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Cisco MDS 9000 Family SANTap Deployment Guide

Cisco MDS 9000 NX-OS Release 5.x

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Cisco MDS 9000 Family SANTap Deployment Guide

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New and Changed Information

As of Cisco DCNM Release 5.2, Cisco Fabric Manager and Cisco Data Center Network Manager for LAN are merged into one unified product called Cisco Data Center Network Manager (DCNM) that can manage both LAN and SAN environments. As a part of this product merger, the name Cisco DCNM for SAN replaces the name Cisco Fabric Manager.

The following documentation changes support the merged Cisco DCNM product:

- Cisco DCNM product documentation for Cisco DCNM Release 5.2 is retitled with the name Cisco DCNM for LAN.
- Cisco Fabric Manager product documentation for Cisco DCNM Release 5.2 is retitled with the name Cisco DCNM for SAN.
- Cisco DCNM for SAN product documentation is now published to the Data Center Network Manager listing page on Cisco.com: http://www.cisco.com/en/US/products/ps9369/tsd_products_support_configure.html

  This URL is also the listing page for Cisco DCNM for LAN product documentation.
- Cisco Fabric Manager documentation for software releases earlier than Cisco DCNM Release 5.2, retains the name Cisco Fabric Manager and remains available at its current Cisco.com listing page: http://www.cisco.com/en/US/products/ps10495/tsd_products_support_configure.html

  You should continue to use the Cisco Fabric Manager documentation if you are using a release of Cisco Fabric Manager software that is earlier than Cisco DCNM Release 5.2.
- The name DCNM-SAN is used in place of Cisco DCNM for SAN in the user interface of Cisco Data Center Network Manager; likewise, the name DCNM-LAN is used in place of Cisco DCNM for LAN in the user interface. To match the user interface, the product documentation also uses the names DCNM-SAN and DCNM-LAN.
- The following new publications support both Cisco DCNM for LAN and DCNM for SAN, and address the new licensing model, the new installation process, and the new features of Cisco DCNM:
  - *Cisco DCNM Installation and Licensing Guide*
  - *Cisco DCNM Release Notes*

For a complete list of Cisco DCNM documentation, see the “Related Documentation” section in the Preface.

As of Cisco MDS NX-OS Release 4.2(1), software configuration information is available in new feature-specific configuration guides for the following information:

- System management
- Interfaces
- Fabric

- Quality of service
- Security
- IP services
- High availability and redundancy

The information in these new guides previously existed in the *Cisco MDS 9000 Family CLI Configuration Guide* and in the *Cisco MDS 9000 Family Fabric Manager Configuration Guide*. Those configuration guides remain available on Cisco.com and should be used for all software releases prior to MDS NX-OS Release 4.2(1). Each guide addresses the features introduced in or available in a particular release. Select and view the configuration guide that pertains to the software installed in your switch.

Some information from the *Cisco MDS 9000 Family CLI Configuration Guide* and the *Cisco MDS 9000 Family Fabric Manager Configuration Guide* now appears in the following guides that are common among products that run the Nexus operating system:

- *Cisco NX-OS Family Licensing Guide* – Explains the licensing model and describes the feature licenses.
- *Cisco NX-OS Fundamentals Configuration Guide* – Describes the switch setup utility and includes general CLI, file system, and configuration information.

For a complete list of document titles, see the list of Related Documentation in the "Preface."

To find additional information about Cisco MDS NX-OS Release 4.2(x), see the *Cisco MDS 9000 Family Release Notes* available at the following Cisco Systems website:

http://www.cisco.com/en/US/products/ps5989/prod_release_notes_list.htm

Table 1 lists the New and Changed features for this guide.

Table 1 New and Changed Features

Feature	New or Changed Topics	Changed in Release	Where Documented
Rebranding Fabric Manager to DCNM for SAN.	Changed instances of Fabric Manager to DCNM-SAN.	5.2(1)	Throughout the guide.

Preface

This preface describes the audience, organization, and conventions of the *Cisco MDS 9000 Family SANTap Deployment Guide*. It also provides information on how to obtain related documentation.

Note As of NX-OS Release 4.1(1), SAN-OS has been changed to NX-OS. References to SAN-OS releases before 4.1(1) still apply.

Audience

This guide is intended for experienced network administrators who are responsible for planning, installing, configuring, and maintaining the Cisco MDS 9000 SANTap application.

Organization

This document is organized as follows:

Chapter	Title	Description
Chapter 1	Configuring SANTap	Provides an overview of Cisco MDS SANTap.
Chapter 2	Troubleshooting SANTap	Describes the installation, provisioning, and configuration tasks.
Appendix A	SANTap CLI Command Reference	Provides syntax and usage guidelines for Cisco MDS SANTap CLI commands.

Document Conventions

Command descriptions use these conventions:

boldface font	Commands and keywords are in boldface.
italic font	Arguments for which you supply values are in italics.
[ ]	Elements in square brackets are optional.
[**x** | **y** | **z**]	Optional alternative keywords are grouped in brackets and separated by vertical bars.

Screen examples use these conventions:

`screen font`	Terminal sessions and information the switch displays are in screen font.
`boldface screen font`	Information you must enter is in boldface screen font.
`italic screen font`	Arguments for which you supply values are in italic screen font.
`< >`	Nonprinting characters, such as passwords, are in angle brackets.
`[ ]`	Default responses to system prompts are in square brackets.
`!, #`	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.

This document uses the following conventions:

Note Means reader *take note*. Notes contain helpful suggestions or references to material not covered in the manual.

Caution Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Related Documentation

The documentation set for the Cisco MDS 9000 Family includes the following documents. To find a document online, use the Cisco MDS NX-OS Documentation Locator at:

http://www.cisco.com/en/US/docs/storage/san_switches/mds9000/roadmaps/doclocater.htm

Release Notes

- *Cisco MDS 9000 Family Release Notes for Cisco MDS NX-OS Releases*
- *Cisco MDS 9000 Family Release Notes for MDS SAN-OS Releases*
- *Cisco MDS 9000 Family Release Notes for Cisco MDS 9000 EPLD Images*
- *Cisco DCNM Release Notes*

Regulatory Compliance and Safety Information

- *Regulatory Compliance and Safety Information for the Cisco MDS 9000 Family*

Compatibility Information

- *Cisco Data Center Interoperability Support Matrix*
- *Cisco MDS 9000 NX-OS Hardware and Software Compatibility Information and Feature Lists*
- *Cisco MDS 9000 Family Switch-to-Switch Interoperability Configuration Guide*

Hardware Installation

- *Cisco MDS 9500 Series Hardware Installation Guide*
- *Cisco MDS 9200 Series Hardware Installation Guide*
- *Cisco MDS 9100 Series Hardware Installation Guide*
- *Cisco MDS 9124 and Cisco MDS 9134 Multilayer Fabric Switch Quick Start Guide*

Software Installation and Upgrade

- *Cisco MDS 9000 NX-OS Software Upgrade and Downgrade Guide*

Cisco NX-OS

- *Cisco MDS 9000 Family NX-OS Licensing Guide*
- *Cisco MDS 9000 Family NX-OS Fundamentals Configuration Guide*
- *Cisco MDS 9000 Family NX-OS System Management Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Interfaces Configuration Guide*

- *Cisco MDS 9000 Family NX-OS Fabric Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Quality of Service Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Security Configuration Guide*
- *Cisco MDS 9000 Family NX-OS IP Services Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Intelligent Storage Services Configuration Guide*
- *Cisco MDS 9000 Family NX-OS High Availability and Redundancy Configuration Guide*
- *Cisco MDS 9000 Family NX-OS Inter-VSAN Routing Configuration Guide*
- *Cisco MDS 9000 Family Cookbook for Cisco MDS SAN-OS*

Cisco DCNM for SAN

- *Cisco DCNM Fundamentals Guide, Release 5.x*
- *System Management Configuration Guide, Cisco DCNM for SAN, Release 5.x*
- *Interfaces Configuration Guide, Cisco DCNM for SAN, Release 5.x*
- *Fabric Configuration Guide, Cisco DCNM for SAN, Release 5.x*
- *Quality of Service Configuration Guide, Cisco DCNM for SAN, Release 5.x*
- *Security Configuration Guide, Cisco DCNM for SAN, Release 5.x*
- *IP Services Configuration Guide, Cisco DCNM for SAN, Release 5.x*
- *Intelligent Storage Services Configuration Guide, Cisco DCNM for SAN, Release 5.x*
- *High Availability and Redundancy Configuration Guide, Cisco DCNM for SAN, Release 5.x*
- *Inter-VSAN Routing Configuration Guide, Cisco DCNM for SAN, Release 5.x*
- *SMI-S and Web Services Programming Guide, Cisco DCNM for SAN, Release 5.x*

Command-Line Interface

- *Cisco MDS 9000 Family Command Reference*

Intelligent Storage Networking Services Configuration Guides

- *Cisco MDS 9000 Family I/O Acceleration Configuration Guide*
- *Cisco MDS 9000 Family SANTap Deployment Guide*
- *Cisco MDS 9000 Family Data Mobility Manager Configuration Guide*
- *Cisco MDS 9000 Family Storage Media Encryption Configuration Guide*

Troubleshooting and Reference

- *Cisco MDS 9000 Family and Nexus 7000 Series System Messages Reference*
- *Cisco MDS 9000 Family SAN-OS Troubleshooting Guide*
- *Cisco MDS 9000 Family NX-OS MIB Quick Reference*

- *Cisco DCNM for SAN Database Schema Reference*

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html

- Subscribe to the *What's New in Cisco Product Documentation* as a Really Simple Syndication (RSS) feed and set content to be delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS version 2.0.

CHAPTER 1

Configuring SANTap

This chapter describes Cisco SANTap and provides configuration information and other related procedures.

This chapter includes the following sections:

Information About SANTap

Cisco SANTap is one of the Intelligent Storage Services features supported on the Storage Services Module (SSM), MDS 9222i Multiservice Modular Switch and MDS 9000 18/4-Port Multiservice Module (MSM-18/4). These three SANTap enabling platforms will be referred to with the general term Services Nodes (SNs). The Storage Services Module (SSM) supports SANTap in Cisco MDS SAN-OS Release 3.0(2a), 3.0(2b), 3.1(1), 3.1(2), 3.1(2a), 3.1(2b), 3.1(3a), and 3.2(2c) or higher, and in Cisco NX-OS 4.1(x). The MDS 9222i Multiservice Modular Switch and MDS 9000 18/4-Port Multiservice Module (MSM-18/4) support SANTap only starting from Cisco NX-OS Release 4.1(x).

The Cisco MDS 9000 SANTap service enables customers to deploy third-party appliance-based storage applications without compromising the integrity, availability, or performance of a data path between the server and disk.

The Cisco SANTap service can run on the following modules and switches:

- The Cisco Storage Services Module (SSM) and 18/4-Port Multiservice Module (MSM-18/4) which can be installed into any Cisco MDS 9500 Series switch or Cisco MDS 9200 Series multilayer intelligent storage switch
- The MDS 9222i Multiservice Modular switch

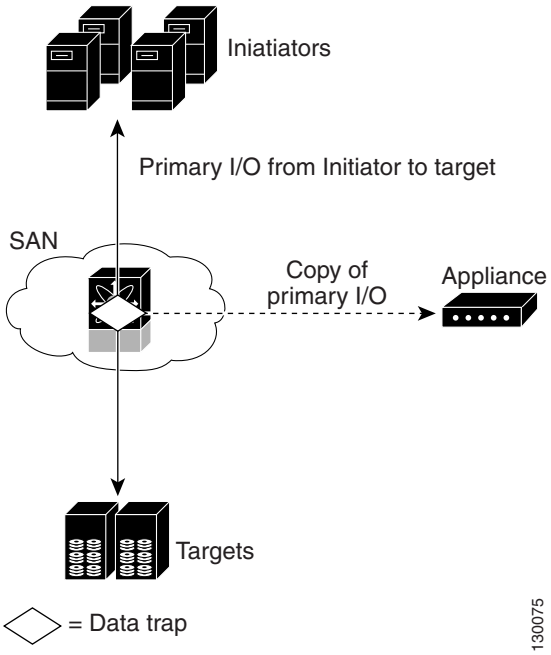
The architecture of these services nodes enables SANTap to service devices connected directly to the ports on the module, or devices connected anywhere in the fabric, including devices attached to legacy switches.

The SANTap feature allows third-party data storage applications, such as long distance replication and continuous backup, to be integrated into the SAN.

SANTap provides several advantages such as high performance, low cost of ownership, high availability, ease of deployment, and high interoperability.

The protocol-based interface that is offered by SANTap allows easy and rapid integration of the data storage service application because it delivers a loose connection between the application and an SSM, which reduces the effort needed to integrate applications with the core services being offered by the SSM. Figure 1-1 shows integrating third-party storage applications in a SAN.

Figure 1-1 Integrating Third-Party Storage Applications in a SAN



This section includes the following topics:

- SANTap Scalability Matrix, page 1-7

SANTap Control and Data Path

SANTap has a control path and a data path. The control path handles requests that create and manipulate replication sessions sent by an appliance. The control path is implemented using an SCSI-based protocol. An appliance sends requests to a Control Virtual Target (CVT), which the SANTap process creates and monitors. Responses are sent to the control logical unit number (LUN) on the appliance. SANTap also allows LUN mapping to Appliance Virtual Targets (AVTs). You can have a maximum of 512 target LUNs.

SANTap does not require reconfiguration of either the host or target when introducing SANTap-based applications. Also, neither the host initiator nor the target is required to be directly connected to an SSM. The configuration is accomplished by assigning Cisco-specific WWNs to the virtual initiators (VIs) and Data Virtual Targets (DVTs). A host initiator or a target can be connected directly to an SSM. However, you must partition the SAN using VSANs.

You must configure the host initiator and the DVT in one VSAN and configure the VI and the target in another VSAN.

You can use SANTap to remove your appliance-based storage applications from the primary data path in a SAN. Removing these applications from the primary data path prevents them from compromising the security, availability, and performance of the SAN. SANTap copies the data at line speed and makes it available to other storage applications; these storage applications are prevented from affecting the SAN while maintaining the integrity of the data that storage applications need.

Dynamic LUNs is a feature introduced in Cisco SAN-OS Release 3.2(1). When one or more LUNs are removed or added on the backend target during the periodic scan, SANTap automatically uninstalls the deleted DVT LUNs and installs any additional LUNs. Uninstallation of the deleted DVT LUNs occurs even if the total number of LUNs remains the same.

In previous releases, when the set of LUNs changed on the target, the original LUN list was displayed on the DVT. The new and changed LUNs were not reflected on the DVT. However, if the total number of LUNs increases, then the additional LUNs are installed and displayed on the host.

Before Cisco SAN-OS Release 3.2(1), a user had the following options for displaying the LUN list on the DVT:

- Shut down the host interface: Purge the DVT LUNs for the IT pair. All the LUNs for the existing IT pair were removed, and the correct set of LUNs is recreated when the host logs in.
- Reload the SSM.

In Cisco SAN-OS Release 3.2(1) or NX-OS Release 4.1(x), SANTap supports 32-bit LUNs on the target.

SANTap Proxy Mode

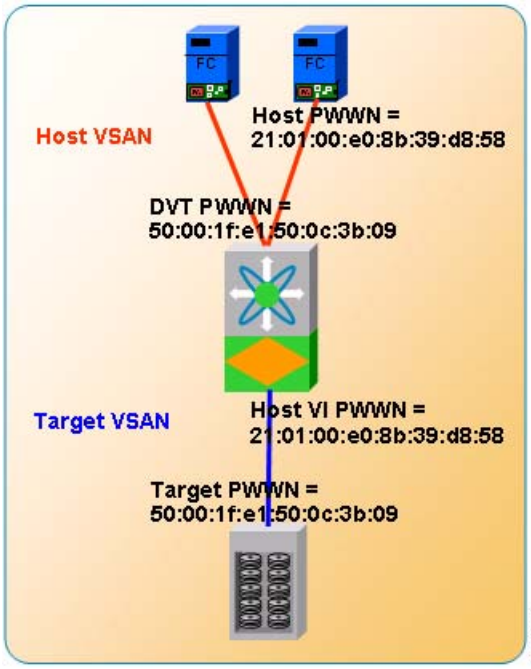
SANTap proxy mode is designed to provide SANTap functionality to devices connected anywhere in the fabric, whether using modern SANTap-capable switches or legacy switches. Proxy mode allows SANTap to be enabled in a fabric with minimal downtime and minimal reconfiguration and recabling. The keys to SANTap functioning in this mode are the ability to segment fabrics using VSANs and the virtual interfaces that the SSM presents to the fabric. These virtual interfaces can be added into any VSAN and present a virtual initiator to the target in one VSAN and present a virtual target to a host in another VSAN.

SANTap proxy mode offers the following advantages:

- The ports to which the storage devices and hosts are attached are not moved.
- Devices can remain attached to a legacy switch rather than be migrated to a modern SANTap-capable switch.
- More than four hosts can use the same data path processor (DPP).
- The SANTap service is not coupled to a physical port.

Figure 1-2 shows a SANTap proxy mode-2 example.

Figure 1-2 SANTap Proxy Mode-2 Example



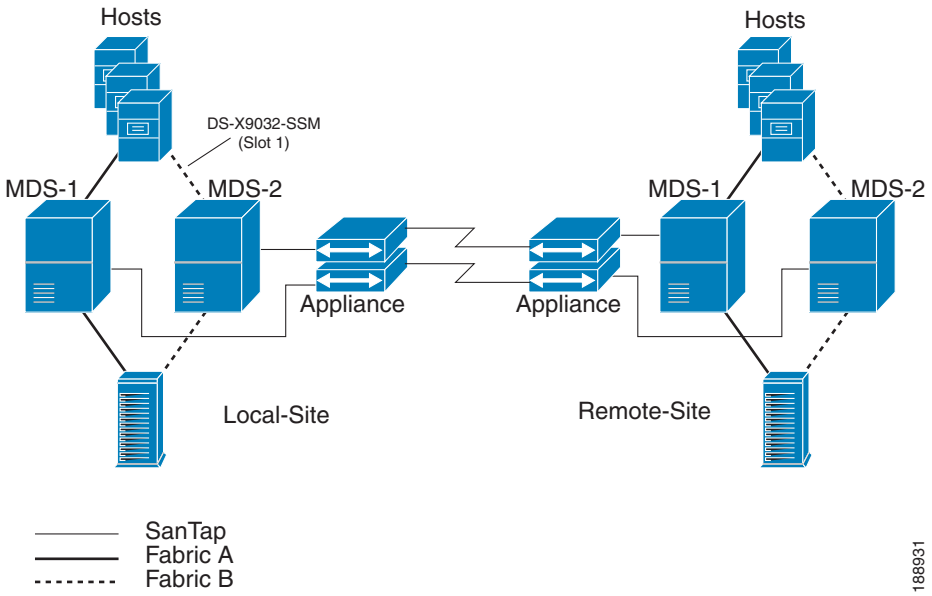
Migrating SANTap from a 9513 Chassis to a 9216 Chassis

This section explains the environments required for migrating SANTap from an existing MDS 9513 to a MDS 9216 switch and provides the migration procedure.

A dual-fabric topology setup provides extra resiliency during this migration procedure. Both of the fabrics in Figure 1-3 are built using MDS 9513 Directors, which need to be replaced by MDS 9216 Switches. The appliance setup is also a dual-node cluster configured for continuous remote replication (CRR) between the local and remote sites.

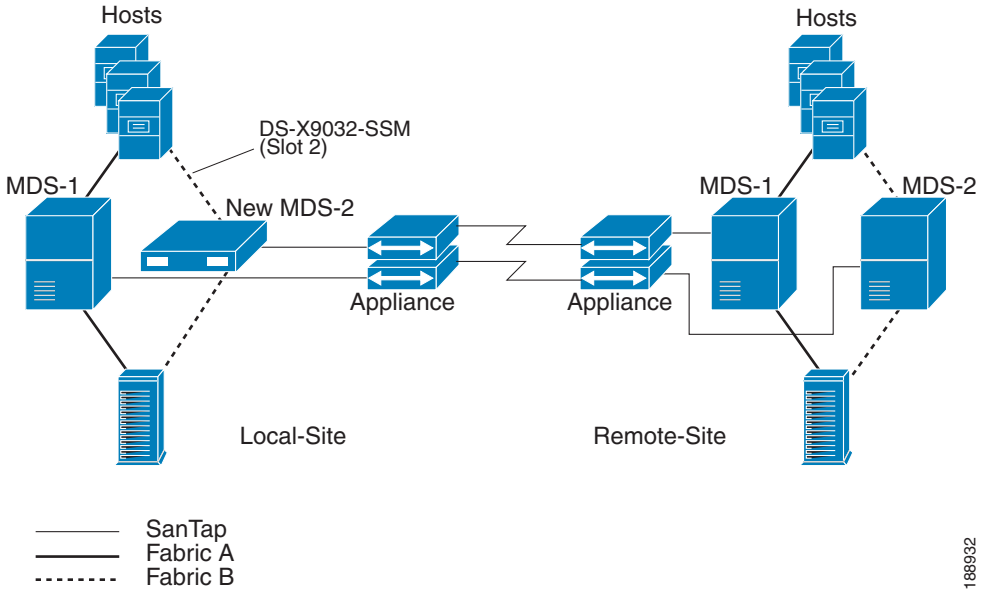
Figure 1-3 shows the setup before migration.

Figure 1-3 Setup Before Migration



The Fabric B switch on the local site (MDS-2) should be replaced by an MDS 9216 (new MDS-2) switch. The same SSM card used in the current topology (MDS-2) will be swapped with the MDS 9216 switch on slot 2. After reconfiguration, the SANTap configuration with the appliance should be reestablished. Figure 1-4 shows the setup after migration.

Figure 1-4 Setup After Migration



Concepts and Terminology

Table 1-1 includes brief definitions of some of the common SANTap acronyms and terms.

Table 1-1 SANTap Acronyms

Acronym / Term	Definition
AVT	Appliance virtual target. The portal through which an appliance can complete its synchronization with the target LUN. AVT can be thought of as a host proxy for the appliance.
CVT	Control virtual target. The portal through which an appliance communicates with SANTap. An initiator port on the appliance sends out SANTap Control Protocol requests to the SANTap process. When the request is processed, the response is sent back by the Cisco VI (virtual initiator) to a target port on the appliance.
DVT	Data virtual target. A DVT is created for every port on a multi-ported target that is included in SANTap-based services. The DVT is created in the host VSAN. Once a DVT is created and a host logs into the DVT, SANTap installs a DVTLUN for every configured LUN on the target for this host.
ILC	Intelligent Line Card. Line card module available with the MDS family of switches that has hardware assist that facilitate exchange management and SCSI header inspection. Many switch-based storage service applications run on this card.
ITL	Initiator/target/LUN tuple. Uniquely identifies a LUN on a target.
Session	A record/object that is created for every ITL whose WRITE I/Os the appliance is interested in. A session can be thought of as a target LUN that requires SANTap-based services.
SN	Services Node. A generic term that can refer to either a system (Cisco MDS 9222i switch) or a line card (Cisco MDS SSM or MSM-18/4 module) capable of offering intelligent services.
VI	Virtual initiator. SANTap creates 9 VIs in the appliance and target VSANs. In the appliance, VIs are used to send responses to SANTap CP requests and also to send copies of WRITE I/Os. In the target, VIs are used when the appliance is down and one of the SANTap recovery tools (ARL, PWL-BPR) is enabled. **Note** If the appliance implementation chooses not to use these recovery tools, the VIs are not used.

SANTap on the SSM

The SANTap service can be configured to run in proxy operating mode. This mode offers unique design advantages that allow SANTap to fit customer requirements with minimal changes to current configurations.

The SANTap feature allows third-party data storage applications, such as long distance replication and continuous backup, to be integrated into the SAN. The protocol-based interface that is offered by SANTap allows easy and rapid integration of the data storage service application because it provides a loose connection between the application and an SSM, which reduces the effort needed to integrate

applications with the core services being offered by the SSM. SANTap has a control path and a data path. The control path handles requests that create and manipulate replication sessions be sent by an appliance. The control path is implemented using a SCSI-based protocol.

The SANTap service provides a reliable copy of storage write operations to a third-party appliance, which enables applications to provide data protection, data migration, remote replication, and SLA monitoring, without the disadvantages of deploying devices in-band within the data path or out-of-band in conjunction with host-based software agents.

SANTap Scalability Matrix

Table 1-2 lists the scalability limits for the SAN-OS and NX-OS releases that support SANTap.

Table 1-2 SANTap Scalability Matrix on SSM

Attribute	3.1(2m)	3.1(3)	3.2(3)	4.1(x)
Hosts per DVT	16	16	64	64
LUNs per Host per DVT	256	256	256	256
LUNs per DVT	1 K	1 K	3 K	3 K
DVTs per SSM	16	32	64	128
Sessions per SSM	2 K	2 K	2 K	2 K
LUN ID address size	16	16	32	32
DVT LUNs per SSM	2 K	4 K	16 K	16 K
ITLs per DPP	1 K	1 K	3 K	3 K
ITLs per SSM	2 K	4 K	24 K	24 K

Table 1-3 lists the scalability limits for NX-OS Release 4.1(1i) on the MSM-18/4 module and the MDS 9222i switch.

Table 1-3 SANTap Scalability on the MSM-18/4 Module and the MDS 9222i Switch

Attribute	4.1(1i)
Hosts per DVT	64
LUNs per Host per DVT	256
LUNs per DVT	3K
DVTs per SN	128
Sessions per SN	2K
LUN ID address size	32
DVT LUNs per SN	16K
ITLs per DPP	24K
ITLs per SN	24K

Licensing Requirements for SANTap

The following are the licensing requirements to set up SANTap:

Software Licensing Requirements

SANTap has the following software license requirement:

- STORAGE_SERVICES_ENABLER_PKG

The MSM-18/4 module and the MDS 9222i switch require the following licenses:

- STORAGE_SERVICES_184
- STORAGE_SERVICES_9222i

Hardware Requirements

SANTap has the following hardware requirements:

- MDS 9222i: DS-X9222I-K9
- SSM: DS-X9032-SSM
- MSM-18/4: DS-X9304-18K9

Guidelines and Limitations

Cisco SANTap has the following guidelines and limitations:

Configuration Using CLI and Cisco DCNM for SAN

SANTap provides a set of CLI commands for configuration. It can be configured using the Cisco DCNM-SAN, which is a GUI-based application.

High Performance and Scalability

The ASIC-based innovation provides high-throughput IOPS. SANTap offloads the replication tasks from the initiators and appliance. A host software, driver, license, and agent are not required.

High Availability

The SANTap appliance does not reside on the primary data path. The primary I/Os are not impacted if the appliance becomes unavailable. The solution takes advantage of dual-fabric redundancy.

The appliances are in a highly available cluster.

Manageability

There is no need to reconfigure end devices. SANTap works with heterogeneous hosts and targets. The hosts and storage can be added on-demand.

Ease of Deployment

There is no rewiring required for SANTap. The hosts and targets do not have to be connected to the SSM. You do not need to reconfigure the hosts and targets.

Leveraging the SAN Investment

The SSM can be deployed in the following switches:

- MDS 9216 or MDS 9216i Multilayer Fabric Switches
- MDS 9222i Multiservice Modular Switch
- MDS 9506 Director
- MDS 9509 Director
- MDS 9513 Director

In addition, SANTap also works with Supervisor-1 and Supervisor-2 modules. The hosts and storage can be connected to the existing 1-/2-/4-/10-Gbps Fibre Channel switching modules.

Protocol-Based Interface

The protocol-based interface offered by SANTap allows easy and rapid integration of the data storage service application because it delivers a loose coupling between the application and the Intelligent Line Card (ILC), which reduces the effort needed to integrate applications with the core services being offered by the ILC.

Default Settings

Table 1-4 lists the default settings for SANTap parameters.

Table 1-4 Default SANTap Parameters

Parameters	Default
SANTap feature	Disabled.
DVT I/O timeout	10 seconds.
DVT LUN size handling flag	1 (enabled).

Note The LUN-size handling flag is enabled by default.

Configuring SANTap on the SSM Using the CLI

This section describes how to configure SANTap and includes the following topics:

- Creating a SANTap CVT, page 1-16
- Deleting a SANTap CVT, page 1-17
- Task Flow for Configuring SANTap on SSM, page 1-10
- Enabling SANTap on the SSM, page 1-10
- Deploying SANTap, page 1-10

Task Flow for Configuring SANTap on SSM

Follow these steps to configure SANTap on SSM:

Step 1 Enable SANTap on the SSM.

Step 2 Deploy SANTap on the SSM.

Step 3 Configure DVTs on the SSM.

Enabling SANTap on the SSM

Restrictions

- Only one intelligent service can be configured on a single SSM.

Detailed Steps

To enable the SANTap feature, follow these steps:

	Command	Purpose
Step 1	`switch# config t` `switch(config)#`	Enters configuration mode.
Step 2	`switch(config)# ssm enable feature santap module` *num*	Enables the SANTap application on the entire SSM in the specified slot.
	`switch(config)# no ssm enable feature santap module` *num*	Disables the SANTap application on the entire SSM in the specified slot.

Deploying SANTap

Detailed Steps

To deploy SANTap, follow these steps:

Step 1 Identify the Storage Service Module (SSM) slot number.

```
switch# show module
Mod  Ports  Module-Type                       Model              Status
---  -----  --------------------------------- ------------------ ------------
1    16     1/2 Gbps FC/Supervisor            DS-X9216-K9-SUP    active *
2    32     Storage Services Module           DS-X9032-SMA       ok

Mod  Sw              Hw      World-Wide-Name(s) (WWN)
---  --------------  ------  --------------------------------------------------
1    4.1(1)          1.0     20:01:00:05:30:00:43:5e to 20:10:00:05:30:00:43:5e
```

```
2    4.1(1)          0.5     20:41:00:05:30:00:43:5e to 20:60:00:05:30:00:43:5e
Mod      Application Image Description       Application Image Version
-------- ----------------------------       -------------------------
2        SSI linecard image                 4.1(1)

Mod  MAC-Address(es)                        Serial-Num
---  -------------------------------------  ----------
1    00-0b-46-a1-a4-28 to 00-0b-46-a1-a4-2c  JAB065004G7
2    00-05-30-00-ad-12 to 00-05-30-00-ad-16  JAB070605MW
* this terminal session
```

Step 2 Verify that a SANTap license is installed.

```
switch# show license usage
Feature                      Ins  Lic   Status Expiry Date Comments
                                Count
--------------------------------------------------------------------------------
STORAGE_SERVICES_ENABLER_PKG  No    0   Unused             Grace 106D 18H
```

Step 3 Enable SANTap services on the SSM module.

```
switch(config)# ssm enable feature santap module number
```

Step 4 Check for SSM provisioning.

```
switch# show ssm provisioning
Module   Ports/Nodes       Application        Provisioning Status
----------------------------------------------------------
   7      1-32          santap          success
```

Step 5 Create two VSANs.

SANTap uses two VSANs: a Back-End VSAN (BE-VSAN) and a Front-End VSAN (FE-VSAN). The BE-VSAN includes all storage targets, RPAs, and the control virtual target (CVT). A FE-VSAN includes host initiators and the data virtual target (DVT), which is a virtual representation of a storage target.

Step 6 Create a CVT in the BE-VSAN.

```
switch(config)# santap module number appl-vsan number cvt-name name
```

Step 7 Create a DVT in the FE-VSAN.

You must create a DVT for each storage port that you want to replicate. You can create several DVTs in one FE-VSAN or create DVTs in different VSANs.

```
switch(config)# santap module number dvt target-pwwn pwwn target-vsan number dvt-name name
dvt-vsan number lun-size-handling 1
```

The BE-VSAN is zoned using the WWNs of the host initiator ports and the storage target ports. The same WWNs will be used in the FE-VSAN. Consequently, the back-end zoning scheme may be used for the FE-VSAN.

At this point, all I/O activity between the host and the target is relayed by SANTap. The I/Os are relayed from the actual host port in the FE-VSAN to the actual target port in the BE-VSAN via the DVT and the host port VI. This process has no impact to the hosts and is completely transparent.

Configuring DVTs on the SSM

Restrictions

- In Cisco SAN-OS Release 3.2(1) or NX-OS Release 4.1(x), SANTap supports 32 host initiators per DVT.

Detailed Steps

To configure a DVT, follow these steps:

	Command	Purpose
Step 1	`switch# config t` `switch(config)#`	Enters configuration mode.
Step 2	`switch(config)# santap module` *num* `dvt target-pwwn` *pwwn-id* `target-vsan` *vsan-id* `dvt-name` *name* `dvt-vsan` *vsan-id*	Configures the pWWN, target VSAN (which contains the target and VI), DVT name, and DVT VSAN (which contains the host and the CVT).
	`switch(config)# santap module` *num* `dvt target-pwwn` *pwwn-id* `target-vsan` *vsan-id* `dvt-name` *name* `dvt-vsan` *vsan-id* `dvt-port` *num*	Configures the pWWN, target VSAN, DVT name, DVT VSAN, and DVT port. **Note** SANTap has to be provisioned for the entire module 2. When using the **interface** command, it should be provisioned on interface fc1/1-4. If not, you will not be able to provide the dvt-port option. The DVT port maps to one of the ports on the SSM. You can assign a port for explicit load balancing or not assign a port, which allows the SSM to select the port and handle the load balancing (default).
	`switch(config)# santap module` *num* `dvt target-pwwn` *pwwn-id* `target-vsan` *vsan-id* `dvt-name` *name* `dvt-vsan` *vsan-id* `lun-size-handling` *num*	Configures the pWWN, target VSAN, DVT name, DVT VSAN, and LUN size handling flag (enabled). Enabling the LUN size handling flag allows special LUN resize handling by the vendor. The default LUN size handling flag value is 1 (enabled).
	`switch(config)# santap module` *num* `dvt target-pwwn` *pwwn-id* `target-vsan` *vsan-id* `dvt-name` *name* `dvt-vsan` *vsan-id* `io-timeout` *seconds*	Configures the pWWN, target VSAN, DVT name, DVT VSAN, and timeout value in seconds. The timeout determines the interval after which to time out I/Os on the target side. The range is 10 to 200 seconds and the default value is 10 seconds.
	`switch(config)# no santap module` *num* `dvt target-pwwn` *pwwn-id*	Removes the DVT configuration.

Configuring SANTap on the SSM Using DCNM-SAN

This section includes the following topics:

Creating a SANTap CVT SSM

Prerequisites

- You have to configure a logical port on a switch to create the CVT for SANTap. CVTs create the control path, which processes the SANTap service requests sent by an appliance. Before requesting the SANTap service, the appliance contacts the CVT, and specifies the initiator and the target for replicating the data flowing between them.

Detailed Steps

To create a SANTap CVT, follow these steps:

Step 1 Expand **Switches > End Devices**, and then select **Intelligent Features** from the Physical Attributes pane.

You see the FCWA tab in the Information pane.

Step 2 Click the **SANTap CVT** tab.

You see the SANTap configuration in the Information pane.

Step 3 Click **Create Row**.

You see the create SANTap CVT dialog box.

Step 4 Select the switch and the module on which you want to configure a SANTap CVT.

Note SANTap must be enabled and provisioned as a service on the SSM module of the selected switch.

Step 5 Select the VSAN ID in which you want to configure the SANTap CVT.

Step 6 Click **Create** to create this SANTap CVT.

Deleting a SANTap CVT SSM

Detailed Steps

To delete a SANTap CVT, follow these steps:

Step 1 Expand **End Devices**, and then select **Intelligent Features** from the Physical Attributes pane.

You see the FCWA tab in the Information pane.

Step 2 Click the **SANTap CVT** tab.

You see the SANTap configuration in the Information pane.

Step 3 Select the SANTap CVT that you want to delete.

Step 4 Click **Delete Row**.

You see the DCNM-SAN confirmation dialog box.

Step 5 Click **Yes** to proceed with the deletion or click **No** to discard the changes.

Creating a SANTap DVT SSM

Detailed Steps

To create a SANTap DVT, follow these steps:

Step 1 Expand **End Devices**, and then select **Intelligent Features** from the Physical Attributes pane.

You see the FCWA tab in the Information pane.

Step 2 Click the **SANTap DVT SSM** tab.

You see the SANTap configuration in the information pane.

Step 3 Click **Create Row**.

You see the create SANTap DVT SSM dialog box.

Step 4 Select the switch on which the SANTap DVT SSM will be configured.

Step 5 Select the **interface**. This is the port on the module where the DVT will be created.

Step 6 Select the VSAN ID in which you want to create the SANTap DVT SSM.

Step 7 Select the port WWN of the real target for which this corresponding DVT is being created. The DVT has the same port WWN as the target.

Step 8 Select the target VSAN ID for the VSAN of the real target for which this DVT is being created.

Note Uncheck the **Automatically Choose Interface** check box to select the interface.

Step 9 Assign a name to this SANTap DVT SSM.

Step 10 Check the **LunSizeHandling** check box if you want to use the real target LUN size for the virtual LUN or the maximum LUN size supported (2 TB).

Step 11 From the IOTimeout drop-down list, select the I/O timeout value for the DVT. The default value is 10 seconds.

Step 12 Click **Create** to create this SANTap DVT SSM.

Deleting a SANTap DVT SSM

Detailed Steps

To delete a SANTap DVT, follow these steps:

Step 1 Expand **End Devices**, and then select **Intelligent Features** from the Physical Attributes pane.

You see the FCWA tab in the information pane.

Step 2 Click the **SANTap DVT SSM** tab.

You see the SANTap configuration in the Information pane.

Step 3 Select the SANTap DVT that you want to delete.

Step 4 Click **Delete Row**.

You see the DCNM-SAN confirmation dialog box.

Step 5 Click **Yes** to proceed with the deletion or click **No** to discard the changes.

Configuring SANTap Multiservice Module Using the CLI

This section includes the following topics:

Task Flow to Configure SANTap on MSM-18/4 Module

Follow these steps to configure SANTap on the MSM-18/4 Module:

Step 1 Enable SANTap on the MDS 9222i switch and MSM-18/4 Modules.

Step 2 Deploy SANTap on the MSM-18/4 Module.

Step 3 Configure DVTs on the MDS 9222i switch and MSM-18/4 Modules.

Enabling SANTap on the MDS 9222i Switch and the MSM-18/4 Module

You will need a license to provision SANTap. Set the **boot ssi** value for module 1 (MDS 9222i Switch) and then reload the switch before you provision SANTap on Module 1.

SANTap can be enabled on an MDS 9222i Switch and an MSM-18/4 platform.

Enter the following command to enable SANTap on an Octeon-based Module:

```
switch(config)#
switch(config)#ssm enable feature santap module x
```

module x is where the MSM module is present.

Creating a SANTap CVT

You have to configure a logical port on a switch to create the CVT for SANTap. CVTs create the control path, which processes the SANTap service requests sent by an appliance.

Before requesting the SANTap service, the appliance contacts the CVT, specifies the initiator and the target for replicating the data flowing between them.

To create a CVT for SANTap on the Fibre Channel switch modules, follow these steps:

Step 1 Expand **Switches > End Devices,** and then select **Intelligent Features** from the Physical Attributes pane.

You see the FCWA tab in the Information pane.

Step 2 Click the **SANTap CVT** tab.

You see the SANTap configuration in the Information pane.

Step 3 Click **Create Row**.

You see the create SANTap CVT dialog box.

Step 4 Select the switch and the module on which you want to configure a SANTap CVT.

Note SANTap must be enabled and provisioned as a service on the SSM module of the selected switch.

Step 5 Select the VSAN ID in which you want to configure the SANTap CVT.

Step 6 Click **Create** to create this SANTap CVT.

Deleting a SANTap CVT

To delete a SANTap CVT, follow these steps:

Step 1 Expand **Switches > End Devices,** and then select **Intelligent Features** from the Physical Attributes pane.

You see the FCWA tab in the Information pane.

Step 2 Click the **SANTap CVT** tab.

You see the SANTap configuration in the Information pane.

Step 3 Select the SANTap CVT that you want to delete.

Step 4 Click **Delete Row**.

You see the DCNM-SAN confirmation dialog box.

Step 5 Click **Yes** to proceed with the deletion or click **No to discard the changes**.

Enabling SANTap on the SSM

The following command enables SANTap on the SSM:

```
switch(config)#
switch(config)# ssm enable feature santap module 1
```

Note SANTap can be enabled on SSM Module 2.

Deploying SANTap on the MSM-18/4

Detailed Steps

To deploy SANTap, follow these steps:

Step 1 Identify the MSM slot number.

```
switch# show module
Mod  Ports  Module-Type                       Model              Status
---  -----  --------------------------------- ------------------ ------------
1    22     4x1GE IPS, 18x1/2/4Gbps FC/Sup2   DS-X9222I-K9       active *

Mod  Sw              Hw      World-Wide-Name(s) (WWN)
---  --------------  ------  --------------------------------------------------
1    3.2(1a)         0.610   20:01:00:0d:ec:4a:c8:40 to 20:12:00:0d:ec:4a:c8:40
Mod      Application Image Description       Application Image Version
-------- ------------------------------      -------------------------
1        SSI linecard image (Packaged in SAN-OS) 3.2(1a)


Mod  MAC-Address(es)                         Serial-Num
---  --------------------------------------  ----------
1    00-17-5a-b5-6d-1c to 00-17-5a-b5-6d-24  JAE1123KB03
```

```
* this terminal session
```

Step 2 Verify that SANTap license is installed.

```
switch# show license usage
Feature                      Ins  Lic   Status Expiry Date Comments
                                Count
--------------------------------------------------------------------------------
FM_SERVER_PKG                 No    -   Unused             Grace expired
MAINFRAME_PKG                 No    -   Unused             -
ENTERPRISE_PKG                No    -   Unused             -
DMM_FOR_SSM_PKG               No    0   Unused             -
SAN_EXTN_OVER_IP              No    0   Unused             -
PORT_ACTIVATION_PKG           No    0   Unused             -
SAN_EXTN_OVER_IP_18_4         No    0   Unused             -
SAN_EXTN_OVER_IP_IPS2         No    0   Unused             -
SAN_EXTN_OVER_IP_IPS4         No    0   Unused             -
10G_PORT_ACTIVATION_PKG       No    0   Unused             -
STORAGE_SERVICES_ENABLER_PKG  No    0   Unused             Grace 117D 23H
switch# --------------------------------------------------------------------------------
```

Step 3 Enable SANTap services on the SSM module.

```
switch(config)# ssm enable feature santap module number
```

Step 4 Check for SSM provisioning.

```
switch# show ssm provisioning
Module   Ports/Nodes       Application        Provisioning Status
----------------------------------------------------------
  12      1-1           santap          success
```

Step 5 Create two VSANs.

SANTap uses two VSANs: a Back-End VSAN (BE-VSAN) and a Front-End VSAN (FE-VSAN). The BE-VSAN includes all storage targets, RPAs, and the control virtual target (CVT). A FE-VSAN includes host initiators and the data virtual target (DVT), which is a virtual representation of a storage target.

Step 6 Create CVT in the BE-VSAN.

```
switch(config)# santap module number appl-vsan number cvt-name name
```

Step 7 Create DVT in the FE-VSAN.

You must create a DVT for each storage port that you want to replicate. You may create several DVTs in one FE-VSAN or create DVTs in different VSANs.

```
switch(config)# santap module number dvt target-pwwn pwwn target-vsan number dvt-name name
dvt-vsan number lun-size-handling 1
```

The BE-VSAN is zoned using the WWNs of the host initiator ports and the storage target ports. The same WWNs will be used in the FE-VSAN. Consequently, the back-end zoning scheme may be used for the FE-VSAN.

At this point, all I/O activity between the host and the target is relayed by SANTap. The I/Os are relayed from the actual host port in the FE-VSAN to the actual target port in the BE-VSAN via the DVT and the host port VI. This process has no impact to the hosts and is completely transparent.

Configuring DVTs on the MDS 9222i Switch and MSM-18/4 Module

A data virtual target (DVT) is a logical target port that resides on the switch and is used to intercept traffic for a real target.

Restrictions

- Assigning a DVT to a different front-panel port is supported only on an SSM but not on an MDS 9222i Switch and MSM-18/4 Module. SANTap provisioning using the **interface** command is not supported on an SSM.
- In Cisco SAN-OS Release 3.2(1) or NX-OS Release 4.1(x), SANTap supports 32 host initiators per DVT.
- Do not use the **dvt-port** option for the MDS 9222i Switch and MSM-18/4 Module from the **dvt-port help** CLI.

Detailed Steps

To configure a DVT, follow these steps:

	Command	Purpose
Step 1	`switch# config t` `switch(config)#`	Enters configuration mode.
Step 2	`switch(config)# santap module num dvt target-pwwn pwwn-id target-vsan vsan-id dvt-name name dvt-vsan vsan-id`	Configures the pWWN, target VSAN (which contains the target and VI), DVT name, and DVT VSAN (which contains the host and the CVT).
	`switch(config)# santap module num dvt target-pwwn pwwn-id target-vsan vsan-id dvt-name name dvt-vsan vsan-id dvt-port num`	Configures the pWWN, target VSAN, DVT name, DVT VSAN, and DVT port. **Note** SANTap has to be provisioned for the entire module 2. When using the interface command, it should be provisioned on interface fc1/1-4. If not, you will not be able to provide the dvt-port option. The DVT port maps to one of the ports on the SSM. You can assign a port for explicit load balancing or not assign a port, which allows the SSM to select the port and handle the load balancing (default).
	`switch(config)# santap module num dvt target-pwwn pwwn-id target-vsan vsan-id dvt-name name dvt-vsan vsan-id lun-size-handling num`	Configures the pWWN, target VSAN, DVT name, DVT VSAN, and LUN size handling flag (enabled). Enabling the LUN size handling flag allows special LUN resize handling by the vendor. The default LUN size handling flag value is 1(enabled).
	`switch(config)# santap module num dvt target-pwwn pwwn-id target-vsan vsan-id dvt-name name dvt-vsan vsan-id io-timeout seconds`	Configures the pWWN, target VSAN, DVT name, DVT VSAN, and timeout value in seconds. The timeout determines the interval after which to time out I/Os on the target side. The range is 10 to 200 seconds and the default value is 10 seconds.
	`switch(config)# no santap module num dvt target-pwwn pwwn-id`	Removes the DVT configuration.

Configuring SANTap on the MSM-18/4 Using DCNM-SAN

This section includes the following topics:

Creating a SANTap DVT MSM

Detailed Steps

To create a SANTap DVT MSM, follow these steps:

Step 1 Expand **End Devices**, and then select **Intelligent Features** from the Physical Attributes pane.

You see the FCWA tab in the information pane.

Step 2 Click the **SANTap DVT MSM** tab.

You see the SANTap configuration in the information pane.

Step 3 Click **Create Row**.

You see the create SANTap DVT MSM dialog box.

Step 4 Select the switch on which the SANTap DVT MSM will be configured.

Step 5 Select the **interface**. This is the port on the module where the DVT will be created.

Step 6 Select the VSAN ID in which you want to create the SANTap DVT MSM.

Step 7 Select the port WWN of the real target for which this corresponding DVT is being created. The DVT has the same port WWN as the target.

Step 8 Select the target VSAN ID for the VSAN of the real target for which this DVT is being created.

Note Uncheck the **Automatically Choose Interface** check box to select the interface.

Step 9 Assign a name to this SANTap DVT MSM.

Step 10 Check the **LunSizeHandling** check box if you want to use the real target LUN size for the virtual LUN or the maximum LUN size supported (2 TB).

Step 11 From the IOTimeout drop-down list, select the I/O timeout value for the DVT. The default value is 10 seconds.

Step 12 Click **Create** to create this SANTap DVT MSM.

Deleting a SANTap DVT MSM

Detailed Steps

To delete a SANTap CVT, follow these steps:

Step 1 Expand **End Devices**, and then select **Intelligent Features** from the Physical Attributes pane.

You see the FCWA tab in the Information pane.

Step 2 Click the **SANTap CVT** tab.

You see the SANTap configuration in the Information pane.

Step 3 Select the SANTap CVT you want to delete.

Step 4 Click **Delete Row**.

You see the DCNM-SAN confirmation dialog box.

Step 5 Click **Yes** to proceed with the deletion or click **No** to discard the changes.

Deleting a SANTap DVT MSM

Detailed Steps

To delete a SANTap DVT MSM, follow these steps:

Step 1 Expand **End Devices**, and then select **Intelligent Features** from the Physical Attributes pane.

You see the FCWA tab in the information pane.

Step 2 Click the **SANTap DVT MSM** tab.

You see the SANTap configuration in the information pane.

Step 3 Select the SANTap DVT that you want to delete.

Step 4 Click **Delete Row**.

You see the DCNM-SAN confirmation dialog box.

Step 5 Click **Yes** to proceed with the deletion or click **No** to discard the changes.

Removing Appliance-Generated Entities

An appliance might terminate its SANTap application without removing generated entities on the MDS switch. This section describes how to remove these entities using the CLI on the MDS switch.

This section includes the following topics:

Removing AVTs and AVT LUNs

The AVT and AVT LUN configuration occasionally remains after a SANTap application terminates.

Detailed Steps

To remove AVTs and AVT LUNs, follow these steps:

	Command	Purpose
Step 1	`switch# show santap module num avt`	Displays the AVT pWWNs.
	`switch# show santap module num avtlun`	Displays the AVT pWWNs and LUNs

	Command	Purpose
Step 2	`switch# clear santap module num avt 2a:4b:00:05:30:00:22:25 lun 234456`	Removes a LUN from the AVT.
	`switch# clear santap module num avt 2a:4b:00:05:30:00:22:25`	Removes the AVT. **Note** You can remove the AVT only after all the LUNs are removed.

Removing SANTap Sessions

A SANTap session continues occasionally after a SANTap application terminates.

Detailed Steps

To remove a SANTap session, follow these steps:

	Command	Purpose
Step 1	`switch# show santap module 2 session`	Displays SANTap session information on the SSM in slot 2.
Step 2	`switch# clear santap module 2 session 1`	Removes SANTap session 1 on the SSM in slot 2.

Removing Initiator-Target-LUNs

The initiator-target-LUN (ITL) triplet identifies a LUN loaded on a DVT. The ITL configuration occasionally remains after a SANTap application terminates.

Detailed Steps

To remove all LUNs for an ITL triplet, follow these steps:

	Command	Purpose
Step 1	`switch# show santap module 2 dvtlun`	Displays the target and host pWWNs for the ITLs on the SSM in slot 2.
Step 2	`switch# clear santap module 2 itl target-pwwn 22:00:00:20:37:88:20:ef host-pwwn 22:00:00:20:37:88:20:ef`	Removes an ITL on the SSM in slot 2. **Note** The host port should be shut down before executing this command.

Migrating SANTap Switches

This section describes the SANTap migration procedures and the environments required for migrating SANTap from an existing switch, such as an MDS 9513 Director, to another switch, such as an MDS 9216 Switch. The chapter also discusses how to move a host from a dedicated data path processor (DPP) to a different DPP.

This section includes the following topics:

- Moving a Host from a Dedicated DPP to a Different DPP, page 1-25

Migrating the Switches

Detailed Steps

To complete the migration procedure, follow these steps:

Step 1 Shut down the host port connecting to MDS-2.

Step 2 Shut down the storage port connecting to MDS-2.

Step 3 Clear all ITL sessions associated and AVT and AVT LUNs. Use the following command to clear all ITLs:

```
switch# clear santap module slot-number {avt avt-pwwn [lun avt-lun] | itl target-pwwn
host-pwwn | session session-id}
```

Step 4 Delete the relevant SANTap and splitter configuration of MDS-2 from the appliance.

Step 5 Delete DVT from MDS-2.

```
switch# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
switch(config)# no santap module num dvt target-pwwn pwwn
```

Step 6 Delete CVT from MDS-2.

```
switch# conf t
Enter configuration commands, one per line. End with CNTL/Z.
switch(config)# no santap module num appl-vsan ID
```

At this point, all MDS-2 associated DVTs, CVTs, AVT and AVT LUNs are deleted.

Step 7 Clear all persistent SANTap information from the SSM module. Use the **clear ssm-nvram santap module 1** command.

This command will purge all SANTap information for the SSM in slot 1.

Step 8 Unprovision the SANTap feature on MDS-2. Use the following command to unprovision SANTap:

```
switch# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
switch(config)# no ssm enable feature santap module num
switch(config)# end
```

Verify that the SANTap feature is unprovisioned from MDS-2:

```
switch# show ssm provisioning
Module   Ports/Nodes       Application        Provisioning Status
----------------------------------------------------------
   7      1-32          santap          success
```

Step 9 Power off the SSM module. The module is ready to be swapped over to the MDS 9216 chassis.

This completes the necessary steps on the MDS-2 switch. Ensure that the appropriate cable is connected to the MDS 9216 chassis.

Configuring the Replacement Chassis

Detailed Steps

To configure the replacement MDS 9216 chassis (new MDS-2), follow these steps:

Step 1 Insert the SSM card removed from the MDS 9513 chassis and finish initial configuration of the switch.

Step 2 Ensure that the correct SAN-OS or NX-OS release SSI image is loaded on the switch.

Step 3 Install the license. An SSE license is required for the new chassis.

Step 4 Complete cable connection from the hosts, targets and the appliance to the new switch.

Step 5 Reconfigure SANTap on the new MDS 9216.

Refer to the "Deploying SANTap" section to reconfigure the new MDS 9216 chassis.

After reconfiguration, ensure that the appliance communicates to the new MDS-2 switch, and follow the same procedure to swap the Fabric A on the MDS-1 switch.

Moving a Host from a Dedicated DPP to a Different DPP

Restrictions

- Follow this procedure only if advised by Cisco Technical Support.

Detailed Steps

To move a dedicated DPP to a different DPP, follow these steps:

Step 1 Shut down the Host Fibre Channel interface on the switch.

Step 2 Shut down the Target Fibre Channel interface on the switch.

Step 3 Delete the DVT associated to the host-target pair.

```
switch# conf t
Enter configuration commands, one per line. End with CNTL/Z.
switch(config)# no santap module num dvt target-pwwn pwwn
```

Step 4 Clear the related SANTap information for that host-target pair and reload the SSM module.

```
switch(config)# clear santap module slot-number {avt avt-pwwn [lun avt-lun] | <itl
target-pwwn host-pwwn | session session-id}
```

Step 5 Reload the SSM module.

```
switch# reload module X
```

X is the SSM module number.

Step 6 Verify that the virtual entries purged in step 3 and 4 are not present after the module reload.

Step 7 Create a DVT on the DPP, using the **dvt-port** *num* option.

```
switch# santap module num dvt target-pwwn pwwn target-vsan vsan-id dvt-name name dvt-vsan
vsan-id dvt-port num
```

This will place the new DVT on DPP 4.

Step 8 Verify the new DVT gets created in the appropriate DPP by using the **show isapi virtual-nport database** command.

Step 9 Complete the remaining SANTap configuration to establish communication with the appliance.

For more information, refer to the "Deploying SANTap" section.

Verifying the SANTap Configuration

Displaying SANTap Information

Use the **show santap module** command to display information about SANTap (see Example 1-1 to Example 1-6).

Example 1-1 Displays SANTap CVT Information

```
switch# show santap module 2 cvt

CVT Information :
        cvt pwwn     = 23:4f:00:0d:ec:09:3c:02
        cvt nwwn     = 23:9d:00:0d:ec:09:3c:02
        cvt id       = 135895180
        cvt xmap_id  = 135895212
        cvt vsan     = 8
        cvt name     = MYCVT
```

Example 1-2 Displays SANTap DVT Information

```
switch# show santap module 2 dvt

DVT Information :
       dvt pwwn     = 50:06:0e:80:03:81:32:36
       dvt nwwn     = 50:06:0e:80:03:81:32:36
       dvt id       = 136773180
       dvt mode     = 3
       dvt vsan     = 12
       dvt if_index = 0x1080000
       dvt fp_port  = 1
       dvt name     = MYDVT
       dvt tgt-vsan = 9
       dvt io timeout            = 10 secs
       dvt lun size handling     = 0
       dvt app iofail behaviour  = 1
       dvt quiesce behavior      = 1
       dvt tgt iofail behavior   = 0
       dvt appio failover time   = 50 secs
       dvt inq data behavior     = 0
```

Example 1-3 Displays SANTap DVT LUN Information

```
switch# show santap module 2 dvtlun

 DVT LUN Information :
```

```
        dvt pwwn     = 22:00:00:20:37:88:20:ef
        dvt lun      = 0x0
        xmap id      = 8
        dvt id       = 3
        dvt mode     = 0
        dvt vsan     = 3
        tgt pwwn     = 22:00:00:20:37:88:20:ef
        tgt lun      = 0x0
        tgt vsan     = 1
```

Example 1-4 Displays SANTap Session Information

```
switch# show santap module 2 session
Session Information :
        session id   = 1
        host pwwn     = 21:00:00:e0:8b:12:8b:7a
        dvt pwwn     = 50:06:0e:80:03:81:32:36
        dvt lun      = 0x0
        tgt pwwn     = 50:06:0e:80:03:81:32:36
        tgt lun      = 0x0
        adt pwwn     = 33:33:33:33:33:33:33:00
        adt lun      = 0x0
        aci pwwn     = 22:22:22:22:22:22:22:22
        cvt pwwn     = 23:4f:00:0d:ec:09:3c:02
        num ranges   = 0
        session state = 5
        redirect mode = 0
        mrl requested 1
        MRL : vsan 8 RegionSize 4806720, DiskPWWN 0x234f000dec093c02, DiskLun 0x 1,
startLBA 1

        pwl requested 1
        PWL : type 2, UpdatePol 2, RetirePolicy 4, pwl_start 1

        iol requested 0
```

Example 1-5 Displays SANTap AVT Information

```
switch# show santap module 2 avt

 AVT Information :
        avt pwwn     = 2a:4b:00:05:30:00:22:25
        avt nwwn     = 2a:60:00:05:30:00:22:25
        avt id       = 12
        avt vsan     = 4
        avt if_index = 0x1080000
        hi pwwn      = 21:00:00:e0:8b:07:61:aa
        tgt pwwn     = 22:00:00:20:37:88:20:ef
        tgt vsan     = 1
```

Example 1-6 Displays SANTap AVT LUN Information

```
switch# show santap module 2 avtlun

 AVT LUN Information :
        avt pwwn     = 2a:4b:00:05:30:00:22:25
        avt lun      = 0x0
        xmap id      = 16
        avt id       = 12
        tgt lun      = 0x0
```

Additional References

For additional information related to implementing SANTap, see the following sections:

Related Documents

Related Topic	Document Title
SANTap DVT Interoperability Support Matrix	The SANTap DVT Interoperability Support Matrix is located in the SANTap section of the Cisco Data Center Interoperability Support Matrix.
SANTap Compatibility with Storage Service Interface Images	For compatibility information between SANTap, Cisco MDS SAN-OS software releases, and Storage Service Interface (SSI) releases, refer to the Cisco MDS SAN-OS Release Compatibility Matrix for Storage Service Interface Images.

MIBs

MIBs	MIBs Link
• CISCO-SANTAP-MIB	The Cisco SANTap MIB provides an SNMP interface to create and delete a SANTap Control Virtual Target (CVT) and a Data Virtual Target (DVT). For more information on the SANTap MIB, refer to the *Cisco MDS 9000 Family MIB Quick Reference.* To locate and download MIBs, go to the following URL: http://www.cisco.com/dc-os/mibs

CHAPTER 2

Troubleshooting SANTap

This chapter describes how to identify and resolve problems that might occur when implementing SANTap. This chapter includes the following sections:

Note SANTap is not supported in SAN-OS Release 3.3(1).

SANTap Architecture Troubleshooting Best Practices

The Cisco SANTap service provides a level of availability that cannot be achieved with an appliance in the data path between a host and storage. By removing that appliance from the data path, the SANTap service enables a significantly more reliable solution than an appliance could offer because the primary data path between host and storage is independent of the appliance.

Enhanced Availability

If a SANTap-enabled appliance fails, data continues to flow between host and storage. This level of availability may be suitable for data migration, which is generally not mission critical, but not for continuous data protection. Redundant components can be used when deploying the SANTap service in the same way they are used with building fabrics.

Best Practices

The following hardware may be added to enhance the availability of SANTap-enabled applications:

- Redundant SANTap-connected partner appliances to the same fabric. The SANTap service can provide functionality to redundant SANTap connected appliances.
- Redundant SSMs within the same director.
- Redundant switches or directors which have multi-homed SANTap appliances.
- Multiple links between hosts and storage devices.

Multipathing Drivers and Software

The SANTap service enables hosts to see storage through the service as if the service were transparent. For instance, if a particular storage subsystem is attached and being serviced by SANTap, the same communication between host and storage device is uninhibited by the SANTap service. This transparency allows multipathing software to use multiple paths through separate fabrics, even when the SANTap service is enabled on that storage path. A configuration with multipathing software can even be nondisrputively migrated to use the SANTap service by failing over to a single fabric, adding the service to the fabric, failing back to the SANTap enabled fabric, and upgrading the other fabric.

Scaling SANTap

The SANTap service scales linearly by adding additional Service Nodes to the fabric. There is no limit to the number of Service Nodes that can be added to a fabric. Additional SANTap appliances may need to be added. Check with the SANTap partner for specifications on how many devices their appliances can support.

LUN Mapping and LUN Masking Considerations

LUN masking is an access control method that a storage device uses to restrict or permit access to volumes of data, or LUNs (logical unit numbers). The device has a list of hosts, typically identified by worldwide names (WWN), which are allowed to access particular LUNs on the storage device. LUN mapping generally incorporates the LUN masking function, but also adds a reference to a volume that is specific to the host accessing the data. For instance, host A and host B connect to the same port on a storage device. If both of these hosts want to access a volume identified as LUN 0 on the storage device, LUN masking either permits or denies the hosts access to this same volume.

LUN mapping provides an additional layer to actually associate a request from host A for LUN 0 to a different internal volume than a request from host B for LUN 0. Some vendors may have brand names for LUN mapping such as LUN Security or AccessLogix.

The SANTap service was designed in such a way that LUN masking and LUN mapping on a storage device never needs to be changed when SANTap is introduced into the fabric. The SANTap-enabled appliance can send and receive traffic through the virtual initiator, using the virtual initiator's WWN, which eliminates changes required on the storage device. Some SANTap vendors have not implemented this feature and may require changes to LUN masking and LUN mapping to overcome these limitations. Consult the SANTap vendor's documentation regarding any configuration changes that may be required on the storage device.

Best Practices

A common problem when configuring the SANTap service is that a host may be unable to see a LUN that is being serviced by SANTap.

This problem is most likely caused by zoning issues. The best way to configure SANTap is using an incremental process, whereby zoning is checked after the completion of each configuration step. In some instances, it may be practical to enable the default zone set policy in a VSAN to be set to permit to see if the problem is related to zoning. However, never use this method to troubleshoot zoning problems if any critical data resides on storage that is attached to that fabric. Doing so could cause data corruption.

Securing SANTap Using VSANs and Zoning

SANTap entities are presented as virtual devices into the SAN. They are placed into VSANs and send and receive SCSI commands over Fibre Channel, just as any other target or host. Because of these common characteristics that virtual devices share with real devices, they are managed in the same way as real devices. Namely, they are placed into VSANs, which provides fabric isolation, and placed into zones, which isolates communication between the devices.

Best Practices

The most effective way to ensure the security of the fabric is to follow the general best practices of security for both the fabric and management interfaces. Treat SANTap virtual devices as any other devices and incrementally zone the devices as they are added to the fabric. An incremental zoning approach aids in determining which devices are actually the virtual devices that were just added to the fabric. Never rely on a default zone permit communication between devices because this provides no access control when additional devices are added to the fabric.

Treat appliances and virtual devices just as any other device and zone these devices as they are added. Although some SANTap vendors may encourage short-cutting these processes, the additional care ensures the integrity of the fabric in case of error or misconfiguration.

HP-UX for Persistent FCID Limitations in SANTap

With HP-UX 11i v2 and earlier, when you map to an SCSI device, you can use the controller ID, target ID and the LUN ID to build the device filename. For example, if controller is 5, target is 1 and LUN is 0, and the device filename will be /dev/dsk/c5t1d0.

If there is a change in the FC ID and the controller or the target ID, then the device filename changes. This change will cause HP-UX to not to be able to see the target device that was used before the change.

A possible cause of the FC ID change is reloading the switch. By default, the switch assigns the same FC ID to a device. However, if the switch is rebooted, the pWWN/FC ID mapping database is not maintained.

Solution

By enabling persistent FC IDs, this database will be persistent across reboots, and the device name will not change if the switch reloads.

Figure 2-1 shows another case of FC ID change.

Figure 2-1 HP-UX for Persistent FCID Limitations

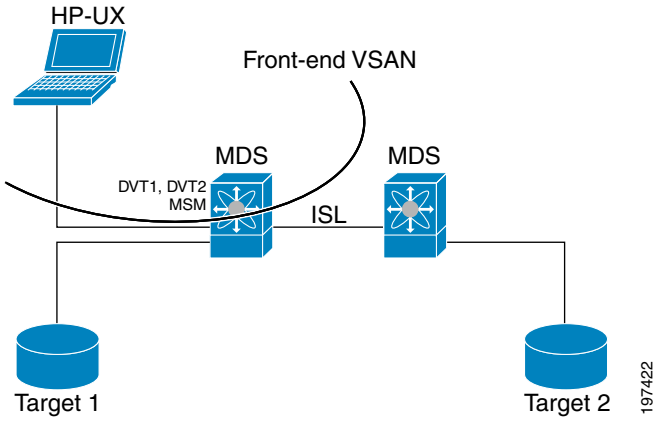


Figure 2-1 shows one path from the host to access the two target devices from two different switches in a same fabric.

If both switches have an MSM-18/4 line card, then you can maintain the same FC ID between the virtual target and the real target.

For HP-UX to see the same target devices, follow these steps:

1. Create a DVT VSAN from each switch by using the same domain ID.
2. Create a persistent FC ID that matches the target's FC ID in the VSAN where the physical target resides.
3. Move the host connection to DVT VSAN to see the same target devices.

If there is only one MSM-18/4 in Switch1, then the persistent FC ID for Target 2 cannot be used because the domain ID of Switch 1 is different from the domain ID of Target 2. When moving the host to DVT VSAN, the DVT2 FC ID is different from the Target 2 FC ID, and the HP-UX host does not see the target device anymore.

Solution

HP-UX 11i v3 introduces the Agile Addressing feature which replaces the device file named /dev/dsk/c5t1d0 with /dev/dsk/disk1 to its hardware path. The changes in the hardware path do not affect the device name.

Design Considerations

Devices connected to legacy switches leverage intelligent applications on the Cisco MDS 9000 Family without requiring the storage and hosts to be directly connected to the Cisco MDS 9000 Director. Some limitations of legacy switches must be considered when adding them to a SANTap design.

Transparent mode is the simpler of the two modes to use for connecting legacy fabrics. The same design considerations apply when using modern directors and switches as well as using legacy switches, namely that either the hosts or disks must be connected directly to the SSM running the SANTap service.

Limitations

The SANTap feature has the following limitations:

- An appliance cluster can have only one target VSAN.
- In the SANTap setup, the real host and real target cannot be in an IVR zone. An IVR zone can only be created between the real host and a SANTap DVT (SANTap virtual target for the real target).

Basic Troubleshooting

This section describes the basic troubleshooting tasks that you can perform, and includes the following topics:

Troubleshooting Checklist

Troubleshooting a SANTap problem involves gathering information about the configuration and connectivity of the various SANTap components. To begin your troubleshooting activity, use the following checklist:

Checklist	Check
Verify licensing requirements. See *Fabric Configuration Guide, Cisco DCNM for SAN*.	☐
Verify that SANTap is enabled on the SSM module of the selected switch.	☐
Verify the VSAN configuration and zones for the appliance, using the configuration and verification tools for the specific appliance.	☐
Verify the physical connectivity for any problem ports or VSANs.	☐
Verify the ports connected to the RPA are operationally up.	☐

Using DCNM-SAN for Troubleshooting

Use the following DCNM-SAN procedures to verify the VSAN configuration for the SANTap components:

- Choose **Fabric*xx* > VSAN*xx*** to view the VSAN configuration in the Information pane.
- Choose **Fabric*xx* > VSAN*xx*** and select the **Host** or **Storage** tab in the Information pane to view the VSAN members.

Using the CLI for Troubleshooting

Use the **show santap module** command to display information about SANTap.

The following examples show the kind of information you can collect with the **show santap module** command.

Example 2-1 Display SANTap CVT Information

```
switch# show santap module 2 cvt

CVT Information :
        cvt pwwn      = 23:4f:00:0d:ec:09:3c:02
        cvt nwwn      = 23:9d:00:0d:ec:09:3c:02
        cvt id        = 135895180
        cvt xmap_id   = 135895212
        cvt vsan      = 8
        cvt name      = MYCVT
```

Example 2-2 Display SANTap DVT Information

```
switch# show santap module 2 dvt

DVT Information :
       dvt pwwn        = 50:06:0e:80:03:81:32:36
       dvt nwwn        = 50:06:0e:80:03:81:32:36
       dvt id          = 136773180
       dvt mode        = 3
       dvt vsan        = 12
       dvt if_index    = 0x1080000
       dvt fp_port     = 1
       dvt name        = MYDVT
       dvt tgt-vsan    = 9
       dvt io timeout                = 10 secs
       dvt lun size handling         = 0
       dvt app iofail behaviour      = 1
       dvt quiesce behavior          = 1
       dvt tgt iofail behavior       = 0
       dvt appio failover time       = 50 secs
       dvt inq data behavior         = 0
```

Example 2-3 Display SANTap DVT LUN Information

```
switch# show santap module 2 dvtlun

DVT LUN Information :

       dvt pwwn       = 22:00:00:20:37:88:20:ef
       dvt lun        = 0x0
       xmap id        = 8
       dvt id         = 3
       dvt mode       = 0
       dvt vsan       = 3
       tgt pwwn       = 22:00:00:20:37:88:20:ef
       tgt lun        = 0x0
       tgt vsan       = 1
```

Example 2-4 Display SANTap Session Information

```
switch# show santap module 2 session

Session Information :

    session id    = 1
    host pwwn     = 21:00:00:e0:8b:12:8b:7a
    dvt pwwn      = 50:06:0e:80:03:81:32:36
    dvt lun       = 0x0
    tgt pwwn      = 50:06:0e:80:03:81:32:36
    tgt lun       = 0x0
    adt pwwn      = 33:33:33:33:33:33:33:00
    adt lun       = 0x0
    aci pwwn      = 22:22:22:22:22:22:22:22
    cvt pwwn      = 23:4f:00:0d:ec:09:3c:02
    num ranges    = 0
    session state = 5
    redirect mode = 0
    mrl requested 1
    MRL : vsan 8 RegionSize 4806720, DiskPWWN 0x234f000dec093c02, DiskLun 0x 1, startLBA 1

    pwl requested 1
    PWL : type 2, UpdatePol 2, RetirePolicy 4, pwl_start 1

    iol requested 0
```

Example 2-5 Display SANTap AVT Information

```
switch# show santap module 2 avt

AVT Information :
      avt pwwn       = 2a:4b:00:05:30:00:22:25
      avt nwwn       = 2a:60:00:05:30:00:22:25
      avt id         = 12
      avt vsan       = 4
      avt if_index   = 0x1080000
      hi pwwn        = 21:00:00:e0:8b:07:61:aa
      tgt pwwn       = 22:00:00:20:37:88:20:ef
      tgt vsan       = 1
```

Example 2-6 Display SANTap AVT LUN Information

```
switch# show santap module 2 avtlun

AVT LUN Information :
      avt pwwn       = 2a:4b:00:05:30:00:22:25
      avt lun        = 0x0
      xmap id        = 16
      avt id         = 12
      tgt lun        = 0x0
```

Use the following commands to display more advanced troubleshooting information for SANTap:

- **show tech-support**
- **show santap module 2 tech-support**
- **show isapi tech-support**
- **show santap vttbl dvt** *dvt-pwwn*

Using Messages, Logs, and Databases

The following log files and databases can provide helpful information when troubleshooting SANTap problems:

- Look for SSM_CRIT in Supervisor syslog messages.
- Obtain the SANTap logs by using the **show isapi tech-support** CLI command. Search for the strings "Error" and "failed" or "failure."
- Review the FCNS and FLOGI databases by using the **show fcns** and **show flogi** CLI commands.

SANTap Technical Support

To collect SANTap technical support information, first attach to the module by entering the **attach module** command, and then enter the **show isapi tech-support santap file cisco** command:

```
switch# attach module 13
Attaching to module 13 ...
To exit type 'exit', to abort type '$.'
Bad terminal type: "ansi". Will assume vt100.
module-13# show isapi tech-support santap file cisco
Re-directing tech support information to file: cisco
```

SANTap technical support logs collected through this command are stored in the module's modflash modflash://modnumber-1. It includes iSAPI technical support and the outputs of the **show debug santap event-history** and **show santap tech-support** commands. The two outputs are not present in ISAPI technical support, and are not collected after a DPP crash.

The size of the modflash is limited to approximately 60 MB in NX-OS 4.1(x). If the size of the output file is greater than the space that remains on modflash, an unusable truncated file is created. To ensure that the SANTap technical support file is created in the modflash correctly, at least 20 MB of free space should be available before issuing the CLI command. Ensure that you copy the technical support file after collecting the technical support logs, and then delete the file from the modflash.

ISAPI technical support logs collected using the **show isapi tech-support file** *filename* command are stored in the line card log directory log://*modnumber* on the line card.

The size of the log directory is also limited to 180 MB. At least 20 MB free space should be available in the log directory before collecting the iSAPI technical support logs, and the file should be copied and deleted from the log directory once the process is complete.

To copy and delete files from the modflash and log directories on the line card, use the following commands:

- **copy log**://*module>/file name target fs*

(Issued on the supervisor module) Copies the iSAPI technical support file from /var/log/external.

- **copy modflash**://*module>-1/file name target fs*

(Issued on supervisor module) Copies the SANTap iSAPI technical support file from /mnt/cf/partner.

- **clear debug-logfile** *filename*

(Issued on module) Deletes the log files in /var/log/external.

- **delete modflash**://*module-1/filename*

(Issued on supervisor module) Deletes the log files in /mnt/cf/partner.

SANTap Issues

This section describes SANTap issues and includes the following topics:

Host Login Problems

Host login problems can be caused by DVT limitations, connectivity, or other issues.

To diagnose host login problems, follow these steps:

Step 1 Use the **show santap vttbl dvt** *dvt-pwwn* command to display SANTap information for the DVT.

Step 2 Use the **show santap vttbl dvt** *dvt-pwwn* **host** *host-pwwn* command to display SANTap information for the DVT and the host.

Step 3 Enable logging on the appropriate SSM module.

Step 4 Enter the following debug commands:

- **debug vsd vfc-felogin**
- **debug partner 0x92810000 d1**
- **debug partner 0x92810000 d2**
- **no debug partner 0x92810000 d3**

To turn off debug logs, enter the following command:

- **no debug all**

Note The debug logs need to be turned on only when necessary or as part of troubleshooting with Cisco TAC.

Step 5 Review the logs to determine the problem, and then take the appropriate corrective action.

Enabling ISAPI Log Collection and Debug Information

To collect logs, use these commands:

```
show tech-support details
show santap module X tech-support
show ssm-nvram santap module X
attach module x
     show isapi tech-support
```

```
show isapi dpp all queue
```

To obtain iSAPI debug information, use these commands:

```
attach mod x
debug dpp logfile debugdpp
debug dpp instance all
debug dpp level 7
debug dpp control
debug dpp exception
```

To turn off debug information, use this command:

```
no debug dpp all
```

To clear the debug DPP log files, use these commands:

```
attach mod x
clear debug-logfile debugdpp.1
clear debug-logfile debugdpp.2
clear debug-logfile debugdpp.3
clear debug-logfile debugdpp.4
clear debug-logfile debugdpp.5
clear debug-logfile debugdpp.6
clear debug-logfile debugdpp.7
clear debug-logfile debugdpp.8
```

Note The debug logs need to be turned on only when necessary or as part of troubleshooting with Cisco TAC.

ITL Problems

An initiator target LUN (ITL) problem may occur if the number of ITLs exceeds the limitations for the release of Cisco SAN-OS or NX-OS and SSI in use. For specific ITL limitations, see the "Scaling SANTap" section on page 2-2.

To diagnose and resolve ITL problems, follow these steps:

Step 1 Use the show **isapi dpp 4 queue** command to display DPP queue information.

Step 2 Verify that the number of ITLs on a DPP is within the limitations for the release of Cisco SAN-OS or NX-OS and SSI in use. Use the **show isapi dpp 4 queue | incl LUN** and **show isapi dpp 4 queue | count** commands.

Step 3 Verify that the number of ITLs on an SSM is within the limitations for the release of Cisco SAN-OS or NX-OS and SSI in use. Enter the **show isapi dpp all queue** command, using the **incl LUN** and **count** parameters.

Common Mismatch Problems

Problems are often caused by mismatching component versions, or using devices that are not supported by the interoperability matrix.

Table 2-1 lists the common mismatch situations.

Table 2-1 Common SANTap Mismatch Problems

Problem	Description
Version mismatch between the SSM and the RPA.	The version of SSM and the version of the replication appliance are not compatible.
Version mismatch between the supervisor and the SSI image.	The version of the supervisor and the SSI image are not compatible.
Hosts, targets, HBAs, or switches are not supported by the interoperability matrix.	Review the Cisco SANTap interoperability matrix at http://www.cisco.com/en/US/products/ps5989/products_device_support_tables_list.html.
CVT is in the host VSAN.	The CVT is the portal through which the appliance communicates with SANTap, and cannot be in the host VSAN.
IVR and SANTap are being used together.	In the SANTap setup, the real host and real target cannot be in IVR zone. IVR zone can only be created between real host and SANTap DVT (SANTap virtual target for the real target)
VIs in a DVT VSAN (CVT and DVT in the same VSAN).	This results in the creation of one CPP VI and eight DPP VIs in the DVT VSAN. The VIs attempt to log in to DVT, resulting in nondeterministic behavior.

Table 2-1 Common SANTap Mismatch Problems (continued)

Problem	Description
Overprovisioning, including: • Too many ITLs per SSM • Too many hosts per DVT • Too many ITLs per DPP	When replication is enabled, AVT LUNs are created, and that can increase the ITL count over the limit. (See "Scaling SANTap" section on page 2-2.) If Reservation Support is not enabled on the Recovery Point Application (RPA): • 26 AVT LUNs are created at a time. • The appliance completes recovery of these LUNs, and then deletes them before creating more. • This behavior does not significantly increase the ITL count. If Reservation Support is enabled on the RPA: • All AVT and AVT LUNs are permanently created. • In RPA 2.3, only half the appliance posts are zoned with AVTs. This does not increase the ITL count significantly. • In RPA 2.4, all appliance ports are zoned with AVTs. This behavior **can** increase the ITL count significantly.
Same pWWN occurs more than once in the same VSAN.	Misconfiguration can result in two DVTs (or two VIs) with the same WWN in the same VSAN. For example, assume that two DVTs are created on different SSMs or on different DPPs. Both of these DVTs have the same back-end VSAN. When a host HBA logs into both DVTs, an attempt is made to create two VIs with the same WWN in the same back-end VSAN. This results in nondeterministic behavior.
A host is moved from the front-end VSAN to the back-end VSAN.	There is a VI in the back-end VSAN with the same pWWN as the host. Before you can move the host: • Shut the host port. • Purge to remove VI from the back-end VSAN. The host can now be safely moved.

Table 2-1 Common SANTap Mismatch Problems (continued)

Problem	Description
Inaccurate zoning.	Zoning solutions differ based on the Cisco SAN-OS or NX-OS and SSI versions in use. • With SSI 3.0(2j), you must have default zoning in the back-end VSAN, or zone the target and VIs together in the back-end VSAN. • With SSI 3.1(2), only the host VI and target need to be zoned together in the back-end VSAN.
Adding and removing hosts without performing a purge.	If you have 16 hosts and you remove one and add another, the new host will not see the LUNs. In this situation, perform a purge to clear one of the 16 entries after removing the host. Then you can add the new host to the DVT.

Troubleshooting General Issues

This section describes some general SANTap troubleshooting issues.

SSM_CRIT in the Supervisor syslog Messages

You might see SSM_CRIT errors, which indicate the following problems:

- ITL count per DPP exceeded

```
 %ISAPI-SLOT2-2-SSM_CRIT: Error: Commit failed, number of ITLs exceeded limit for the DPP.
token = 3
```

- Too many LUNs for an IT pair

```
 %ISAPI-SLOT2-2-SSM_CRIT: Error : SCAN_FSM_0x83f978c_0 : hi_wwn[210000e08b926292]
vt_wwn[50060e8003813236] : Too many LUNs
 %ISAPI-SLOT2-2-SSM_CRIT: Error : 16 LUNS installed
```

- Too many hosts logging into DVT

```
 %ISAPI-SLOT2-2-SSM_CRIT: Error : 16 hosts are already logged in the DVT.
 %ISAPI-SLOT2-2-SSM_CRIT: Error : New [host=0x10000000c93f9021] trying to log in to
[dvt=0x50060e8003813236]
```

iSAPI Technical Support has SANTap Logs

You can examine the SANTap Logs in iSAPI Technical Support and do the following actions:

- Search for errors.
- Search for failed and failure.
- Check FCNS database.
- Check FLOGI database.

Host Login Problems

In case of host login problems, use the following commands:

```
module-2# show santap vttbl dvt dvt_pwwn

module-2# show santap vttbl dvt dvt_pwwn host host_pwwn
```

To enable the log, use the following commands:

```
module-2# debug vsd vfc-felogin
module-2# debug partner 0x92810000 d1
module-2# debug partner 0x92810000 d2
```

To turn off debug log, use the following commands:

```
module-2# no debug vsd vfc-felogin
module-2# no debug partner 0x92810000 d1
module-2# no debug partner 0x92810000 d2
module-2# debug vsd vfc-felogin
module-2# debug partner 0x92810000 d1
module-2# no debug all
```

ITL Problems

To check the ITLs, use this command:

```
module-2# show isapi dpp 4 queue
```

To check the number of ITLs on a DPP, use this command:

```
module-2# show isapi dpp 4 queue | incl LUN | count
```

To check the number of ITLs on an SSM, use this command:

```
module-2# show isapi dpp all queue | incl LUN | count
```

Configuration Errors

The following are some of the common configuration errors:

- Version mismatch between the SSM and appliance
- Version mismatch between the supervisor and SSI image
- Overprovisioning
- Too many ITLs per SSM
- Too many hosts per DVT
- Too many ITLs per DPP
- Not supported by interoperability matrix
- CVT in host VSAN
- Using IVR and SANTap together
- Same pWWN occurs twice in one VSAN
- Moving the host from front-end VSAN to back-end VSAN
- VIs in DVT VSAN
- Inaccurate zoning

CVT and DVT in the Same VSAN

When a CVT and DVT are in the same VSAN, the result is that one CPP VI and eight DPP VIs get created in a DVT VSAN. The VIs attempt to log in to DVT, which results in nondeterministic behavior.

Duplicate WWNs in the Same VSAN

Configuration errors can lead to duplicate WWNs in the same VSAN. This can lead to either of the two scenarios:

- Two DVTs with the same WWN in the same VSAN
- Two VIs with the same WWN in the same VSAN

Duplicate VIs

Duplicate VIs are created due to these configuration errors:

- Two DVTs are created on different SSMs or on different DPPs.
- The DVTs have the same back-end VSAN.

- A host HBA logs in to both DVTs.
- An attempt is made to create two VIs with same WWN in the same back-end VSAN.

This results in nondeterministic behavior.

Moving the Host

Moving the host from a front-end VSAN to a back-end VSAN creates the following problems:

- A VI is in the back-end VSAN.
- VI pWWN is the same as host pWWN.
- After shutting the host port, a purge has to be done to remove the VI in the back-end VSAN.

Now the host can be moved to the back-end VSAN.

Adding and Removing Hosts

Note If you remove a host and add another host, the new host will not see the LUNs.

After removing the host, a purge has to be done. One of the entries created is cleared, which enables the new host to log in to the DVT.

Interoperability Matrix

- Always make sure that the hosts, targets, HBAs and switches have been certified by Cisco.
- Cisco publishes a SANTap Interoperability Matrix, which is different from the Layer 2 Interoperability Matrix.

APPENDIX A

SANTap CLI Command Reference

The Cisco MDS SANTap feature provides CLI commands that support scripting and advanced operations.

This appendix contains a list of alphabetically arranged commands that are unique to Cisco MDS SANTap.

clear santap module

To clear SANTap information, use the **clear santap module** command.

clear santap module *slot-number* {**avt** *avt-pwwn* [**lun** *avt-lun*] | **itl** *target-pwwn host-pwwn* | **session** *session-id*}

Syntax Description

slot-number	Specifies the Storage Services Module (SSM) module number. The range is 1 through 13.
avt *avt-pwwn*	Removes the appliance virtual target (AVT) pWWN. The format is *hh:hh:hh:hh:hh:hh:hh:hh*.
lun *avt-lun*	(Optional) Removes the appliance virtual target (AVT) LUN. The format is *0xhhhh*[*:hhhh*[*:hhhh*[*:hhhh*]]].
itl *target-pwwn host-pwwn*	Removes the SANTap Initiator Target LUN (ITL) triplet. The format of the *target-pwwn* and the *host-pwwn* is *hh:hh:hh:hh:hh:hh:hh:hh*.
session *session-id*	Removes a session. The range for session ID is 0 through 2147483647.

Defaults

None.

Command Modes

EXEC mode.

Command History

Release	Modification
3.0(1)	This command was introduced.

Usage Guidelines

None.

Examples

The following example shows how to remove a SANTap session:

```
switch# clear santap module 13 session 2020
```

Related Commands

Command	Description
santap module	Configures the mapping between the Storage Services Module (SSM) and the VSAN where the appliance is configured.
show santap module	Displays the configuration and statistics of the SANTap feature.

clear ssm-nvram santap module

To clear the SANTap configuration for a specific slot stored on the supervisor flash, use the **clear ssm-nvram santap module** command in the configuration mode.

clear ssm-nvram santap module *slot*

Syntax Description

slot	Displays SANTap configuration for a module in the specified slot.

Defaults

None.

Command Modes

EXEC mode.

Command History

Release	Modification
3.2(1)	This command was introduced.

Usage Guidelines

None.

Examples

The following example shows how to clear the SANTap configuration for a slot 2:

```
switch# clear ssm-nvram santap module 2
```

Related Commandss

Command	Description
ssm enable feature	Enables the SANTap feature on the SSM.

santap module

To configure the mapping between the Storage Services Module (SSM) and the VSAN where the appliance is configured, use the **santap module** command in configuration mode. To disable this feature, use the **no** form of the command.

santap module *slot-number* {**appl-vsan** *vsan-id* [**cvt-name** *cvt-name*] |
dvt target-pwwn *target-pwwn* **target-vsan** *target-vsan-id* **dvt-name** *dvt-name* **dvt-vsan** *dvt-vsan-id* [**dvt-port** *port-number*] [**lun-size-handling** *enable/disable*] [**io-timeout** *timeout-value*]}

no santap module *slot-number* {**appl-vsan** *vsan-id* [**cvt-name** *cvt-name*] |
dvt target-pwwn *target-pwwn*}

Syntax Description

slot-number	Specifies the slot number of the SSM where the control virtual target (CVT) is created.
appl-vsan *vsan-id*	Specifies the appliance VSAN identification number used to communicate with the appliance. The range is 1 to 4093.
cvt-name *cvt-name*	(Optional) Specifies the control virtual target (CVT) name. The maximum size is 80 characters.
dvt	Configures the data virtual target (DVT).
target-pwwn *target-pwwn*	Specifies the target pWWN for the DVT. The format is *hh:hh:hh:hh:hh:hh:hh:hh*.
target-vsan *target-vsan-id*	Specifies the target VSAN for the DVT. The range for the real *target-vsan-id* is 1 through 4093.
dvt-name *dvt-name*	Specifies the DVT name. The maximum size is 80 characters.
dvt-vsan *dvt-vsan-id*	Specifies the DVT VSAN. The range for the *dvt-vsan-id* is 1 through 4093.
dvt-port *port-number*	(Optional) Specifies the DVT port. The range for the port number is 1 through 32.
lun-size-handling *enable/disable*	(Optional) Enables or disables LUN size handling. Specify 1 to enable or 0 to disable LUN size handling, with the default being enable.
io-timeout *timeout-value*	(Optional) Specifies the I/O timeout value. The range is 10 to 200 seconds, with the default being 10 seconds.

Defaults

Disabled.

The IO-timeout is 10 seconds.

Lun-size-handling is Enabled.

Command Modes

Configuration mode.

Command History

Release	Modification
2.1(1a)	This command was introduced.
3.0(1)	Added the following options: **cvt-name**, **dvt**, **target-pwwn**, **target-vsan**, **dvt-name**, **dvt-vsan**, **dvt-port**, **lun-size-handling**, and **io-timeout**.

Usage Guidelines

To access this command, you must first enable the SANTap feature on the SSM using the **ssm enable feature** command.

When the **lun-size-handling** option is set (enabled), the maximum logical block addressing (LBA) for DVT LUN is set to 2 TB. As a result, there is no issue with LUN resizing.

Note You can delete the **dvt target-pwwn** option using the **no santap module** *slot* **dvt target-pwwn** command. Other **dvt** options are not supported by the **no** form of the command.

Examples

The following example shows the configuration of the SSM where the SANTap feature is enabled and the VSAN used to communicate with the appliance:

```
switch# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
switch(config)# santap module 1 appl-vsan 1
```

Related Commands

Command	Description
show santap module	Displays the configuration and statistics of the SANTap feature.
ssm enable feature	Enables the SANTap feature on the SSM.

santap module dvt target

To configure SANTap target pWWN on a DVT, use the **santap module dvt target-pwwn** command in configuration mode.

santap module *slot-number* **dvt target-pwwn** *target-pwwn* **target-vsan** *target-vsan-id* **dvt-name** *dvt-name* **dvt-vsan** *dvt-vsan-id* [**dvt-port** *port-number*]

Syntax Description

slot-number	Specifies the slot number of the SSM where the control virtual target (CVT) is created.
dvt	Configures the data virtual target (DVT).
target-pwwn *target-pwwn*	Specifies the target pWWN for the DVT. The format is *hh:hh:hh:hh:hh:hh:hh:hh*.
target-vsan *target-vsan-id*	Specifies the target VSAN for the DVT. The range for the real *target-vsan-id* is 1 through 4093.
dvt-name *dvt-name*	Specifies the DVT name. The maximum size is 80 characters.
dvt-vsan *dvt-vsan-id*	Specifies the DVT VSAN. The range for the *dvt-vsan-id is* 1 through 4093.
dvt-port *port-number*	(Optional) Specifies the DVT port. The range for the port number is 1 through 32.

Defaults

None.

Command Modes

Configuration mode.

Command History

Release	Modification
2.1(1a)	This command was introduced.
3.0(1)	Added the following options: **cvt-name**, **dvt**, **target-pwwn**, **target-vsan**, **dvt-name**, **dvt-vsan**, and **dvt-port**

Usage Guidelines

To access this command, you must first enable the SANTap feature on the SSM using the **ssm enable feature** command.

Note You can delete **dvt target-pwwn** using the **no santap module** *slot* **dvt target-pwwn** command. Other **dvt** options are not supported by the **no** form of the command.

Examples

The following example shows how to configure SANTap target pwwn on a DVT:

```
switch# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
switch(config)# santap module 1 dvt target-pwwn 50:06:0e:80:03:81:32:36 taget-vs
an 9 dvt-name MYDVT dvt-vsan 12 dvt-port 1
```

Related Commands

Command	Description
show santap module	Displays the configuration and statistics of the SANTap feature.
ssm enable feature	Enables the SANTap feature on the SSM.

show santap module

To display the SANTap configuration on the Storage Services Module (SSM), use the **show santap module** command in EXEC mode.

show santap module *slot* {**avt** [*name* | **brief**] | **avtlun** | **cvt** [*cvt-id* | **brief**] | **dvt** [*name* | **brief**] | **dvtlun** | [*name* | **brief**] | **session** [*session-id* | **brief**] | **tech-support**}

Syntax Description

slot	Displays SANTap configuration for a module in the specified slot.
avt *name*	Displays the appliance virtual target (AVT) configuration. (Optional) Specifies the user name.
brief	(Optional) Displays a brief format version of the display.
avtlun	Displays the appliance AVT LUN configuration.
cvt	Displays the control virtual target (CVT) configuration.
cvt-id	(Optional) Specifies a user configured CVT ID. The range is 1 to 65536.
dvt	Displays the data virtual target (DVT) configuration.
dvtlun	Displays the DVT LUN configuration.
session	Displays the SANTap session information.
session-id	(Optional) Specifies a user configured session ID. The range is 1 to 65536.
tech-support	Displays information for technical support.

Defaults

None.

Command Modes

EXEC mode.

Command History

Release	Modification
2.1(1a)	This command was introduced.
3.1(2)	Added the **tech-support** option.

Usage Guidelines

None.

Examples

The following example displays the SANTap AVT configuration:

```
switch# show santap module 2 avt

 AVT Information :
        avt pwwn     = 2a:4b:00:05:30:00:22:25
        avt nwwn     = 2a:60:00:05:30:00:22:25
        avt id       = 12
        avt vsan     = 4
        avt if_index = 0x1080000
        hi pwwn      = 21:00:00:e0:8b:07:61:aa
```

```
        tgt pwwn     = 22:00:00:20:37:88:20:ef
        tgt vsan     = 1
```

The following example displays the SANTap AVT LUN configuration:

```
switch# show santap module 2 avtlun

 AVT LUN Information :
        avt pwwn     = 2a:4b:00:05:30:00:22:25
        avt lun      = 0x0
        xmap id      = 16
        avt id       = 12
        tgt lun      = 0x0
```

The following example displays the SANTap CVT configuration:

```
switch# show santap module 2 cvt

 CVT Information :
        cvt pwwn     = 25:3c:00:05:30:00:22:25
        cvt nwwn     = 25:3d:00:05:30:00:22:25
        cvt id       = 1
        cvt xmap_id  = 2
        cvt vsan     = 10
```

The following example displays the SANTap DVT configuration:

```
switch# show santap module 2 dvt

 DVT Information :
        dvt pwwn     = 22:00:00:20:37:88:20:ef
        dvt nwwn     = 20:00:00:20:37:88:20:ef
        dvt id       = 3
        dvt mode     = 3
        dvt vsan     = 3
        dvt fp_port  = 0
        dvt if_index = 0x1080000
        dvt name     = MYDVT
```

The following example displays the SANTap DVTLUN configuration:

```
switch# show santap module 2 dvtlun

 DVT LUN Information :
        dvt pwwn     = 22:00:00:20:37:88:20:ef
        dvt lun      = 0x0
        xmap id      = 8
        dvt id       = 3
        dvt mode     = 0
        dvt vsan     = 3
        tgt pwwn     = 22:00:00:20:37:88:20:ef
        tgt lun      = 0x0
        tgt vsan     = 1
```

The following example displays the SANTap configuration session:

```
switch# show santap module 2 session

 Session Information :
        session id    = 1
        host pwwn     = 21:00:00:e0:8b:07:61:aa
        dvt pwwn      = 22:00:00:20:37:88:20:ef
        dvt lun       = 0x0
        tgt pwwn      = 00:00:00:00:00:00:00:00
        tgt lun       = 0x0
```

```
        adt pwwn      = 77:77:77:77:77:77:77:77
        adt lun       = 0x0
        num ranges    = 0
        dvt id        = 0
        vdisk id      = 0
        session state = 0
        mrl requested = 1
        pwl requested = 1
        iol requested = 0
```

The following example displays information for technical support:

```
switch# show santap module 4 tech-support

 DVT Information :
        dvt pwwn     = 22:00:00:20:37:39:b1:00
        dvt nwwn     = 20:00:00:20:37:39:b1:00
        dvt id       = 0x83fe924
        dvt mode     = 3
        dvt vsan     = 1
        dvt if_index = 0x1180000
        dvt fp_port  = 1
        dvt name     = MYDVT3
        dvt tgt-vsan = 2
        dvt io timeout            = 10 secs
        dvt lun size handling     = 1
        dvt app iofail behaviour  = 0
        dvt quiesce behavior      = 0
        dvt tgt iofail behavior   = 0
        dvt appio failover time   = 0 secs
        dvt inq data behavior     = 0

 DVT Information :
        dvt pwwn     = 22:00:00:20:37:88:20:ef
        dvt nwwn     = 20:00:00:20:37:88:20:ef
        dvt id       = 0x8405bbc
        dvt mode     = 3
        dvt vsan     = 1
        dvt if_index = 0x1186000
        dvt fp_port  = 7
        dvt name     = MYDVT3
        dvt tgt-vsan = 2
        dvt io timeout            = 10 secs
        dvt lun size handling     = 1
        dvt app iofail behaviour  = 0
        dvt quiesce behavior      = 0
        dvt tgt iofail behavior   = 0
        dvt appio failover time   = 0 secs
        dvt inq data behavior     = 0

 DVT Information :
        dvt pwwn     = 22:00:00:20:37:39:87:70
        dvt nwwn     = 20:00:00:20:37:39:87:70
        dvt id       = 0x8405b2c
        dvt mode     = 3
        dvt vsan     = 3
        dvt if_index = 0x118c000
        dvt fp_port  = 13
        dvt name     = MYDVT3
        dvt tgt-vsan = 2
        dvt io timeout            = 10 secs
        dvt lun size handling     = 1
        dvt app iofail behaviour  = 0
        dvt quiesce behavior      = 0
```

```
        dvt tgt iofail behavior    = 0
        dvt appio failover time    = 0 secs
        dvt inq data behavior      = 0

 CVT Information :
        cvt pwwn      = 29:5d:33:33:33:33:33:36
        cvt nwwn      = 29:5e:33:33:33:33:33:36
        cvt id        = 0x83b11e4
        cvt xmap_id   = 0x83b1204
        cvt vsan      = 2
        cvt name      =

--------------------------------------------------------------------------
VSAN                  USAGE COUNT
--------------------------------------------------------------------------
2                     4
switch#
```

Table A-1 describes the significant fields shown in the previous displays.

Table A-1 show santap Field Descriptions

Field	Description
app lun	Displays the appliance LUN.
app pwwn	Displays the appliance port world wide name.
app vsan	Displays the appliance VSAN number.
avt id	Displays the AVT ID number.
avt if_index	Displays the AVT interface index number.
avt lun	Displays the AVT LUN.
avt nwwn	Displays the AVT node port world wide name.
avt pwwn	Displays the AVT port world wide name
avt vsan	Displays the AVT VSAN number.
cvt id	Displays the CVT ID number.
cvt nwwn	Displays the CVT node port world wide name.
cvt pwwn	Displays the CVT port world wide name
cvt vsan	Displays the CVT VSAN number.
cvt xmap_id	Displays the CVT Xmap ID number.
dvt fp_port	Displays the DVT fabric port number.
dvt id	Displays the DVT.
dvt if_index	Displays the DVT interface index number.
dvt lun	Displays the DVT LUN.
dvt mode	Displays the DVT mode.
dvt name	Displays the DVT name.
dvt nwwn	Displays the DVT node port world wide name.
dvt pwwn	Displays the DVT port world wide name.
dvt vsan	Displays the DVT VSAN number.
host pwwn	Displays the host port world wide name.

Table A-1 show santap Field Descriptions (continued)

Field	Description
num ranges	Displays the number ranges.
session id	Displays the session ID number.
session state	Displays the session state.
tgt lun	Displays the target LUN.
tgt pwwn	Displays the target port world wide name.
tgt vsan	Displays the target VSAN number.
vdisk id	Displays the virtual disk ID number.
xmap id	Displays the Xmap ID number.

Related Commands

Command	Description
santap module	Configures the mapping between the SSM and the VSAN where the appliance is configured.

show santap module dvt brief

To display the SANTap Data Virtual Target (DVT) configuration in a brief format on the Storage Service Module (SSM), use the **show santap module dvt brief** command in the EXEC mode.

show santap module dvt brief *slot*

Syntax Description

slot	Displays SANTap configuration for a module in the specified slot.

Defaults

None.

Command Modes

EXEC mode.

Command History

Release	Modification
3.2(1)	This command was introduced.

Usage Guidelines

None.

Examples

The following example displays the SANTap module DVT brief infomation for slot 13:

```
switch# show santap module 13 dvt brief
--------------------------------------------------------------------------------
DVT WWN                 DVT ID               MD  DVT VSAN    DVTIFIDX
--------------------------------------------------------------------------------
50:06:0e:80:00:c3:e0:46 139639316            3   30          0x1604000
switch# attach  module 13
Attaching to module 13 ...
To exit type 'exit', to abort type '$.'
Bad terminal type: "xterm". Will assume vt100.
```

The following example displays the SANTap vttbl DVT configuration.

```
switch# attach module 2
module-3# show santap vttbl dvt 50:00:1f:e1:50:0c:3b:09
DVT Entry  :
        Activated        : FALSE
        Number LUNs     : 16
        Possible Hosts  :
             hi_pwwn = 10:00:00:00:c9:3f:90:21 : 4 LUNs
             hi_pwwn = 10:00:00:00:c9:4c:c0:e5 : 2 LUNs
             hi_pwwn = 21:00:00:e0:8b:0c:7d:21 : 2 LUNs
             hi_pwwn = 10:00:00:00:c9:56:ed:f2 : 2 LUNs
             hi_pwwn = 50:06:0b:00:00:60:2a:a0 : 4 LUNs
             hi_pwwn = 21:00:00:e0:8b:92:62:92 : 2 LUNs
```

The following example displays the SANTap vttbl DVT host configuration:

```
switch# show santap vttbl dvt 50:00:1f:e1:50:0c:3b:09 host 10:00:00:00:c9:3f:90:21
HI-LIST Entry  :
        State               : PRLI
        UA Power On         : 1
        FIT Created         : 1
        NVP Index           : 0x10000000c93f9021

    HI-LUNS Entry  :
        Number of LUNs    : 4
        DVT ID              : 0x83f978c
        HI Index            : 0
        LUNs Installed      : TRUE
        Target Lun, DVT Lun pairs :

        (0, 0)(1, 1)(2, 2)(3, 3)
```

Related Commands

Command	Description
show santap vttbl	Displays the SANTap VTTBL configuration.

show santap vttbl dvt

To display the host information logged into the Data Virtual Target (DVT) and the LUNs exposed to the hosts, use the **show santap vttbl dvt** command in the EXEC mode.

show santap vttbl dvt *dvt_pwwn*

Syntax Description

dvt_pwwn	Displays the pWWN information for DVT.

Defaults

None.

Command Modes

EXEC mode.

Command History

Release	Modification
3.2(1)	This command was introduced.

Usage Guidelines

None.

Examples

The following example displays the host information logged into the DVT:

```
module-2# show santap vttbl dvt 50:06:04:82:cc:ab:31:8c

    DVT Entry  :
        Activated      : TRUE
        Number LUNs    : 96
        Possible Hosts :
             hi_pwwn = 10:00:00:00:c9:63:a0:47  : 48 LUNs
             hi_pwwn = 10:00:00:00:c9:63:9f:b7  : 48 LUNs
             hi_pwwn = 10:00:00:00:c9:63:a1:cc  : 0 LUNs
             hi_pwwn = 10:00:00:00:c9:63:a1:a6  : 0 LUNs
```

Related Commands

Command	Description
show santap vttbl	Displays the SANTap VTTBL configuration.
show santap vttbl dvt host	Displays the login status of the host on a DVT.

show santap vttbl dvt host

To display the login status of the host on a Data Virtual Target (DVT), use the **show santap vttbl dvt host** command in the EXEC mode.

show santap vttbl dvt *dvt_pwwn* **host** *host_pwwn*

Syntax Description

dvt_pwwn	Displays the pWWN information for DVT.
host_pwwn	Displays the pWWN information for host.

Defaults

None.

Command Modes

EXEC mode.

Command History

Release	Modification
3.2(1)	This command was introduced.

Usage Guidelines

None.

Examples

The following example displays the login status of the host on a DVT:

```
module-2# show santap vttbl dvt 50:06:01:60:41:e0:0a:3f host 21:00:00:e0:8b:9a:07:a3

    HI-LIST Entry  :
        State          : PRLI
        UA Power On    : 1
        FIT Created    : 1
        NVP Index      : 0x210000e08b9a07a3

    HI-LUNS Entry  :
        Number of LUNs : 21
        DVT ID         : 0x83f977c
        HI Index       : 5
        LUNs Installed : FALSE
        Target Lun, DVT Lun pairs :

        (0, 1280)(1, 1281)(2, 1282)(3, 1283)(4, 1284)(5, 1285)(6, 1286)(7, 1287)
        (8, 1288)(9, 1289)(10, 1290)(11, 1291)(12, 1292)(13, 1293)(14, 1294)(15, 1295)
        (16, 1296)(17, 1297)(18, 1298)(19, 1299)(20, 1300)
```

Related Commands

Command	Description
show santap vttbl	Displays the SANTap VTTBL configuration.

ssm enable feature santap module

To enable SANTap on a particular module in a SSM, use the **ssm enable feature santap module** command in configuration mode. To disable this feature, use the **no** form of the command.

ssm enable feature santap module *slot-number*

no ssm enable feature santap module *slot-number*

Syntax Description

slot-number	Specifies the slot number of the SSM where SANTap is enabled.

Defaults

None.

Command Modes

Configuration mode.

Command History

Release	Modification
2.1(1a)	This command was introduced.

Usage Guidelines

None.

Examples

The following example shows the configuration of SANTap on an SSM:

```
switch# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
switch(config)# ssm enable feature santap module 1
```

Related Commands

Command	Description
no ssm enable feature	Disables the SANTap feature on the SSM.

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