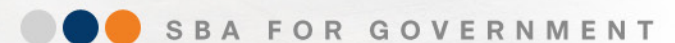




NetApp Storage Deployment Guide



The Purpose of this Guide

This guide focuses on best practices for the integration of NetApp® storage systems into networks built upon the Cisco Smart Business Architecture (SBA) for Government. It provides an overview of NetApp storage solutions and the value they offer agencies of all sizes.

It includes:

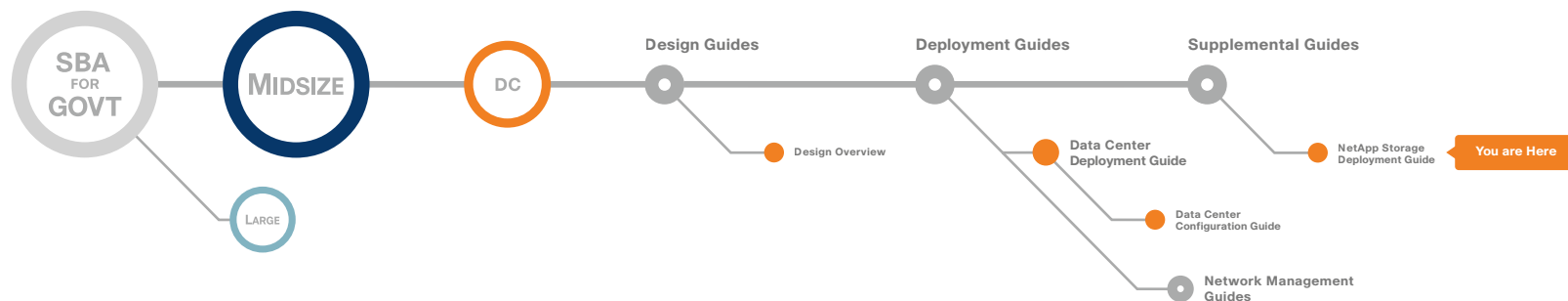
- Simple instructions for how to set up and configure a basic NetApp storage system
- An introduction to the advanced NetApp features that can deliver exceptional storage efficiency and functionality for backup, restoration, and disaster recovery

This guide is a companion document to the SBA for Midsize Customers Design Guide and Deployment Guide.

Who Should Read This Guide

This guide is intended for the reader with any or all of the following:

- Responsibility for selection or implementation of disk storage resources for their agencies
- 100–1,000 connected network users
- 15–250 physical or virtualized servers



The reader may be looking for any or all of the following:

- A way to easily scale available disk capacity for application servers
- The ability to easily and efficiently manage their overall investment in storage capacity
- Shared storage access to facilitate deployment of server virtualization
- To understand NetApp storage systems
- A way to expand their existing storage network to address additional agency requirements
- Guidance and best practices for initial configuration and management of a NetApp storage system

Related Documents

Before reading this guide

- **BN** Foundation Design Overview
- **BN** Foundation Deployment Guide
- **BN** Foundation Configuration Files Guide

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SBA Overview

The Cisco® SBA for Government is a comprehensive design for networks with up to 1000 users. This out-of-the-box design is simple, fast, affordable, scalable, and flexible.

The Cisco SBA for Midsize Agencies incorporates LAN, WAN, wireless, security, WAN optimization, and unified communication technologies tested together as a solution. This solution-level approach simplifies the system integration normally associated with multiple technologies, allowing you to select the modules that solve your agency's problems rather than worrying about the technical details.

We have designed the Cisco SBA to be easy to configure, deploy, and manage. This architecture:

- Provides a solid network foundation
- Makes deployment fast and easy
- Accelerates ability to easily deploy additional services
- Avoids the need for re-engineering of the core network

By deploying the Cisco SBA, your agency can gain:

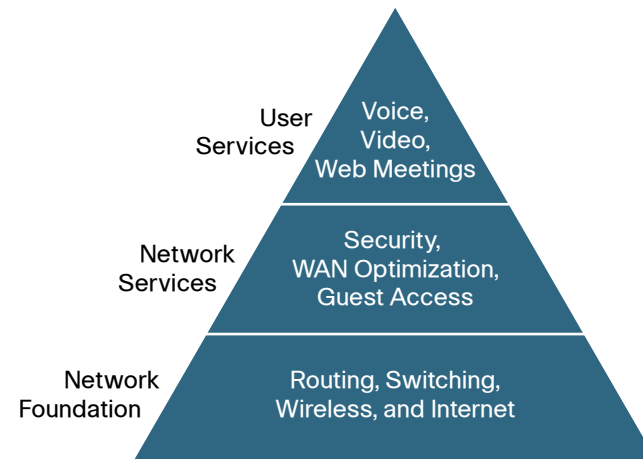
- A standardized design, tested and supported by Cisco
- Optimized architecture for midsize agencies with up to 1000 users and up to 20 remote sites
- Flexible architecture to help ensure easy migration as the agency grows
- Seamless support for quick deployment of wired and wireless network access for data, voice, teleworker, and wireless guest
- Security and high availability for agency information resources, servers, and Internet-facing applications
- Improved WAN performance and cost reduction through the use of WAN optimization
- Simplified deployment and operation by IT workers with CCNA® certification or equivalent experience
- Cisco enterprise-class reliability in products designed for midsize agencies

Guiding Principles

We divided the deployment process into modules according to the following principles:

- **Ease of use:** A top requirement of Cisco SBA was to develop a design that could be deployed with the minimal amount of configuration and day-two management.
- **Cost-effective:** Another critical requirement as we selected products was to meet the budget guidelines for midsize agencies.
- **Flexibility and scalability:** As the agency grows, so too must its infrastructure. Products selected must have the ability to grow or be repurposed within the architecture.
- **Reuse:** We strived, when possible, to reuse the same products throughout the various modules to minimize the number of products required for spares.

Figure 1. SBA for Government Model



The Cisco SBA can be broken down into the following three primary, modular yet interdependent components for the midsize agency.

- **Network Foundation:** A network that supports the architecture
- **Network Services:** Features that operate in the background to improve and enable the user experience without direct user awareness
- **User Services:** Applications with which a user interacts directly

Introduction

This guide focuses on best practices for integration of NetApp storage systems into networks built upon the SBA. Components of the entire storage solution are present in all three layers of the SBA. The Cisco Ethernet or Fibre Channel switching infrastructure forms the Network Foundation for access to storage, along with providing additional Network Services such as security. The NetApp storage systems themselves are end nodes to the network, but provide additional security services and multiprotocol storage access as a User Service, using either block-based access methods such as iSCSI and Fibre Channel or network-attached storage (NAS) protocols.

Notes

Business Challenges

As the value and amount of electronic data increases, deploying the right storage strategy becomes even more critical. A centralized storage strategy offers the best solution to store, protect, and retain your valuable data. Today's solutions address technology trends around managed scalability, server virtualization, and networking with advanced features and simplified management for agencies with limited IT staff.

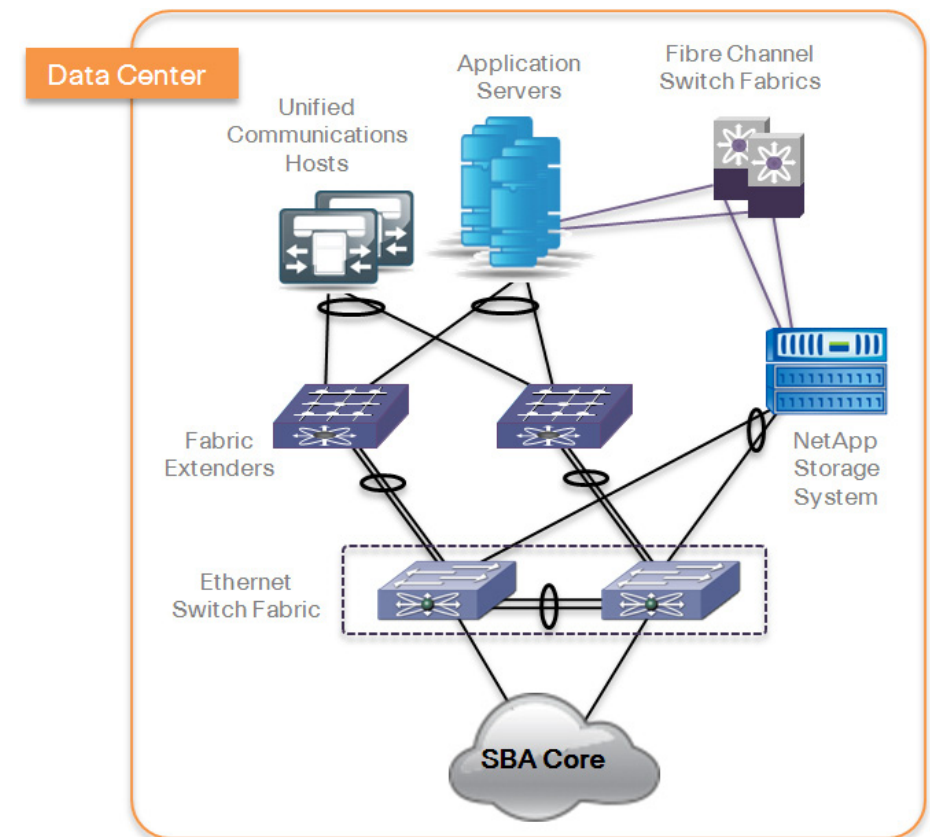
Trying to keep up with data growth can be a challenge, especially when using direct-attached storage (DAS). Selecting the right amount of storage for a given application is not an exact science. You must estimate how much data you need to store over time and then choose a server with enough drive bays to accommodate the expected data growth. When the drive bays have all been filled, you can directly attach an external disk shelf or Just a Bunch of Disks (JBOD) via a small computer system interface (SCSI) or Serial Attached SCSI (SAS), but that is an expensive solution if you expect to use only a portion of the capacity of the shelf. A directly attached storage shelf typically cannot be used by more than one server at a time.

One of the most compelling technology trends today is server virtualization. Server virtualization offers the ability to increase the utilization of excess Central Processing Unit (CPU) processing capacity available with today's high-performing multicore CPUs. Hosting many virtual servers on a physical server CPU allows better utilization of this untapped processing capacity. Once a server is virtualized from the physical hardware, it can be moved from one physical server to another to support load balancing, hardware servicing or failover, and site-to-site mobility. These advanced virtualization features are only available in shared networked storage environments.

Server virtualization is also driving the need for more robust data networks. The ratio of virtual servers to physical servers is typically 10:1 or greater, resulting in much higher Input/Output (I/O) loads per physical server. Ethernet is emerging as an increasingly robust and capable storage network that offers flexibility, simplicity, and performance for agencies of all sizes. The ability to share a common network technology for data traffic, voice, video, and storage offers tremendous value over alternative dedicated solutions. The skill sets required for Ethernet management are common in the industry and the penetration of this technology into every home and agency drives economies of scale to keep costs low.

The growth of data is not unique to larger agencies. Agencies of all sizes face the challenges of acquiring, storing, and retaining large amounts of data. In response to these challenges, solutions that were once considered overly complicated and expensive for smaller agencies have been made simpler to procure, deploy, and manage. Advanced functionality once reserved for costly solutions is now common in lower-priced solutions, making it easier for midsize agencies to address data growth and retention.

Figure 2. Storage Connectivity over Fibre Channel and Ethernet



NetApp leads the industry in storage efficiency and innovation. With features such as thin provisioning, deduplication, high-performing and space-efficient Snapshot™ copies, and advanced disaster recovery capabilities, NetApp offers solutions to help you achieve your agency goals. With a shared vision of a virtual dynamic data center and a partnership that extends back to 2003, NetApp and Cisco are developing technologies that deliver the value and performance to meet your IT requirements. We partner with

industry leaders to provide reference architectures and proven configurations to enable agencies of all sizes to meet the IT and agency needs of today and tomorrow.

NetApp storage solutions are built on a single platform that scales from small deployments of a few terabytes to large deployments beyond a petabyte, all with a common set of features and management tools. Each NetApp Fabric Attached Storage (FAS) system is capable of running multiple block- and file-based protocols at the same time, including Network File System (NFS), Common Internet File Service (CIFS), Fibre Channel (FC), and Internet Small Computer System Interface (iSCSI). NetApp unified storage simplifies data management with the ability to scale your storage environment as your agency grows, without the need for staff retraining or forklift equipment upgrades. NetApp V-Series storage systems can extend the life of your existing FC storage investments by extending many of the same advanced features as the FAS storage systems to the management of legacy installed-base storage systems from third-party manufacturers. Figure 2 illustrates IP/Ethernet based, and Fibre Channel based connections to a NetApp Storage System.

The Cisco SBA for Midsize Agencies is a prescriptive architecture that delivers an easy-to-use, flexible, and scalable network with wired, wireless, security, Wide-Area Network (WAN) optimization, and unified communication components. It eliminates the challenges of integrating the various network components by using a standardized design that is reliable with comprehensive support offerings.

The Cisco SBA for Midsize Agencies is designed to address the common requirements of agencies with 100 to 1,000 employees. Each agency is unique, however, and so are its requirements so we ensured that the Cisco SBA was built so that additional capabilities could be added on without redesigning the network.

Storage Networking

A network infrastructure that uses Fibre Channel or Ethernet should have no single point of failure. A highly available solution includes:

- Two or more Fibre Channel or Ethernet network switches
- Two or more host bus adapters (HBAs) or network interface cards (NICs) per server
- Two or more target Fibre Channel ports or Ethernet NICs per storage controller
- In addition, when using Fibre Channel, two fabrics are required to have a truly redundant architecture.

NetApp unified storage solutions enable powerful thin provisioning, simplified data management, and scalable and consistent I/O performance for all protocols across Network-Attached Storage (NAS; NFS, CIFS) and Storage Area Networks (SANs; Fibre Channel, Fibre Channel Over Ethernet [FCoE], and iSCSI) in a single pool of storage. These solutions:

- Support SAN (Fibre Channel, FCoE, and iSCSI) or NAS
- Scale non-disruptively from a few terabytes to over 1 petabyte
- Are easily installed, configured, managed, and maintained
- Dynamically expand and contract storage volumes as needed
- Offer features that provide:
 - Rapid backup and recovery with zero-penalty Snapshot copies
 - Simple, cost-effective replication for disaster recovery
 - Instant space-efficient data clones for provisioning and testing
 - Data deduplication to reduce capacity requirements

NetApp storage solutions offer these powerful data management and data protection capabilities that enable you to lower costs while meeting capacity, utilization, and performance requirements.

Data Protection

A byproduct of any consolidation effort is increased risk if the consolidation platform fails. As physical servers are converted to virtual machines and multiple Virtual Machines (VMs) are consolidated onto a single physical platform, the impact of a failure to the single platform can be catastrophic. Fortunately, hypervisors provide multiple technologies that enhance the availability of a virtual data center. These technologies include physical server clustering, application load balancing, and the ability to non-disruptively move running VMs and data sets between physical servers.

To ensure storage availability, many levels of redundancy are available for deployments, including purchasing physical servers with multiple storage interconnects or HBAs, deploying redundant storage networking and network paths, and leveraging storage arrays with redundant controllers. A deployed storage design that meets all of these criteria can be considered to have eliminated all single points of failure.

The reality is that data protection requirements in a virtual infrastructure are greater than those in a traditional physical server infrastructure. Data protection is a paramount feature of shared storage devices. NetApp RAID-DP® is an advanced RAID technology that is provided as the default RAID level on all NetApp FAS systems. RAID-DP protects against the simultaneous loss of two drives in a single RAID group. It is very economical to deploy; the overhead with default RAID groups is a mere 12.5%. This level of resiliency and storage efficiency makes data residing on RAID-DP safer than data stored on RAID 5 and more cost-effective than RAID 10.



Reader Tip

For information about designing and deploying a networked storage iSCSI solution, refer to the *Cisco SBA for Midsize Agencies—Data Center Deployment Guide* and to the NetApp Fibre Channel and iSCSI Configuration Guide on NOW™ (NetApp on the Web) for your version of NetApp Data ONTAP®.

Notes

Deploying a NetApp Storage Solution

NetApp System Manager is a feature-rich yet easy-to-use storage management tool for basic configuration and management of NetApp storage systems. System Manager is ideal for initial setup and configuration of one system at a time. As your environment grows, NetApp offers a suite of storage management tools.

Process

Preparing the Network

1. Complete the Initial System Setup
2. Getting Started with Array Management

This guide uses System Manager to demonstrate how to easily configure a NetApp storage system. Version 1.1 is supported on all NetApp FAS2000, FAS3000, FAS3100, and FAS6000 systems, and on the corresponding V-Series systems. NetApp System Manager is supported on the following host systems:

- Windows XP 32-bit, SP2 and later (also supported in a VMware 32-bit guest OS)
- Windows Vista Enterprise 32-bit and 64-bit
- Windows Server 2003 SP1
- Windows Server 2008 Enterprise 64-bit

Procedure 1

Complete the Initial System Setup

The setup includes the basic configuration such as hostname, IP address, subnet, credentials, management interface, and system default IP gateway. It also sets up the time and date and CIFS in workgroup mode.

Connect the management interface of the storage system or array on a network with Dynamic Host Configuration Protocol (DHCP) enabled and working.



Tech Tip

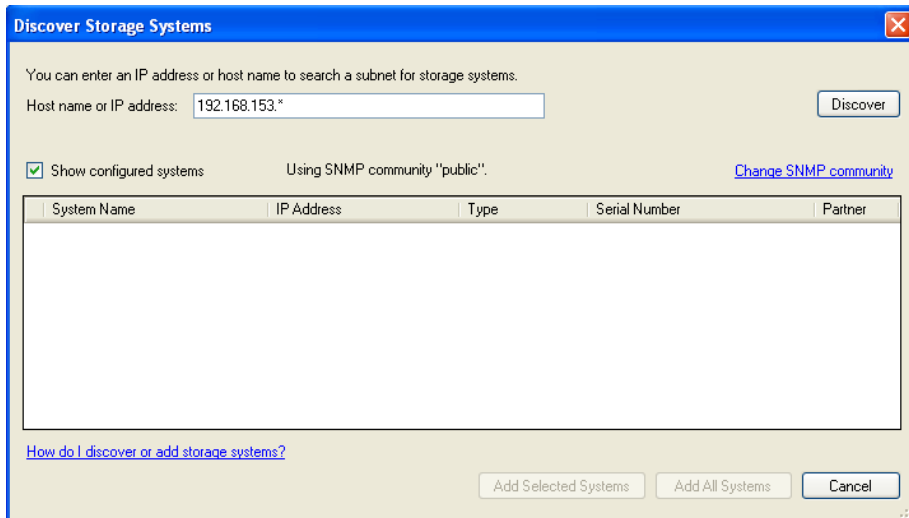
SBA designs do not generally illustrate DHCP services to be active and available in a Server Farm or Data Center environment. If a source of DHCP services is not available to provide initial configuration, the console port on the NetApp system provides an alternate command-line approach to set the IP address of the management port.

Step 1: Install NetApp Storage Manager from the software CD and launch System Manager.

Step 2: When you launch System Manager for the first time, you are prompted to either add individual systems or to discover all systems on a network, so you can select the controllers you want to manage. To search for your controller, enter an IP address in the subnet that contains your controller in the **Host Name** or **IP Address** field and click **Discover**, as shown in Figure 3.

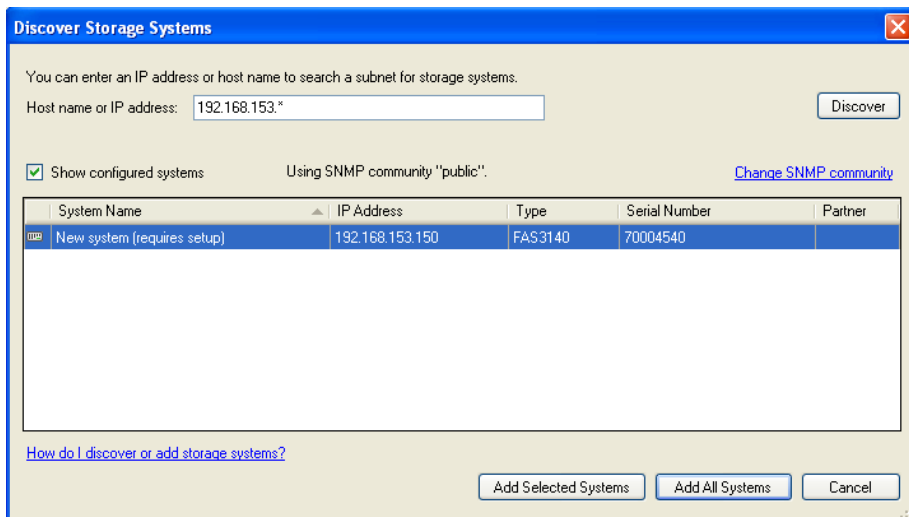
System Manager uses DHCP and Simple Network Management Protocol (SNMP) to discover storage controllers. New controllers are represented as **New system (requires setup)**.

Figure 3. Discover Storage Systems



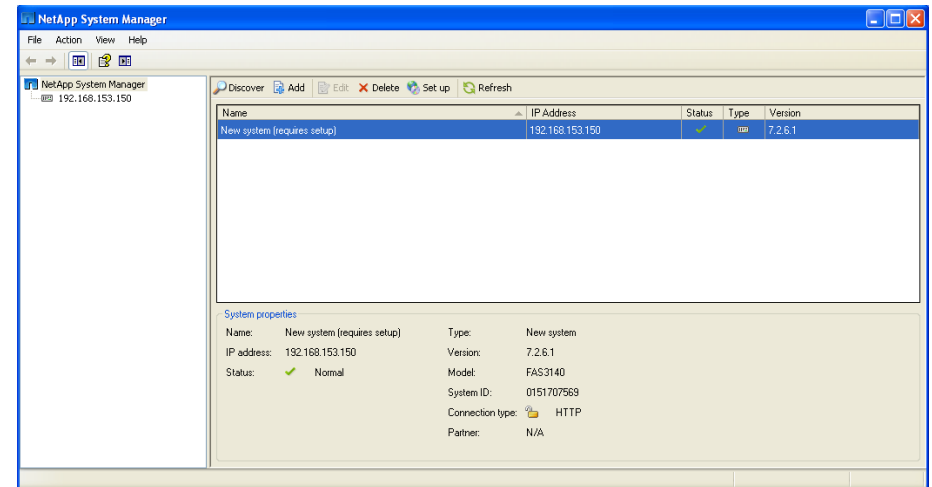
Step 3: Select the new system as shown in Figure 4 and click **Add Selected Systems**.

Figure 4. Discover Storage Systems



In the window that opens, the left pane shows the new controller with the IP address acquired by the controller from DHCP, as shown in Figure 5.

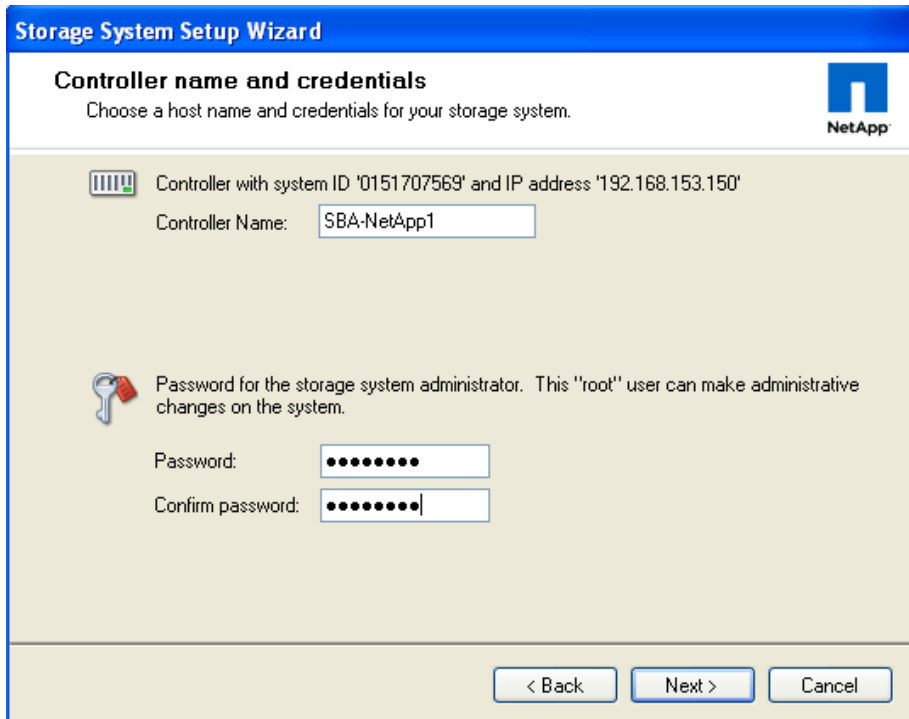
Figure 5. NetApp System Manager



Step 4: Select the new controller IP address. A message displays in the right pane: **This new storage system requires setup**. To set up the new storage system, click the **Set Up Storage System** link, which launches the Storage System Setup Wizard.

The wizard prompts you for the controller name and credentials, as shown in Figure 6.

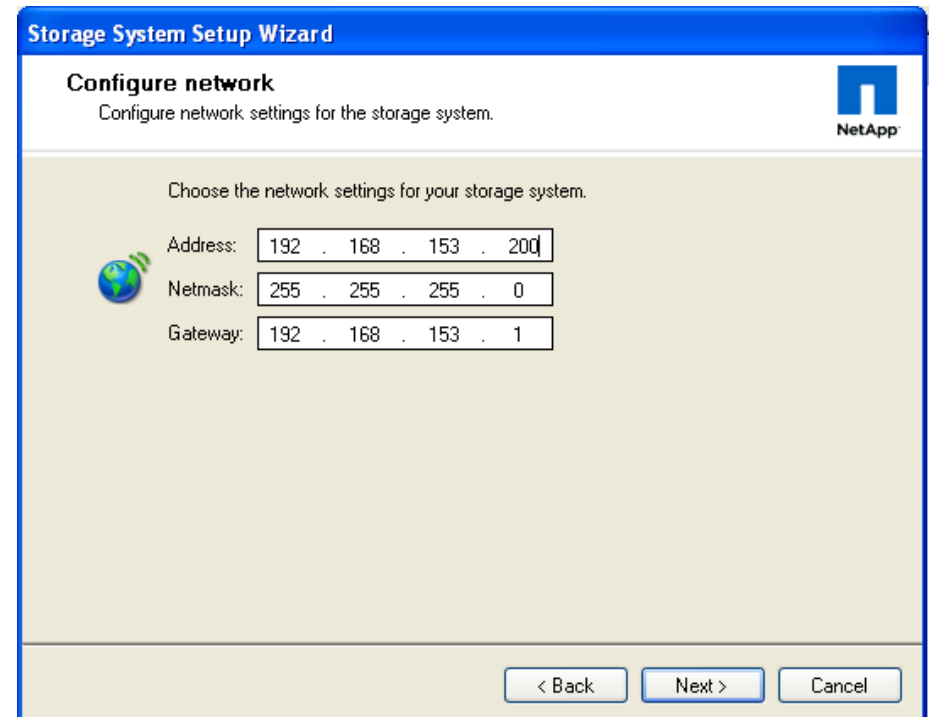
Figure 6. Enter Name and Credentials



The screenshot shows the 'Storage System Setup Wizard' window. The title bar reads 'Storage System Setup Wizard'. The main heading is 'Controller name and credentials' with the instruction 'Choose a host name and credentials for your storage system.' Below this, there is a status bar indicating 'Controller with system ID '0151707569' and IP address '192.168.153.150''. The 'Controller Name' field contains 'SBA-NetApp1'. A password section is also present with the instruction 'Password for the storage system administrator. This "root" user can make administrative changes on the system.' It includes 'Password:' and 'Confirm password:' fields, both filled with dots. At the bottom, there are '< Back', 'Next >', and 'Cancel' buttons.

Step 5: System Manager displays the IP address that the controller has acquired from DHCP. This is the final step to configure your storage on the network. Change this IP address to a static IP address assigned to you by the network administrator, as shown in Figure 7.

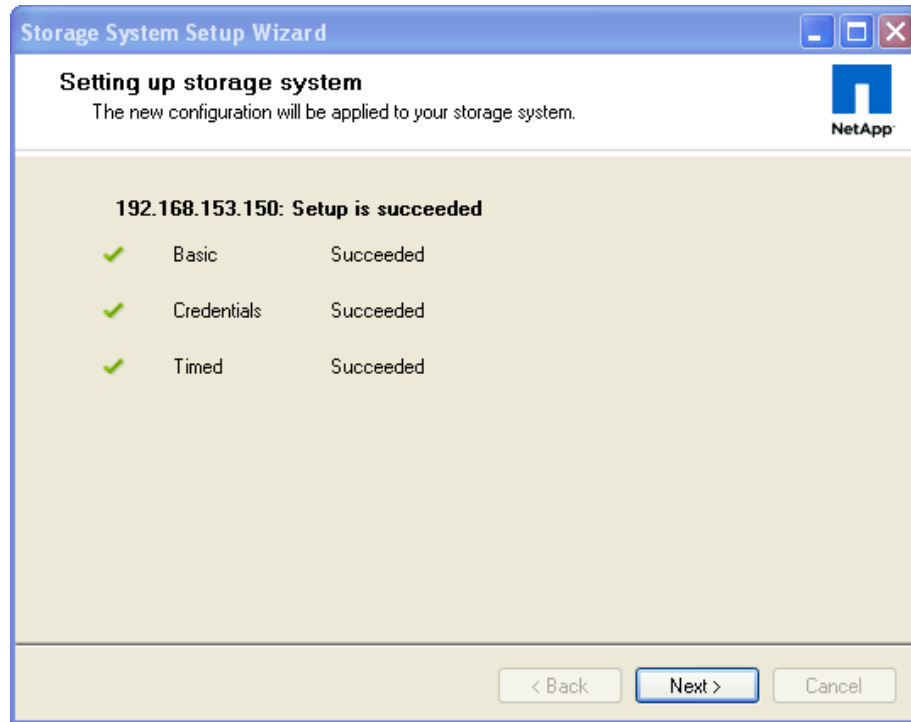
Figure 7. IP Address Configuration



The screenshot shows the 'Storage System Setup Wizard' window at the 'Configure network' step. The title bar reads 'Storage System Setup Wizard'. The main heading is 'Configure network' with the instruction 'Configure network settings for the storage system.' Below this, there is a status bar indicating 'Choose the network settings for your storage system.' The 'Address' field contains '192 . 168 . 153 . 200', the 'Netmask' field contains '255 . 255 . 255 . 0', and the 'Gateway' field contains '192 . 168 . 153 . 1'. At the bottom, there are '< Back', 'Next >', and 'Cancel' buttons.

Step 6: Click **Next** to display a summary of the configuration. Then, click **Next** again to complete the configuration, as shown in Figure 8.

Figure 8. Successful Initial Setup



Tech Tip

System Manager provides the ability to set up basic SSL to establish a secure link between the host and controller for management. These settings can be configured by clicking on the **Storage > Security** tab in the left pane.

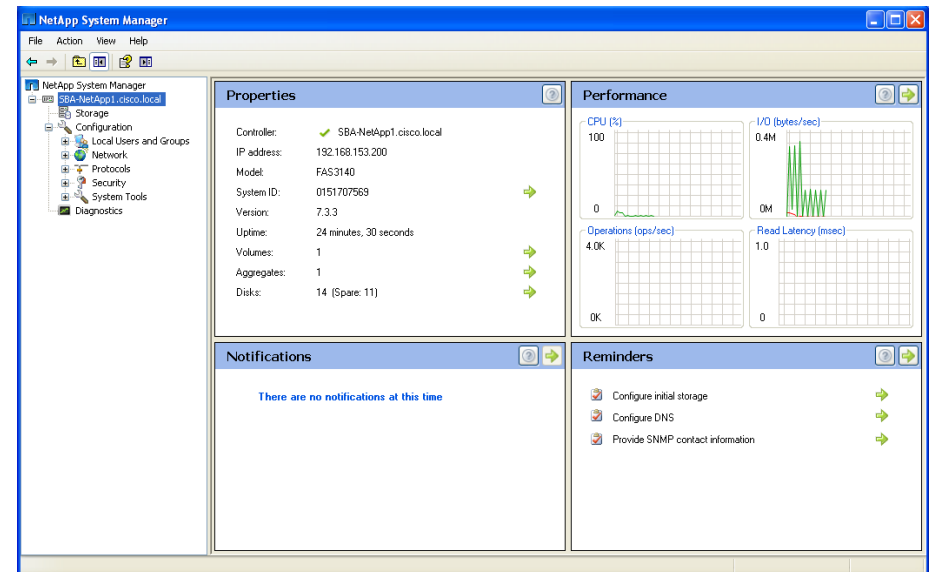
Procedure 2 Getting Started with Array Management

Step 1: To view system details, click the controller name in the left pane. The dashboard view that opens displays system properties including name, IP address, model, system ID, Data ONTAP version, system uptime, and number of volumes, aggregates, and disks.

Step 2: To manage these items, click the green arrows to their right, as shown in Figure 9.

System Manager also provides basic performance graphs for CPU utilization, total I/O, combined operations of all protocols, and latency for all protocols.

Figure 9. NetApp System Manager



Step 3: System Manager also offers Notifications and Reminders roll-ups. The Notifications area shows the current event list by scanning through the syslog. The Reminders area shows reminders or a to-do list. To go directly to the source of the reminder, click the green arrow next to it.

Your NetApp storage system is configured and ready to use. You can now perform storage management (manage disks, aggregates, volumes, qtrees, Logical Unit Numbers [LUNs]), protocol management (CIFS, NFS, iSCSI, FCP, FCoE), and system configuration (network, licenses, SNMP, users, groups).

Process

Storage Provisioning

1. Create an Aggregate
2. Configure Flexible Volumes
3. Enable an Additional Ethernet Interface
4. Enable Ethernet Storage as a VIF
5. Add an iSCSI Initiator Group

Storage provisioning on NetApp storage is easy, involving only a few steps to provision a LUN or file share. Aggregates form the foundation storage layer from which flexible volumes and then LUNs are stored. The layers of storage virtualization offer a number of advantages to manage and optimize the storage, protection, and retention of your data.

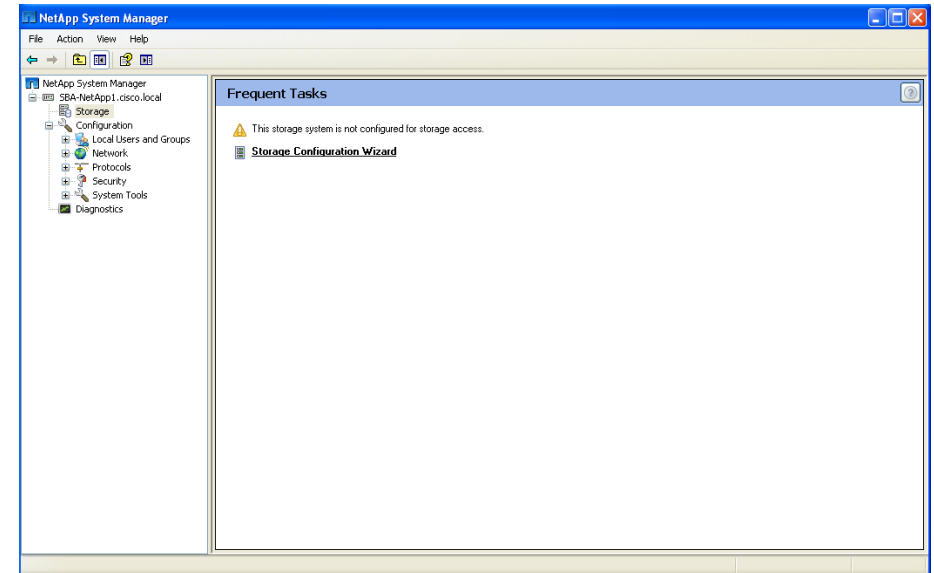
Procedure 1 **Create an Aggregate**

An aggregate is NetApp's virtualization layer, which abstracts physical disks on a storage device from logical data sets that are referred to as flexible volumes. Aggregates are the means by which the total IOPS (input/output operations per second) available from all of the individual physical disks are pooled as a resource. Aggregates are well suited to meet users' differing security, backup, performance, and data-sharing needs, as well as the most unpredictable and mixed workloads.

NetApp recommends that whenever possible, a separate small aggregate with RAID-DP should be used to host the root volume. This stores the files required to run and provide GUI management tools for the NetApp storage system. The remaining storage should be placed into a small number of large aggregates. This provides optimal performance because of the ability of a large number of physical spindles to service I/O requests. On smaller arrays, it might not be practical to have more than a single aggregate, due to the restricted number of disk drives on the system. In these cases, it is acceptable to have only a single aggregate.

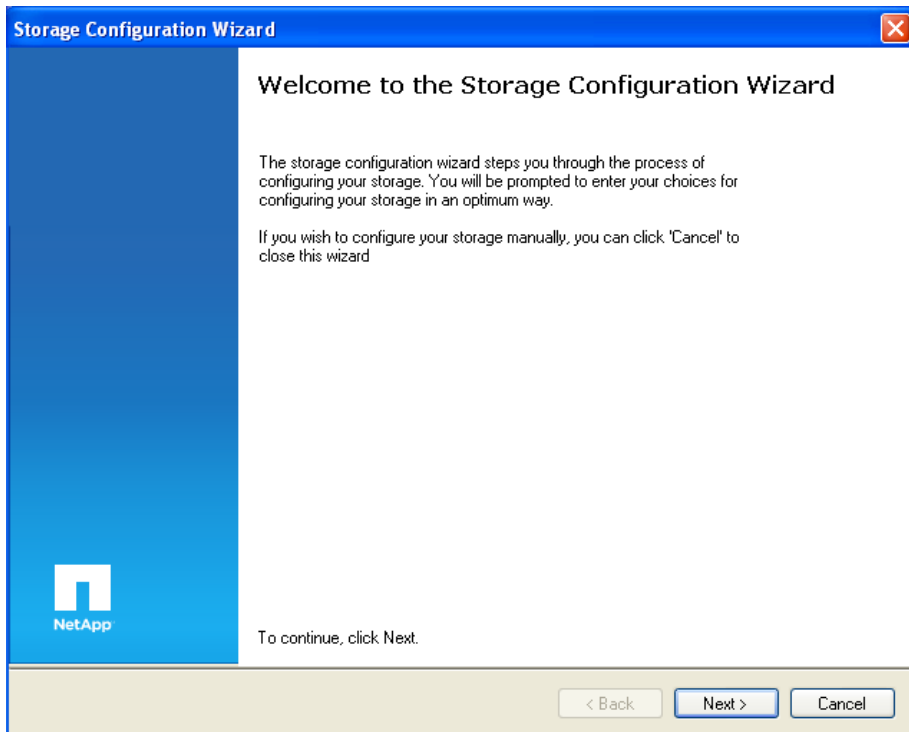
Step 1: Select **Storage** in the left pane. Then click on the **Storage Configuration Wizard** link in the right pane to launch, as shown in Figure 10.

Figure 10. Launching the Storage Configuration Wizard



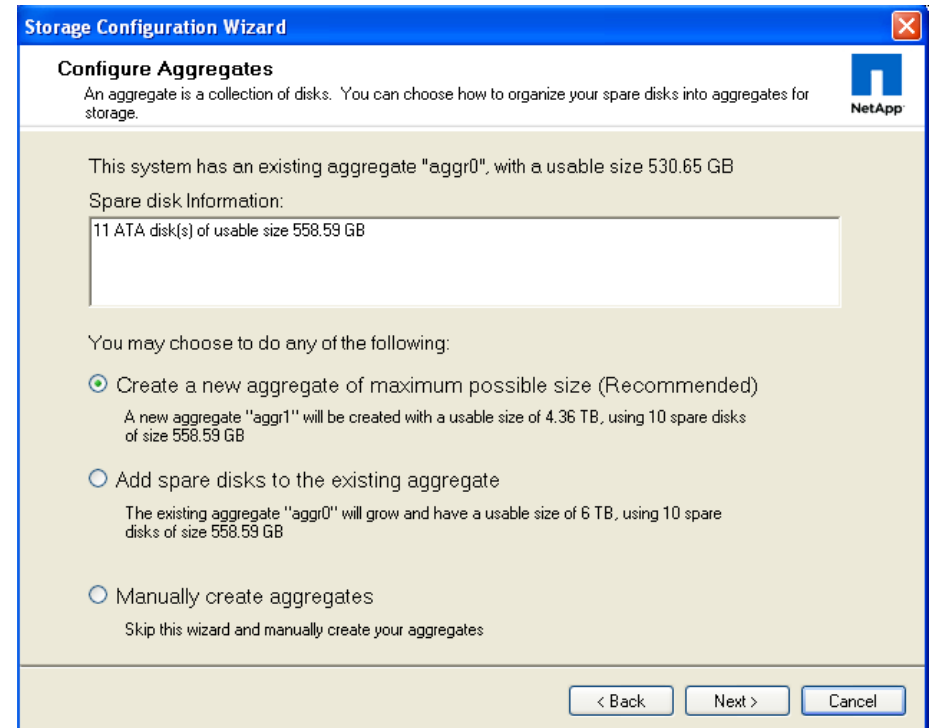
Step 2: Click **Next** to proceed with initial storage configuration, as shown in Figure 11.

Figure 11. Storage Configuration Wizard Initial Screen



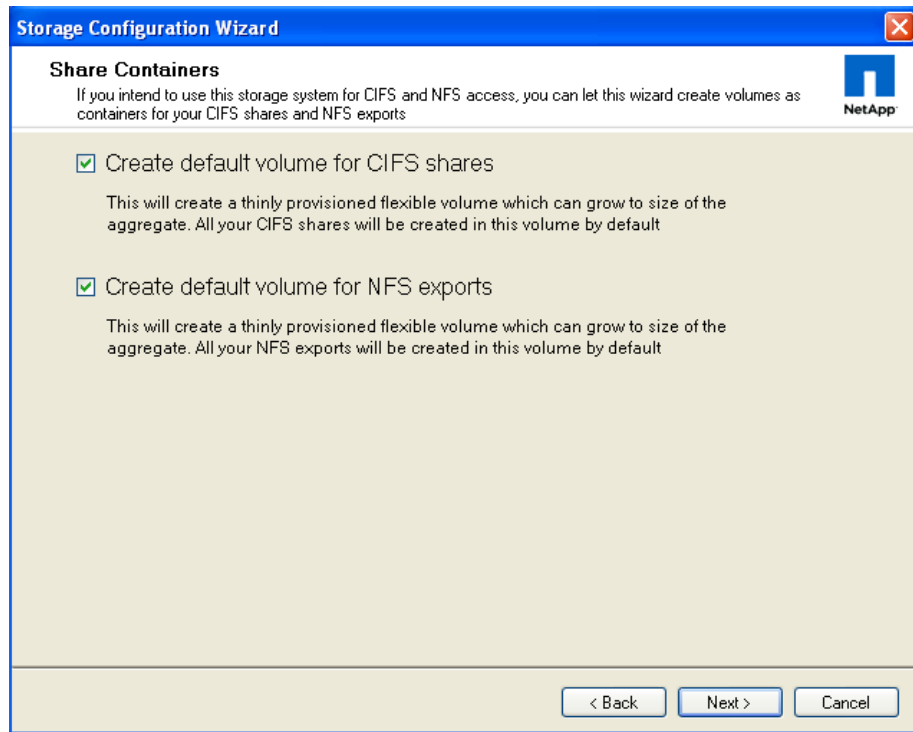
Step 3: Choose the appropriate radio button for your desired configuration of aggregates. For this example, we will choose the recommended item; **Create a new aggregate of maximum possible size** as shown in Figure 12.

Figure 12. Configure Aggregates



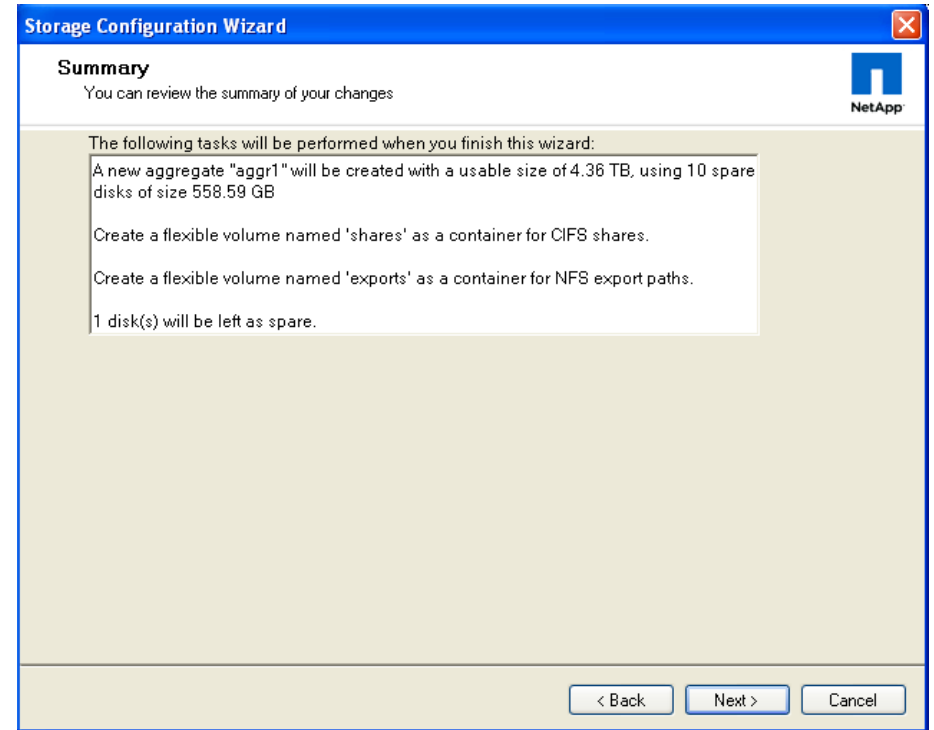
Step 4: In the following step, check boxes are provided to create default CIFS shares and NFS exports if required in your configuration, as shown in Figure 13. Choose the desired options and click **Next** to continue.

Figure 13. Create Default CIFS and NFS Volumes



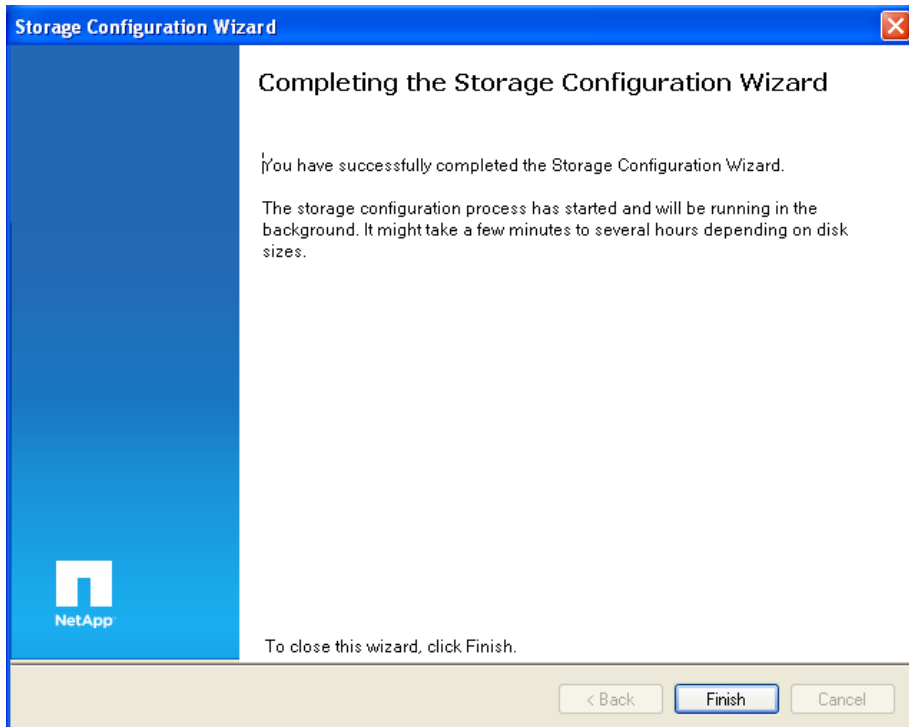
Step 5: Verify the summary of settings being performed by the Storage Configuration Wizard displayed in the window. Then click **Next** to create the aggregate.

Figure 14. Summary Screen



Step 6: The creation of an aggregate takes place in the background, allowing you to begin storing data immediately. A summary screen showing the changes being applied is provided, as shown in Figure 14. Click **Finish** to close the wizard.

Figure 15. Storage Configuration Wizard Completing



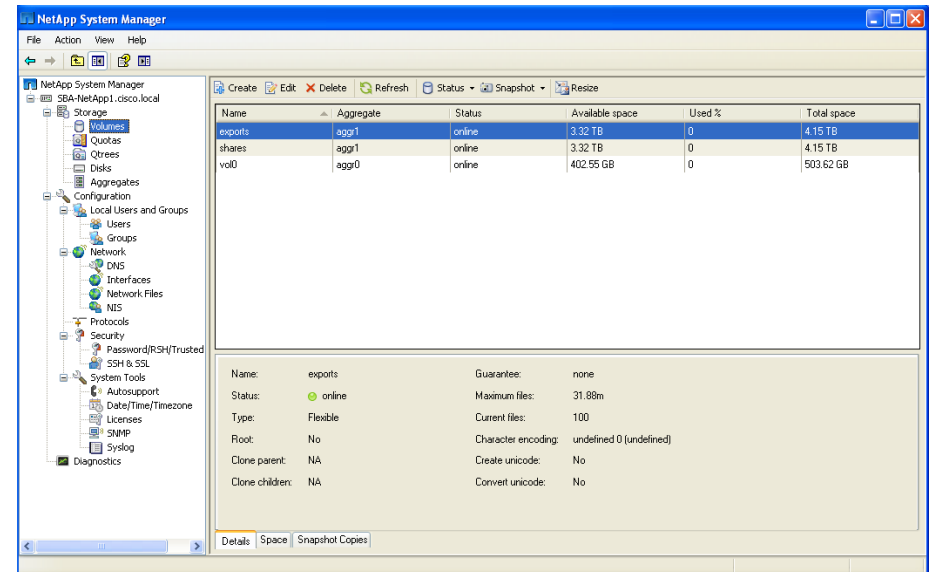
Procedure 2

Configure Flexible Volumes

FlexVol® volumes (flexible volumes) are thin storage containers that can contain LUNs and/or file shares that are accessed by servers over Fibre Channel (FC), Fibre Channel over Ethernet (FCoE), iSCSI, NFS, or CIFS. A FlexVol volume is a virtual volume that you can manage and move independently from physical storage. It can be created and resized, larger or smaller, as your application needs change.

Step 1: Select **Storage > Volumes** and then click **Create** to create a volume.

Figure 16. Storage Volumes Screen



Reader Tip

For details on manually configuring an aggregate, see “Configure an Aggregate” in section 3.6.1 of the *Data ONTAP Storage Management Guide*.

Step 2: To create a volume, you must define the following properties:

- **Volume name:** NetApp suggests using a combination of the hostname, physical disk, and replication policy. Example: HostB_Disk1_4hmirror.
- **Storage type:** NAS (file properties) or SAN (block properties).
- **Aggregate:** Specify an aggregate for the LUN.
- **Volume size:** The LUN capacity.
- **Snapshot reserve:** The amount of the LUN to be reserved for Snapshot data. This dedicates space in the LUN for Snapshot data. The default setting is 20%, which means that 20% of the LUN is not available for other data storage. You can choose a higher value or as little as 0%, depending on your requirements. NetApp recommends configuring all volumes with 0% and disabling the default Snapshot schedule.

Figure 17. Creating a Volume

Create Volume

Details | Space settings | Quotas

Name:

Storage type: NAS
Used for NFS or CIFS access.

SAN
Used for FCP or iSCSI access.

Aggregate:

Size

Total volume size: Maximum 4.32 TB

Snapshot reserve (%):

Percentage of the total volume size to be reserved for storing Snapshot copies.

GB Data space

GB Snapshot space

Step 3: The **Space Settings** tab is used to reserve space on disk for the volume. You can reserve space for the whole volume or for a file with reservation properties. Additionally, you can select None to create a thinly provisioned volume that consumes space on disk only as data is written.



Reader Tip

For a description of thin provisioning see **Thin Provisioning** in the **Advanced Features** section in this document.

Step 4: Click **Create** to create the volume.

Space Settings Tab

Figure 18. Space Settings Tab

Create Volume

Details | Space settings | Quotas

Guarantee

Volume
Data DNTAP pre-allocates space in the aggregate for the volume. The pre-allocated space cannot be allocated to any other volume in that aggregate.

File
Data DNTAP pre-allocates space in the volume so that any file in the volume with space reservation enabled can be completely rewritten, even if its blocks are pinned for a Snapshot copy.

None
Data DNTAP reserves no extra space for the volume. Writes to LUNs or files contained by that volume could fail if the containing aggregate does not have enough available space to accommodate the write.

[How do I choose the correct settings for space guarantee on a volume?](#)



Tech Tip

Because out-of-space errors aren't expected in a CIFS environment, do not set the space guarantee to "None" for volumes accessed by CIFS.

Space guarantees are honored only for online volumes. If you take a volume offline, any committed but unused space for that volume becomes available for other volumes in that aggregate.

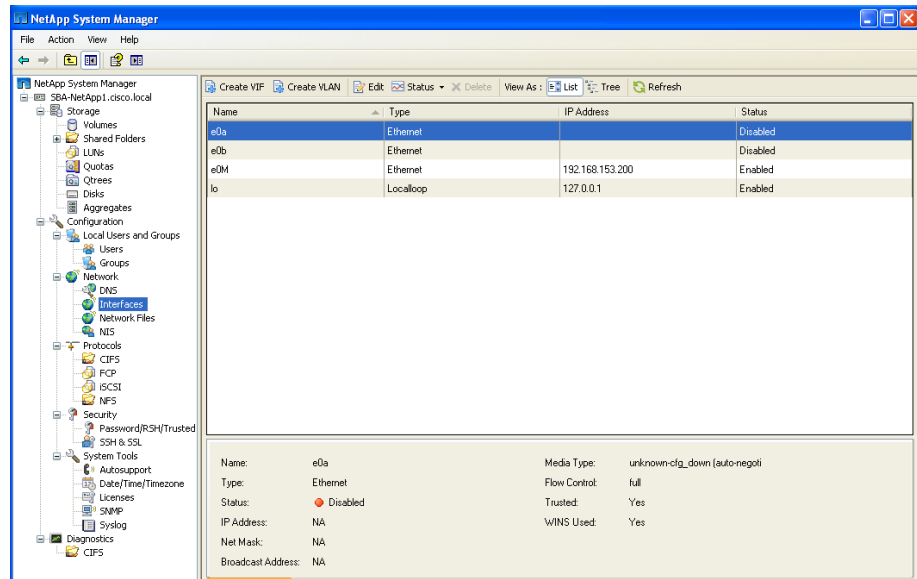
Procedure 3 Enable an Additional Ethernet Interface

On a system that will support Ethernet-based access to storage, it is desirable to dedicate the e0M for system management traffic, and use one or more separate physical Ethernet interface for iSCSI initiators or NAS clients to access storage.

Step 1: Choose **Configuration > Network > Interfaces** from the left pane, and highlight an available Ethernet interface in the right pane.

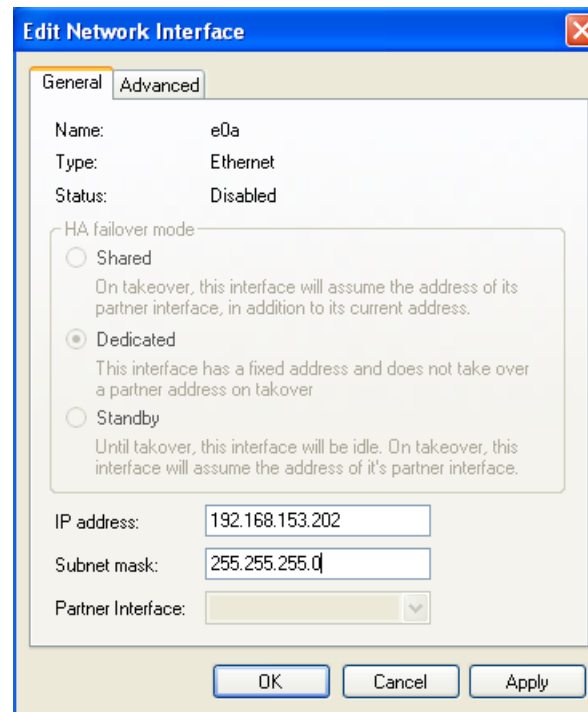
Step 2: Choose the Edit button to edit the interface settings, as shown in Figure 19.

Figure 19. Network Interfaces



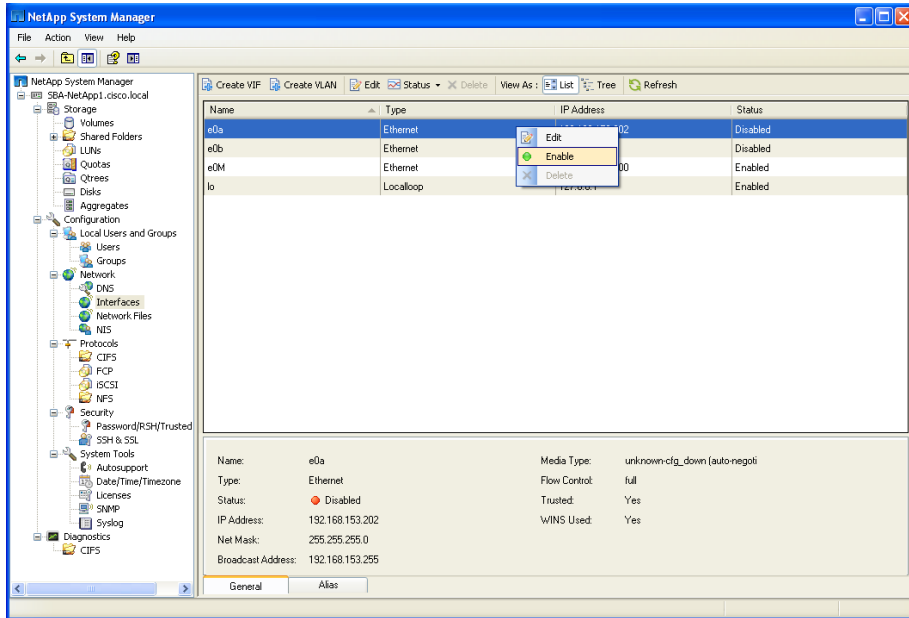
Step 3: Configure the IP address and subnet mask information on the **General** tab of the **Edit Network Interface** window, and click **OK** as shown in Figure 20.

Figure 20. Edit Network Interface



Step 4: Once the interface has an IP address, right-click the configured interface and choose **Enable** from the pop-up menu as shown in Figure 21.

Figure 21. Enabling the Network Interface



The address configured on the new interface should be used as the target IP address for iSCSI initiators. This configuration allows management traffic to be isolated on a separate interface from production storage traffic, and provide separate management access in the case the Ethernet storage interface ever needs to be reset or changed.

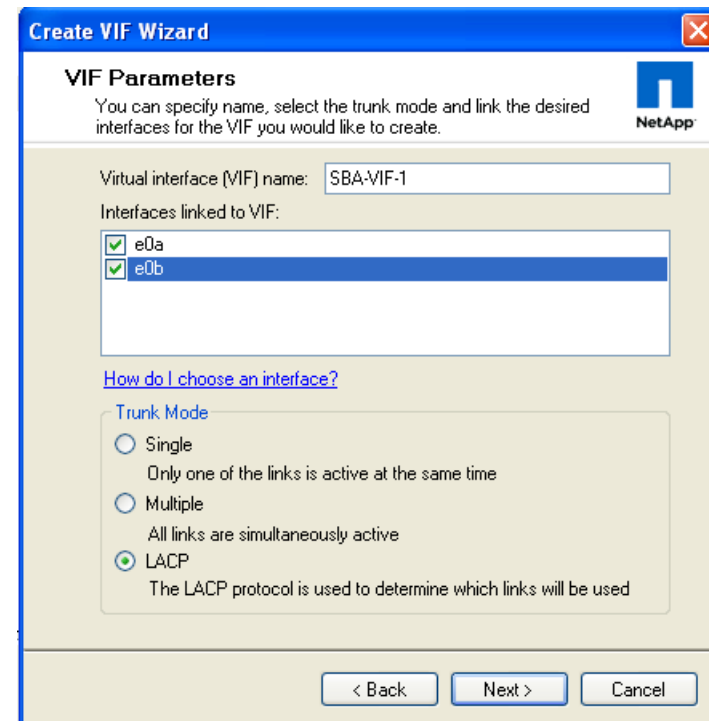
Procedure 4 Enable Ethernet Storage as a VIF

The Cisco SBA Data Center for Midsize Agencies design illustrates the storage system dual-attached to the Ethernet switching fabric using a port-channel connection. This type of connection on a NetApp system is referred to as a virtual interface, or VIF. With a VIF configuration the dual interfaces provide system resiliency, and when configured as a port-channel using Link Aggregation Control Protocol (LACP), both links can actively carry storage traffic.

Step 1: To enable the Ethernet Storage interface as a VIF, choose **Create VIF** from the **Network Interfaces** screen.

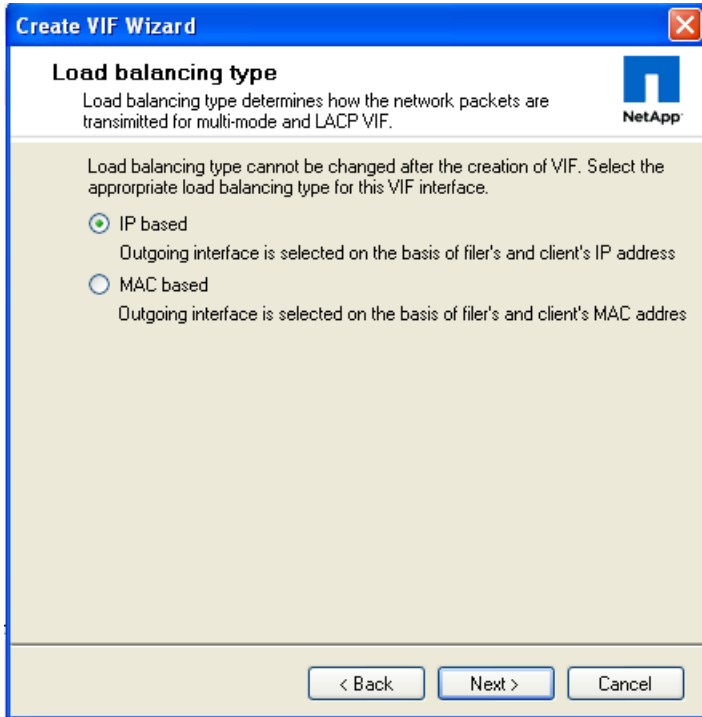
Step 2: Choose the two interfaces that will be part of the VIF, and select **LACP** as the trunk mode to connect to an Ethernet switch fabric configured for an LACP port-channel connection as shown in Figure 22.

Figure 22. VIF Parameters



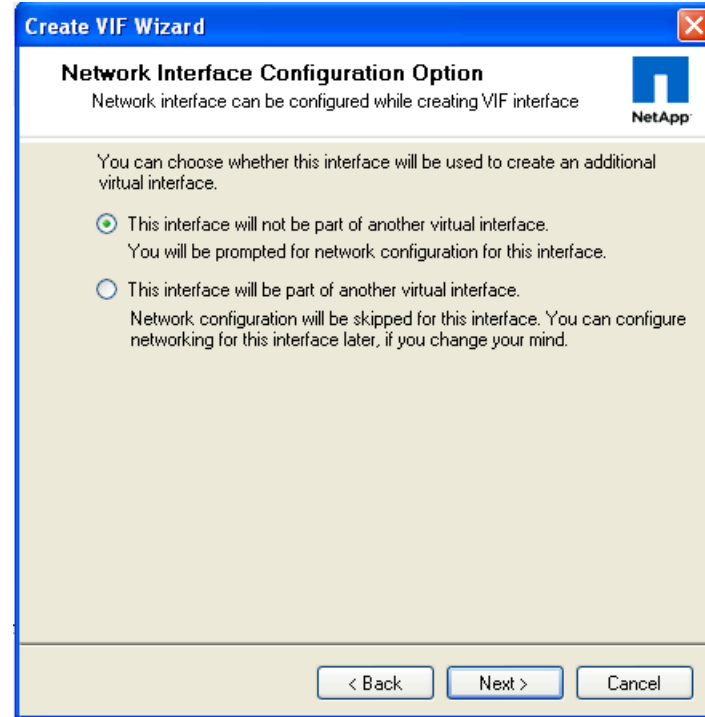
Step 3: Click **Next** to continue, then choose the load balancing type on the following screen. IP-based balancing is the default and recommended type, as shown in Figure 23.

Figure 23. Choose Load Balancing Type



Step 4: Click **Next** to continue, then on the **Network Interface Configuration Option** screen, choose the **This interface will not be part of another virtual interface** radio button, as shown in Figure 24.

Figure 24. Network Interface Configuration Option



Step 5: Click **Next** to continue.

Step 6: Assign an IP Address to the VIF. If you are converting a single interface configuration to a VIF, any existing IP Address will automatically be removed from the physical interfaces as they are placed into the VIF. So the same interface address previously used on a single interface may be reapplied to the VIF.

Figure 25. VIF Interface Parameters

IP address: 192.168.153.201

Subnet mask: 255.255.255.0

Partner Interface: [Dropdown]

MTU size (in bytes): 1500

Trusted network
Network in which this interface is attached is trusted

Register this interface with WINS

< Back Next > Cancel

Step 7: Leave the other choices on the screen at default as shown in Figure 25 and choose **Next** to continue and create the VIF.

Step 8: Once the VIF is created, you can opt to monitor the port status on the **Network Interfaces** screen. When LACP negotiation is completed with the Ethernet switching fabric, the port status will be shown as **Enabled**.



Tech Tip

You may require configuration of the management and Ethernet storage interfaces on different subnets. In that case it would be necessary to send traffic to different default gateways through separate specific interfaces.

For more information on this type of configuration, consult the NetApp online knowledge base (see <https://now.netapp.com/Knowledgebase/solutionarea.asp?id=kb27012>). The NetApp knowledge base requires a login, which is available free of charge.

Procedure 5

Add an iSCSI Initiator Group

An iSCSI Initiator Group may be associated to a LUN for iSCSI access, and holds one or more Initiator IDs. Initiator IDs are text identifiers configured on the host systems that need to access storage. Initiator Groups are also commonly referred to as igroups, access control lists, or LUN masking lists. When creating a LUN for iSCSI access, it is helpful if the appropriate iSCSI initiator group already exists so that it can be associated to the LUN directly within the LUN creation wizard.

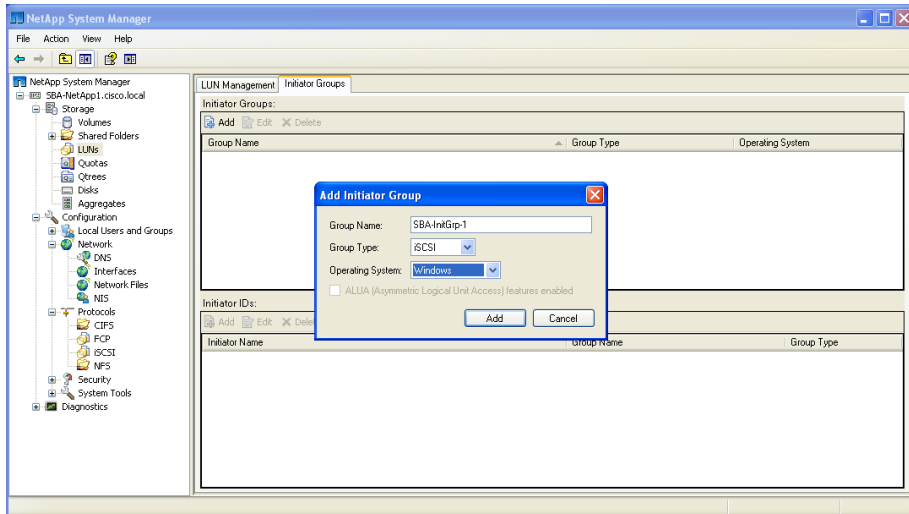
Step 1: Choose **Storage > LUNs** in the left pane of System Manager, and select the **Initiator Groups** tab.

Step 2: Click the **Add** button, and enter a name for the initiator group.

Step 3: Select **iSCSI** as the group type, and select the appropriate Operating System for the host that will be accessing this group, as shown in Figure 26.

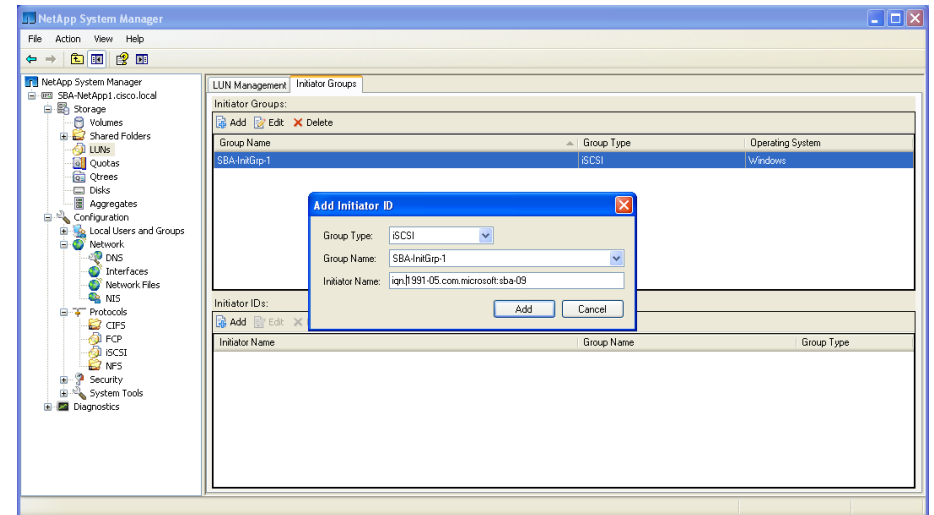
Step 4: Click the **Add** button in the **Add Initiator Group** window to create the group.

Figure 26. Add Initiator Group



Step 5: Once the group has been created, highlight the group name in the upper half of the right pane, and click the **Add** button in the lower half of the right pane to add an initiator ID to the group. The Initiator Name must match the name identified in the iSCSI configuration of the host machine that will be accessing storage.

Figure 27. Add Initiator ID



Step 6: Click the **Add** button in the **Add Initiator ID** window to complete the addition of the new ID, as shown in Figure 27. With the initiator Group and ID created, you are now ready to proceed with adding a LUN to the system to be accessed via iSCSI.

Tech Tip

To create an initiator group for a Fibre Channel host, use the **Group Type** pull-down box to change the type to **FCP**.

Tech Tip

To add an initiator ID for a Fibre Channel host, choose **FCP** in the **Group Type** pull-down box, and enter the appropriate WWN in the **Initiator Name** field.

Process

Adding a LUN

1. Create a LUN for iSCSI or Fibre Channel
2. Create a LUN Mapped to an iSCSI Initiator

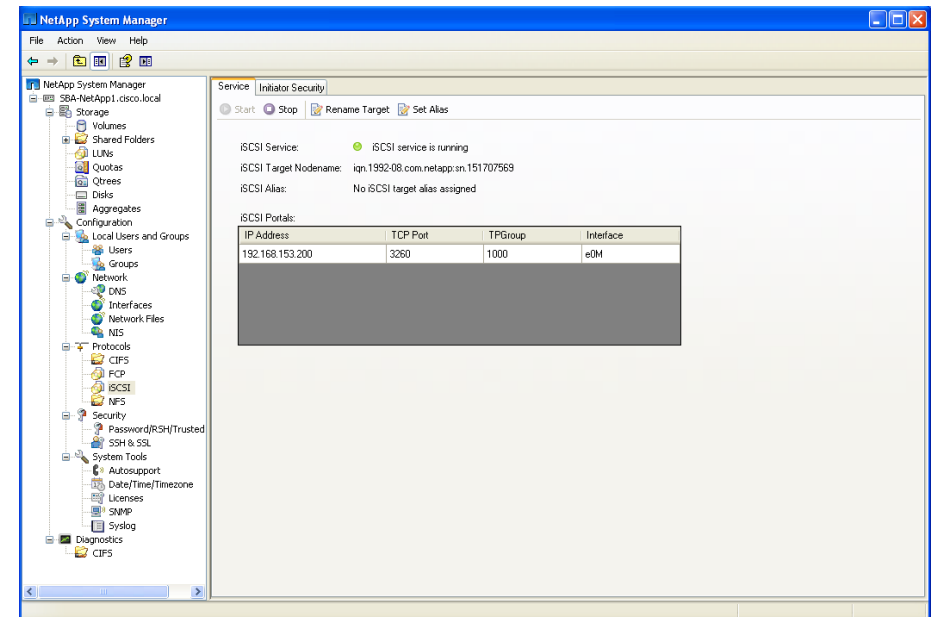
Procedure 1 Create a LUN for iSCSI or Fibre Channel

LUNs are logical units of storage provisioned from a NetApp storage system directly to servers. Hosts can access the LUNs as physical disks using Fibre Channel, FCoE, or iSCSI protocols. The following example shows how to configure an iSCSI LUN.

Step 1: Before configuring the LUN, you must start the iSCSI service on the storage system. Select **Configuration > Protocols > iSCSI** and then click **Start**. If the service is already running, the **Start** button will appear greyed out as shown in .

NetApp System Manager

Figure 28. Starting the iSCSI Service



Step 2: You can create four different types of storage objects on the same storage system. Click the storage icon to list the four available options:

- Create volume
- Create LUN
- Create share/export
- Create NFS datastore for VMware

LUNs and file shares/exports are objects within a volume. Creating a LUN automatically creates a default volume as part of the process. If you want to configure a volume with properties other than the defaults, you can do so separately. Also, you can create an NFS data object optimized for VMware applications.

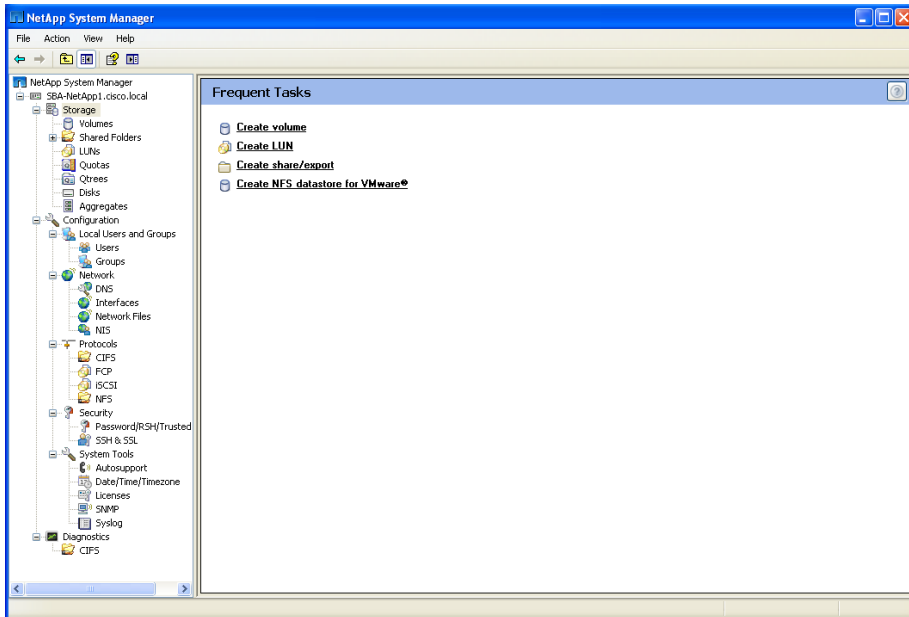
Procedure 2

Create a LUN Mapped to an iSCSI Initiator

The process of configuring a Fibre Channel LUN or file share/export is essentially the same as that used for an iSCSI LUN. The protocol used for access to the LUN is determined by the type of initiator group created earlier.

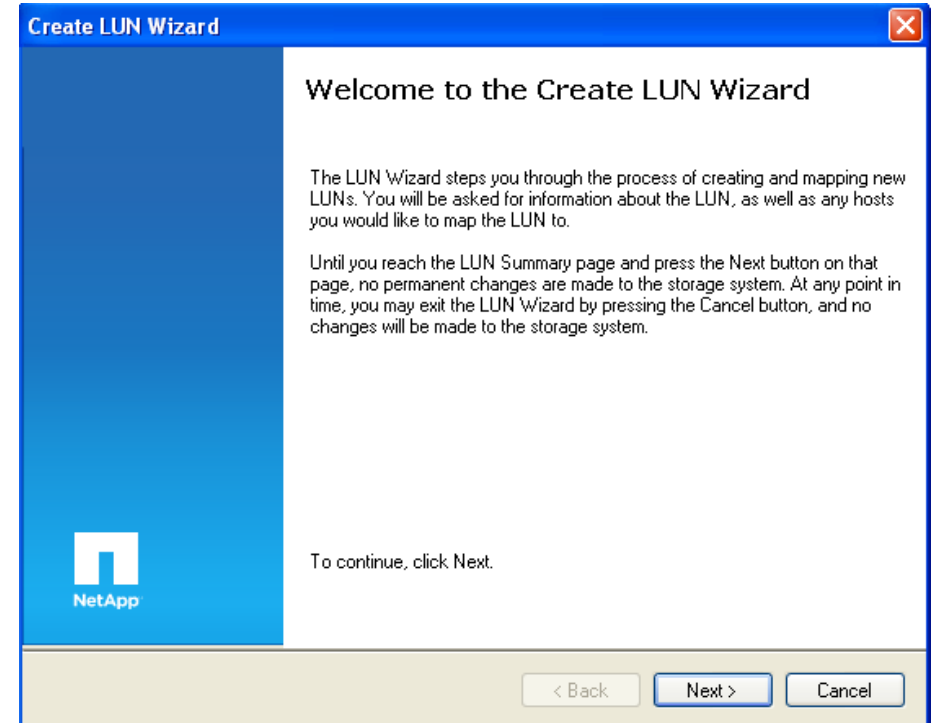
Step 1: With Storage selected in the left pane, click **Create LUN** to launch the Create LUN Wizard as shown in Figure 29.

Figure 29. Starting the Create LUN Wizard



Step 2: At the Create LUN Wizard Welcome screen, shown in Figure 30, click **Next** to begin creating a LUN.

Figure 30. Create LUN Wizard



Step 3: Define the following properties for your LUN using the General Properties screen shown in Figure 31:

- LUN name
- Description (optional)
- LUN size
- Operating system type

Figure 31. LUN General Properties Screen

Each operating system (OS) maps data to LUNs slightly differently. The OS type parameter determines the on-disk layout of the LUN. It is important to specify the correct OS type to make sure that the LUN is properly aligned with the file system on it. This is because optimal performance with the storage system requires that I/O be aligned to a 4096-byte boundary. Unaligned I/O:

- Can cause an increase in per-operation latency
- Requires the storage system to read from or write to more blocks than necessary to perform logical I/O

This issue is not unique to NetApp storage. Any storage vendor or host platform can exhibit this problem. Once the LUN is created, you cannot modify the LUN host operating system type.

Tech Tip

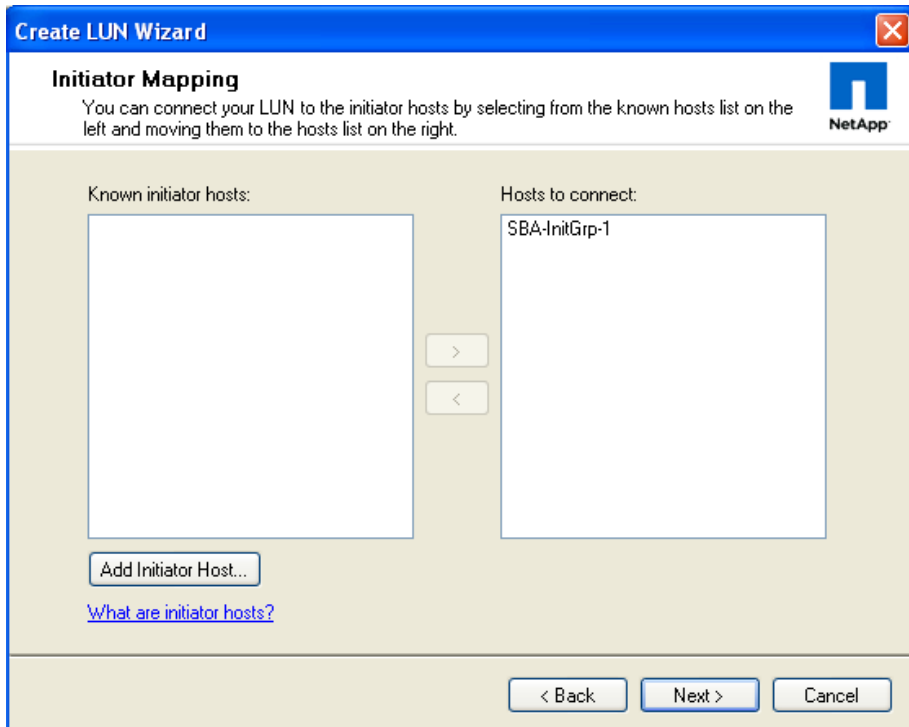
If you have selected the incorrect OS type and then created the LUN, the LUN at the storage array will be misaligned. To properly align the LUN, you must create a new LUN, then select the correct OS type.

Step 4: Specify whether you want to automatically create a new volume or select an existing volume. If you created a separate volume before creating a LUN, the option exists to choose an existing volume as shown in Figure 32.

Figure 32. LUN Container

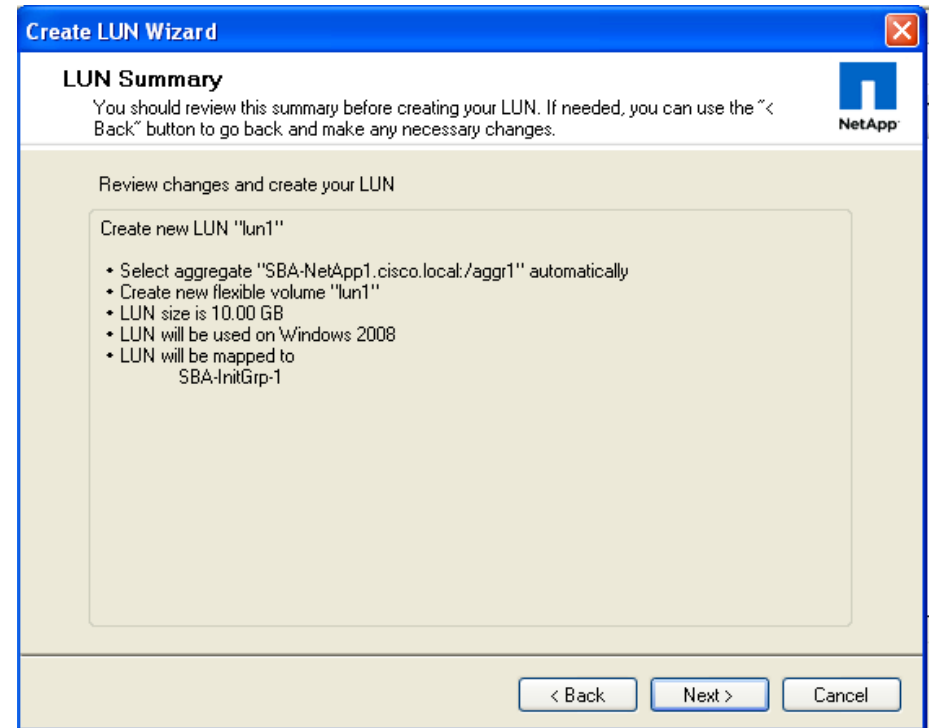
Step 5: Use the **Initiator Mapping** window to map the LUN to the initiator group (host) that was previously created. Select the group name in the left side of the window, and click the right arrow to move the selected name into the **Hosts to connect** list as shown in Figure 33.

Figure 33. Initiator Mapping



Step 6: Click the **Next** button to proceed, and verify the changes that will be applied to the system listed in the **LUN Summary** window. Click **Next** in the **LUN Summary** window to complete creation of the LUN as shown in Figure 34.

Figure 34. LUN Summary Window



Once the LUN has been created, it will be accessible to the iSCSI host that was identified in the initiator mapping.

Increasing Efficiency and Flexibility with Advanced Features

Thin Provisioning

Traditional storage provisioning and preallocation of storage on disk is a method that storage administrators understand well. It is a common practice for server administrators to overprovision storage to avoid running out of storage and the associated application downtime when expanding the provisioned storage.

Although no system can be run at 100% storage utilization, there are storage virtualization methods that allow administrators to address and oversubscribe storage in the same manner as with server resources (such as CPU, memory, networking, and so on). This form of storage virtualization is referred to as thin provisioning.

Traditional provisioning preallocates storage; thin provisioning provides storage on demand. The value of thin-provisioned storage is that storage is treated as a shared resource pool and is consumed only as each individual application requires it. This sharing increases the total utilization rate of storage by eliminating the unused but provisioned areas of storage that are associated with traditional storage. The drawback to thin provisioning and oversubscribing storage is that (without the addition of physical storage), if every application requires its maximum possible storage at the same time, there will not be enough storage to satisfy the requests.

NetApp FlexVol uses thin provisioning to allow LUNs that are presented as physical disks to be provisioned to their total capacity, yet consume only as much physical storage as is required to store data. LUNs connected as pass-through disks can also be thin provisioned. Thin provisioning applies equally to file shares.

NetApp Deduplication

With NetApp deduplication, server deployments can eliminate the duplicate data in their environment, enabling greater storage utilization. Deduplication can be seamlessly introduced into the server environment without having to make any changes to server administration, practices, or tasks. Deduplication runs on the NetApp storage system at scheduled intervals and does not consume any CPU cycles on the server.

Deduplication can be extremely helpful for virtual server scenarios such as fixed-size virtual hard drives, frequent creation and deletion of virtual disk files on the SAN LUNs, and data in the child VM.

Deduplication is enabled on the NetApp volume, and the amount of data deduplication realized is based on the commonality of the data stored in a deduplication-enabled volume.

NetApp Snapshot

A NetApp Snapshot copy is a locally retained, frozen, space-efficient read-only view of a volume or an aggregate. Its improved stability, scalability, recoverability, and performance make it more efficient than other storage snapshot technologies.

Snapshot copies facilitate frequent low-impact, user-recoverable online backup of files, directory hierarchies, LUNs, and application data. They offer a secure and simple method of restoring data so that users can directly access the Snapshot copies and recover from accidental file deletion, data corruption, or modification. The SnapManager® suite of products, which are available for various enterprise applications, uses the features of Snapshot copies and delivers an enterprise-class data protection solution.

NetApp FlexClone

NetApp FlexClone® technology creates true cloned volumes—instantly replicated data sets, files, LUNs, and volumes that use no additional storage space at the time of creation. A FlexClone volume is a writable point-in-time copy generated from the Snapshot copy of a FlexVol volume. It has all the features of a FlexVol volume, including growing, shrinking, and being the base for a Snapshot copy or even another FlexClone volume.

FlexClone volumes deployed in a virtualized environment offer significant savings in dollars, space, and energy. Additionally, the performance of a FlexClone volume or file is identical to the performance of any other FlexVol volume or individual file.

Backup, Disaster Recovery, and High Availability

Backup and recovery is the most critical component of the data protection plan. If data is changed unexpectedly, a system is compromised, or a site is lost, a backup is crucial to protect and recover agency information.

NetApp backup and recovery solutions equip users to increase the reliability of data protection while minimizing management overhead and cost. These solutions fit into any strategy, enabling users to meet their service-level requirements.

Backup and Recovery Concepts

Data protection plans for a virtualized environment become more critical as consolidation brings all crucial data into one place so that any failure results in a massive impact on the agency applications.

Backup tasks running in the server virtualized infrastructure are often resource (CPU, memory, disk I/O, and network) intensive and can result in bottlenecks that adversely affect the performance of the other critical applications that share the environment. Backup schedules must be closely coordinated with the applications that are running on the available resources.

Disaster Recovery

Business operations depend heavily on information systems and the related IT infrastructure. A minor application outage can cause a significant impact, and the effect of data loss is even more critical. There are various metrics that are commonly used in designing a business continuity plan. Two of the most frequently used metrics are recovery point objective (RPO) and recovery time objective (RTO). RPO, measured in minutes and hours, describes how far the recovered data are out of sync with the production data at the time of disaster. RTO, measured in minutes, describes how fast the operations can be restored.

Several approaches have been developed to increase data availability and business continuity in case of disaster occurring at the hardware or software level, and even site failures. Backup methods primarily provide a way to recover from data loss from an archived medium—a high-level data protection method.

Redundant hardware setups can provide second-level protection to mitigate damage caused by hardware failures. Data mirroring is another mechanism to increase data availability and minimize downtime.

NetApp offers the SnapMirror® solution, which empowers IT infrastructures with a fast, flexible data replication mechanism over Ethernet and Fibre Channel networks. It is a key component to consider when designing and deploying enterprise data protection plans. SnapMirror is an efficient data replication solution that takes advantage of underlying NetApp technologies such as Snapshot, FlexClone, deduplication, and so on. Disaster recovery is its primary objective, and SnapMirror can also assist in other critical application areas such as DR testing, application testing, load sharing, remote tape archiving, and remote data access.

Business Continuity Concepts

Disaster can occur in any IT infrastructure, and a data protection plan is even more critical for environments that are consolidated by using server virtualization. This is true because consolidation adds complexity by sharing reduced physical hardware resources for the applications and the critical data that are running.

The infrastructure must be designed with special attention to the following challenges that can crop up in a virtualized environment.

- Less time (or even no time) is available to schedule downtime windows to perform cold backup on virtual machines.
- Performing hot backup of virtual machines can result in inconsistent backup copies, which are of no use during recovery.
- Infrastructure contains various OS instances, making it difficult to identify a consistent state for backup.
- Replicating data over Local-Area Network (LAN) or WAN can consume twice as much of the available resources.
- Planning for identical resources at the Disaster Recovery (DR) site results in increased Total Cost of Ownership (TCO) and unused infrastructure.

NetApp Advanced Solutions

NetApp offers solutions that complement the server virtualization solutions and help to mitigate these challenges. Solutions such as NetApp Snapshot, FlexClone, deduplication, and so on enable an architect to design a complete data protection solution and to efficiently use available resources.

NetApp SnapMirror

NetApp SnapMirror software is a simple, flexible, cost-effective disaster recovery and data distribution solution that is deployed for more of the enterprise application infrastructure. Data is replicated across LAN or WAN, offering high availability and faster disaster recovery for critical applications. Continuous data mirroring and mirror updates across multiple NetApp storage systems facilitate the mirrored data for multiple purposes. Agencies in different geographical locations can take advantage of SnapMirror and make local copies of mirrored data available to all locations, enhancing efficiency and productivity.

NetApp SnapVault

NetApp SnapVault® leverages disk-based backup and block-level incrementals for reliable, low-overhead backup and recovery of NetApp storage suitable for any environment.

With SnapVault, data protection occurs at the block level—copying only the data blocks that have changed since the last backup, not entire files. This enables backups to run more frequently and to use less capacity, because no redundant data is moved or stored.

For distributed agencies, this not only makes disk-based backup cost-effective, it offers the option of backing up directly from remote facilities to a core data center, centralizing management and minimizing investment needs at the edge.

Monitoring and Management

Storage monitoring and management are critical to the success of the server environment. NetApp offers tools to monitor the health of storage systems, provide alerts, generate reports, and manage storage growth.

NetApp SnapManager

NetApp SnapManager management tools integrate with the leading applications to automate and simplify the complex, manual, and time-consuming processes associated with the backup, restoration, recovery, and cloning of the leading applications, including Oracle, Microsoft Exchange, SQL Server, SharePoint, SAP, and server virtualization.

Leverage the NetApp technology stack to create near-instant and space-efficient Snapshot copies and clones of your applications. Integrate with native application technologies and achieve complete automation of data management.

Use policies to simplify, standardize, and automate data protection. Increase back-up frequency—without affecting performance—for better data protection. Recover and restore a failed database to full production in minutes, regardless of size.

Create complete data clones in seconds on primary storage or directly to your development and test environment. Use clones to engage in parallel QA, development, testing, and other processes, and deploy applications faster than ever before.

NetApp Operations Manager

NetApp Operations Manager monitors, manages, and generates reports on all of the NetApp storage systems in an agency. When you are using NetApp thin provisioning, NetApp recommends deploying Operations Manager and setting up email and pager notifications to the appropriate administrators. With thin-provisioned storage, it is very important to monitor the free space available in the aggregates. Proper notification of the available free space means that additional storage can be made available before the aggregate becomes completely full.



Reader Tip

For information about setting up notifications in Operations Manager, see the Configuring Alarms and Managing Aggregate Capacity within the Operations Manager Administration Guide on NOW.

NetApp Protection Manager

Protection Manager's policy-based management, global monitoring, and reporting allow you to automate your data protection operations.

Managing data protection can be complicated and time consuming. Most tools fail to give you a comprehensive and easy-to-understand view of your data protection environment. What's more, they make it difficult to efficiently provision and use storage resources.

Protection Manager can simplify common data protection tasks and automate management across Snapshot, SnapMirror, SnapManager, SnapVault, and Open Systems SnapVault operations. It automates storage provisioning and provides global policy-based management, monitoring, and alerting.

Protection Manager makes it easy to define, apply, and update data protection policies across the enterprise. It minimizes effort, cuts administrative overhead, and helps to meet best practices and service-level agreements globally.

A simple dashboard shows comprehensive data protection information, including unprotected data, alerts, and utilization, at a glance.

Protection Manager automation combines with thin provisioning, deduplication, NetApp Snapshot, and block incremental technology to shrink the storage footprint and increase management efficiency.

NetApp Provisioning Manager

NetApp Provisioning Manager can speed the creation of new NetApp storage resources and help improve capacity management of existing storage resources. Storage administrators can use Provisioning Manager's policy-based automation to create repeatable, automated provisioning processes to improve the availability of data and enable provisioned storage to comply with policies. These processes are faster than manually provisioning storage, are easier to maintain than scripts, and help to minimize the risk of data loss due to misconfigured storage.

NetApp Provisioning Manager applies user-defined policies to consistently select the appropriate resources for each provisioning activity. This frees administrators from the headache of searching for available space to provision and allows more time for strategic issues. A centralized management console allows administrators to monitor the status of their provisioned storage resources.

NetApp Provisioning Manager can help improve your agency agility and capacity utilization, shrink provisioning time, and improve administrator productivity. By leveraging Provisioning Manager's thin provisioning and deduplication capabilities, you can get a high level of storage efficiency from your NetApp storage investment. This allows you to store more data more efficiently, and helps improve your agency agility.

Notes

Conclusion

The requirements of midsized agencies increasingly reflect those of larger agencies, although generally on a smaller scale. However, with limited IT skill sets, midsized agencies must rely on partners and vendors that can deliver effective solutions in a simplified manner. Cisco's SBA solutions address these needs.

NetApp storage solutions offer the performance and functionality to unlock the value of your agency regardless of size. The NetApp family of storage solutions offers class-leading storage efficiency and performance that scale with your agency. Whether you deploy a NetApp FAS system or choose to extend the life of your existing FC storage with a NetApp V-Series system, NetApp storage solutions offer a common storage platform that is designed to maximize the efficiency of your data storage. Capable of data-in-place upgrades to more powerful FAS or V-Series systems, running the same Data ONTAP operating system and using the same management tools and feature sets, NetApp systems grow with your agency and are ideal for midsized agencies as well as large agencies.

Notes

Appendix A: Contacting NetApp

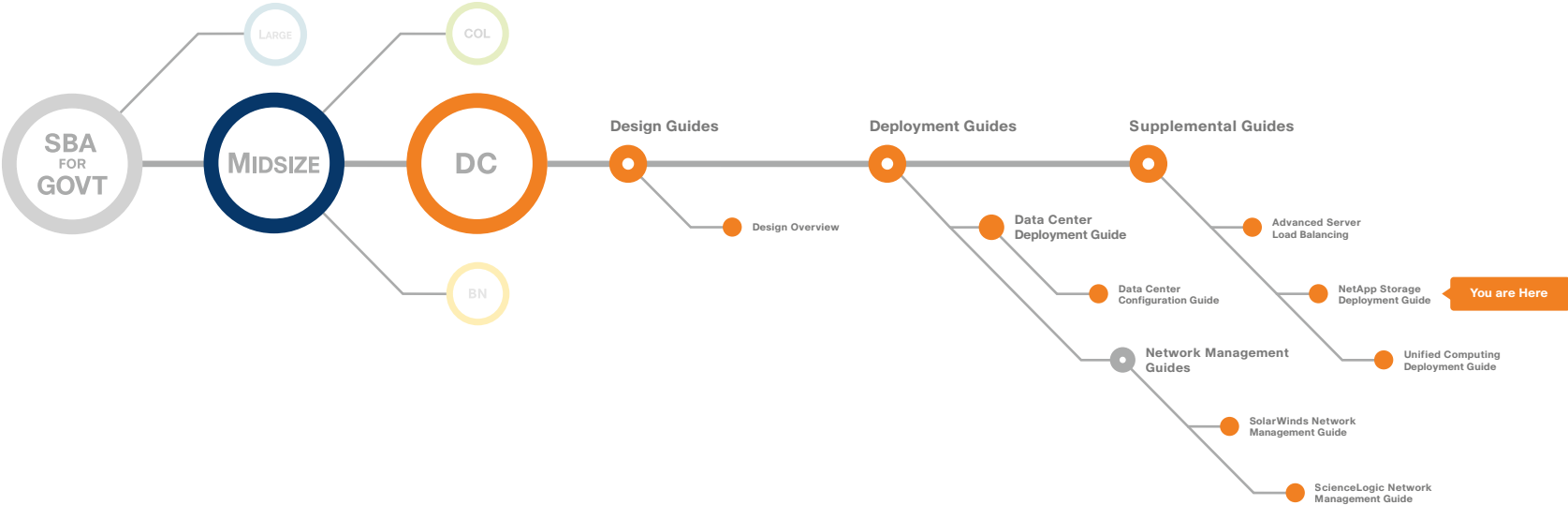
For more information on NetApp products, services, and solutions, NetApp sales representatives and reseller partners are ready to answer your questions and provide you with the pricing and configuration information you need to make your purchasing decision.

In the United States you can reach NetApp directly at: 1-877-263-8277 or select from the list of reseller partners located at: <http://www.netapp.com/us/how-to-buy/>.

If you are calling from outside the United States, please select your country from the list located on the right side of the link provided above.

Notes

Appendix B: SBA for Midsize Agencies Document System





SMART BUSINESS ARCHITECTURE



Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV
Amsterdam, The Netherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at www.cisco.com/go/offices.

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