Bay 1: 10GBase-T
- RMC shared and dedicated management ports

NDMP accelerator node

- Two 3.5" hard drives
- Dual 1100W power supplies
- One SLIC, containing four 10GbE network ports:
 - Bay 0: 10GBase-T or 10GbE Twinax/Optical
- RMC shared and dedicated management ports

Service port connectivity

For all Gen4T nodes, perform service via the following ports. Connecting to the internal and external network ports is only possible after the node has booted.

Note

Traffic for the RMC can be configured during installation to share the primary backup network port, or to use the dedicated RMC port. The following table lists the default ports for both configurations, where applicable.

Table 3 Service ports

Node state	Service port	Notes
All	Serial port	<ul style="list-style-type: none"> • Authorized service personnel use the serial port to configure nodes, install the Avamar software, and perform maintenance.

Table 3 Service ports (continued)

Node state	Service port	Notes
		<ul style="list-style-type: none"> Customers use the serial port to perform the initial network configuration when installing a single-node server. The serial port is always available, including when the node is straight from manufacturing and after rekickstart.
After multi-node installation	Internal network switch port 24	<ul style="list-style-type: none"> Use the internal network IP address that was assigned to each node during installation. The default internal network IP addresses typically start at 192.168.255.1 for the utility node.
After single-node installation	eth1 (SLIC0NIC0) eth0 (RMC shared)	<p>The primary backup network port.</p> <ul style="list-style-type: none"> Use the external (backup) network IP address that was assigned to the server during installation.
After single- or multi-node installation	RMC dedicated eth0 (RMC shared)	<p>The dedicated or shared RMC port.</p> <ul style="list-style-type: none"> Use the RMC port IP address that was assigned to the node during installation. Because configuration of the RMC ports is optional, the RMC may not always be accessible. When configured, the RMC ports are always available, including before the system has booted and when the node is off.

Node components

Before handling Gen4T equipment, first familiarize yourself with the node types and component locations for your specific hardware. See the figures and tables that follow for details.

Figure 5 Front view



Table 4 Front panel components

Feature	Description
Hard drives	<p>Hot swappable 3.5" hard drives:</p> <ul style="list-style-type: none"> • Utility node - Two in the 0 and 1 drive locations. All others are blank. • M600 node - Four in the 0 through 3 drive locations. All others are blank. • M1200 node - Six in the 0 through 5 drive locations. All others are blank. • M2400 node - 12 in the 0 through 11 drive locations. • Avamar Business Edition (S2400) node - Eight in the 0 through 7 drive locations. All others are blank. • NDMP accelerator node - Two in the 0 and 1 drive locations. All others are blank.

Figure 6 Rear view

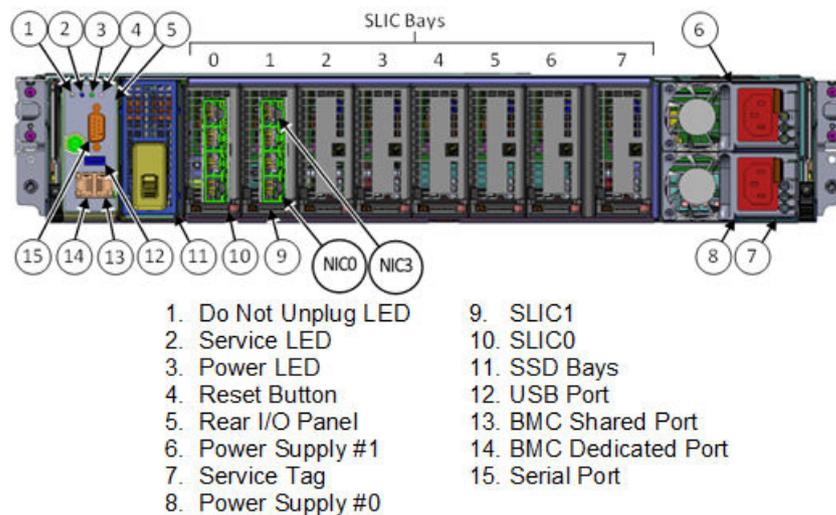


Table 5 Rear panel components

Feature	Description
Service tag	A pull-out label with the serial number and other system information.
Power supply #0	1100W power supply.
Power supply #1	1100W power supply.
SLIC bays	Hosts for network interfaces. Each 10GBase-T or 10GbE Twinax/Optical SLIC hosts four network ports. All unoccupied bays contain fillers.
SSD bays	Host for SSD storage devices. Only the S2400 and M2400 contain an SSD. All other models contain two fillers.

Table 5 Rear panel components (continued)

Feature	Description
RMC shared port	The remote management port that is used to share remote management traffic and backup traffic.
RMC dedicated port	The remote management port that is used when remote management traffic is not shared.
USB port	Connects a USB device.
Serial port	Connects a device via RS-232 to provide direct access to the console.
	Gen4T hardware does not support direct monitor and keyboard connectivity.
Do Not Unplug LED	Indicates that the node should not be powered off or unplugged.
Service LED	Indicates that the node requires some type of service.
Power LED	Indicates that the node is powered on.
Reset	Reset the node by using the end of a paper clip to press the Reset button. Use this button only if directed to do so by qualified support personnel.

CHAPTER 3

Networking

This chapter provides a comprehensive description of optional networking features and requirements for both single-node and multi-node ADS Gen4T systems, including the following topics:

- [Overview](#)26
- [Default port configuration](#)26
- [Basic networking configuration](#)28
- [Supported network configurations](#)29
- [Advanced network configuration – dpnnetutil utility](#)34
- [Replication](#)36

Overview

The information in this chapter is for reference only. If advanced network or replication configuration is required, Dell EMC personnel must perform those activities before installing the Avamar software.

Included in this chapter are:

- General overview of Gen4T networking principles
- Descriptions of different network configurations with which Gen4T servers can interconnect
- An overview of the optional `dpnnetutil` advanced configuration utility
- Descriptions of replication schemes that Gen4T supports

Default port configuration

Notation

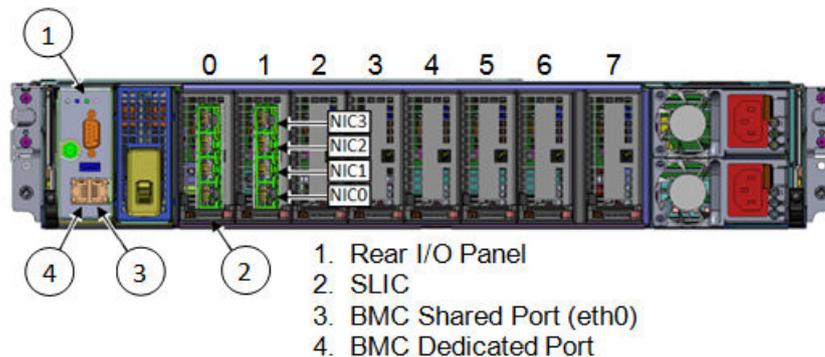
With Gen4T, the notation *SLICXNICY* describes the physical location of network ports that reside on SLICs, where *X* and *Y* are the SLIC number and the network port number on that SLIC, respectively.

- SLICs are numbered from left to right, starting at 0.
- Network ports on SLICs are numbered from bottom to top, starting at 0.

Location

The dedicated and shared remote management console ports are located on the rear I/O panel. All other network ports reside on SLICs.

Figure 7 Gen4T network ports



The Avamar software installation performs default network configuration. The following topics describe default configuration and basic networking principles.

Multi-node servers

A multi-node server divides network traffic between internal Avamar traffic and external customer communications. Two internal switches (to support high-availability) on an isolated network route internal Avamar traffic between nodes. Customers provide external switching and connections to match their infrastructure for backups, replication, and node management.

All nodes connect to dual dedicated network switches through the eth7 (SLIC1NIC2) and eth8 (SLIC1NIC3) ports. These ports are normally bonded together as bond1.

- eth7 (SLIC1NIC2) is the primary, eth8 (SLIC1NIC3) is the secondary.

The internal network is a redundant, high availability, fault-tolerant network that connects all nodes in the cluster for RAIN, rebuilding, and maintenance functions. It carries all Avamar internal operations and data management traffic.

For the external network, the default configuration depends on whether you use the shared or dedicated RMC port.

For high availability, the primary and secondary external network ports are normally bonded together as bond0 to back up customer data.

For systems configured with dedicated RMC ports:

All nodes connect directly to a customer network switch through the eth1 (SLIC0NIC0) port. For high availability, all nodes can also connect to a different customer network switch through the eth2 (SLIC0NIC1) port.

eth1 (SLIC0NIC0) is the primary, eth2 (SLIC0NIC1) is the secondary.

The remote management connection is made through the RMC dedicated port on the rear I/O panel.

For systems configured with shared RMC ports:

All nodes connect directly to a customer network switch through the eth0 (RMC shared) port. For high availability, all nodes can also connect to a different customer network switch through the eth1 (SLIC0NIC0) port.

eth0 (RMC shared) is the primary, eth1 (SLIC0NIC0) is the secondary.

The remote management connection is made through the eth0 (RMC shared) port on the rear I/O panel.

The default settings can be changed through the `dpnnetutil` utility that is described in [Advanced network configuration – dpnnetutil utility](#) on page 34.

Single-node servers

A single-node server divides different types of network traffic onto different network interfaces. Customers provide external switching and connections to match their infrastructure for backups, replication, and management.

For the external network, the default configuration depends on whether you use the shared or dedicated RMC port.

When high availability is desired, the primary and secondary external network ports are normally bonded together as bond0 for backing up customer data.

For servers configured with dedicated RMC ports:

The server connects directly to a customer network switch through the eth1 (SLIC0NIC0) port. For high availability, the server can also connect to a different customer network switch through the eth2 (SLIC0NIC1) port.

eth1 (SLIC0NIC0) is the primary, eth2 (SLIC0NIC1) is the secondary.

The remote management connection is made through the RMC dedicated port on the rear I/O panel.

For servers configured with shared RMC ports:

The server connects directly to a customer network switch through the eth0 (RMC shared) port. For high availability, the server can also connect to a different customer network switch through the eth1 (SLIC0NIC0) port.

eth0 (RMC shared) is the primary, eth1 (SLIC0NIC0) is the secondary.

The remote management connection is made through the eth0 (RMC shared) port on the rear I/O panel.

The default settings can be changed through the `dpnnetutil` utility that is described in [Advanced network configuration – dpnnetutil utility](#) on page 34.

Basic networking configuration

Gen4T servers follow these configuration principles:

- All connections to the customer network are standard leaf connections.
- The external customer network switch can be shared with other applications.
- All networking ports are bonded in pairs, by default.
- Both remote management ports on the rear I/O panel auto-negotiate to 1 Gb Ethernet (full duplex).
- All four network ports on a 10GBase-T SLIC in bay 0 auto-negotiate to 1 Gb or 10 Gb Ethernet (full duplex).
- All four network ports on a 10GbE Twinax/Optical SLIC in bay 0 operate at 10 Gb Ethernet (full duplex).
- Both management network ports eth5 (SLIC1NIC0) and eth6 (SLIC1NIC1) autonegotiate to 1 Gb Ethernet (full duplex).

If the customer network environment segregates traffic by using backup virtual local area networks (VLANs), configure the corresponding VLANs on the Avamar server. The customer network administrator must provide a list of VLAN IDs for Dell EMC personnel to run the `dpnnetutil` utility.

For networks that do not require advanced configuration like VLAN and network address translation (NAT) support, the server uses the network configuration from the standard software installation. The exception is the primary backup network port, which must be configured in advance of software installation.

Note

As noted in this list of basic network configurations, Avamar systems support the use of VLANs and separately support the use of NAT. However, Avamar does not support the use of NAT on VLANs.

If you use all of the backup, replication, and management interfaces, ensure that you configure the interfaces for different subnets.

See [Node components](#) on page 21 for descriptions and images of node components. The following topics provide further clarification of the possible Gen4T networking configurations.

Multi-node servers

The primary and secondary port bonding on storage nodes can be broken to facilitate incoming replication, which is delivered directly to storage nodes, or for node management. Breaking this bond prevents use of the high-availability backup capability.

You can also connect the utility node to a customer network switch through its additional four network interfaces for optional outgoing replication and node management. These interfaces are also bonded in pairs for high availability configuration:

- Outgoing replication: eth3 (SLIC0NIC2) and eth4 (SLIC0NIC3)
- Management: eth5 (SLIC1NIC0) and eth6 (SLIC1NIC1)

Both internal network ports eth7 (SLIC1NIC2) and eth8 (SLIC1NIC3) autonegotiate to 1 Gb Ethernet (full duplex).

Supported network configurations

The following sections describe networking scenarios supported by ADS Gen4T servers.

- Single uplink to an external customer network
- Dual uplink to an external customer network
- Dual uplink plus options to an external customer network

Multi-node servers

Single uplink to external customer network

The following figures illustrate a single uplink from all nodes to the customer network and connections for the dual dedicated internal switches (switch A and B).

Figure 8 Single uplink, dedicated RMC port

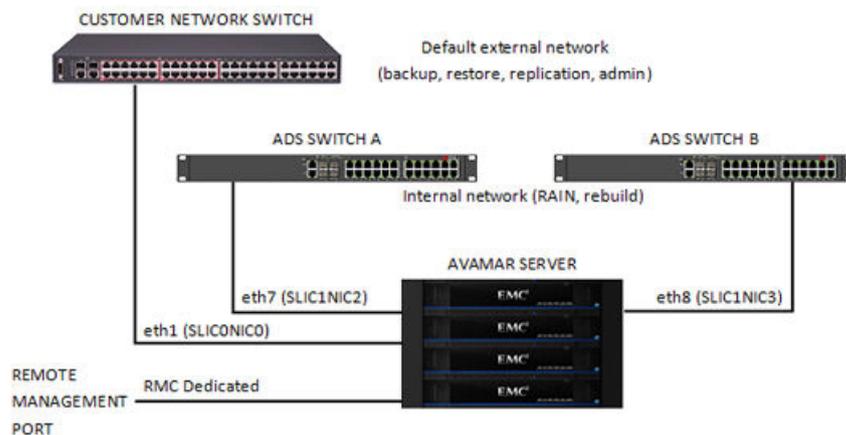
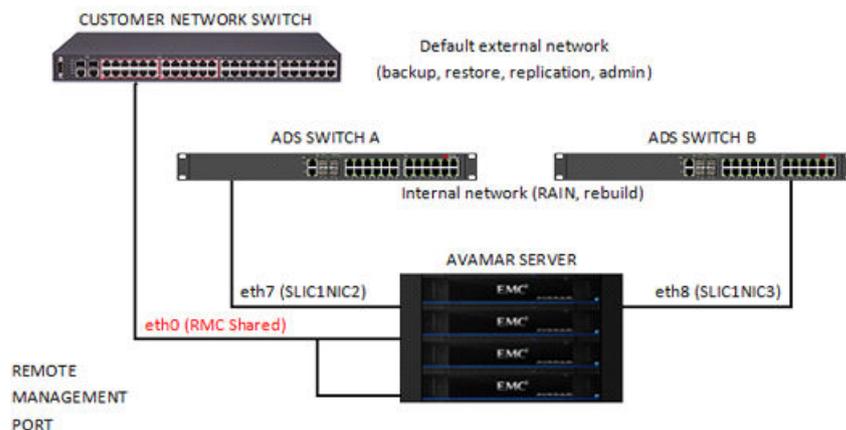


Figure 9 Single uplink, shared RMC port



Dual uplink to external customer network

For high-availability configurations, the following figures illustrate a dual uplink from all nodes to the customer network and connections for the dual dedicated internal switches (switch A and B).

Figure 10 Dual uplink, dedicated RMC port

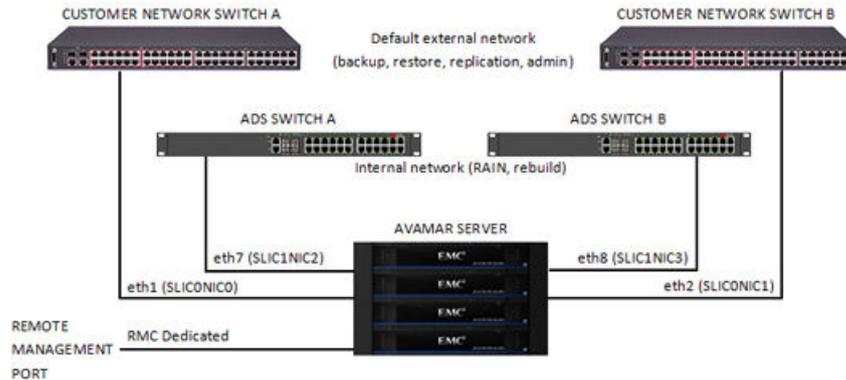
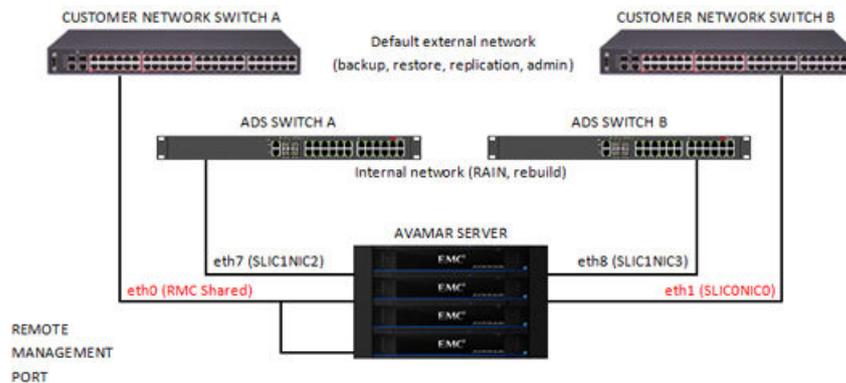


Figure 11 Dual uplink, shared RMC port



The high-availability external network provides an Avamar server that continues operating through any single network component failure, including:

- Any network interface on the Avamar external network
- Any single uplink cable from the server to the customer network
- Any port on the customer network used in the uplink
- An entire customer switch used in the uplink
- Connectivity between customer switches used in the uplink

Dual uplink plus options to external customer network

For high-availability configurations plus replication and management traffic options, the following figures illustrate:

- Dual dedicated internal switches (switch A and B),
- Dual uplinks from all nodes to the customer network switch for high-availability backups, and
- Single or dual connections to the customer network for outgoing replication or administration traffic.

Figure 12 Dual uplink plus options, dedicated RMC port

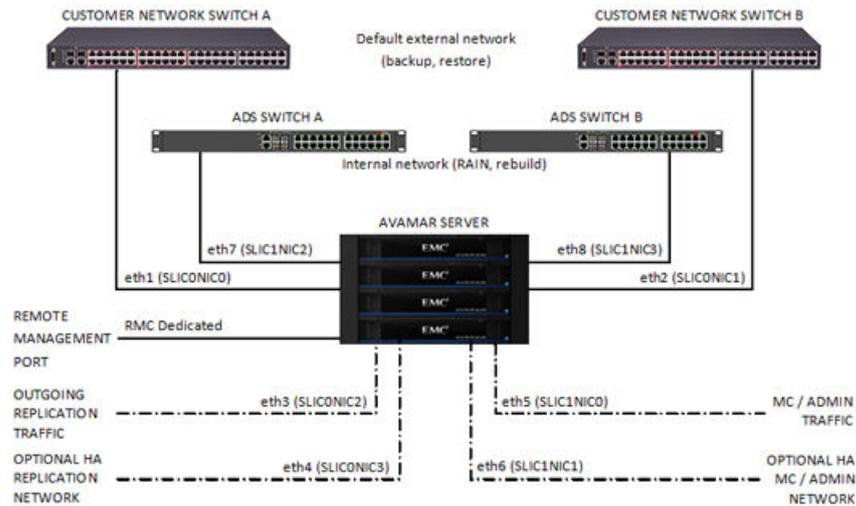
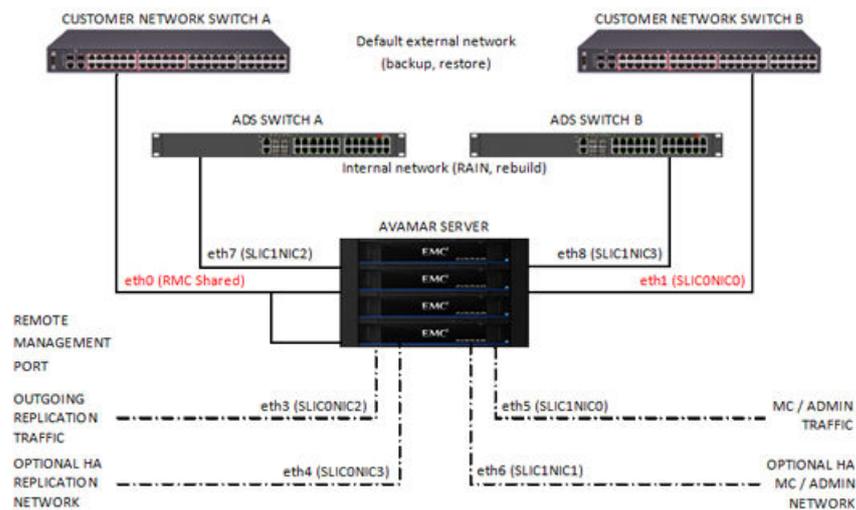


Figure 13 Dual uplink plus options, shared RMC port



This high-availability external network provides an Avamar server that continues operating through any single failure in a default or optional network component, including:

- Any network interface on the Avamar external network
- Any single uplink cable from the server to the customer network
- Any port on the customer network used in the uplink
- An entire customer switch used in the uplink
- Connectivity between customer switches used in the uplink

Single-node servers

Single uplink to external customer network

The following figures illustrate a single uplink from the server to the customer network switch.

Figure 14 Single uplink, dedicated RMC port

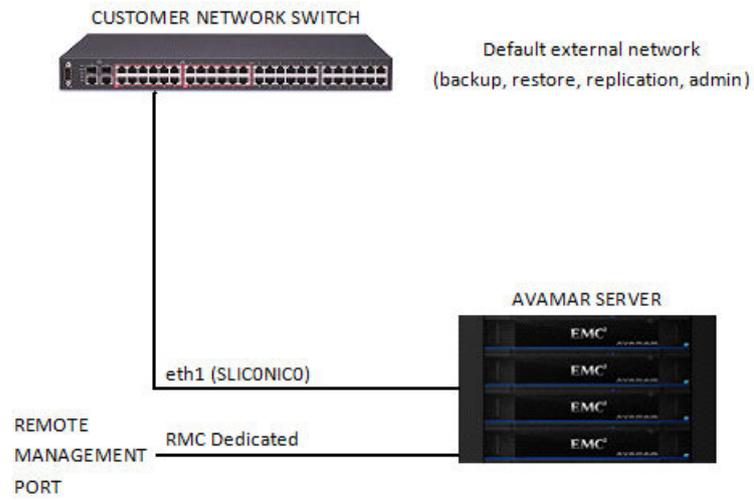
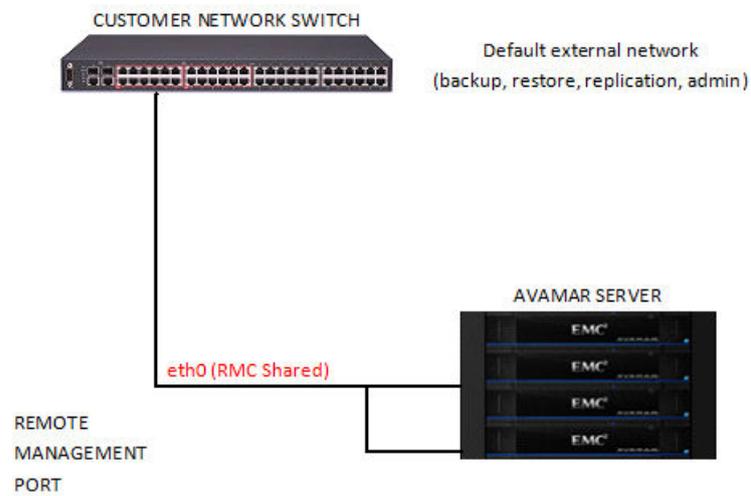
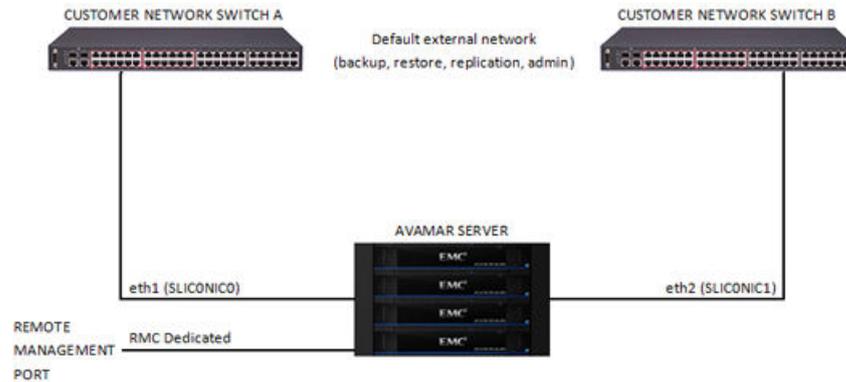
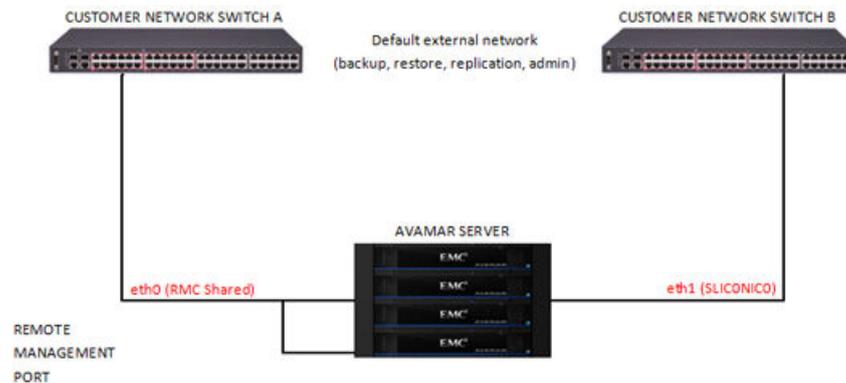


Figure 15 Single uplink, shared RMC port



Dual uplink to external customer network

For high-availability configurations, the following figures illustrate dual uplinks from the server to the customer network.

Figure 16 Dual uplink, dedicated RMC port**Figure 17** Dual uplink, shared RMC port

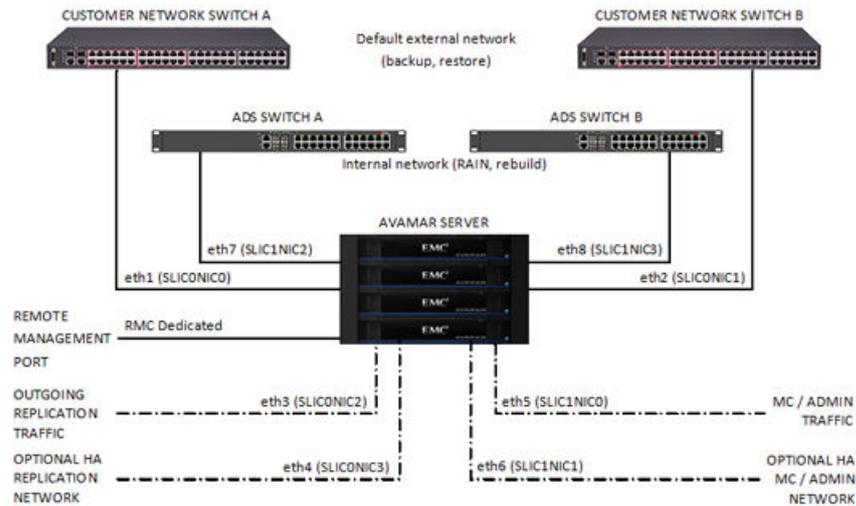
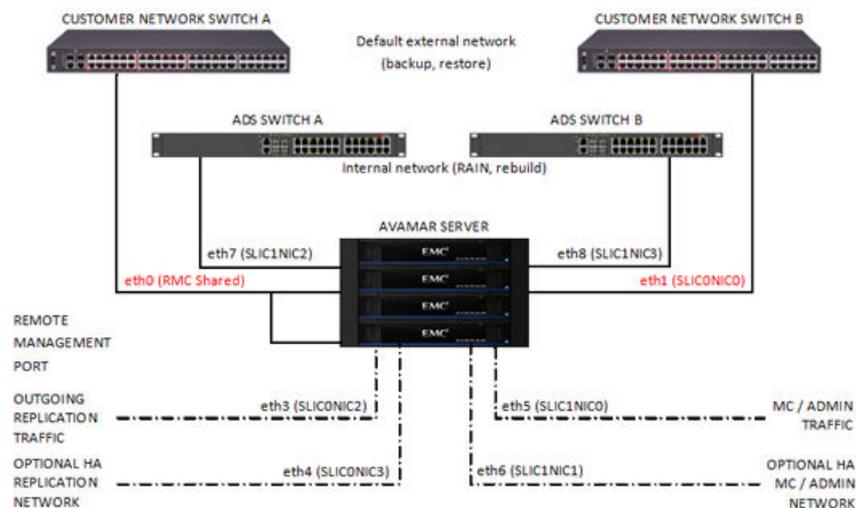
The high-availability external network provides an Avamar server that continues operating through any single network component failure, including:

- Any network interface on the Avamar external network
- Any single uplink cable from the server to the customer network
- Any port on the customer network used in the uplink
- An entire customer switch used in the uplink
- Connectivity between customer switches used in the uplink

Dual uplink plus options to external customer network

For high-availability configurations plus replication and management traffic options, the following figures illustrate:

- Dual uplinks from the server to the customer network switch for high-availability backups, and
- Single or dual connections to the customer network for outgoing replication or administration traffic.

Figure 18 Dual uplink plus options, dedicated RMC port**Figure 19** Dual uplink plus options, shared RMC port

The high-availability external network provides an Avamar server that continues operating through any single network component failure, including:

- Any network interface on the Avamar external network
- Any single uplink cable from the server to the customer network
- Any port on the customer network used in the uplink
- An entire customer switch used in the uplink
- Connectivity between customer switches used in the uplink

Advanced network configuration – `dpnnetutil` utility

For ordinary implementations, the normal software installation process provides all functionality that is required to configure Avamar networking.

For more advanced configurations, the interactive `dpnnetutil` utility must be run before software installation. Advanced configuration scenarios include:

- Support for VLAN interfaces to backup networks
- Setting custom hostnames
- Configuring Network Address Translation (NAT)
- Circumstances in which the internal network subnet must be changed due to a conflict with existing customer network devices

Note

Only Dell EMC personnel can run the `dpnnetutil` utility. If the customer site requires advanced network configuration, alert the Dell EMC Account Team that the implementation specialist must run `dpnnetutil` before installing the Avamar software. While `dpnnetutil` is running, the customer may be asked to check certain hardware-related connectivity errors that the utility might report.

Features provided by `dpnnetutil`

Running `dpnnetutil` provides the following features:

Single-node Gen4T servers

For single-node servers, the feature set includes:

- Detection of cabling and connectivity errors during configuration, including:
 - No link is detected on a network interface
 - Link speed below 1GB
 - Auto negotiation
 - Full duplex

When an error is detected, displays a dialog box that describes the error and the affected network interfaces.

- Determination of the cabling schema that is based on the number of physical network interfaces and link presence.
- Configuration of the backup, replication, and management networks, including:
 - Requesting IP addresses and netmask for replication and management networks
 - Allowing edit and confirmation later

Note

If you configure all backup, replication, and management interfaces on the single-node server, you must configure the interfaces for different subnets.

- Configuration of backup VLAN interfaces, including:
 - Requesting a list of VLAN IDs available on the customer network switch
 - Requesting corresponding parameters for each VLAN ID (IP, netmask)

The customer network administrator must provide a list of correct VLAN IDs (typically in the range 1 to 4094). The site networking topology must be such that all clients are able to resolve the Avamar server by the same hostname from different VLANs. Otherwise, backup failures may occur.

The `dpnnetutil` utility populates `probe.xml` with information obtained during the configuration procedure.

Multi-node Gen4T servers

For multi-node servers, the feature set includes:

- Detection of cabling and connectivity errors during configuration, including:
 - No link is detected on a network interface
 - Link speed below 1GB
 - Auto negotiation
 - Full duplex

When an error is detected, displays a dialog box that describes the error and the affected network interfaces.

- Determination of the cabling schema that is based on the number of physical network interfaces and link presence.
- Configuration of the internal network for advanced schemas, including:
 - Offering predefined IP ranges for the internal network
 - Allowing modification of the IP addresses and netmask later

The internal network isolates internal switches and internal traffic between nodes from the external customer network. To simplify internal network configuration, `dpnnetutil` offers predefined ranges of IP addresses.

Select an IP subnet from this list. Otherwise, to avoid ambiguous routing because one of the predefined IP addresses exists on the customer network or for other reasons, configure new IP addresses manually.

- Configuration of the backup, replication, and management networks, including:
 - Requesting IP addresses and netmask for replication and management networks
 - Allowing edit and confirmation later
- Configuration of backup VLAN interfaces, including:
 - Requesting a list of VLAN IDs available on the customer network switch
 - Requesting corresponding parameters for each VLAN ID (IP, netmask)

The customer network administrator must provide a list of correct VLAN IDs (typically in the range 1 to 4094). The site networking topology must be such that all clients can resolve the Avamar server by the same hostname from different VLANs. Otherwise, backup failures may occur.

The `dpnnetutil` utility populates `probe.xml` with information obtained during the configuration procedure.

Replication

The following sections describe the types of supported replication architectures. For complete instructions on setting up and performing replication, including terms and concepts, capabilities and limitations, and best practices, the *Avamar Administration Guide* provides more information.

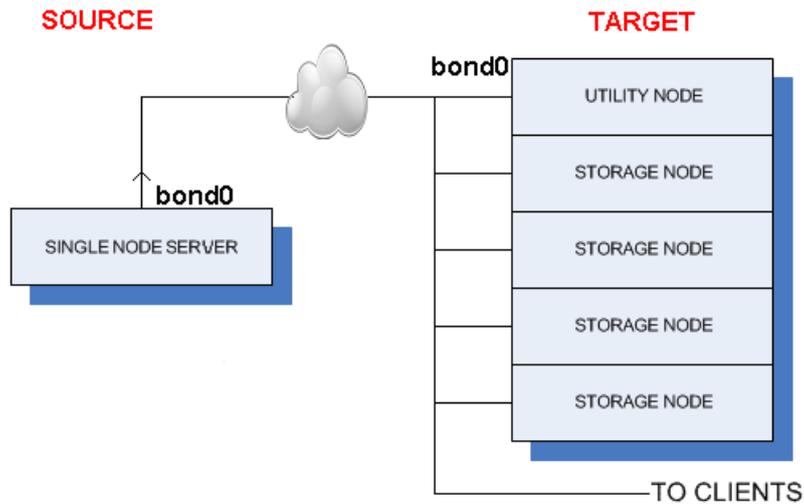
Single-node servers

The Gen4T networking architecture and the Avamar software provide two types of replication: basic and dedicated. The following sections describe each type of replication.

Basic replication

The source and target servers each have a single network for all traffic. Incoming and outgoing replication occurs on this single network between the source and target pair. Target servers can be either multi-node or single-node. The following figure shows a multi-node server as the target.

Figure 20 Basic replication network

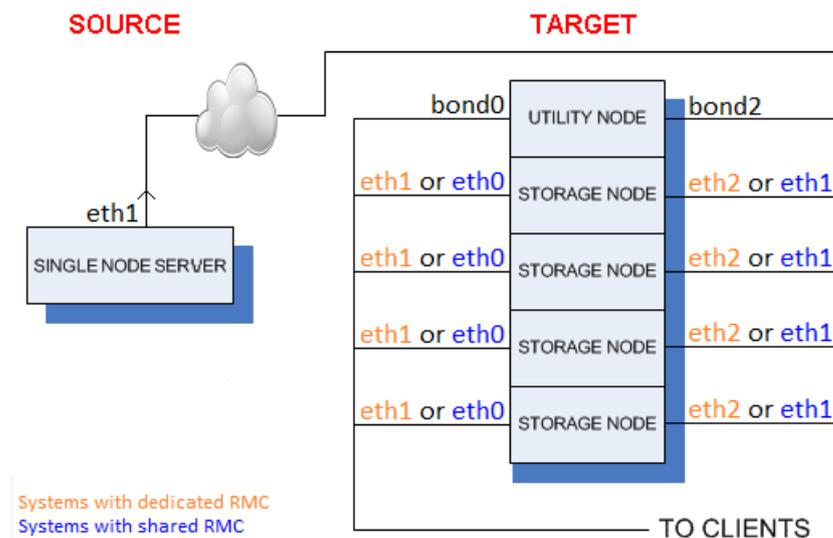


Configure basic replication after installation of the Avamar software. The *Avamar Administration Guide* provides more information.

Dedicated replication

Servers that are configured for dedicated replication have dedicated networks on both the source and target. On the source server, you can configure dedicated backup, replication, and management ports. The following figure shows a multi-node server as the target.

Figure 21 Dedicated replication network



Configure dedicated replication after installation of the Avamar software. An Dell EMC implementation specialist must manually perform additional steps.

Multi-node servers

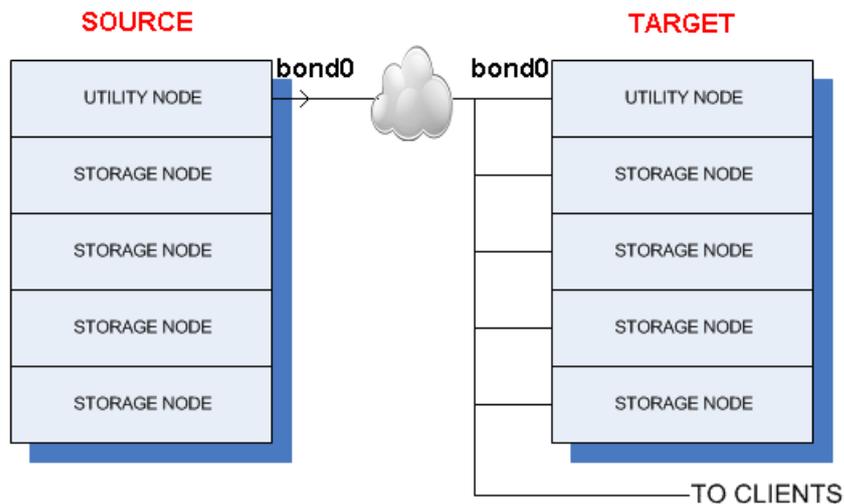
The Gen4T networking architecture and the Avamar software provide three types of replication: basic, dedicated, and disaster recovery (DR). The following sections describe each type of replication.

Basic replication

The source and target systems each have a single network for all traffic. Incoming and outgoing replication occurs on this single network between the source and target pair.

Avamar supports cross-replication between source and target systems by performing the same procedure on the target.

Figure 22 Basic replication network



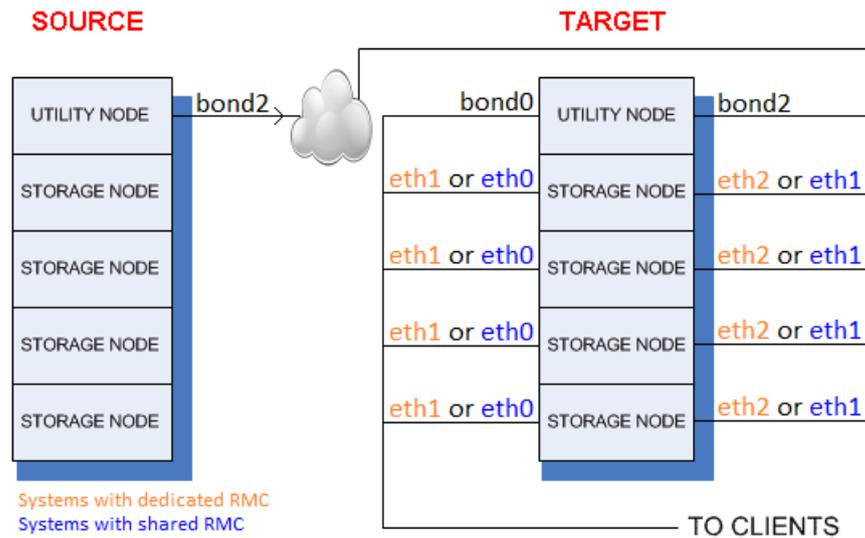
Configure basic replication after installation of the Avamar software. The *Avamar Administration Guide* provides more information.

Dedicated replication

Servers that are configured for dedicated replication have dedicated networks on both the source and target. On the source server, you can configure dedicated backup, replication, and management ports on the utility node. On the target server, the bonds between primary and secondary backup ports on the storage nodes are broken, and the secondary backup ports become dedicated to replication traffic.

Avamar supports cross-replication between source and target systems by performing the same procedure on the target.

Figure 23 Dedicated replication network



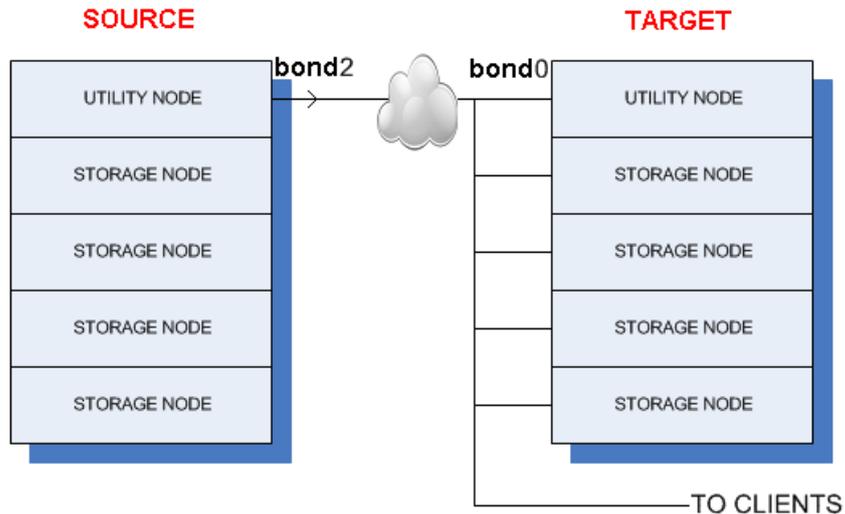
Configure dedicated replication after installation of the Avamar software. An Dell EMC implementation specialist must manually perform additional steps.

DR replication

This configuration is similar to dedicated replication, except that replication is configured to the backup ports on the target system. Only the source server segregates replication traffic from backup traffic. DR replication provides a target server as a standby to the source, in case of disaster.

Cross-replication between source and target servers is not supported.

Figure 24 DR replication



Configure DR replication after installation of the Avamar software. An Dell EMC implementation specialist must manually perform additional steps.

CHAPTER 4

Installation and beyond

The following topics describe setup procedures and followup activities:

- [Avamar "installation" process](#)..... 42
- [Everyday use of Avamar servers](#)..... 42
- [Maintenance of the server](#)..... 43

Avamar "installation" process

The industry term "installation" is generally used to describe the entire process of installing a product. For ADS hardware, at a high level, installation is actually a three-step process:

- Siting
- Installation
- Implementation

Siting

Siting is the process of determining where to locate ADS hardware. The siting process must account for numerous thermal, acoustic, electrical, regulatory, and environmental requirements before you continue with installation and implementation.

See the *Avamar Data Store Gen4, Gen4S, and Gen4T Site Prep Technical Specifications* document on the Online Support site (<http://support.emc.com>) for comprehensive information about siting ADS hardware.

Installation

Installation consists of racking, stacking, and cabling the ADS equipment and then performing a minimal amount of network configuration to place the system on the customer's network for remote implementation.

Customer can perform ADS single-node server installation. The *Avamar Data Store Single Node Customer Installation Guide* provides additional information. ADS multi-node server installation must be performed by Dell EMC personnel, who use instructions from the SolVe Desktop utility that is only accessible to Dell EMC personnel.

Implementation

Implementation consists of copying and configuring the Avamar software on each node in the ADS system and preparing the Avamar subsystem to function as a backup and restore tool. Implementation also involves procedures for setting up the initial Avamar configuration as it relates to the unique backup, restore, and replication requirements of the customer environment.

Everyday use of Avamar servers

The customer is responsible for the everyday configuration and use of the backup, restore, and replication functions of the Avamar server. The Avamar core documentation set describes those activities in detail and provides a comprehensive set of feature overview, operational task, and technical reference information.

The primary user document is the *Avamar Administration Guide*, which is part of a wide range of guides that help define the possible uses of the Avamar server, including the following:

- *Avamar Release Notes*
- *Avamar Product Security Guide*
- *Avamar Operational Best Practices Guide*

- *Avamar and Data Domain System Integration Guide*
- *Avamar Backup Clients User Guide*
- *Avamar for VMware User Guide*
- *Avamar for Exchange VSS User Guide*
- *Avamar for Lotus Domino User Guide*
- *Avamar for Oracle User Guide*
- *Avamar for SharePoint VSS User Guide*
- *Avamar for SQL Server User Guide*
- *Avamar for Hyper-V VSS User Guide*
- *Avamar for SAP with Oracle User Guide*
- *Avamar for Sybase ASE User Guide*
- *Avamar for Windows Server User Guide*
- *Avamar for IBM DB2 User Guide*
- *Avamar Management Console Command Line Interface (MCCLI) Programmer Guide*
- *Avamar NDMP Accelerator for NAS Systems User Guide*
- *Backup & Recovery Manager User Guide*

You can find these documents by using the search function on the Online Support site to search for each guide by the names that are listed here.

In addition, various technical notes on the Online Support site provide details about specific product features, including step-by-step tasks, where necessary. These documents usually focus on supplemental information about rare, unique, or version-specific installation, implementation, and configuration scenarios.

Maintenance of the server

ADS hardware requires maintenance from time to time, including replacement of defective components, upgrading software, and adding capacity to servers running out of backup space.

In general, Dell EMC personnel replace most components. Customers can replace defective hard drives and power supplies, the *Avamar Data Store Customer Service Guide* provides instructions. To fix any other node component, contact Customer Support.

Only Dell EMC personnel can perform the following activities:

- Avamar software upgrades, which consist of changes to the Linux operating system, firmware, and patches to the Avamar software itself.
- Capacity upgrades for existing multi-node servers, which consist of installing and configuring additional nodes, and then including the additional nodes as part of the server.

