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Preface

The Preface contains the following sections:

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Changes to This Document

This table lists the technical changes made to this document since it was first printed.

<table>
<thead>
<tr>
<th>Date</th>
<th>Change Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 2014</td>
<td>Initial release of this document.</td>
</tr>
<tr>
<td>October 2014</td>
<td>Republished with documentation updates for Cisco IOS XR Release 5.2.2 features.</td>
</tr>
</tbody>
</table>

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see What's New in Cisco Product Documentation.

To receive new and revised Cisco technical content directly to your desktop, you can subscribe to the What's New in Cisco Product Documentation RSS feed. RSS feeds are a free service.
New and Changed nV System Features

This chapter lists all the features that have been added or modified in this guide. The table also contains references to these feature documentation sections.

- New and Changed Satellite nV Feature Information, page 1

New and Changed Satellite nV Feature Information

This table summarizes the new and changed feature information for R5.2.x.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Introduced/Changed in Release</th>
<th>Where Documented</th>
</tr>
</thead>
<tbody>
<tr>
<td>No New Features Introduced</td>
<td>Not Applicable</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>
CHAPTER 2

Configuring the Satellite Network Virtualization (nV) System

This module describes Satellite Network Virtualization (Satellite nV) system configurations on Cisco CRS Router.

Table 1: Feature History for Configuring Satellite System

<table>
<thead>
<tr>
<th>Release</th>
<th>Modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Release 4.3.2</td>
<td>• Multi-chassis and back to back support on Cisco CRS-3 Router was included.</td>
</tr>
</tbody>
</table>

• Prerequisites for Configuration, page 4
• Overview of Satellite nV System, page 4
• Benefits of Satellite nV System, page 5
• Cisco ASR 9000 Series Router Satellite nV Hardware Compatibility Matrix, page 6
• IOS XR 64 Bit Satellite nV Hardware Compatibility Matrix, page 7
• Overview of Port Extender Model, page 7
• Satellite System Physical Topology, page 9
• Features Supported in the Satellite nV System, page 9
• Restrictions of the Satellite nV System, page 11
• Implementing a Satellite nV System, page 13
• Synchronous Ethernet (SyncE) in Satellite nV System, page 22
• Upgrading and Managing Satellite nV Software, page 23
• Configuration Examples for Satellite nV System, page 31
• Additional References, page 33
Prerequisites for Configuration

You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Before configuring the Satellite nV system, you must have these hardware and software installed in your chassis:

- **Host** — Cisco CRS-3 Modular Services Line Card with fixed PLIM (14x10GE, 20x10GE, and MSC140). The Line card that hosts the Satellite nV device can be a Cisco CRS Multi Chassis and Back to Back system.
- **Satellite** — Cisco ASR9000v.
- **Software** — Cisco IOS XR Software Release 4.3.1 or later with hfr-asr9000v-nV-px.pie.

Overview of Satellite nV System

The Satellite Network Virtualization (nV) service or the Satellite Switching System enables you to configure a topology in which one or many satellite switches complement one or many Cisco CRS-3 Routers, to collectively realize a single virtual switching system. In this system, the satellite switches act under the management control of the routers.

The complete configuration and management of the satellite chassis and features are performed through the control plane and management plane of the Cisco CRS-3 Router, referred to as the Host.

Interconnection between the Cisco CRS-3 Router and its satellites is through standard Ethernet interfaces or bundle ethernet interfaces coming from a single modular services line card. All bundle members must be connected to the same satellite device.

When the Satellite nV service was introduced in Cisco IOS XR Software Release 4.3.x, Cisco ASR 9000v was used as the satellite device. It had four 10 Gigabit ports that were used as Interchassis Links (ICL).

In general, the type of interface used on the host is decided on the basis of the satellite device used.

*Figure 1: Satellite nV System*
This type of architecture can be realized in a carrier Ethernet transport network, with the satellite switches used as either access switches, pre-aggregation, or aggregation switches. These switches feed into the Cisco CRS Router where more advanced Layer 2 and Layer 3 services are provisioned.

You can also utilize this model in a Fiber To The Business (FTTB) network application, where business internet and VPN services are offered on a commercial basis. Further, it can also be used in other networks, such as wireless or Radio Access Network (RAN) back-haul aggregation networks.

Benefits of Satellite nV System

The satellite nV system offers these benefits:

1. **Extended port scalability and density** - You can create a virtual line card with more than 100 physical Gigabit Ethernet ports per slot. There is a significant increase of Ethernet port density in the resulting logical Cisco CRS-3 Router. For example, a single 14-port or 20-port Ten Gigabit Ethernet line card on the Cisco CRS-3 Router could integrate multiple satellite switches with a maximum of 100 Gig Ethernet ports per line card. This is beneficial because the Cisco CRS-3 Router has a per-slot non blocking capacity of up to 400 Gbps (with appropriate RSPs) and there is no other way of physically fitting hundreds of gigabit ethernet ports/ SFPs on the face plate of a single Cisco CRS-3 line card. As a result, in order to utilize the full capacity of an Cisco CRS-3 line card, it is necessary to physically separate out the ethernet ports, while maintaining logical management control. This would appear as if all ports were physically on a single large line card of the Cisco CRS-3 Router.

2. **Reduced cost** - All the core-routing capabilities and application features of the Cisco IOS XR Software are available on low cost access switches.

3. **Reduced operating expense** - You can upgrade software images, and also manage the chassis and services from a common point. This includes a single logical router view, single point of applying CLI or XML interface for the entire system of switches, a single point of monitoring the entire system of switches and a single point of image management and software upgrades for the entire system.

4. **Enhanced feature consistency** - All the features on the regular GigE ports and 10GigE ports of Cisco CRS Router are also available on the access ports of a satellite access switch in a functionally identical and consistent manner. The typical application of a satellite system would be in the access and aggregation layers of a network. By integrating the access switches along with the aggregation or core switch, you can ensure that there are no feature gaps between the access switch and the aggregation or core switch. All features, such as carrier ethernet features, QoS and OAM, function consistently, from access to core, because of this integrated approach.

5. **Improved feature velocity** - With the satellite solution, every feature that is implemented on the Cisco CRS Router becomes instantly available at the same time in the access switch, resulting in an ideal feature velocity for the edge switch.

6. **Better resiliency** - The nV satellite solution enables better multi-chassis resiliency, as well as better end-to-end QoS. For more information on QoS capabilities, see Cisco IOS XR Quality of Service Configuration Guide for the Cisco CRS Router.
Cisco ASR 9000 Series Router Satellite nV Hardware Compatibility Matrix

The following table lists Satellite Network Virtualization (nV) hardware compatibility matrix for the Cisco ASR 9000 Series Routers.

Table 2: Cisco ASR 9000 Series Router Satellite nV Hardware Compatibility Matrix

<table>
<thead>
<tr>
<th>Line Cards</th>
<th>9000v Supported Version</th>
<th>NCS5000 Series Supported Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>A9K-MPA-20X1GE on MOD80 and MOD160</td>
<td>4.2.1</td>
<td>–</td>
</tr>
<tr>
<td>A9K-MPA-2X10GE on MOD80 and MOD160</td>
<td>4.2.1</td>
<td>6.0.1</td>
</tr>
<tr>
<td>A9K-MPA-4X10GE on MOD80 and MOD160</td>
<td>4.2.1</td>
<td>6.0.1</td>
</tr>
<tr>
<td>A9K-24X10GE-SE</td>
<td>4.2.1</td>
<td>6.0.1</td>
</tr>
<tr>
<td>A9K-24X10GE-TR</td>
<td>4.2.1</td>
<td>6.0.1</td>
</tr>
<tr>
<td>A9K-36X10GE-SE</td>
<td>4.2.3</td>
<td>6.0.1</td>
</tr>
<tr>
<td>A9K-36X10GE-TR</td>
<td>4.2.3</td>
<td>6.0.1</td>
</tr>
<tr>
<td>A9K-40GE-TR</td>
<td>5.2.2</td>
<td>6.0.1</td>
</tr>
<tr>
<td>A9K-40GE-SE</td>
<td>5.2.2</td>
<td>6.0.1</td>
</tr>
<tr>
<td>A9K-4X100G-SE</td>
<td>5.3.1</td>
<td>6.0.1</td>
</tr>
<tr>
<td>A9K-4X100G-TR</td>
<td>5.3.1</td>
<td>6.0.1</td>
</tr>
<tr>
<td>A9K-8X100G-SE</td>
<td>5.3.1</td>
<td>6.0.1</td>
</tr>
<tr>
<td>A9K-8X100G-TR</td>
<td>5.3.1</td>
<td>6.0.1</td>
</tr>
<tr>
<td>A9K-MPA-2X10GE on MOD200 and MOD400</td>
<td>5.3.3</td>
<td>6.0.1</td>
</tr>
<tr>
<td>A9K-MPA-4X10GE on MOD200 and MOD400</td>
<td>5.3.3</td>
<td>6.0.1</td>
</tr>
<tr>
<td>A9K-MPA-8X10GE on MOD200 and MOD400</td>
<td>5.3.3</td>
<td>6.0.1</td>
</tr>
</tbody>
</table>
### IOS XR 64 Bit Satellite nV Hardware Compatibility Matrix

The following table lists the IOS XR 64 bit Satellite nV hardware compatibility matrix.

**Table 3: IOS XR 64 Bit Satellite nV Hardware Compatibility Matrix**

<table>
<thead>
<tr>
<th>Line Cards</th>
<th>9000v Supported Version</th>
<th>NCS5000 Series Supported Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>A9K-MPA-20x10GE on MOD200 and MOD400</td>
<td>5.3.3</td>
<td>6.0.1</td>
</tr>
<tr>
<td>A9K-48X10GE-1G-SE</td>
<td>6.2.2</td>
<td>6.2.2</td>
</tr>
<tr>
<td>A9K-48X10GE-1G-TR</td>
<td>6.2.2</td>
<td>6.2.2</td>
</tr>
<tr>
<td>A9K-24X10GE-1G-SE</td>
<td>6.2.2</td>
<td>6.2.2</td>
</tr>
</tbody>
</table>

### Overview of Port Extender Model

In the Port Extender Satellite switching system, a satellite switch is attached to its host through physical ethernet ports.
The parent router, Cisco CRS-3 Router is referred to as the host in this model. From a management or a provisioning point of view, the physical access ports of the satellite switch are equivalent to the physical ethernet ports on the Cisco CRS-3 Router. You do not need a specific console connection for managing the Satellite Switching System, except for debugging purposes. The interface and chassis level features of the satellite are visible in the control plane of Cisco IOS XR software running on the host. This allows the complete management of the satellites and the host as a single logical router.

**Figure 2: Port Extender Satellite Switching System**

In this model, a single Cisco CRS-3 Router hosts two satellite switches, SAT1 and SAT2, to form an overall virtual switching system; represented by the dotted line surrounding the Cisco CRS-3 Router, SAT1, and SAT2 in the Figure.

This structure effectively appears as a single logical Cisco CRS-3 Router to the external network. External access switches (A1, A2) connect to this overall virtual switch by physically connecting to SAT1 and SAT2 using normal ethernet links. The links between the satellite switches and the Cisco CRS-3 Router are ethernet links referred to as the Inter-Chassis Links (ICL). The Cisco CRS-3 Router is referred to as the Host. When there is congestion on the ICLs, an inbuilt QoS protection mechanism is available for the traffic.

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**Note**

SAT1, SAT2, and the host Cisco CRS-3 Router need not be located in the same geographic location. This means that the ICLs need not be of nominal length for only intra-location or intra-building use. The ICLs may be tens, hundreds, or even thousands of miles in length, thereby creating a logical satellite switch spanning a large geography. This distance depends on the pluggables used on the CRS host and Satellite ICL port.
Satellite System Physical Topology

The Satellite nV system supports point-to-point hub and spoke physical topology for the ICLs between satellite switches and the host. This topology allows a physical Ethernet MAC layer connection from the satellite to the host. This can be realized using a direct Ethernet over Fiber or Ethernet over Optical transport (such as, Ethernet over a SONET/SDH/CWDM/DWDM network).

This topology also allows a satellite switch to geographically be at a different location than the host, Cisco CRS-3 Router.

Features Supported in the Satellite nV System

This section provides details of the features of a satellite system.

Inter-Chassis Link Redundancy Modes and Load Balancing

The Satellite system supports these redundancy modes:

- **Non-redundant inter-chassis links mode** - In this mode, there is no link level redundancy between inter-chassis links of a satellite.

- **Redundant inter-chassis links mode** - In this mode, the link level redundancy between inter-chassis links are provided using a single link aggregation (LAG) bundle.

In the redundant ICL mode, the load balancing of traffic between members of the IC bundle is done using a simple hashing function based on the satellite access port ID, and not based on the flow based hash using L2 or L3 header contents from the packets. This ensures that a single ICL is used by all packets for a given satellite access port. As a result, the actions applied for QoS and other features consider all the packets belonging to a single satellite access port.

Note

Both the Access Bundles and ICL bundles can co-exist, but not concurrently.

For more details on QoS application and configuration on ICLs, see *Cisco IOS XR Modular Quality of Service Configuration Guide for the Cisco CRS Router*.

Satellite Discovery and Control Protocols

Cisco's proprietary discovery and control protocols are used between the satellite switches and the host devices, to handle discovery, provisioning, and monitoring of the satellite devices from the host Cisco CRS-3 Satellite System in-band over the ICLs. The Satellite Discovery And Control (SDAC) Protocol provides the behavioral, semantic, and syntactic definition of the relationship between a satellite device and its host.
Satellite Discovery and Control Protocol IP Connectivity

The connectivity for the SDAC protocol is provided through a normal in-band IP routed path over the ICLs using private and public IP addresses appropriate for the carrier's network.

You can configure a management IP address on the host CLI for each satellite switch and corresponding IP addresses on the ICLs. You can select addresses from the private IPv4 address space (for example, 10.0.0.0/8 or 192.1.168.0/24) in order to prevent any conflict with normal service level IPv4 addresses being used in the IPv4 FIB. You can also configure a private VRF that is used for only satellite management traffic, so that the IP addresses assigned to the satellites can be within this private VRF. This reduces the risk of address conflict or IP address management complexity compared to other IP addresses and VRFs that are used on the router.

Auto-IP is the recommended mode of configuration. For more information on Auto-IP mode, see Auto-IP, on page 15.

BFD over Satellite Interfaces

Bidirectional Forwarding Detection (BFD) over satellite interfaces feature enables BFD support on satellite line cards. Satellite interfaces are known as virtual (bundle) interfaces. BFD uses multipath infrastructure to support BFD on satellite line cards. BFD over satellite is a multipath (MP) single-hop session and is supported on IPv4 address, IPv6 global address, and IPv6 link-local address. BFD over Satellite is supported on the Cisco CRS-3 Modular Services Line Card or the Cisco CRS Modular Services Line Card.

Limitations

These limitations apply for BFD over Satellite interfaces:

• BFD async mode is supported on Satellite GigabitEthernet links when they are not part of the bundle.
• BFD echo mode is not supported on Satellite GigabitEthernet links.
• BFD over bundles (BOB) is not supported.
• When the Satellite links are part of the Access Bundle, only BFD over Logical Bundle (BLB) is supported.
• In BLB, only one BFD session is supported on the bundle.

Quality of Service

Most Layer-2, Layer-3 QoS and ACL features are supported on Satellite Ethernet interfaces that are similar to normal physical Ethernet interfaces, with the exception of any ingress policy with a queuing action. However, for QoS, there may be some functional differences in the behavior because, in the Cisco IOS XR Software Release 4.2.x, user-configured MQC policies are applied on the Cisco CRS Router, and not on the satellite switch interfaces.

For more detailed information on QoS offload and QoS policy attributes, features, and configuration, see Cisco IOS XR Modular Quality of Service Configuration Guide for the Cisco CRS Router.
User-configured QoS policies are independent of any default port level QoS that are applied in order to handle IC link congestion and over-subscription scenarios. In addition to the default port-level QoS applied on the satellite system ports, default QoS is also applied on the Host side, to the ingress and egress traffic from and to the Satellite Ethernet ports.

---

**Time of Day Synchronization**

The Time of Day parameter on the satellite switch is synchronized with the time of day on the host. This ensures that time stamps on debug messages and other satellite event logs are consistent with the host, and with all satellite switches across the network. This is achieved through the SDAC Discovery Protocol from the host to the satellite switch when the ICLs are discovered.

**Satellite Chassis Management**

The chassis level management of the satellite is done through the host because the satellite switch is a logical portion of the overall virtual switch. This ensures that service providers get to manage a single logical device with respect to all aspects including service-level, as well as box-level management. This simplifies the network operations. These operations include inventory management, environmental sensor monitoring, and fault/alarm monitoring for the satellite chassis through the corresponding CLI, SNMP, and XML interfaces of the host.

**Restrictions of the Satellite nV System**

Software restrictions of the Cisco CRS-3 satellite system are:

- The inter-chassis link redundancy is supported only through the static EtherChannel, and not through LACP based link bundles. Minimum and maximum link commands are not applicable when ICL is a bundle.
- Access bundles having both satellite and non-satellite interfaces is not supported.
- For hub and spoke topologies, irrespective of the line card variant, a maximum of up to 200 satellite access ports can be supported per NPU.

For all nV satellite topologies on the –TR (Packet Transport Optimized) line card variants, a maximum of up to 200 satellite access ports can be supported per NPU. With the buffer, memory and 8 queue per port restrictions, the use of –TR card variants has restrictions for advanced, large scale nV satellite deployments like simple ring and L2 fabric topologies. These deployments require 200 and more access ports on a single ICL fabric port. For such network mode nV satellite configuration, an – SE (Services Edge Optimized) line card variant is strongly recommended for hosting the line cards on the ASR 9000 nV host

- On A9K-40GE-TR and A9K-40GE-SE line card variants, only the 1st 16 ports can be used as ICL or fabric ports to host nV satellites. Also, only a maximum of up to 170 satellite access ports can be supported per NPU on these line card variants.

- These features, protocols, and topologies are not supported on the nV Satellite System:
Restrictions of the Satellite nV System

- L2VPN
- QinQ
- TE tunnel over Satellite Interface
- Pseudowire Headend
- GRE over satellite interface
- L2TPv3
- Multicast over satellite interface
- Satellite interface as core facing interface
- 801.1ad/.1ah encapsulation
- HSRP and VRRP
- HW DBA based netflow

- If a satellite system is operating in redundant ICL mode, then Cisco Discovery Protocol (CDP) and Link Layer Discovery Protocol (LLDP) are not supported on the access ports of that satellite.
- You cannot connect the same satellite box to more than one Cisco CRS-3 Modular Services Line Card.
- Both the access link bundles and ICL bundles can co-exist, but not concurrently.
- BFD echo mode is not supported on Satellite Gigabit Ethernet links. BFD Asynchronous mode is supported on the Satellite Gigabit Ethernet links that are not part of a bundle. When Satellite links are part of the Access bundle, only BFD over Logical Bundles (BLB) is supported.
- Adding non-ICL links (normal TenGigE links) to ICL bundle is not supported. This configuration is not rejected, but the behavior is unpredictable.
- Only Cisco CRS-3 Modular Services Line Card with fixed PLIM (14x10GE and 20x10GE) can be used to interconnect with the Satellite boxes.
- All bundle members must be from same satellite. The maximum number of bundle members is restricted to 44.
- ISSU and MDR are not supported on the satellite.

This table provides the release-wise support for CDP/LLDP, UDLD, and Ethernet OAM:

<table>
<thead>
<tr>
<th></th>
<th>Single-Homed</th>
<th>Dual-Homed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physical ICL</td>
<td>Bundle ICL</td>
</tr>
<tr>
<td>CDP</td>
<td>IOS XR 4.2.1</td>
<td>IOS XR 5.1.1</td>
</tr>
</tbody>
</table>
## Implementing a Satellite nV System

The Interface Control Plane Extender (ICPE) infrastructure has a mechanism to provide the Control Plane of an interface physically located on the Satellite device in the local Cisco IOS XR software. After this infrastructure is established, the interfaces behave like other physical ethernet interfaces on the router.

The ICPE configuration covers these functional areas, which are each required to set up full connectivity with a Satellite device:

### Defining the Satellite nV System

Each satellite that is to be attached to Cisco IOS XR Software must be configured on the host, and also be provided with a unique identifier. In order to provide suitable verification of configuration and functionality, the satellite type, and its capabilities must also be specified.

Further, in order to provide connectivity with the satellite, an IP address must be configured, which will be pushed down to the satellite through the Discovery protocol, and allows Control protocol connectivity.

This task explains how to define the satellite system by assigning an ID and basic identification information.
## DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> configure</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>RP/0/RP0/CPU0:router# configure</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> nv</td>
<td>Enters the nV configuration submode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>RP/0/RP0/CPU0:router(config)# nv</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> satellite Satellite ID</td>
<td>Declares a new satellite that is to be attached to the host and enters the satellite configuration submode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>RP/0/RP0/CPU0:router(config-nV)# satellite &lt;100-239&gt;</td>
<td>The Cisco CRS Router chassis supports 139 satellite racks. Satellite IDs ranges from 100 to 239.</td>
</tr>
<tr>
<td><strong>Step 4</strong> serial-number string</td>
<td>(Optional) Serial number is used for satellite authentication.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>RP/0/RP0/CPU0:router(config-satellite)# serial-number CAT1521B1BB</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> description string</td>
<td>(Optional) Specifies any description string that is associated with a satellite such as location and so on.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>RP/0/RP0/CPU0:router(config-satellite)# description Milpitas Building12</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> type type_name</td>
<td>Defines the expected type of the attached satellite.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>RP/0/RP0/CPU0:router(config-satellite)# satellite 200 type asr9000v</td>
<td>Satellite type</td>
</tr>
<tr>
<td><strong>Step 7</strong> ipv4 address address</td>
<td>Specifies the IP address to assign to the satellite. ICPE sets up a connected route to the specified IP address through all configured ICLs.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>RP/0/RP0/CPU0:router(config-satellite)# ipv4 address 10.22.1.2</td>
<td></td>
</tr>
<tr>
<td><strong>Step 8</strong> end or commit</td>
<td>Saves configuration changes.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>RP/0/RP0/CPU0:router(config)# end or commit</td>
<td></td>
</tr>
</tbody>
</table>

- When you issue the `end` command, the system prompts you to commit changes:
  Uncommitted changes found, commit them before exiting(yes/no/cancel)?
  [cancel]:
  - Entering `yes` saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
### Auto-IP

The Auto IP feature improves the plug-and-play set up of an nV satellite system. With the Auto IP feature, IP connectivity to the satellite is automatically provisioned. As a result:

- The nV Satellite Loopback interface is created on the host
  - Loopback interface is given an IP address from a private satellite VRF
  - Satellite fabric links are unnumbered to the loopback interface
  - The IP address assigned to satellite is auto-generated from the satellite VRF

In the case of Auto IP, you do not need to provide IP address on the nv satellite global configuration and on the ICL. In the case of manual IP, you need to provide IP address on the nV satellite global configuration and on ICL.

The auto-IP feature assigns an IP address in the format 10.x.y.1 automatically, where:

- x is the top (most significant) 8 bits of the satellite ID
- y is the bottom 8 bits (the rest) of the satellite ID

### Configuration Example for Auto IP

```plaintext
configure
nv satellite 150
type asr9000v

configure
interface TenGigabitEthernet 0/1/0/0
nv satellite-fabric-link satellite 150
remote-ports GigabitEthernet 0/0/0-5
```

- You do not have to assign IP for the satellite and 10.0.<satellite-id>.1 is assigned automatically.
- `nV-Loopback0` is created automatically. `**nVSatellite VRF` is created automatically, and assigned to `**nV-Loopback0`. `10.0.0.1/32` is assigned to `nV-Loopback0`.
- `nV-Loopback0` is referenced by the Ten Gigabit Ethernet interface automatically when it is made as an ICL.
There is no CLI to enable Auto IP. If you do not configure manual IP, this will be invoked.

**Note**
You can also override the Auto IP feature by using the standard IP configuration.

## Configuring the Host IP Address

This procedure gives you the steps to configure a host IP address on a loopback interface.

### Detailed Steps

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td><strong>configure</strong></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td><code>RP/0/0RSP0/CPU0:router# configure</code></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td><strong>interface loopback0</strong></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td><code>RP/0/0RSP0/CPU0:router(config)# interface loopback0</code></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td><strong>ipv4 address</strong></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td><code>RP/0/0RSP0/CPU0:router(config-int)# ipv4 address 8.8.8.8 255.255.255.255</code></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td><strong>end or commit</strong></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>- <code>RP/0/0RSP0/CPU0:router(config)# end</code></td>
</tr>
<tr>
<td></td>
<td>- <code>RP/0/0RSP0/CPU0:router(config)# commit</code></td>
</tr>
</tbody>
</table>

**Purpose**

- Enters global configuration mode.
- Specifies the loopback address for the interface.
- Configures the host IP address on a loopback interface.
- Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes:
  
  Uncommitted changes found, commit them before exiting(yes/no/cancel)?
  
  [cancel]:
  
  - Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
  
  - Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
  
  - Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.

- Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.
Configuring the Inter-Chassis Links and IP Connectivity

Inter-Chassis Links (ICLs) need to be explicitly configured, in order to indicate which satellite is expected to be connected. You must also specify the access port, that is down-stream 10GigE ports, which cross-link up to the Host through the configured ICL. In order to establish connectivity between the host and satellite, suitable IP addresses must be configured on both sides. The satellite IP address is forwarded through the Discovery protocol. The configuration is described in the section, Defining the Satellite nV System, on page 13.

Note
This configuration shows the use of the global default VRF. The recommended option is to use a private VRF for nV IP addresses as shown in the Satellite Management Using Private VRF, on page 32 subsection under Configuration Examples for Satellite nV System.

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> configure</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>RP/0/RP0/CPU0:router# configure</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> interface interface-name</td>
<td>The supported inter-chassis link interface types are limited by the connectivity provided on the supported satellites. GigabitEthernet, TenGigE, and Bundle-Ether interfaces are the only support ICL types.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>RP/0/RP0/CPU0:router(config)# interface TenGigE0/2/1/0</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> description</td>
<td>Specifies the description of the supported inter-chassis link interface type.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>RP/0/RP0/CPU0:router(config-interface)# description To Sat5 1/46</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> ipv4 point-to-point</td>
<td>(Optional) Configures the IPv4 point to point address.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>RP/0/RP0/CPU0:router(config-interface)# ipv4 point-to-point</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> ipv4 unnumbered loopback0</td>
<td>(Optional) Configures the IPv4 loopback address on the interface.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>RP/0/RP0/CPU0:router(config-interface)# interface unnumbered loopback0</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> nV</td>
<td>Enters the Network Virtualization configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>RP/0/RP0/CPU0:router(config-if)# nV</td>
<td></td>
</tr>
</tbody>
</table>
### Configuring Inter-Chassis Links and IP Connectivity in Redundant ICL mode

This procedure describes the configuration of ICL in redundant mode.

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>configure</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>RP/0/RP0/CPU0:router# configure</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>------------------</td>
<td>---------</td>
</tr>
</tbody>
</table>
| **Step 2** | **interface bundle-ether id**  
Example: RP/0/RP0/CPU0:router(config)# interface Bundle-Ether 100 |
| Specifies the supported inter-chassis link interface type. |
| **Step 3** | **description**  
Example: RP/0/RP0/CPU0:router(config-interface)# description To Sat5 1/46 |
| Specifies the description of the supported inter-chassis link interface type. |
| **Step 4** | **nv**  
Example: RP/0/RP0/CPU0:router(config-if)# nv |
| Enters the Network Virtualization configuration mode. |
| **Step 5** | **satellite-fabric-link satellite <id>**  
Example: RP/0/RP0/CPU0:router(config-int-nv)# satellite-fabric-link satellite 200 |
| Specifies that the interface is an ICPE inter-chassis link. |
| **Step 6** | **remote-ports interface-type**  
Example: RP/0/RP0/CPU0:router(config-int-nv)# remote-ports GigabitEthernet 0/0/0-43 |
| Configures the remote satellite ports 0 to 43. |
| **Step 7** | **interface interface_type**  
Example: RP/0/RP0/CPU0:router(config-interface)# interface TenGigE0/0/0/6 |
| Configures the specified interface. |
| **Step 8** | **bundle id mode on**  
Example: RP/0/RP0/CPU0:router(config-interface)# bundle id 100 mode on |
| Specifies the bundle id and activates it. |
| **Step 9** | **end** or **commit**  
Example:  
RP/0/RP0/CPU0:router(config)# end  
RP/0/RP0/CPU0:router(config)# commit |
| Saves configuration changes.  
- When you issue the end command, the system prompts you to commit changes:  
  Uncommitted changes found, commit them before exiting(yes/no/cancel)?  
  [cancel]:  
  > *Entering yes saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.* |
### Purpose

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Entering no</em> exits the configuration session and returns the router to EXEC mode without committing the configuration changes.</td>
<td></td>
</tr>
<tr>
<td><em>Entering cancel</em> leaves the router in the current configuration session without exiting or committing the configuration changes.</td>
<td></td>
</tr>
<tr>
<td>Use the commit command to save the configuration changes to the running configuration file and remain within the configuration session.</td>
<td></td>
</tr>
</tbody>
</table>

**Note**  
For information on QoS configuration on ICLs, see *Cisco IOS XR Modular Quality of Service Configuration Guide for the Cisco CRS Router.*

---

### Configuring the Satellite nV Access Interfaces

The access 1Gigabit Ethernet/10GigE interfaces on the satellite are represented locally in Cisco IOS XR Software using interfaces named GigabitEthernet similar to other non-satellite 1Gigabit Ethernet/10GigE interfaces. The only difference is that the rack ID used for a satellite access 1Gigabit Ethernet/10GigE interface is the configured satellite ID for that satellite.

These interfaces support all features that are normally configurable on 1Gigabit Ethernet/10GigE interfaces (when running over a physical ICL), or Bundle-Ether interfaces (when running over a virtual ICL).

### Plug and Play Satellite nV Switch Turn up: (Rack, Plug, and Go installation)

1. Unpack the satellite rack, stack, and connect to the power cord.
2. Plug in the qualified optics of correct type into any one or more of the SFP+ slots and appropriate qualified optics into SFP+ or XFP slots on the host. Connect through the SMF/MMF fiber.

**Note**  
Connect the 10GigE or 100GigE fibers (in any order) from the Host to any of the 10G SFP+ ports on the Satellite device.

**Note**  
The Satellite nV service can use the Cisco CRS-3 Router as host. The Cisco ASR 9000v can be used as satellite device.

To configure wavelength on DWDM SFP+, use the following CLI command on satellite console:

```
test dwdm wavelength set ppmId wavelength_channel_number
```
Note ppmId = port number -1

The following example shows how to configure wavelength channel 20 on port 45.
```
Satellite# test dwdm wavelength set 44 20
```
To see the configured wavelength, use the following CLI command on satellite console:

- `show satellite dwdm-dump ppmId`
- `show satellite inventory port 45`

Note It is mandatory to configure the same wavelength on both hosts and satellite, you can follow the same steps above on the hosts.

3 Configure the host for nV operations as described in the sections Defining the Satellite nV System, on page 13, Configuring the Host IP Address, on page 16 and Configuring the Inter-Chassis Links and IP Connectivity, on page 17. Configure the satellite nV system through CLI or XML on the host on 100GigE ports for Cisco NCS 5002 Satellite.

4 Power up the chassis of the satellite device.

Note For power supply considerations of ASR 9000v, refer to the Appendix C, Cisco ASR 9000 and Cisco CRS Satellite Systems (ASR 9000v) of the Cisco ASR 9000 Series Aggregation Services Router Hardware Installation Guide online.

5 You can check the status of the satellite chassis based on these chassis error LEDs on the front face plate.

- If the Critical Error LED turns ON, then it indicates a serious hardware failure.
- If the Major Error LED turns ON, then it indicates that the hardware is functioning well but unable to connect to the host.
- If the Critical and Major LEDs are OFF, then the satellite device is up and running and connected to the host.
- You can do satellite ethernet port packet loopback tests through the host, if needed, to check end to end data path.

Note When the satellite software requires an upgrade, it notifies the host. You can do an inband software upgrade from the host, if needed. Use the `show nv satellite status` on the host to check the status of the satellite.
Synchronous Ethernet (SyncE) in Satellite nV System

Cisco IOS XR Software Release 5.2.0 supports Synchronous Ethernet (SyncE), a physical layer frequency protocol used to provide frequency synchronization in an nV satellite system both from the host to the satellites, and from the satellites to downstream devices.

Synchronous Ethernet (SyncE) is a physical layer frequency protocol used to provide frequency synchronization in an nV satellite system both from the host to the satellites, and from the satellites to downstream devices. SyncE can be configured on hosts and the host's fabric interfaces and satellite-specific configuration is not required. SyncE is disabled on the satellite until Ethernet Synchronization Messaging Channel (ESMC) messages are received from the host; when an ESMC message is received, the satellite enables SyncE on fabric and access ports.

SyncE configuration is available to explicitly enable SyncE on a per-fabric basis. Satellite Discovery And Control (SDAC) messages are sent from the host to the satellite to enable or disable SyncE and to inform the satellite of the Quality Level (QL) level to use.

SyncE is enabled on receiving an Inter-Chassis Link (ICL) and all cross-linked access ports.

The show frequency synchronization interfaces and clear frequency synchronization esmc statistics commands on the host are extended to include satellite access ports.

Restrictions of SyncE in Satellite nV System

The following are some of the restrictions of Synchronous Ethernet within an nV satellite system:

- Only limited SyncE support is provided to customers in release 5.2.0.
- ASR9000v and NCS 5000 are the supported satellites.
- Hub-and-spoke (Dual-home) is the only supported topology.
- Physical and Bundle ICLs are supported.
- Host cannot synchronize to the satellite.
- Minimal configuration support.
- Minimum show command support.
- Only supported for directly connected satellites in hub-and-spoke topologies.
- Commands to configure the host's fabric interfaces as SyncE inputs are not permitted, as synchronizing the host to one of its sites is not supported.
- Application of Frequency Synchronization configuration commands on the satellite access ports is not permitted.
- SyncE features will not work on Copper SFPs and GLC-GE-100FX SFPs.
- SyncE is supported only on 10G ICL ports of ASR9000v1/v2 satellites operating in 10G mode.
- SyncE is not supported on 1G ICL ports and 10G ICL ports operating in 1G mode of ASR9000v1/v2 satellites.
Upgrading and Managing Satellite nV Software

Satellite software images are bundled inside a PIE and the PIE name is dependent on the type of satellite, such as hfr-asr9000v-nV-px.pie within the Cisco CRS-3 Router package. The Cisco IOS XR software production SMU tool can be used to generate patches for the satellite image in the field to deliver bug fixes or minor enhancements without requiring a formal software upgrade.

Prerequisites

• You must have installed the satellite installation procedure using the Plug and Play Satellite installation procedure. For more information, check the topic Plug and Play Satellite nV Switch Turn up: (Rack, Plug, and Go installation), on page 20 in this chapter.

Installing a Satellite

To download and activate the software image on the satellite, use the install nv satellite satellite ID / all transfer/activate commands. The transfer command downloads the image to the satellite. When the transfer command is followed by the activate command, the software is activated on the satellite.

```
RP/0/RSP0/CPUD0:sat-host# install nv satellite 100 transfer
Install operation initiated successfully.
RP/0/RSP0/CPUD0:sat-host# install nv satellite 100 activate
Install operation initiated successfully.
```

In the case of simple ring topology, the image must be transferred to all the satellites using install nv satellite transfer <range of satellites> command followed by install nv satellite activate <range of satellites> command. You cannot use only the install nv satellite activate command in the case of simple ring topology.

```
RP/0/RSP0/CPUD0:sat-host# install nv satellite 100 activate
Install operation initiated successfully.
```

Note

If the activate command is run directly, then the software image is transferred to the satellite and also activated.

```
RP/0/RSP0/CPUD0:sat-host# install nv satellite 101 activate
Install operation initiated successfully.
```

Cisco IOS XR nV System Configuration Guide for the Cisco CRS Router, Release 5.2.x
For the satellite image upgrade to work, you must ensure that the management-plane CLI is not configured on the Cisco CRS-3 Router. If it is configured, then you need to add this exception for each of the 10GigE interfaces, which are the satellite ICLs. This is not required for Auto IP configurations from Cisco IOS XR Software Release 5.3.2.

You can include the exception using this CLI:

```
control-plane
management-plane
inband
!
!
interface TenGigE0/0/0/5  
allow TFTP
```

If you do not include this exception, then the image download and upgrade fails.

### Monitoring the Satellite Software

#### Status Check

To perform a basic status check, use the `show nv satellite status brief` command.

```
RP/0/RSP0/CPU0:router# show nv satellite status brief
```

<table>
<thead>
<tr>
<th>Sat-ID</th>
<th>Type</th>
<th>IP Address</th>
<th>MAC address</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>asr9000v</td>
<td>101.102.103.105</td>
<td>dc7b.9426.1594</td>
<td>Connected (Stable)</td>
</tr>
<tr>
<td>200</td>
<td>asr9000v</td>
<td>101.102.103.106</td>
<td>0000.0000.0000</td>
<td>Halted; Conflict: no links configured</td>
</tr>
<tr>
<td>400</td>
<td>194.168.9.9</td>
<td>0000.0000.0000</td>
<td>0000.0000.0000</td>
<td>Halted; Conflict: satellite has no type configured</td>
</tr>
</tbody>
</table>

#### Check if Upgrade is Required

To check if an upgrade is required on satellite, run the `show nv satellite status satellite satellite_id`.

```
RP/0/RSP0/CPU0:router# show nv satellite status satellite 100
```

Satellite 100
-------------
State: Connected (Stable)
Type: asr9000v
Description: sat-test
IPv4 address: 100.1.1.1
Configured Serial Number: CAT1521B1BB
Received Serial Number: CAT1521B1BB
Remote version: Compatible (latest version)
ROMMON: 125.0 (Latest)
FPGA: 1.13 (Latest)
IOS: 200.8 (Latest)
Configured satellite fabric links:
TenGigE0/2/0/6
-------------
State: Satellite Ready
Port range: GigabitEthernet0/0/0-9
TenGigE0/2/0/13
-------------
State: Satellite Ready
Port range: GigabitEthernet0/0/30-39
TenGigE0/2/0/9
-------------
State: Satellite Ready
Port range: GigabitEthernet0/0/10-19

If the satellite pie is not installed on the Cisco ASR 9000 Series Router Host, then the compatibility status will be shown as unknown as there is no local version to compare against. For the Cisco NCS 5000 Series satellites, in the case where there is no satellite pie on the host and the native image is pushed onto the satellite, this will always be the case. However, in such situations, a "Recommended" version will be displayed for guidance.

Check if Upgrade is Required

To check if an upgrade is required on satellite, run the `show nv satellite status satellite satellite_id`.

```
RP/0/RSP0/CPU0:router# show nv satellite status satellite 100
Satellite 100
------------
State: Connected (Stable)
Type: asr9000v
Description: sat-test
IPv4 address: dc7b.9427.47e4
IPV4 address: 100.1.1.1
Configured Serial Number: CAT1521B1BB
Received Serial Number: CAT1521B1BB
Remote version: Compatible (latest version)
ROMMON: 125.0 (Latest)
FPGA: 1.13 (Latest)
IOS: 200.8 (Latest)
Configured satellite fabric links:
  TenGigE0/2/0/6
------------
State: Satellite Ready
  Port range: GigabitEthernet0/0/0-9
  TenGigE0/2/0/13
------------
State: Satellite Ready
  Port range: GigabitEthernet0/0/30-39
  TenGigE0/2/0/9
------------
State: Satellite Ready
  Port range: GigabitEthernet0/0/10-19
```

In this example output, Remote version, ROMMON, FPGA, and IOS must show the latest version. If it does not, an upgrade is required on the satellite. The version numbers displayed are the installed version on the ASR 9000v. If a version number is displayed, instead of latest key word in the above output, that would correspond to the ASR9000v image bundles in the satellite pie.

Note
show tech from satellite devices can be pulled out remotely using `show tech-support satellite remote satellite [sat id] file disk0:/[filename]` option for offline analysis of the states on the satellite device. This works for Cisco ASR 9000v and Cisco NCS 5000 Series satellites.
Monitoring the Satellite Protocol Status

To check the status of the satellite discovery protocol, use the `show nv satellite protocol discovery` command.

```
RP/0/RSP0/CPU0:router# show nv satellite protocol discovery brief
Interface    Sat-ID Status            Discovered links
-------------- ------ ------------------------------ -----------------------
Te0/1/0/0     100 Satellite Ready        Te0/1/0/0
Te0/1/0/1     100 Satellite Ready        Te0/1/0/1
```

(Or)
```
RP/0/RSP0/CPU0:router# show nv satellite protocol discovery interface TenGigE 0/1/0/0
Satellite ID: 100
Status: Satellite Ready
Remote ports: GigabitEthernet0/0/0-15
Satellite IPv4 Address: 101.102.103.105
Vendor: cisco, ASR9000v-DC-E
Remote ID: 2
Remote MAC address: dc7b.9426.15c2
Chassis MAC address: dc7b.9426.1594
```

To check the status of the satellite control protocol status, use the `show nv satellite protocol control` command.

```
RP/0/RSP0/CPU0:router# show nv satellite protocol control brief
Sat-ID IP Address Protocol state Channels
------ ------------ -------------- -----------------------------------
101.102.103.105 Connected Ctrl, If-Ext L1, If-Ext L2, X-link, Soft Reset, Inventory, EnvMon, Alarm
```

```
RP/0/RSP0/CPU0:shanghai# sh nv satellite protocol control
Satellite 100
-------------
IP address: 101.102.103.105
Status: Connected
Channels:
Control
---------
Channel status: Open
Messages sent: 24 (24 control), received: 23 (23 control).
Interface Extension Layer 1
----------------------------
Channel status: Open
Messages sent: 7 (3 control), received: 14 (2 control).
Interface Extension Layer 2
-----------------------------
Channel status: Open
Messages sent: 11 (3 control), received: 10 (2 control).
Interface Extension Cross-link
-----------------------------
Channel status: Open
Messages sent: 4 (3 control), received: 3 (2 control).
```

Monitoring the Satellite Inventory

You can use the `show inventory chassis`, `show inventory fans` commands in the admin configuration mode to monitor the status of satellite inventory.
Along with a physical entity for the ASR-9000v/v2 satellite, logical entities are also created for the satellite and the power module. Both these entities (physical and logical) are seen in the inventory details command output and in SNMP MIBs. The logical entities can be identified by the lack of serial number (SN) and version identifier (VID).

Note

```
RP/0/RSP0/CPU0:router(admin)# show inventory chassis
NAME: "module 0/RSP0/CPU0", DESCR: "ASR9K Fabric, Controller, 4G memory"
PID: A9K-RSP-4G, VID: V02, SN: FOC143781GJ
...
NAME: "fantray SAT100/FT0/SP", DESCR: "ASR9000v"
PID: ASR-9000v-FTA, VID: V00, SN: CAT1507B228
NAME: "module SAT100/0/CPU0", DESCR: "ASR-9000v GE-SFP Line Card"
PID: ASR-9000v, VID: N/A, SN: /*Logical Entity of the Satellite*/
NAME: "module mau GigabitEthernet100/0/CPU0/8", DESCR: "CISCO-AVAGO"
PID: SFP-GE-S, VID: V01, SN: A6M142D908N
NAME: "module mau TenGigE100/0/CPU0/3", DESCR: "CISCO-FINISAR"
PID: SFP-10G-SR, VID: V02, SN: FNS144502Y3
NAME: "module SAT100/0/CPU0", DESCR: "ASR-9000 Power Module"
PID: ASR-9000v, VID: N/A, SN: /*Physical Entity of the Satellite*/
NAME: "Satellite Chassis ASR-9000v ID 100", DESCR: "ASR9000v"
PID: ASR-9000v-AC-A, VID: V00, SN: CAT12345678
```

```
RP/0/RSP0/CPU0:router(admin)# show inventory fans
NAME: "fantray 0/FT0/SP", DESCR: "ASR-9006 Fan Tray"
PID: ASR-9006-FAN, VID: V02, SN: FOX1519XHU8
NAME: "fantray 0/FT1/SP", DESCR: "ASR-9006 Fan Tray"
PID: ASR-9006-FAN, VID: V02, SN: FOX1519XHTM
NAME: "fantray SAT100/FT0/SP", DESCR: "ASR9000v"
PID: ASR-9000v-FTA, VID: V01, SN: CAT1531B4TC
NAME: "fantray SAT101/FT0/SP", DESCR: "ASR9000v"
PID: ASR-9000v-FTA, VID: V01, SN: CAT1531B4L7
NAME: "fantray SAT102/FT0/SP", DESCR: "ASR9000v"
PID: ASR-9000v-FTA, VID: V01, SN: CAT1531B4T7
```

```
RP/0/RSP0/CPU0:sat-host(admin)# show inventory | b GigabitEthernet100/
NAME: "module mau GigabitEthernet100/0/CPU0/0", DESCR: "CISCO-FINISAR"
PID: SFP-GE-S, VID: , SN: FNS11350L5E
NAME: "module mau GigabitEthernet100/0/CPU0/1", DESCR: "CISCO-FINISAR"
PID: SFP-GE-S, VID: V01, SN: FNS0934M290
NAME: "module mau GigabitEthernet100/0/CPU0/2", DESCR: "CISCO-FINISAR"
PID: SFP-GE-S, VID: , SN: FNS12280L59
```
Monitoring the Satellite Environment

You can use the `show environment temperatures` and `show environment fans` commands in the admin configuration mode to monitor the status of satellite environment.

```
RP/0/RSP0/CPU0:router (admin)# show environment temperatures

R/S/I Modules Sensor (deg C)
0/RSP0/*
 host Inlet0    33.1
 host Hotspot0  46.9

0/RSP1/*
 host Inlet0    32.1
 host Hotspot0  45.9

0/0/*
 host Inlet0    37.3
 host Hotspot0  52.3

0/1/*
 spa0 InletTemp 34.0
 spa0 Hotspot   34.5
 spa1 LocalTemp 38.0
 spa1 Chan1Temp 36.0
 spa1 Chan2Temp 39.0
 spa1 Chan3Temp 39.0
 spa1 Chan4Temp 48.0
 host Inlet0    36.1
 host Hotspot0  64.0

0/2/*
 host Inlet0    39.2
 host Hotspot0  54.6

0/3/*
 host Inlet0    41.3
 host Hotspot0  48.5

0/FT0/*
 host Inlet0    42.3
 host Hotspot0  36.1

0/FT1/*
 host Inlet0    40.4
 host Hotspot0  35.8

SAT100/FT0/*
 host Hotspot0  53.0

SAT101/FT0/*
 host Hotspot0  56.0

SAT102/FT0/*
 host Hotspot0  53.0

RP/0/RSP0/CPU0:router (admin)# show environment fans

Wed Apr  8 17:40:00.313 UTC
Fan speed (rpm) and run time (in hours) :

<table>
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<tr>
<th></th>
<th>FAN0</th>
<th>FAN1</th>
<th>FAN2</th>
<th>FAN3</th>
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<th>FAN6</th>
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<tr>
<td>Fan</td>
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<td>FAN10</td>
<td>FAN11</td>
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<td>8010</td>
<td>8010</td>
<td>7950</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

0/FT0/* (Speed)
   7980 7830 7920 8010 7920 7920 7950 7920
```

Cisco IOS XR nV System Configuration Guide for the Cisco CRS Router, Release 5.2.x
Reloading the Satellite and Monitoring DOM Parameters

In order to reload the satellite device, use the `hw-module satellite satellite id/all reload` command.

RP/0/RSP0/CPU0:router# hw-module satellite 101 reload

Reload operation completed successfully.

In order to see the DOM parameters of the SFPs and XSPs or access ports and ICL ports of the satellite, use the `show controllers gigabitEthernet interface phy` command.

For access ports

```console
RP/0/RSP0/CPU0:Saturn#show controllers gigabitEthernet 100/0/0/22 phy
Wed Apr  8 17:42:32.100 UTC
Port: 22
Xcvr Type: SFP
Vendor Name: CISCO-FINISAR
CLEI Code: IPUIALJRAA
Part Number: 10-2143-01V01
Product Id: SFP-GE-S
Thresholds: Alarm High Warning High
Warning Low Alarm Low
Temperature: 109C 103C
-13C -29C
Voltage: 3900uV 3700uV
2900uV 2700uV
Bias: 15mAmps 12mAmps
2mAmps 1mAmps
Transmit Power: 0.63100 mW (-1.99971 dBm) 0.63100 mW (-1.99971 dBm)
0.07900 mW (-11.02373 dBm) 0.06600 mW (-11.80456 dBm)
Receive Power: 1.25800 mW (0.99681 dBm) 0.79400 mW (-1.00179 dBm)
0.01500 mW (-18.23909 dBm) 0.01000 mW (-20.00000 dBm)
Temperature: 32 C
Voltage: 3327 uV
Bias: 5 mAmps
Tx Power: 0.28100 mW (-5.51294 dBm)
Rx Power: 0.000 mW (<-40.00 dBm)
```

For ICL port

```console
RP/0/RSP0/CPU0:Saturn#show controllers nvFabric-TenGigE 100/0/0/46 phy
Wed Apr  8 17:46:57.045 UTC
Port: 46
Xcvr Type: SFP
Vendor Name: CISCO-FINISAR
CLEI Code: COUIA75CAA
Part Number: 10-2457-02V02
Product Id: SFP-10G-LR
Thresholds: Alarm High Warning High
Warning Low Alarm Low
Temperature: 75C 70C
0C -5C
Voltage: 3630uV 3465uV
3135uV 2970uV
Bias: 70mAmps 68mAmps
2mAmps 1mAmps
Transmit Power: 2.23800 mW (3.49860 dBm) 1.12200 mW (0.49993 dBm)
0.15100 mW (-8.21023 dBm) 0.06000 mW (-12.21849 dBm)
```

Cisco IOS XR nV System Configuration Guide for the Cisco CRS Router, Release 5.2.x
Port Level Parameters Configured on a Satellite

These are the port-level parameters that can be configured on a satellite nV system:

- Admin state (shut and no shut)
- Ethernet MTU

**Note**
For Cisco ASR 9000v access ports, the maximum MTU is 9212 for a hub and spoke topology and 9194 for a ring or L2FAB topology.

- Ethernet MAC Address.
- Ethernet link auto-negotiation that includes,
  - Half and full duplex
  - Link speed
  - Flow control
- Static configuration of auto-negotiation parameters such as speed, duplex, and flow control
- Carrier delay
- Layer-1 packet loopback which includes,
  - Line loopback
  - Internal loopback
- All satellite access port features on Cisco ASR 9000 Series Router.

Loopback Types on Satellite Ports

There are two types of loopback interfaces that can be configured on satellite ports. They are,

- Line Loopback
- Internal Loopback
These illustrations show how the loopback interface types function on a satellite.

*Figure 3: Line Loopback*

*Figure 4: Internal Loopback*

You can specify the type of loopback to be used, as specified in this example:

```
Interface GigabitEthernet 100/0/0/0
loopback line | internal
```

**Configuration Examples for Satellite nV System**

This section contains configuration examples for the Satellite nV system:

**Satellite System Configuration: Example**

This example shows a sample configuration to configure connectivity for a Satellite System:

**Satellite Global Configuration**

The satellite ID, type, serial number, description, and satellite IP address are configured in the satellite global configuration sub-mode:

```
nv
satellite 100
type asr9000v
serial-number CAT1521B1BB
description milpitas bldg20
ipv4 address 10.0.0.100
```

**ICL (satellite-fabric-link) Interface Configuration**

On an interface connected to a Satellite (TenGigE or Bundle interface), the ports associated with the satellite-id must be specified. All fabric links connected to the same Satellite must use the same (Host) IPv4 address. This Host IPv4 addresses can be used for the same Host to connect to different Satellites.
Before you remove or change a configuration on an ICL interface, shut down the ICL port.

```
interface Loopback1000
vrf <vrf_name>
ipv4 address 10.0.0.1 255.0.0.0
vrf <vrf_name>
interface TenGigE0/2/1/0
description To Sat5 1/46
ipv4 point-to-point
ipv4 unnumbered Loopback1000
nv
satellite-fabric-link satellite 200
remote-ports GigabitEthernet 0/0/0-30
!
```

To manage satellite traffic, use the IP addresses from the global VRF of the router (shown in the examples). As mentioned in Satellite Discovery and Control Protocol IP Connectivity section, you can use a private VRF to prevent IP address conflict with global VRF. In such a case, the loopback interface and ICL interface (in the examples) must be assigned to the private VRF dedicated for satellite management traffic.

```
Satellite Interface Configuration

A Satellite interface can be used like any other regular Gigabit Ethernet interfaces:

```
interface TenGigE 200/0/0/0
l2transport
!
interface TenGigE 200/0/0/0
ip address 99.0.0.1 255.255.255.0
!
interface TenGigE 200/0/0/2
bundle id 100 mode active
!
```

Satellite Management Using Private VRF

You can use a special private VRF instead of the global default routing table, to configure the loopback interface and ICLs used for satellite management traffic. IP addresses in this VRF will not conflict with any other addresses used on the router.

```
router(config)# vrf NV_MGMT_VRF
router(config)# address ipv4 unicast

router(config)# interface Loopback 1000
router(config)# vrf NV_MGMT_VRF
router(config)# ipv4 address 10.0.0.1 / 24

router(config)# interface TenGige 0/1/0/3
router(config)# vrf NV_MGMT_VRF
router(config)# ipv4 point-To-point
router(config)# ipv4 unnumbered Loopback 1000
router(config)# nv
```
router(config-nv)# satellite-fabric-link satellite 500
router(config-nv)# remote-ports GigabitEthernet 0/0/28-39
router(config)# nv satellite 500
router(config)# ipv4 address 10.0.0.2 / 24

**Additional References**

These sections provide references to related documents.

**Related Documents**

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<td>Cisco IOS XR Master Commands List</td>
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<tr>
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<td>Cisco IOS XR Getting Started Guide for the Cisco CRS Router</td>
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<tr>
<td>Cisco IOS XR interface configuration commands</td>
<td>Cisco IOS XR Interface and Hardware Component Command Reference</td>
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<tr>
<td>Satellite QoS configuration information for the Cisco IOS XR software</td>
<td>Cisco IOS XR Modular Quality of Service Configuration Guide</td>
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<tr>
<td>Bidirectional Forwarding Detection features on the satellite system</td>
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<td>Multicast features on the satellite system</td>
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<td>Information about user groups and task IDs</td>
<td>Configuring AAA Services on Cisco IOS XR Software module of Cisco IOS XR System Security Configuration Guide</td>
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**Standards**

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MIBs

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<th>MIBs Link</th>
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<td>There are no applicable MIBs for this module.</td>
<td>To locate and download MIBs for selected platforms using Cisco IOS XR software, use the Cisco MIB Locator found at the following URL: <a href="http://cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml">http://cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml</a></td>
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RFCs

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Technical Assistance

<table>
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<tr>
<td>The Cisco Technical Support website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.</td>
<td><a href="http://www.cisco.com/support">http://www.cisco.com/support</a></td>
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