



Cisco cBR Converged Broadband Routers Basic Configuration and Provisioning Construct for Cisco IOS XE Gibraltar 16.10.x

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Americas Headquarters

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
<http://www.cisco.com>
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883



CHAPTER 1

Video Services Provisioning Model

The Cisco cBR-8 router offers the next generation CCAP platform supporting converged CMTS and EQAM functionality. The redesigned video data model supports the creation of virtual edge devices within the platform. This data model simplifies the provisioning procedure and enables seamless migration to virtualized video service management in the future.

The video provisioning constructs of the new data model provide hardware abstraction and divides services into virtual edge devices for easier provisioning at scale. It also provides isolation between the service applications at the software layer. A bind-operation connects these constructs to the physical resources.

- [Information about Video Services Provisioning](#) , on page 1
- [Feature Information for Video Services Provisioning](#), on page 3

Information about Video Services Provisioning

Video Provisioning Constructs

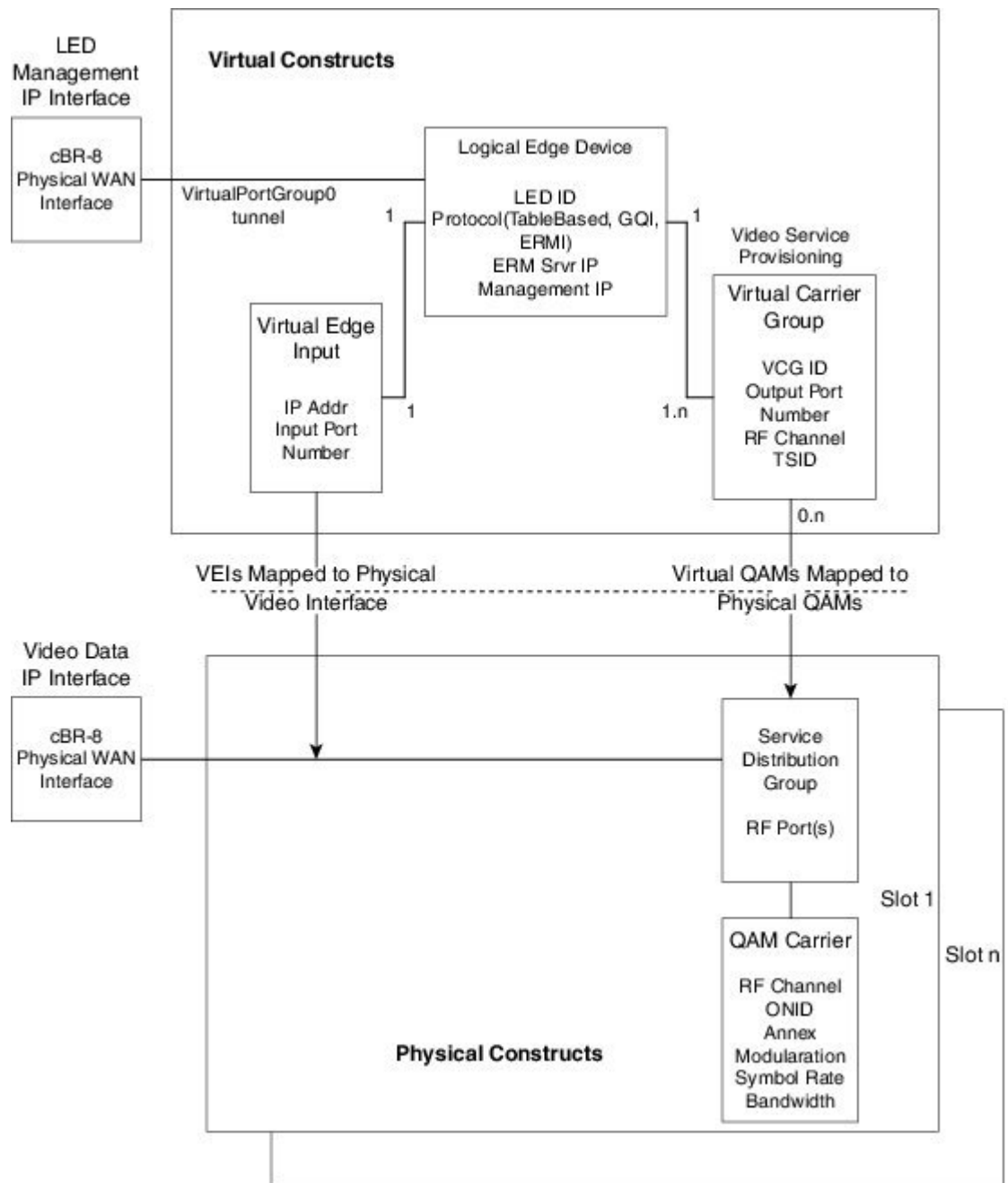
The Video Services Provisioning Model has the following elements:

- **Logical Edge Device (LED)**—a virtual edge device in the Cisco cBR-8 chassis that can be provisioned for static or dynamic sessions.
- **Virtual Carrier Group (VCG)**—a collection of Virtual QAM Carriers (RF channels) provisioned on an LED.
- **Virtual Edge Input (VEI)**—assigned either globally to all VCGs in the LED or optionally assigned uniquely to an individual VCG.
- **Service Distribution Group (SDG)**—a collection of one or more RF ports that define the physical slot/bay/port to be used in a video service.

Connection of Virtual and Physical Constructs

The VCGs are bound to an SDG using a bind command (bind-vcg). This connects the virtual carriers to the physical ports listed in the SDG. After binding, a path from the VEI is mapped to the RF ports.

The image below shows the elements in the Video Provisioning Construct.



Feature Information for Video Services Provisioning

Table 1: Feature Information for Video Services Provisioning

Feature Name	Releases	Feature Information
Video Services Provisioning	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.



CHAPTER 2

Video Virtual Carrier Group and Virtual Edge Input

A Virtual Carrier Group (VCG) is a collection of virtual QAM carriers (RF channels) provisioned on a Logical Edge Device (LED). A Virtual Edge Input (VEI) is a customer assigned IP address that is used, from the Head End, as a destination IP address for unicast video IP packets.

- [Information about Virtual Carrier Group and Virtual Edge Input, on page 5](#)
- [How to Configure Virtual Carrier Group and Virtual Edge Input, on page 6](#)
- [Configuration Examples for Virtual Carrier Group and Virtual Edge Input, on page 9](#)
- [Feature Information for Virtual Carrier Group and Virtual Edge Input, on page 10](#)

Information about Virtual Carrier Group and Virtual Edge Input

Virtual Carrier Group

A Virtual Carrier Group (VCG) is a collection of virtual QAM carriers (RF channels) provisioned on a Logical Edge Device (LED).

Each VCG must have a unique name and ID, since it also assigns attributes such as TSID and output port number to the virtual QAM carriers. The output port number only needs to be unique per LED. However, TSID/ONID pair must be unique for the chassis.

Duplicate TSIDs can be assigned to multiple QAM carriers by overriding the default TSID. Overriding the default TSID does not affect the unique TSID/ONID pair on the cBR router. The duplicate TSID overrides the unique TSID on the PAT header.

For more information, see [Overriding the Default TSID](#) section.

The service type must be designated in each VCG and the `encrypt` command must be entered if the carriers are to be encrypted. Enabling the VCG to use encryption and service type designates that each QAM carrier listed in the VCG will consume a QAM encryption license and video service type license. The actual number of licenses consumed will be done at VCG binding operation and is also dependent on the QAM replication requirements.

For more information on how the licenses are consumed, see [Cisco Smart Licensing for Video](#).

Virtual Edge Input

A Virtual Edge Input (VEI) is a customer assigned IP address that is used, from the Head End, as a destination IP address for unicast video IP packets. Each VEI will need to be configured with a routable IP address from within the customer's network.

A VEI is assigned within a Logical Edge Device. Each Virtual Carrier Group (VCG) is associated with one or more IP addresses that represent VEIs.

For GQI protocol, VEI must be configured under the LED, since GQI expects VEI to be able to reach any Virtual QAM carrier listed in the same LED. Again, for GQI protocol, there is a limit of five VEIs per LED.

For the table based protocol, VEI may be configured under the LED or under a VCG. If the VEI is configured under a VCG, it can only reach the virtual QAM carriers associated with that particular VCG.

During the VCG binding operation, each VEI IP address will be bound to a single Video IP interface.

You can isolate the video traffic from other network traffic using MPLS (Multiprotocol Label Switching) and VRF (Virtual Routing and Forwarding), by configuring the VRF name parameter in video-edge-input command.



Note Do not use the same VEI IP address in multiple VRFs, as Head End video session management servers are not MPLS or VRF aware.

How to Configure Virtual Carrier Group and Virtual Edge Input

Configuring Virtual Carrier Group

Before you begin

Since each VEI needs to be configured with a routable IP address from within the customer's network, choose the IP addresses to use prior to configuring the VEIs.

Error messages for problems with the VCG configuration will become evident during the bind operation. Errors include overlapping rf-channels.

In virtual-edge-input-ip command line configuration, vrf is an optional parameter and can be used for MPLS routing or to make VEI private from other parts of the network.

To configure virtual carrier group, follow the steps below:

```
enable
configure terminal
cable video
virtual-carrier-group name [id number]
virtual-edge-input-ip ip-address [vrf vrf-name] input-port-number port-number
encrypt
service-type narrowcast
rf-channel start_channel-end_channel tsid start_tsid-end_tsid output-port-number
start_number-end_number
```


Overriding the Default TSID

To assign duplicate TSIDs to multiple QAM carriers, you can override the default TSID by using the **override-tsid** command as shown in the example below.

```
enable
configure terminal
cable video
virtual-carrier-group name [id number]
override-tsid TSID
```

Verifying Virtual Carrier Group Configuration

To verify the virtual carrier group configuration, use the **show cable video virtual-carrier-group** command as shown in the example below.

```
Router# show cable video virtual-carrier-group all
Number of Virtual Carrier Groups: 1
```

ID	Name	Service	Logical	ServiceType	Encrypted	Low Latency	Override TSID	Total VEI	Total RF-Channel
		-Distribution -Group Name	-Edge -Device Name						
1	vcg1	sdg1	led1	narrowcast	N	N	-	0	1

Configuring Virtual Edge Input under Logical Edge Device

Before you begin

Since each VEI will need to be configured with a routable IP address from within the customer's network, choose the IP addresses to use prior to configuring the VEIs.

To configure virtual edge input, follow the steps below:

```
enable
configure terminal
cable video
virtual-carrier-group name [id] number
virtual-edge-input-ip ip-address [vrf vrf-name] input-port-number port-number
vcg vcg-name
active
```

To configure virtual edge input under logical edge device, follow the steps below:

```
enable
configure terminal
cable video
logical-edge-device name [id] number
protocol table-based
virtual-edge-input-ip ip-address [vrf vrf-name] input-port-number port-number
vcg vcg-name
active
```

Verifying Virtual Edge Input Configuration

To verify the virtual edge input configuration, use the **show cable video logical-edge-device** command as shown in the example below.

```
Router# show cable video logical-edge-device id 1
Logical Edge Device: led
Id: 1
Protocol: GQI
Service State: Active
Discovery State: Disable
Management IP: 1.33.2.10
MAC Address: c414.3c17.6000
Number of Servers: 2
  Server 1: 1.200.1.193
  Server 2: 1.200.1.183
Reset Interval: 5
Keepalive Interval: 5
Retry Count:3
Number of Virtual Carrier Groups: 2
Number of Share Virtual Edge Input: 1
Number of Physical Qams: 94
Number of Sessions: 240
No Reserve PID Range

Virtual Edge Input:
Input Port   VEI           Slot/Bay Bundle Gateway
ID           IP            ID           ID           IP
-----
1            174.102.1.1  7/0         -           -  --

Virtual Carrier Group:
ID Name      Total Total      Service-Distribution-Group Service-Distribution-Groupup
      VEI    RF-channel  Name                               ID
-----
1  vcg  0    28      sdg                               1
2  vcg-2 0    19      sdg                               1

Integrated Physical Admin Operational TSID ONID Output VCG SDG Encryption
Cable      QAM ID   State State         ID  ONID  Port  ID  ID  Capable
-----
7/0/0:1    1       ON   UP           29  1000 30    2  1  powerkey
7/0/0:2    2       ON   UP           30  1000 30    2  1  powerkey
7/0/0:3    3       ON   UP           31  1000 30    2  1  powerkey
7/0/0:4    4       ON   UP           32  1000 30    2  1  powerkey
7/0/0:5    5       ON   UP           33  1000 30    2  1  powerkey
7/0/0:6    6       ON   UP           34  1000 30    2  1  powerkey
7/0/0:7    7       ON   UP           35  1000 30    2  1  powerkey
7/0/0:8    8       ON   UP           36  1000 30    2  1  powerkey
7/0/0:9    9       ON   UP           37  1000 30    2  1  powerkey
```

To verify the VEI configuration with MPLS-VPN VRF, use the **show ip arp vrf** command as shown in the example below:

```
Router# show ip arp vrf Video-VOD-Vrf
Protocol  Address           Age (min)  Hardware Addr  Type  Interface
Internet  174.102.1.1      -          12ab.0007.ce01 ARPA  Video7/0/0
```

Configuration Examples for Virtual Carrier Group and Virtual Edge Input

This section provides configuration examples for the Virtual Carrier Group and Virtual Edge Input:

Example: Configuring Virtual Carrier Group

The following example shows how to configure virtual carrier group:

```
enable
configure terminal
cable video
virtual-carrier-group vcg-0 id 1
virtual-edge-input-ip 174.101.1.1 input-port-number 1
virtual-edge-input-ip 174.102.1.1 vrf Video-VOD-Vrf input-port-number 2
encrypt
service-type narrowcast
rf-channel 0-10 tsid 1-11 output-port-number 1-11
```

Example: Configuring Virtual Edge Input

The following example shows how to configure virtual edge input:

```
enable
configure terminal
cable video
logical-edge-device led_bc1 id 1
protocol table-based
virtual-edge-input-ip 174.102.1.1 input-port-number 1
vcg vcg_bc1
active
```

You can also configure VEI to be associated with a MPLS-VPN VRF:

```
enable
configure terminal
cable video
virtual-carrier-group vcg1 id 1
virtual-edge-input-ip 174.102.1.1 vrf Video-VOD-Vrf input-port-number 1
vcg vcg-name
active
```

Under logical edge device, follow the steps below:

```
enable
configure terminal
cable video
logical-edge-device led_bc1 id 1
protocol table-based
virtual-edge-input-ip 174.102.1.1 vrf Video-VOD-Vrf input-port-number 1
```

Example: Overriding the Default TSID

```
vcb vcg_bc1
active
```

Example: Overriding the Default TSID

The following example shows how to override the default TSID:

```
enable
configure terminal
cable video
virtual-carrier-group vcg1 id 1
override-tsid 100
%%Configuring this will regenerate the PAT with overridden TSID value for all QAM channels
  under this VCG.
Do you want to continue? [Yes/No][confirm]y
```

Feature Information for Virtual Carrier Group and Virtual Edge Input

Table 2: Feature Information for Virtual Carrier Group and Virtual Edge Input

Feature Name	Releases	Feature Information
Virtual Carrier Group and Virtual Edge Input	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.
Using VRF for Video Session Traffic	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.



CHAPTER 3

Service Distribution Group

The Service Distribution Group (SDG) is a collection of one or more RF ports and defines the physical slot/bay/port to be used in a video service.

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- [How to Configure the Service Distribution Group, on page 12](#)
- [Troubleshooting Tips, on page 15](#)
- [Configuration Examples, on page 15](#)
- [Feature Information for Service Distribution Group, on page 16](#)

Information About Service Distribution Group

The following are the required components for configuring an SDG:

- **Multiple Ports**—Multiple ports in an SDG replicate all QAMs from the Virtual Carrier Group (VCG) to every port.
- **Unicast**—Unicast (VoD) services cannot be replicated across line cards.
- **TSID**—The TSIDs should always be unique (North American MSO). Non-unique TSIDs can be used if the ONID is changed from the default value of zero (0).

The convention slot/bay/port represents the following:

- **Slot**—Slot is the line card slot number. Slot can be configured 0–3 or 6–9. Slots 4 and 5 are the supervisor slots.
- **Bay**—Bay is the Cisco cBR-8 chassis number. This parameter is always configured as 0.
- **Port**—Port is the RF port number. This parameter can be configured 1–8.

**Note**

- For a Remote PHY line card, the SDG does not describe a collection of RF ports. SDG specifies the line card, bay, and downstream cable controller where the video will be destined. Use **rpdc downstream-cable slot/bay/controller** command instead of **rf-port integrated-cable slot/bay/port** command. Only one downstream cable controller can be specified for an SDG, so QAM replication is not supported. (However, the controller can be multicast to multiple remote PHY devices which is similar to QAM replication but occurs external to the cBR-8.)
- Cisco Remote PHY Device 1x2 can join up to 30 multicast streams simultaneously for video.
- Cisco HA Shelf can join up to 30 multicast streams simultaneously per RPD for video.

How to Configure the Service Distribution Group

This section describes how to configure SDGs for the video session on Cisco cBR-8.

Defining the Physical Slot/Bay/Port

To define the Service Distribution Group (SDG), you must define the physical *slot/bay/port* to be used in a video service.

Before You Begin

Make sure that the controller type is **video** for the *slot/bay/port* that you use for the SDG. Errors due to the incorrect controller type used in the SDG appear during the bind operation.

To define the physical *slot/bay/port*, complete the following procedure:

```
configure terminal
cable video
service-distribution-group sdg name
rf-port integrated-cable slot/bay/port
```

Configuring QAM Replication

To configure QAM replication for service group size alignment between the DOCSIS and video services to one or more ports, you can add more ports into the service distribution group configuration.

Before You Begin

Make sure that the controller type is **video** for the *slot/bay/port* that you would use for the SDG. For more information, see the **Video QAM Carriers** section. Errors due to the incorrect controller type used in the SDG appear during the bind operation.

To configure QAM replication, complete the following procedure:

```
configure terminal
cable video
service-distribution-group service distribution group name
rf-port integrated-cable slot/bay/port
rf-port integrated-cable slot/bay/port
```

Overriding the Default ONID

You can override the default ONID, by defining a new ONID value in the SDG configuration. If you perform this configuration, all channels associated with the configured SDG will have the new ONID value. By default, the system ONID is 0, which is commonly used in North America.

To override the default ONID, complete the following procedure:

```
configure terminal
cable video
service-distribution-group service distribution group name
onid onid number
```

Overriding the Default PSI Value

To override the default PSI value, complete the following procedure:

```
configure terminal
cable video
service-distribution-group service distribution group name
psi-interval psi-interval msec
```

Configuring the Serving Area

Configure the serving area to enable the set tops to discover VOD content.

```
configure terminal
cable video
service-distribution-group service distribution group name id id
serving-area value
```

To configure the service descriptor default, complete the following procedure:

```
configure terminal
cable video
service-descriptor-default
service-id id
service-name string
service-type id
provider-name string
```

If the serving area is specified and there are no defaults specified, the service name should be set as **VOD** and provider name should be set as **VOD-SERVER**, service id set as **1**, service type set as **1**.

Verifying the Serving Area Configuration

If the serving area is configured, session detail output will list the SDT information.

```
Router# show cable video session logical-edge-device id 2 session-id 270532608
Session Name      : mpts1.2.199
Session Id       : 270532608
Creation Time    : Fri Oct 12 22:07:03 2018

Output Port      : 41
```

```

TSID                : 41
Override TSID       : not specified
ONID                : 2
Number of Sources   : 1
  Source IP         : 176.51.1.2
  Group IP          : 238.11.1.106
  UDP Port          : 0
Config Bitrate      : not specified
Jitter              : 100 ms
Processing Type     : Passthru
Stream Rate         : CBR
Program Number      : -
Idle Timeout        : 2000 msec
Init Timeout        : 2000 msec
Off Timeout         : 60 sec
Encryption Type     : Pre-encrypted
Encryption Status   : Encrypted

Input Session Stats:
=====
State: ACTIVE-PSI, Uptime: 0 days 02:50:59
IP Packets: In 2569416, RTP 0, Drop 0
TP Packets: In 16910560, PCR 262629, PSI 292104, Null 1075352
             Unreference 102351, Discontinuity 0
Errors: Sync loss 0, CC error 0, PCR Jump 4,
        Underflow 2, Overflow 0, Block 0
Bitrate: Measured 2463450 bps, PCR 2637379 bps

Output Session Stats:
=====
State: ON, Uptime: 0 days 02:50:59
TP Packets: In 17056642, PCR 262628, PSI 292102,
             Drop 0, Forward 16764540, Insert 0
Errors: Info Overrun 0, Info Error 0, Block 0, Overdue 0,
        Invalid Rate 0, Underflow 0, Overflow 0
Bitrate: Measured 2439152 bps

SDT Info:
=====
Version 2, TSID 10, len 41, carousel 450

PAT Info:
=====
Version 18, TSID 1, len 16, section 0/0
Program 1: PMT 16

Input PMT Info:
=====
Program 1, Version 1, PCR 17, Info len 0
PID 17: Type 2, Info len 9, (CA SYS-ID 3584, PID 1, Private data: 010101)
PID 18: Type 4, Info len 15, (lang eng), (CA SYS-ID 3584, PID 1, Private data: 010102)
PID 19: Type 4, Info len 15, (lang spa), (CA SYS-ID 3584, PID 1, Private data: 010103)
PID 20: Type 4, Info len 15, (lang fre), (CA SYS-ID 3584, PID 1, Private data: 010104)

Output PMT Info:
=====
Program 1, Version 1, PCR 17, Info len 0
PID 17: Type 2, Info len 9, (CA SYS-ID 3584, PID 1, Private data: 010101)
PID 18: Type 4, Info len 15, (lang eng), (CA SYS-ID 3584, PID 1, Private data: 010102)
PID 19: Type 4, Info len 15, (lang spa), (CA SYS-ID 3584, PID 1, Private data: 010103)
PID 20: Type 4, Info len 15, (lang fre), (CA SYS-ID 3584, PID 1, Private data: 010104)

```

To verify the service descriptor default value, use the command as shown in the following example:


```
Router# show run | s service-descriptor-default
Service-descriptor-default
Service-id 200
Service-name HD-Service
Service-type 1
Provider-name NEWS-channel
```

Verifying Service Distribution Group Configuration

To verify the SDG configuration, use the **show cable video service-distribution-group** command as shown in the example below:

```
Router# show cable video service-distribution-group all
Number of Service Distribution Groups: 1
ID Name      Virtual-Carrier-Group Logical-Edge-Device RF-Port  ONID  PSI    Serving
-----
          Name                Name
-----
1  sdg1   vcg1                table-based      9/0/0   0     100   10
```

```
Router# show cable video service-distribution-group id 1
Name: sdg1
Id: 1
ONID: 0
PSI Interval: 100
Serving Area: 10
```

```
RF Ports:
  Integrated-Cable 9/0/0
```

```
Number of Virtual Carrier Groups: 1
```

VCG ID	VCG Name	LED ID	LED Name
1	vcg 1	1	table-based

Troubleshooting Tips

To undo any configuration, use the **no** form of the command. This command is useful if you have configured something by mistake. The errors are not apparent until you perform the bind operation.

Configuration Examples

This section provides example configurations for the service distribution group.

Configuring a Service Distribution Group

```
configure terminal
cable video
service-distribution-group vod id 1
onid 100
rf-port integrated-cable 7/0/0
rf-port integrated-cable 7/0/1
```

```
rf-port integrated-cable 7/0/2  
rf-port integrated-cable 7/0/3
```

Feature Information for Service Distribution Group

Table 3: Feature Information for Service Distribution Group

Feature Name	Releases	Feature Information
Service Distribution Group	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.
SDT	Cisco IOS XE Gibraltar 16.10.1c	This feature was introduced on the Cisco cBR Series Converged Broadband Routers.



CHAPTER 4

QAM Profile

A QAM profile describes the common downstream channel modulator settings, referred to as physical layer parameters. This includes QAM constellation, symbol rate, interleaver-depth, spectrum-inversion, and annex.

For more information about the downstream interface configuration, see [Downstream Interface Configuration](#).

But be aware that, if you configure annex A 6MHz or 7MHz in a QAM profile, then this QAM profile cannot be applied to a DOCSIS channel.

- [QAM Profile, on page 17](#)
- [How to Configure the Video QAM Carriers, on page 17](#)
- [Configuration Examples, on page 19](#)
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- [Feature Information for QAM Video Carriers, on page 21](#)

QAM Profile

A QAM profile describes the common downstream channel modulator settings, referred to as physical layer parameters. This includes QAM constellation, symbol rate, interleaver-depth, spectrum-inversion, and annex.

For more information about the downstream interface configuration, see [Downstream Interface Configuration](#).

But be aware that, if you configure annex A 6MHz or 7MHz in a QAM profile, then this QAM profile cannot be applied to a DOCSIS channel.

How to Configure the Video QAM Carriers

Configuring the Video QAM Profile

To configure the video QAM profile, complete the following procedure:

```
configure terminal
cable downstream qam-profile id
annex {A freq_spacing|B|C}
modulation value
```

```

interleaver-depth value
symbol-rate value
spectrum-inversion {on|off}
description line

```

The frequency spacing of 6MHz, 7MHz and 8 MHz can be selected or annex A. In this case, the QAM profile can only be applied to a video channel.

Spectral inversion happens as a result of mixing processes in RF or IF electronics. Spectrum inversion allows for the adaptation of older equipment with the new plant. The mixing of I and Q are used to create a quadrant profile. For some settops, the inversion of the quadrant profile is needed where the axis are flipped such that I represents the X and Q represents the Y-axis. Most modern equipment can detect and resolve the inversion split.

Configuring the Video QAM Carriers

To configure the Video QAM carriers, complete the following procedure:

```

configure terminal
controller integrated-cable slot/bay/port
rf-channel start-channel - end-channel
type video
start-frequency frequency
rf-output normal
power-adjust number
qam-profile qam-profile number

```



Note For video provisioning, the carriers must be of type “video” in the controller integrated-cable configuration.

Verify the configuration of the RF Channel

To verify the RF channel configuration, use the Show controller integrated-cable rf-chan command as shown in the example below:

```

Router#show controllers integrated-Cable 9/0/7 rf-channel 0-10
Load for five secs: 6%/0%; one minute: 5%; five minutes: 5%
Chan State Admin Frequency Type Annex Mod srate Interleaver dcid power output
0 UP UP 100000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
1 UP UP 106000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
2 UP UP 112000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
3 UP UP 118000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
4 UP UP 124000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
5 UP UP 130000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
6 UP UP 136000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
7 UP UP 142000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
8 UP UP 148000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
9 UP UP 154000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
10 UP UP 160000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL

```

Configuration Examples

This section provides configuration examples for the QAM video carrier.

Video QAM Carriers

The following is a sample for the Video QAM carrier configuration:

```
Router#enable
Router(config)#cable downstream qam-profile 4
Router(config-qam-prof)#annex A 6MHz
Router(config-qam-prof)#modulation 256
Router(config-qam-prof)#interleaver-depth I32-J4
Router(config-qam-prof)#symbol-rate 5361
Router(config-qam-prof)#spectrum-inversion off
Router(config-qam-prof)#description default-annex-a-256-qam
Router(config-qam-prof)#exit
Router(config)#controller Integrated-Cable 3/0/0
Router(config-controller)#max-carrier 128
Router(config-controller)#base-channel-power 34
Router(config-controller)#freq-profile 0
Router(config-controller)#rf-chan 0 95
Router(config-rf-chan)#type video
Router(config-rf-chan)#frequency 93000000
Router(config-rf-chan)#rf-output NORMAL
Router(config-rf-chan)#power-adjust 0
Router(config-rf-chan)#docsis-channel-id 1
Router(config-rf-chan)#qam-profile 1
```

Feature Information for QAM Video Carriers

Table 4: Feature Information for QAM Video Carriers

Feature Name	Releases	Feature Information
QAM Video Carriers	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.
Annex A Variable Channel Width	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.

How to Configure the Video QAM Carriers

Configuring the Video QAM Profile

To configure the video QAM profile, complete the following procedure:

```
configure terminal
cable downstream qam-profile id
```

```

annex {A freq_spacing|B|C}
modulation value
interleaver-depth value
symbol-rate value
spectrum-inversion {on|off}
description line

```

The frequency spacing of 6MHz, 7MHz and 8 MHz can be selected or annex A. In this case, the QAM profile can only be applied to a video channel.

Spectral inversion happens as a result of mixing processes in RF or IF electronics. Spectrum inversion allows for the adaptation of older equipment with the new plant. The mixing of I and Q are used to create a quadrant profile. For some settops, the inversion of the quadrant profile is needed where the axis are flipped such that I represents the X and Q represents the Y-axis. Most modern equipment can detect and resolve the inversion split.

Configuring the Video QAM Carriers

To configure the Video QAM carriers, complete the following procedure:

```

configure terminal
controller integrated-cable slot/bay/port
rf-channel start-channel - end-channel
type video
start-frequency frequency
rf-output normal
power-adjust number
qam-profile qam-profile number

```



Note For video provisioning, the carriers must be of type “video” in the controller integrated-cable configuration.

Verify the configuration of the RF Channel

To verify the RF channel configuration, use the Show controller integrated-cable rf-chan command as shown in the example below:

```

Router#show controllers integrated-Cable 9/0/7 rf-channel 0-10
Load for five secs: 6%/0%; one minute: 5%; five minutes: 5%
Chan State Admin Frequency Type Annex Mod srate Interleaver dcid power output
0 UP UP 100000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
1 UP UP 106000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
2 UP UP 112000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
3 UP UP 118000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
4 UP UP 124000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
5 UP UP 130000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
6 UP UP 136000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
7 UP UP 142000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
8 UP UP 148000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
9 UP UP 154000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL
10 UP UP 160000000 VIDEO A 256 5361 I12-J17 - 34.0 NORMAL

```

Configuration Examples

This section provides configuration examples for the QAM video carrier.

Video QAM Carriers

The following is a sample for the Video QAM carrier configuration:

```
Router#enable
Router(config)#cable downstream qam-profile 4
Router(config-qam-prof)#annex A 6MHz
Router(config-qam-prof)#modulation 256
Router(config-qam-prof)#interleaver-depth I32-J4
Router(config-qam-prof)#symbol-rate 5361
Router(config-qam-prof)#spectrum-inversion off
Router(config-qam-prof)#description default-annex-a-256-qam
Router(config-qam-prof)#exit
Router(config)#controller Integrated-Cable 3/0/0
Router(config-controller)#max-carrier 128
Router(config-controller)#base-channel-power 34
Router(config-controller)#freq-profile 0
Router(config-controller)#rf-chan 0 95
Router(config-rf-chan)#type video
Router(config-rf-chan)#frequency 93000000
Router(config-rf-chan)#rf-output NORMAL
Router(config-rf-chan)#power-adjust 0
Router(config-rf-chan)#docsis-channel-id 1
Router(config-rf-chan)#qam-profile 1
```

Feature Information for QAM Video Carriers

Table 5: Feature Information for QAM Video Carriers

Feature Name	Releases	Feature Information
QAM Video Carriers	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.
Annex A Variable Channel Width	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.



CHAPTER 5

PSIP and EAS Support for Broadcast QAM

This document provides information on the support for PSIP and EAS and how to configure Cisco cBR series routers to avail the support.

Finding Feature Information

Your software release may not support all the features that are documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. The Feature Information Table at the end of this document provides information about the documented features and lists the releases in which each feature is supported.

- [Hardware Compatibility Matrix for the Cisco cBR Series Routers, on page 23](#)
- [Information About PSIP and EAS Support, on page 24](#)
- [How to Configure PSIP and EAS Sessions, on page 25](#)
- [Configuration Example, on page 27](#)
- [Troubleshooting Tips, on page 28](#)
- [Feature Information for PSIP and EAS Support, on page 28](#)

Hardware Compatibility Matrix for the Cisco cBR Series Routers



Note The hardware components that are introduced in a given Cisco IOS-XE Release are supported in all subsequent releases unless otherwise specified.

Table 6: Hardware Compatibility Matrix for the Cisco cBR Series Routers

Cisco CMTS Platform	Processor Engine	Interface Cards
Cisco cBR-8 Converged Broadband Router	<p>Cisco IOS-XE Release 16.5.1 and Later Releases</p> <p>Cisco cBR-8 Supervisor :</p> <ul style="list-style-type: none"> • PID—CBR-SUP-250G • PID—CBR-CCAP-SUP-160G • PID—CBR-CCAP-SUP-60G • PID—CBR-SUP-8X10G-PIC 	<p>Cisco IOS-XE Release 16.5.1 and Later Releases</p> <p>Cisco cBR-8 CCAP Line Cards:</p> <ul style="list-style-type: none"> • PID—CBR-LC-8D30-16U30 • PID—CBR-LC-8D31-16U30 • PID—CBR-RF-PIC • PID—CBR-RF-PROT-PIC • PID—CBR-CCAP-LC-40G • PID—CBR-CCAP-LC-40G-R <p>Cisco cBR-8 Downstream PHY Modules:</p> <ul style="list-style-type: none"> • PID—CBR-D30-DS-MOD • PID—CBR-D31-DS-MOD <p>Cisco cBR-8 Upstream PHY Modules:</p> <ul style="list-style-type: none"> • PID—CBR-D30-US-MOD • PID—CBR-D31-US-MOD

Information About PSIP and EAS Support

The Cisco cBR Series Router provides support for merging of Program and System Information Protocol (PSIP) and Emergency Alert Signaling (EAS) streams. This support allows to merge the PSIP and EAS information for digital terminal adapter (DTA) boxes. Merging these two streams helps in avoiding Continuity Counter (CC) errors and packet drops.

An operator can configure a session as PSIP and EAS when creating a session in a broadcast QAM. Operators can configure Passthru session as psip and data-piping session as eas.

Prerequisites for PSIP and EAS Support

PSIP and EAS are applicable to table based sessions on broadcast QAMs. The following prerequisites are applicable to configuring the PSIP and EAS sessions:

- Service Distribution Group (SDG)
- Virtual Carrier Group (VCG)
- Bind VCG to SDG

- Logical Edge Device (LED)
- Protocol of LED specified as table-based.
- Associate VCG to LED

How to Configure PSIP and EAS Sessions

You should create a Passthru session with PSIP and data session with EAS.

This section contains the following:

Configuring PSIP and EAS Sessions

The following sample commands show how to configure the sessions with PSIP and EAS.

```

cable video
  service-distribution-group service distribution group name id <ID>
  rf-port integrated-cable slot/bay/port
  virtual-carrier-group name [id number]
  service-type narrowcast
  rf-channel start_channel-end_channel tsid start_tsid-end_tsid output-port-number
start_number-end_number
  bind-vcg
  vcg vcg-name sdg <sdg name>
  logical-edge-device name [id] number
  protocol table-based
  virtual-edge-input-ip ip-address [vrf vrf-name] input-port-number port-number
  vcg <vcg name>
  active
  table-based
  vcg <vcg name>
  rf-channel <channel number>
  session SESS_PSIP input-port <id> start-udp-port udp port number processing-type
passthru psip
  session SESS_EAS input-port <id> start-udp-port udp port number processing-type
data eas

```

Verifying the PSIP and EAS Configurations

The following example shows how to verify the configured PSIP and EAS sessions.

```

show cable video session logical-edge-device id 1
Total Sessions = 2

```

Session Id	Output Input	Frequency Output	Streaming Encrypt	Sess Low	Session PMV	Source Session	UDP Input	Output Program	Input Program	Output State
Id	Port	Hz	Type	Type	Lat	Ucast Dest IP/ Mcast IP (S,G)	Port	Program	Program	State
1048576	101	93000000	Passthru	UDP	174.102.1.1	49652	-	-	ACTIVE-PSI	
ON 895556	904871	CLEAR	- N -	SESS_PSIP.1.0.1.0.49652						
1048577	101	93000000	Data-Piping	UDP	174.102.1.1	49653	-	-	ACTIVE	
ON 908578	904857	CLEAR	- N -	SESS_EAS.1.0.1.0.49653						

Verifying the PSIP Session Configuration

```

show cable video session logical-edge-device id 1 session-id 1048576
1048576
Session Name       : SESS_PSIP.1.0.1.0.49652
Session Id        : 1048576
Creation Time     : Fri Feb  2 07:30:06 2018

Output Port       : 101
TSID              : 100
ONID              : 0
Number of Sources : 1
  Destination IP  : 174.102.1.1
  UDP Port        : 49652
Config Bitrate    : not specified
Jitter            : 100 ms
Processing Type    : Passthru
Stream Rate       : VBR
Program Number    : -
Idle Timeout      : 2000 msec
Init Timeout      : 2000 msec
Off Timeout       : 60 sec
Encryption Type   : CLEAR
Encryption Status : -

Input Session Stats:
=====
State: ACTIVE-PSI, Uptime: 0 days 00:00:25
IP Packets: In 5005, RTP 0, Drop 0
TP Packets: In 28092, PCR 1003, PSI 107, Null 1938
             Unreference 0, Discontinuity 0
Errors: Sync loss 0, CC error 0, PCR Jump 0,
        Underflow 0, Overflow 0, Block 0
Bitrate: Measured 1647418 bps, PCR 1836378 bps

Output Session Stats:
=====
State: ON, Uptime: 0 days 00:00:25
TP Packets: In 28074, PCR 1000, PSI 106,
             Drop 0, Forward 27968, Insert 0
Errors: Info Overrun 0, Info Error 0, Block 0, Overdue 0,
        Invalid Rate 0, Underflow 0, Overflow 0
Bitrate: Measured 1643931 bps

PSIP Stats:
=====
Total Packets: in 1905, out 31
MGT: in 1, out 1, version 8, length 1458, carousel 7160
RRT: in 1, out 1, version 0, length 901, carousel 5
STT: in 28, out 28, version 0, length 20, carousel 1
VCT: in 1, out 1, version 4, length 244, carousel 670

PAT Info:
=====
Version 1, TSID 1, len 16, section 0/0
Program 1: PMT 8020

Input PMT Info:
=====
Program 1, Version 1, PCR 8000, Info len 0
PID 8000: Type 2, Info len 5, (desc 2 len 3)
PID 8001: Type 129, Info len 17, (lang eng), (desc 5 len 4), (desc 129 len 3)

Output PMT Info:

```

```

=====
Program 1, Version 1, PCR 8000, Info len 0
PID 8000: Type 2, Info len 5, (desc 2 len 3)
PID 8001: Type 129, Info len 17, (lang eng), (desc 5 len 4), (desc 129 len 3)

```

Verifying EAS Session Configuration

```

show cable video session logical-edge-device id 1 session-id 1048577
Session Name      : SESS_EAS.1.0.1.0.49653
Session Id       : 1048577
Creation Time    : Fri Feb  2 07:30:06 2018

```

```

Output Port      : 101
TSID             : 100
ONID             : 0
Number of Sources : 1
  Destination IP : 174.102.1.1
  UDP Port       : 49653
Config Bitrate   : not specified
Jitter           : 100 ms
Processing Type   : Data-Piping
Stream Rate      : VBR
Program Number    : -
Idle Timeout     : 2000 msec
Init Timeout     : 2000 msec
Off Timeout      : 60 sec
Encryption Type  : CLEAR
Encryption Status : -

```

Input Session Stats:

```

=====
State: ACTIVE, Uptime: 0 days 00:00:30
IP Packets: In 6006, RTP 0, Drop 0
TP Packets: In 33804, PCR 1204, PSI 0, Null 2232
             Unreference 0, Discontinuity 0
Errors: Sync loss 0, CC error 0, PCR Jump 0,
        Underflow 0, Overflow 0, Block 0
Bitrate: Measured 1682436 bps, PCR 1816387 bps

```

Output Session Stats:

```

=====
State: ON, Uptime: 0 days 00:00:30
TP Packets: In 33669, PCR 1201, PSI 0,
             Drop 0, Forward 33669, Insert 0
Errors: Info Overrun 0, Info Error 0, Block 0, Overdue 0,
        Invalid Rate 0, Underflow 0, Overflow 0
Bitrate: Measured 1678854 bps

```

EAS Stats:

```

=====
Total Packets: in 4, out 1
EAS: in 1, out 1, version 19, length 238, carousel 32

```

Configuration Example

This section provides example of PSIP and EAS configuration.

Example: PSIP and EAS Configuration

```

cable video
  service-distribution-group sdg1 id 1
  rf-port integrated-cable 7/0/0
  virtual-carrier-group vcg1 id 1
  service-type narrowcast
  rf-channel 0 tsid 100 output-port-number 101
bind-vcg
  vcg vcg1 sdg sdg1
logical-edge-device led1 id 1
  protocol table-based
  virtual-edge-input-ip 192.168.1.1 input-port-number 1
  vcg vcg1
  active
table-based
  vcg vcg1
  rf-channel 0
  session SESS_PSIP input-port 1 start-udp-port 49652 processing-type passthru psip
  session SESS_EAS input-port 1 start-udp-port 49653 processing-type data eas

```

Troubleshooting Tips

The following tips help in troubleshooting issues:

- Make sure that PSIP session is configured as processing-type passthru and psip
- Make sure that EAS session is configured as processing-type data and eas
- When the PSIP session becomes ACTIVE-PSI, verify the PSIP Stats under the session details command.

Similarly, when the EAS session becomes ACTIVE, verify the EAS Stats under the session details command.

The out-count and carousel-count should increment.

Feature Information for PSIP and EAS Support

Use Cisco Feature Navigator to find information about the platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to the www.cisco.com/go/cfn link. An account on the Cisco.com page is not required.



Note

The following table lists the software release in which a given feature is introduced. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Table 7: Feature Information for PSIP and EAS Support

Feature Name	Releases	Feature Information
PSIP and EAS Support	Cisco IOS XE Fuji 16.7.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.



CHAPTER 6

NIT Reference Support for Broadcast QAM

This document provides information on the support for NIT reference and how to configure Cisco cBR series routers to avail the support.

Finding Feature Information

Your software release may not support all the features that are documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. The Feature Information Table at the end of this document provides information about the documented features and lists the releases in which each feature is supported.

- [Hardware Compatibility Matrix for the Cisco cBR Series Routers, on page 31](#)
- [Information About NIT Reference Support, on page 32](#)
- [How to Configure NIT Reference, on page 33](#)
- [Configuration Example , on page 34](#)
- [Troubleshooting Tips, on page 34](#)
- [Feature Information for NIT Reference Support, on page 34](#)

Hardware Compatibility Matrix for the Cisco cBR Series Routers



Note The hardware components that are introduced in a given Cisco IOS-XE Release are supported in all subsequent releases unless otherwise specified.

Table 8: Hardware Compatibility Matrix for the Cisco cBR Series Routers

Cisco CMTS Platform	Processor Engine	Interface Cards
Cisco cBR-8 Converged Broadband Router	<p>Cisco IOS-XE Release 16.5.1 and Later Releases</p> <p>Cisco cBR-8 Supervisor :</p> <ul style="list-style-type: none"> • PID—CBR-SUP-250G • PID—CBR-CCAP-SUP-160G • PID—CBR-CCAP-SUP-60G • PID—CBR-SUP-8X10G-PIC 	<p>Cisco IOS-XE Release 16.5.1 and Later Releases</p> <p>Cisco cBR-8 CCAP Line Cards:</p> <ul style="list-style-type: none"> • PID—CBR-LC-8D30-16U30 • PID—CBR-LC-8D31-16U30 • PID—CBR-RF-PIC • PID—CBR-RF-PROT-PIC • PID—CBR-CCAP-LC-40G • PID—CBR-CCAP-LC-40G-R <p>Cisco cBR-8 Downstream PHY Modules:</p> <ul style="list-style-type: none"> • PID—CBR-D30-DS-MOD • PID—CBR-D31-DS-MOD <p>Cisco cBR-8 Upstream PHY Modules:</p> <ul style="list-style-type: none"> • PID—CBR-D30-US-MOD • PID—CBR-D31-US-MOD

Information About NIT Reference Support

The Cisco cBR Series Router provides support for Network Information Table (NIT) reference. This feature enables the operator to configure NIT PID from the IOS CLI. The NIT helps in conveying information about the physical organization of the multiplexes and transport streams (TS) carried through a specific network and also the characteristics of the network.

When the NIT PID is not configured, it falls back to the input stream's NIT PID. In this case, the NIT PID may be none or NIT PID based on the input stream.

Table 9: Test 1

Col 1	Col2 Col3	Col3
2	3	4
2	2	38
7	8	7

Table 10: Test 2

Col1	Col 2	Col3
1	3	2
4	42	3
3	3	1

Table 11: Test 3

Test col1	Test col2	Test col3
1	3	4
8	6	7
6	7	r5

How to Configure NIT Reference

This section contains the following topics:

Configuring NIT Reference

The following sample commands show how to configure NIT reference.

```

configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
  cable video
    default-nit-reference ?
    <1-8190> 1-8190

    default-nit-reference 100
%%All existing sessions will be updated with default-nit-reference.
Re-configure Default NIT reference? [Yes/No][confirm]

```

Verifying the NIT Reference Configuration

The following example shows how to verify the NIT reference configuration.

```

video-LWR-S-A4#sh run | s cable vid
cable video
  multicast-uplink Port-channel23 access-list all-multicasts rp 2.23.1.1
  default-nit-reference 100
  mgmt-intf VirtualPortGroup 0
  encryption

```

Removing the NIT Reference

To remove the configured NIT PID, use the **no default-nit-reference <NIT PID>** command.

```
no default-nit-reference
%%All existing sessions will be updated with default-nit-reference.
Re-configure Default NIT reference? [Yes/No][confirm]
```

Configuration Example

This section provides example of Cisco cBR-8 Converged Broadband Router NIT reference configuration.

Example: NIT Reference Configuration

```
video-LWR-S-A4#conf term
Enter configuration commands, one per line. End with CNTL/Z.
video-LWR-S-A4(config)#cable video
video-LWR-S-A4(config-video)#default-nit-reference ?
<1-8190> 1-8190

video-LWR-S-A4(config-video)#default-nit-reference 100
%%All existing sessions will be updated with default-nit-reference.
Re-configure Default NIT reference? [Yes/No][confirm]
video-LWR-S-A4(config-video)#
```

Troubleshooting Tips

The following tips help in troubleshooting issues:

- After configuring NIT PID, check whether the streams are in ACTIVE-PSI for the QAM
- Verify that the configured NIT PID is present in the PAT's program 0
- After removing the NIT reference configuration (NIT PID), verify the following,
 - If the input stream has NIT PID, the PAT's program 0 contains the input stream's NIT PID
 - If the NIT PID is not present in the input stream, the program 0 should not be present in the PAT

Feature Information for NIT Reference Support

Use Cisco Feature Navigator to find information about the platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to the www.cisco.com/go/cfn link. An account on the Cisco.com page is not required.



Note The following table lists the software release in which a given feature is introduced. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Table 12: Feature Information for NIT Reference Support

Feature Name	Releases	Feature Information
NIT Reference Support	Cisco IOS XE Fuji 16.7.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.



CHAPTER 7

Logical Edge Devices

A Logical Edge Device (LED) is a virtual edge device within the cBR-8 and can be provisioned for static or dynamic sessions.

Contents

- [Information about Logical Edge Devices, on page 37](#)
- [How to Configure the Logical Edge Devices, on page 37](#)
- [Configuration Examples, on page 45](#)
- [Feature Information for Logical Edge Devices, on page 46](#)

Information about Logical Edge Devices

An LED interfaces remotely to a head end video Session Resource Manager (SRM) using the GQI protocol. It also represents a group of locally managed table-based video sessions.

In Cisco cBR-8, you can create up to 32 LEDs to simultaneously manage the video QAM carriers. Each LED manages a set of virtual QAM carriers independently. Due to the limitation of the GQI protocol, a GQI LED can only manage a set of QAM carriers in a single line card, unlike the table-based LED, which can manage more than a single line card.

In addition, an LED can be optionally configured to support the D6 discovery protocol to report a QAM resource to the SRM.

How to Configure the Logical Edge Devices

This section describes how to configure LEDs for the video session on Cisco cBR-8.

Configuring Session-Based (Dynamic) Logical Edge Devices

GQI is a protocol for the GQI LED to interface with the remote SRM.

For system using discovery protocol, the D6 discovery protocol should be enabled to report the QAM resources of the LED to the remote SRM.

An active flag should be enabled on the LED to indicate that it is active. This flag indicates that the connectivity with the SRM can be setup and the LED can start handling GQI message exchange from the SRM.

You cannot edit or remove the LED data when it is in the active mode. To do so, you must first move the LED to inactive mode and then disconnect it from the SRM.

Due to the limitations of the GQI protocol, GQI LED cannot have Virtual Carrier Groups that span across multiple cable line cards (CLC).



Note In Cisco IOS-XE Release 16.5.1, only GQI version 2 is supported for all GQI LEDs.

Before You Begin

The following data is necessary to define a GQI LED:

- The Management IP address that the SRM uses to setup connectivity with the LED. The IP address must be in the same subnet as configured in the VirtualPortGroup.
- A unique MAC address per LED. Using the chassis MAC address as a basis, increment the least significant number to give a unique identifier (MAC address) for each LED. This number should be unique with respect to the GQI server and does not really relate to a true MAC address. Thus, the number is irrelevant, but needs to be unique.



Tip Use the **show diag all eeprom detail | include MAC** command to get the chassis MAC address.

- The primary and secondary IP addresses of the remote SRM.
- Virtual Carrier Group (VCG). For more information, see Video Virtual Carrier Group and Virtual Edge Input.
- Connection-orientated controls such as, keep alive, reset interval, and timeout value.
- Virtual Edge Input (VEI) configured with a routable IP address from within the network. For more information, see Video Virtual Carrier Group and Virtual Edge Input.

To configure the session-based LEDs, complete the following procedure:

```
configure terminal
cable video
logical-edge-device name [id number]
protocol gqi
mgmt-ip ip address
server ip address
virtual-edge-input ip address input-port-number port number
vcg vcg name
vcg vcg name
mac-address mac address
keepalive retry retry count interval seconds
reset interval seconds
active
```


Verifying the Session-Based (Dynamic) Logical Edge Devices Configuration

To verify a GQI LED configuration, use the **show cable video logical-edge-device** command as shown in the example below:

```
show cable video logical-edge-device id 1
```

```
Logical Edge Device: led
Id: 1
Protocol: GQI
Service State: Active
Discovery State: Disable
Management IP: 1.33.2.10
MAC Address: c414.3c17.6000
Number of Servers: 2
  Server 1: 1.200.1.193
  Server 2: 1.200.1.183
Reset Interval: 5
Keepalive Interval: 5   Retry Count:3
Number of Virtual Carrier Groups: 2
Number of Share Virtual Edge Input: 1
Number of Physical Qams: 94
Number of Sessions: 240
No Reserve PID Range
```

Virtual Edge Input:

Input Port ID	VEI IP	Slot/Bay	Bundle ID	Gateway IP
1	174.102.1.1	7/0	-	-

Virtual Carrier Group:

ID	Name	Total VEI	Total RF-channel	Service-Distribution-Group Name
1	vcg	0	28	sdg
2	vcg-2	0	19	sdg

Integrated VCG Cable ID	Physical SDG QAM ID	Admin Encryption State Capable	Operational State	TSID	ONID	Output Port
7/0/0:20 1	20 1	ON powerkey	UP	1	1000	1
7/0/0:21 1	21 1	ON powerkey	UP	2	1000	2
7/0/0:22 1	22 1	ON powerkey	UP	3	1000	3
7/0/0:23 1	23 1	ON powerkey	UP	4	1000	4
7/0/0:24 1	24 1	ON powerkey	UP	5	1000	5
7/0/0:25 1	25 1	ON powerkey	UP	6	1000	6
7/0/0:26 1	26 1	ON powerkey	UP	7	1000	7
7/0/0:27 1	27 1	ON powerkey	UP	8	1000	8
7/0/0:28 1	28 1	ON powerkey	UP	9	1000	9

Verifying the Session-Based (Dynamic) Logical Edge Devices Configuration

7/0/0:29	29	ON	UP	10	1000	10
1	1	powerkey				
7/0/0:30	30	ON	UP	11	1000	11
1	1	powerkey				
7/0/0:31	31	ON	UP	12	1000	12
1	1	powerkey				
7/0/0:32	32	ON	UP	13	1000	13
1	1	powerkey				
7/0/0:33	33	ON	UP	14	1000	14
1	1	powerkey				
7/0/0:34	34	ON	UP	15	1000	15
1	1	powerkey				
7/0/0:35	35	ON	UP	16	1000	16
1	1	powerkey				
7/0/0:36	36	ON	UP	17	1000	17
1	1	powerkey				
7/0/0:37	37	ON	UP	18	1000	18
1	1	powerkey				
7/0/0:38	38	ON	UP	19	1000	19
1	1	powerkey				
7/0/0:39	39	ON	UP	20	1000	20
1	1	powerkey				
7/0/0:40	40	ON	UP	21	1000	21
1	1	powerkey				
7/0/0:41	41	ON	UP	22	1000	22
1	1	powerkey				
7/0/0:42	42	ON	UP	23	1000	23
1	1	powerkey				
7/0/0:43	43	ON	UP	24	1000	24
1	1	powerkey				
7/0/0:44	44	ON	UP	25	1000	25
1	1	powerkey				
7/0/0:45	45	ON	UP	26	1000	26
1	1	powerkey				
7/0/0:46	46	ON	UP	27	1000	27
1	1	powerkey				
7/0/0:47	47	ON	UP	28	1000	28
1	1	powerkey				
7/0/7:20	20	ON	UP	1	1000	1
1	1	powerkey				
7/0/7:21	21	ON	UP	2	1000	2
1	1	powerkey				
7/0/7:22	22	ON	UP	3	1000	3
1	1	powerkey				
7/0/7:23	23	ON	UP	4	1000	4
1	1	powerkey				
7/0/7:24	24	ON	UP	5	1000	5
1	1	powerkey				
7/0/7:25	25	ON	UP	6	1000	6
1	1	powerkey				
7/0/7:26	26	ON	UP	7	1000	7
1	1	powerkey				
7/0/7:27	27	ON	UP	8	1000	8
1	1	powerkey				
7/0/7:28	28	ON	UP	9	1000	9
1	1	powerkey				
7/0/7:29	29	ON	UP	10	1000	10
1	1	powerkey				
7/0/7:30	30	ON	UP	11	1000	11
1	1	powerkey				
7/0/7:31	31	ON	UP	12	1000	12
1	1	powerkey				
7/0/7:32	32	ON	UP	13	1000	13
1	1	powerkey				

7/0/7:33	33	ON	UP	14	1000	14
1	1	powerkey				
7/0/7:34	34	ON	UP	15	1000	15
1	1	powerkey				
7/0/7:35	35	ON	UP	16	1000	16
1	1	powerkey				
7/0/7:36	36	ON	UP	17	1000	17
1	1	powerkey				
7/0/7:37	37	ON	UP	18	1000	18
1	1	powerkey				
7/0/7:38	38	ON	UP	19	1000	19
1	1	powerkey				
7/0/7:39	39	ON	UP	20	1000	20
1	1	powerkey				
7/0/7:40	40	ON	UP	21	1000	21
1	1	powerkey				
7/0/7:41	41	ON	UP	22	1000	22
1	1	powerkey				
7/0/7:42	42	ON	UP	23	1000	23
1	1	powerkey				
7/0/7:43	43	ON	UP	24	1000	24
1	1	powerkey				
7/0/7:44	44	ON	UP	25	1000	25
1	1	powerkey				
7/0/7:45	45	ON	UP	26	1000	26
1	1	powerkey				
7/0/7:46	46	ON	UP	27	1000	27
1	1	powerkey				
7/0/7:47	47	ON	UP	28	1000	28
1	1	powerkey				
7/0/0:1	1	ON	UP	29	1000	29
2	1	powerkey				
7/0/0:2	2	ON	UP	30	1000	30
2	1	powerkey				
7/0/0:3	3	ON	UP	31	1000	31
2	1	powerkey				
7/0/0:4	4	ON	UP	32	1000	32
2	1	powerkey				
7/0/0:5	5	ON	UP	33	1000	33
2	1	powerkey				
7/0/0:6	6	ON	UP	34	1000	34
2	1	powerkey				
7/0/0:7	7	ON	UP	35	1000	35
2	1	powerkey				
7/0/0:8	8	ON	UP	36	1000	36
2	1	powerkey				
7/0/0:9	9	ON	UP	37	1000	37
2	1	powerkey				
7/0/0:10	10	ON	UP	38	1000	38
2	1	powerkey				
7/0/0:11	11	ON	UP	39	1000	39
2	1	powerkey				
7/0/0:12	12	ON	UP	40	1000	40
2	1	powerkey				
7/0/0:13	13	ON	UP	41	1000	41
2	1	powerkey				
7/0/0:14	14	ON	UP	42	1000	42
2	1	powerkey				
7/0/0:15	15	ON	UP	43	1000	43
2	1	powerkey				
7/0/0:16	16	ON	UP	44	1000	44
2	1	powerkey				
7/0/0:17	17	ON	UP	45	1000	45
2	1	powerkey				

7/0/0:18	18	ON	UP	46	1000	46
2	1	powerkey				
7/0/0:19	19	ON	UP	47	1000	47
2	1	powerkey				
7/0/7:1	1	ON	UP	29	1000	29
2	1	powerkey				
7/0/7:2	2	ON	UP	30	1000	30
2	1	powerkey				
7/0/7:3	3	ON	UP	31	1000	31
2	1	powerkey				
7/0/7:4	4	ON	UP	32	1000	32
2	1	powerkey				
7/0/7:5	5	ON	UP	33	1000	33
2	1	powerkey				
7/0/7:6	6	ON	UP	34	1000	34
2	1	powerkey				
7/0/7:7	7	ON	UP	35	1000	35
2	1	powerkey				
7/0/7:8	8	ON	UP	36	1000	36
2	1	powerkey				
7/0/7:9	9	ON	UP	37	1000	37
2	1	powerkey				
7/0/7:10	10	ON	UP	38	1000	38
2	1	powerkey				
7/0/7:11	11	ON	UP	39	1000	39
2	1	powerkey				
7/0/7:12	12	ON	UP	40	1000	40
2	1	powerkey				
7/0/7:13	13	ON	UP	41	1000	41
2	1	powerkey				
7/0/7:14	14	ON	UP	42	1000	42
2	1	powerkey				
7/0/7:15	15	ON	UP	43	1000	43
2	1	powerkey				
7/0/7:16	16	ON	UP	44	1000	44
2	1	powerkey				
7/0/7:17	17	ON	UP	45	1000	45
2	1	powerkey				
7/0/7:18	18	ON	UP	46	1000	46
2	1	powerkey				
7/0/7:19	19	ON	UP	47	1000	47
2	1	powerkey				

•

Configuring the D6 Discovery Protocol

D6 discovery protocol is the discovery portion of the Comcast Next Generation on Demand (NGOD) specification. D6 discovery protocol sends out carrier information such as frequency, annex, modulation mode, interleave, and edge input information such as IP address and maximum bandwidth to an Edge Resource Manager (ERM). D6 discovery protocol also sends unique structured names (topological location information) for each edge input or carrier output. From these structured names, and input and RF port numbers, the ERM can infer the topological network location of both the QAM streaming input port (IP) and RF output port (MPEG).

The D6 discovery protocol configuration can be performed only when the LED protocol is either table-based or GQI. The LED must be in inactive mode to edit or create a D6 discovery protocol configuration. The D6 discovery protocol configuration parameters are:

- Management IP—The source IP address used to establish a connection with the external D6 discovery protocol server (ERM). The IP address must be in the same subnet as configured in a virtual port group.

For GQI LED, this configuration is not needed under D6 discovery protocol as it is automatically fetched from the LED configuration.

- D6 discovery protocol server IP address and port—Identifies the remote D6 discovery protocol server (ERM) IP address and listening port used by the D6 discovery protocol client in LED to setup a connection with the peer. You can configure only one server address and port per LED.
- FQDN (Fully Qualified Domain Name)—This can be given instead of IP address for D6 discovery protocol server.
- Streaming zone—Streaming zone as configured in the D6 discovery protocol server (ERM). The name should match with the configured D6 discovery protocol server in the ERM for the connection to be established.
- Component name—The name of the Edge QAM device. Each LED is considered by the D6 discovery protocol server as a separate Edge QAM component. This name is used by the D6 discovery protocol server to represent the LED.
- Timeout value—(Optional) Time to wait for connection in socket call.
- Hold time value—(Optional) Time interval that decides the interval of the keepalive message exchange between the client and the server.
- Input group—(Optional) Each virtual edge input IP address under the LED can be assigned an input group name and the maximum bandwidth that is used to send traffic to it. This information is used in D6 discovery protocol messages when advertising the edge inputs to the D6 discovery protocol server. If these parameters are not configured then for group name, the LED or the VCG name, and the default bandwidth of 20 Gbps are used. You must repeat this command for each VEI and VCG under the LED. For GQI LED, there is no option to set VEI IP under the VCG, so, this input group CLI is not available for the VCGs for GQI LEDs.

To configure the D6 discovery protocol, complete the following procedure:

```
configure terminal
```

```
cable video
```

```
logical-edge-device
```

```
device name [id  
number]
```

```
protocol
```

```
gqi | table-based
```

```
mgmt-ip
```

```
ip address
```

```
server
```

```
ip address
```

```
virtual-edge-input
```

```
ip address  
input-port-number  
port number  
  
vcg  
vcg name  
  
vcg  
vcg name  
  
mac-address  
mac address  
  
keepalive retry  
retry count  
interval  
seconds  
  
reset interval  
seconds  
  
discovery d6  
  
streaming-zone  
name  
  
component-name  
name  
  
d6-server  
ip address [port]  
  
d6-server fqdn  
domain-name  
  
timeout  
seconds  
  
holdtime  
seconds  
  
input-group led vei-ip  
led vei ip address  
group-name  
group name [bandwidth  
mbps]  
  
exit
```

active

Verifying the D6 Configuration

To verify the D6 discovery protocol configuration, use the **show cable video logical-edge-device** command as shown in the example below.

This CLI command shows the status and statistics of the D6 client associated to the LED. In the example below, it shows the duration and number of open, updated, keepalive and notification messages exchanged between the D6 client and the server in that duration. It also indicates how many unknown or unrecognized messages are received from the server. When the open message count is more than 1, it indicates that the connection is terminated and reconnected.

```

show cable video logical-edge-device id 1 d6
Logical Edge Device: led1
Id: 1
D6 Summary:
-----
Enabled           : Yes
VREP Version      : 2
D6 State          : Established
Management IP     : 1.21.2.11
Source Port       : 6069
D6 Server IP      : 172.25.20.144
D6 Server Port    : 6069
Hold Time(negotiated): 30
Timeout           : 90
Keep Alive Interval : 10
Streaming Zone    : Sanjose.ciscolab
failure Reason    : No Failure
-----

D6 Statistics:
-----
Duration  Dir   Open   Update   KeepAlive  Notification  Unknown
-----
1         RX    1      0         9          0             0
1         TX    1      13        11         0             0
-----

```

Configuration Examples

This section provides configuration examples for the LED configuration.

Example: GQI LED Configuration

Example: Example: GQI LED Configuration

```

cable video
  mgmt-intf VirtualPortGroup 0
  encryption
    linecard 7/0 ca-system powerkey scrambler des
  service-distribution-group sdg id 1
  onid 1000

```

```

rf-port integrated-cable 7/0/0
rf-port integrated-cable 7/0/7
virtual-carrier-group vcg id 1
  encrypt
  rf-channel 20-47 tsid 1-28 output-port-number 1-28
virtual-carrier-group vcg-2 id 2
  encrypt
  rf-channel 1-19 tsid 29-47 output-port-number 29-47
bind-vcg
vcg vcg sdg sdg
vcg vcg-2 sdg sdg
logical-edge-device led id 1
  protocol gqi
  mgmt-ip 1.33.2.10
  mac-address c414.3c17.6000
  server 1.200.1.193
  server 1.200.1.183
  virtual-edge-input-ip 174.102.1.1 input-port-number 1
vcg vcg
vcg vcg-2
active

```

Feature Information for Logical Edge Devices

Table 13: Feature Information for Logical Edge Devices

Feature Name	Releases	Feature Information
Logical Edge Devices	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.



CHAPTER 8

Cisco Smart Licensing for Video

The Cisco Smart Licensing for Video on the Cisco cBR router leverages existing Cisco cBR Smart Licensing framework that includes Call Home and SLA capabilities.

- [Video Smart Licensing](#) , on page 47
- [Information About Video Smart Licensing](#), on page 47
- [How to Verify Video Smart Licensing](#), on page 48
- [Configuration Examples](#), on page 49
- [Use Cases or Deployment Scenarios](#), on page 50
- [Feature Information for Video Smart Licensing](#), on page 52

Video Smart Licensing

The Cisco Smart Licensing feature uses a pooled license model. All FRUs in the chassis and multiple such chassis share the entitlements for Upstream (US), Downstream (DS), WAN, Narrowcast (NC), Broadcast (BC), encrypted licenses (PME, PKY, DVB), and Replicate (RPL) as long as they do not exceed the entitlement count for that pool.

For information on entitlement usage, see the [Cisco Smart Licensing](#).

Information About Video Smart Licensing

Benefits of Smart Licensing

Cisco Smart Licensing is intended to overcome the limitations and issues of the enforced licensing method. For more information, see the [Cisco Smart Licensing](#) document .

Prerequisites for Video Smart Licensing

See the [Cisco Smart Licensing](#) document.

Restrictions for Video Smart Licensing

For video services, the VCG service type determines the number of licenses consumed for bound VCGs. The QAM channel **shut/no shut** state has no relevance for video (unlike DOCSIS services). When the service type is not defined, the NC license entitlements are consumed per QAM channel.

How to Verify Video Smart Licensing

Verifying Video Smart Licensing Using Show Commands

Use the **show cable license** command to verify video smart licensing configuration.

To verify all license information, use the **show cable license all** command:

```
Router# show cable license all

-----
Entitlement:  Downstream License
Consumed count: 768
Consumed count reported to SmartAgent: 0 Forced-Shut count: 0 Enforced state: No Enforcement

-----
Entitlement:  Upstream License
Consumed count: 64
Consumed count reported to SmartAgent: 64 Forced-Shut count: 0 Enforced state: No Enforcement

-----
Entitlement:  WAN License
Consumed count: 2
Consumed count reported to SmartAgent: 2 Forced-Shut count: 0 Enforced state: No Enforcement

-----
Entitlement:  LCHA License
Consumed count: 0
Consumed count reported to SmartAgent: 0 Forced-Shut count: 0 Enforced state: No Enforcement

-----
Entitlement:  Video Narrowcast License
Consumed count: 0
Consumed count reported to SmartAgent: 0 Forced-Shut count: 0 Enforced state: No Enforcement

-----
Entitlement:  Video Narrowcast Replicate License Consumed count: 0 Consumed count reported
to SmartAgent: 0 Forced-Shut count: 0 Enforced state: No Enforcement

-----
Entitlement:  Video Narrowcast PKEY License Consumed count: 0 Consumed count reported to
SmartAgent: 0 Forced-Shut count: 0 Enforced state: No Enforcement

-----
Entitlement:  Video Narrowcast PME License Consumed count: 0 Consumed count reported to
SmartAgent: 0 Forced-Shut count: 0 Enforced state: No Enforcement

-----
Entitlement:  Video Narrowcast DVB License Consumed count: 0 Consumed count reported to
SmartAgent: 0 Forced-Shut count: 0 Enforced state: No Enforcement
```

To view specific video license configuration, use the appropriate keyword with the **show cable license** command:

```
Router# show cable license ?
  all      Show all license information
  ds       DOCSIS downstreams
  lcha     LCHA groups
  nc       Narrowcast video
  nc_dvb   Narrowcast video DVB
  nc_pky   Narrowcast video PowerKEY
  nc_pme   Narrowcast video PME
  nc_rpl   Narrowcast video replicate
  us       DOCSIS upstreams
  wan      WAN ports
```

For example, to verify Narrowcast video configuration, use the **show cable license nc** command:

```
Router # show cable license nc
-----
Entitlement:  Video Narrowcast License
Consumed count: 128
Consumed count reported to SmartAgent: 128 Forced-Shut count: 0 Enforced state: No Enforcement
```

Configuration Examples

Example 1: Show Running Output for Basic Configuration

```
cable video
service-distribution-group sdg-lic id 64
  rf-port integrated-cable 7/0/0
service-distribution-group sdg-lic1 id 63
  rf-port integrated-cable 7/0/1
virtual-carrier-group vcg-lic1 id 158
  rf-channel 0 tsid 65535 output-port-number 1
virtual-carrier-group vcg-lic2 id 157
  rf-channel 1-3 tsid 65532-65534 output-port-number 2-4
virtual-carrier-group vcg-lic3 id 156
  rf-channel 4-7 tsid 65528-65531 output-port-number 5-8
virtual-carrier-group vcg-lic4 id 155
  rf-channel 8-15 tsid 65520-65527 output-port-number 9-16
virtual-carrier-group vcg-lic5 id 154
  rf-channel 16-31 tsid 65504-65519 output-port-number 17-32
virtual-carrier-group vcg-lic6 id 153
  rf-channel 32-63 tsid 65472-65503 output-port-number 33-64
virtual-carrier-group vcg-lic7 id 152
  rf-channel 64-127 tsid 65408-65471 output-port-number 65-128
virtual-carrier-group vcg-lic8 id 151
  rf-channel 0-127 tsid 65280-65407 output-port-number 129-256
bind-vcg
vcg vcg-lic1 sdg sdg-lic
vcg vcg-lic2 sdg sdg-lic
vcg vcg-lic3 sdg sdg-lic
vcg vcg-lic4 sdg sdg-lic
vcg vcg-lic5 sdg sdg-lic
vcg vcg-lic6 sdg sdg-lic
```

```

vcg vcg-lic7 sdg sdg-lic
vcg vcg-lic8 sdg sdg-lic1
exit

```

Example 2: Show Running Output for QRG and NC License Configuration

```

cable video
service-distribution-group sdg-lic id 64
  rf-port integrated-cable 7/0/0
  rf-port integrated-cable 7/0/2
service-distribution-group sdg-lic1 id 63
  rf-port integrated-cable 7/0/1
  rf-port integrated-cable 7/0/3
  rf-port integrated-cable 7/0/4
  rf-port integrated-cable 7/0/5
  rf-port integrated-cable 7/0/6
  rf-port integrated-cable 7/0/7
virtual-carrier-group vcg-lic1 id 158
  rf-channel 0-55 tsid 65480-65535 output-port-number 1-56
virtual-carrier-group vcg-lic2 id 157
  rf-channel 0-55 tsid 65424-65479 output-port-number 57-112
bind-vcg
  vcg vcg-lic1 sdg sdg-lic
  vcg vcg-lic2 sdg sdg-lic1
exit

```

Use Cases or Deployment Scenarios

Case 1: Narrowcast Video Services with PowerKEY Encryption

```

cable video
encrypt
linecard 7/0 ca-system powerkey scrambler des
service-distribution-group sdg-lic id 64
  rf-port integrated-cable 7/0/0
  rf-port integrated-cable 7/0/2
  rf-port integrated-cable 7/0/3
service-distribution-group sdg-lic1 id 63
  rf-port integrated-cable 7/0/1
  rf-port integrated-cable 7/0/4
  rf-port integrated-cable 7/0/5
  rf-port integrated-cable 7/0/6
  rf-port integrated-cable 7/0/7
virtual-carrier-group vcg-lic1 id 158
encrypt
  rf-channel 0 tsid 65535 output-port-number 1
virtual-carrier-group vcg-lic2 id 157
  rf-channel 1-3 tsid 65532-65534 output-port-number 2-4
virtual-carrier-group vcg-lic3 id 156
encrypt
  rf-channel 4-7 tsid 65528-65531 output-port-number 5-8
virtual-carrier-group vcg-lic4 id 155
  rf-channel 8-15 tsid 65520-65527 output-port-number 9-16
virtual-carrier-group vcg-lic5 id 154
encrypt
  rf-channel 16-31 tsid 65504-65519 output-port-number 17-32

```

```

virtual-carrier-group vcg-lic6 id 153
  rf-channel 32-63 tsid 65472-65503 output-port-number 33-64
virtual-carrier-group vcg-lic7 id 152
encrypt
  rf-channel 64-127 tsid 65408-65471 output-port-number 65-128
virtual-carrier-group vcg-lic8 id 151
encrypt
  rf-channel 0-127 tsid 65280-65407 output-port-number 129-256
bind-vcg
vcg vcg-lic1 sdg sdg-lic
vcg vcg-lic2 sdg sdg-lic
vcg vcg-lic3 sdg sdg-lic
vcg vcg-lic4 sdg sdg-lic
vcg vcg-lic5 sdg sdg-lic
vcg vcg-lic6 sdg sdg-lic
vcg vcg-lic7 sdg sdg-lic
vcg vcg-lic8 sdg sdg-lic1
exit

```

Case 2: Narrowcast Video Services with PME Encryption

```

cable video
encrypt
linecard 7/0 ca-system pme scrambler dvs042
service-distribution-group sdg-lic id 64
  rf-port integrated-cable 7/0/0
  rf-port integrated-cable 7/0/2
  rf-port integrated-cable 7/0/3
service-distribution-group sdg-lic1 id 63
  rf-port integrated-cable 7/0/1
  rf-port integrated-cable 7/0/4
  rf-port integrated-cable 7/0/5
  rf-port integrated-cable 7/0/6
  rf-port integrated-cable 7/0/7
virtual-carrier-group vcg-lic1 id 158
  rf-channel 0 tsid 65535 output-port-number 1
virtual-carrier-group vcg-lic2 id 157
encrypt
  rf-channel 1-3 tsid 65532-65534 output-port-number 2-4
virtual-carrier-group vcg-lic3 id 156
  rf-channel 4-7 tsid 65528-65531 output-port-number 5-8
virtual-carrier-group vcg-lic4 id 155
encrypt
  rf-channel 8-15 tsid 65520-65527 output-port-number 9-16
virtual-carrier-group vcg-lic5 id 154
  rf-channel 16-31 tsid 65504-65519 output-port-number 17-32
virtual-carrier-group vcg-lic6 id 153
encrypt
  rf-channel 32-63 tsid 65472-65503 output-port-number 33-64
virtual-carrier-group vcg-lic7 id 152
  rf-channel 64-127 tsid 65408-65471 output-port-number 65-128
virtual-carrier-group vcg-lic8 id 151
encrypt
  rf-channel 0-127 tsid 65280-65407 output-port-number 129-256
bind-vcg
vcg vcg-lic1 sdg sdg-lic
vcg vcg-lic2 sdg sdg-lic
vcg vcg-lic3 sdg sdg-lic
vcg vcg-lic4 sdg sdg-lic
vcg vcg-lic5 sdg sdg-lic
vcg vcg-lic6 sdg sdg-lic
vcg vcg-lic7 sdg sdg-lic

```

```
vcg vcg-lic8 sdg sdg-lic1
exit
```

Feature Information for Video Smart Licensing

Table 14: Feature Information for Video Smart Licensing

Feature Name	Releases	Feature Information
Video Smart Licensing	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.



CHAPTER 9

Physical to Virtual Binding

The Virtual Carrier Group (VCG) is bound to a Service Distribution Group (SDG) using a `bind` command (`bind-vcg`). This connects the virtual carriers to the physical ports listed in the SDG. After binding, a path from the Virtual Edge Input (VEI) is mapped to the RF ports.

- [Information About Physical to Virtual Binding, on page 53](#)
- [How to Configure VPME Encryption, on page 53](#)
- [Configuration Examples, on page 54](#)
- [Feature Information for Physical to Virtual Binding, on page 55](#)

Information About Physical to Virtual Binding

In general, more than one VCG can be bound to the same SDG, only if the RF-channels in the VCG are not overlapping each other. However, one VCG cannot be bound to multiple SDGs.

If you want to configure one VCG to multiple SDGs, you should configure QAM replication instead. For more information, see [Configuring QAM Replication](#) section.

How to Configure VPME Encryption

This section describes how to configure physical to virtual binding and QAM replication on Cisco cBR-8.

- [Configuring Physical to Virtual Binding, on page 53](#)
- [Configuring QAM Replication, on page 54](#)

Configuring Physical to Virtual Binding

To bind a set of virtual RF-channels defined in the VCG to the physical port in the SDG, perform the following:

```
enable
configure terminal
cable video
bind-vcg
vcg vcg-name sdg sdg-name
exit
```

Configuring QAM Replication

To configure QAM replication to one or more ports, add the ports to an SDG configuration as following:

```
enable
configure terminal
cable video
service-distribution-group name
rf-port integrated-cable slot/bay/port
rf-port integrated-cable slot/bay/port
exit
```

Configuration Examples

This section provides configuration examples for the physical to virtual binding configuration.

Example 1: Physical to Virtual Binding Configuration

The following is a sample in which the port 7/0/2 of SDG *west-region* binds with 0 to 10 RF-channels of VCG *movie-channels* to physically identify the 7/0/2:0 to 7/0/2:10 QAM carriers.

Example 1 :

```
Router#config t
Router(config)#cable video
Router(config-video)#service-distribution-group west-region
Router(config-video-sdg)#rf-port integrated-cable 7/0/2
Router(config-video-sdg)#exit
Router(config-video)#virtual-carrier-group movie-channels
Router(config-video-vcg)#rf-channel 0-10 tsid 1-11 output-port-num 1-11
Router(config-video-vcg)#exit
Router(config-video)#bind-vcg
Router(config-video-bd)#vcg movie-channels sdg west-regions
```

Example 2: Physical to Virtual Binding Configuration

The following is a sample in which the *movie-channels* VCG and *news-channels* VCG bind with *west-regions* SDG.

Example 2 :

```
Router#config t
Router(config)#cable video
Router(config-video)#service-distribution-group west-region
Router(config-video-sdg)#rf-port integrated-cable 7/0/2
Router(config-video-sdg)#exit
Router(config-video)#virtual-carrier-group movie-channels
Router(config-video-vcg)#rf-channel 0-10 tsid 1-11 output-port-num 1-11
Router(config-video-vcg)#exit
Router(config-video)#virtual-carrier-group news-channels
Router(config-video-vcg)#rf-channel 11-15 tsid 12-16 output-port-num 12-16
Router(config-video-vcg)#exit
Router(config-video)#bind-vcg
Router(config-video-bd)#vcg movie-channels sdg west-regions
Router(config-video-bd)#vcg news-channels sdg west-regions
```


Example 3: QAM Replication Configuration

The following is a sample in which video replication is set across 7/0/0 and 7/0/1 ports:

Example 3 :

```
Router#config t
Router(config)#cable video
Router(config-video)# service-distribution-group qrg-example
Router(config-video-sdg)# rf-port integrated-cable 7/0/0
Router(config-video-sdg)# rf-port integrated-cable 7/0/1
```

Feature Information for Physical to Virtual Binding

Table 15: Feature Information for Physical to Virtual Binding

Feature Name	Releases	Feature Information
Physical to Virtual Binding	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.



CHAPTER 10

Table Based Configuration

The table-based video is a local session management that provisions using CLI. The statically allocated local video sessions can be either unicast or multicast video stream.

- [Information About Table Based Configuration, on page 57](#)
- [Configuring Table Based Session, on page 57](#)
- [Virtual Edge Input Bundling, on page 58](#)
- [10-6 UDP Port Mapping, on page 60](#)
- [Feature Information for Table Based Configuration, on page 62](#)

Information About Table Based Configuration

Table-based video session configuration can be performed for a range or an individual session under each Quadrature Amplitude Modulation (QAM) carrier that is being assigned to a table-based Logical Edge Device (LED). In cBR-8, you can create multiple LEDs for table-based video sessions; each LED manages one set of QAM carriers for table-based sessions. Table-based sessions can be configured as a pass-through, remap, or a data piping session.

Configuring Table Based Session

To configure the encryption type for a VOD session, perform the following steps:

```
enable
configure terminal
cable video
table-based
vcg vcg-name
rf-channel n-m
session sess-name input-port id start-udp-port udp port number
num-sessions-per-qam 1-80 processing-type remap start-program n jitter
10-200 msec [cbr | vbr]
exit
```

Configuration Example

The following is a sample in which two sessions are created per RF channel, HBO-1 and HBO-2 are for channel 0, HBO-3 and HBO-4 are for channel 1. The destination IP address is obtained from VCG (if any), otherwise from the LED broadcast.

```
Router(config)#cable video
Router(config-video)#table-based
Router(config-video-tb)#vcg bcast
Router(config-video-tb-vcg)#rf-channel 0-1
Router(config-video-tb-vcg-sess)# session HBO input-port 10 start-udp-port 1
num-sessions-per-qam 2 processing-type remap start-program 1 jitter 100 cbr
Router(config-video-tb-vcg-sess)# session HBO bundle-id 1 start-udp-port 49152
num-sessions-per-qam 2 processing-type program start-program 1 jitter 100 cbr
```

Virtual Edge Input Bundling

Virtual Edge Input Bundling assists with load balancing from the Head End. This allows multiple VEIs to be accessed via a gateway, since it is unknown at the time of configuration which VEI the stream will come in on. Thus, when the Head End sends a stream to the gateway, it enters the cBR-8 in on any VEI in the bundle. VEI bundling can be performed only if table based protocol is used for a particular LED.

To bundle the VEIs, perform the following steps:

Before You Begin

- All video sessions must have unique UDP ports for the Head End.
- Create two or more Virtual Edge Inputs using the following command:

```
virtual-edge-input-ip ipaddr vrf vrfname input-port-number #
```



Note Same IP address cannot be used in more than one bundle.

```
enable
configure terminal
cable video
logical-edge-device
protocol table-based
vei-bundle id input-port-number #
exit
```

Verifying Virtual Edge Input Data

To verify the VEI data, use the following command:

```
Router# show cable video logical-edge-device [all | id | name]
```

Example:

```
Router# show cable video logical-edge-device id 1
Logical Edge Device: led-vei
Id: 1
Protocol: Table-based
Service State: Active
```

```
Discovery State: Disable
Number of Virtual Carrier Groups: 1
Number of Share Virtual Edge Input: 5
Number of Physical Qams: 5
Number of Sessions: 0
No Reserve PID Range
```

Virtual Edge Input:

Input Port ID	VEI IP	Slot/Bay	Bundle ID	Gateway IP
11	11.11.11.11	7/0	-	-
22	22.22.22.22	7/0	-	-
66	66.66.66.66	7/0	40000	177.0.10.3
77	77.77.77.77	7/0	40000	177.0.10.3
222	222.222.222.222	7/0	40000	177.0.10.3

Virtual Carrier Group:

ID	Name	Total VEI	Total RF-channel	Service-Distribution-Group Name	Service-Distribution-Group ID
1	vcg-vei	5	5	sdg-vei	1

Integrated Cable	Physical QAM ID	Admin State	Operational State	TSID	ONID	Output Port	VCG ID	SDG ID	Encryption Capable
7/0/3:0	208	ON	UP	0	0	1	1	1	clear
7/0/3:1	209	ON	UP	1	0	2	1	1	clear
7/0/3:2	210	ON	UP	2	0	3	1	1	clear
7/0/3:3	211	ON	UP	3	0	4	1	1	clear
7/0/3:4	212	ON	UP	4	0	5	1	1	clear

Verifying VEI Bundles

To view the VEI bundles, use the following command:

```
Router# show cable video vei-bundle all
```

Example:

This is a sample output of the show command that displays the VEI bundle details.

```
Router# show cable video vei-bundle all
Total VEI Bundles: 1
Bundle LED Input Port VEI Slot/Bay Gateway
ID ID ID IP IP
-----
40000 1 33 33.33.33.33 7/0 177.0.10.3
40000 1 44 44.44.44.44 7/0 177.0.10.3
40000 1 66 66.66.66.66 7/0 177.0.10.3
40000 1 77 77.77.77.77 7/0 177.0.10.3
40000 1 222 222.222.222.222 7/0 177.0.10.3
```

Configuration Example

The following is a sample in which five VEIs are created on VCG and bundled:

```
cable video
 service-distribution-group sdg-vei id 1
```

```

rf-port integrated-cable 7/0/3
virtual-carrier-group vcg-vei id 1
  virtual-edge-input-ip 111.111.111.111 input-port-number 111
  virtual-edge-input-ip 222.222.222.222 input-port-number 222
  virtual-edge-input-ip 33.33.33.33 input-port-number 33
  virtual-edge-input-ip 44.44.44.44 input-port-number 44
  virtual-edge-input-ip 55.55.55.55 vrf Video-VOD-Vrf input-port-number 55
  rf-channel 0-4 tsid 0-4 output-port-number 1-5
virtual-carrier-group vcg-veil id 2
  virtual-edge-input-ip 111.111.111.111 input-port-number 111
  virtual-edge-input-ip 222.222.222.222 input-port-number 222
  virtual-edge-input-ip 33.33.33.33 input-port-number 33
  virtual-edge-input-ip 44.44.44.44 input-port-number 44
  rf-channel 5-10 tsid 5-10 output-port-number 5-10
bind-vcg
  vcg vcg-vei sdg sdg-vei
  vcg vcg-veilsdg sdg-vei
logical-edge-device led-vei id 1
  protocol table-based
    virtual-edge-input-ip 11.11.11.11 input-port-number 11
    virtual-edge-input-ip 22.22.22.22 input-port-number 22
    virtual-edge-input-ip 66.66.66.66 input-port-number 66
    virtual-edge-input-ip 77.77.77.77 input-port-number 77
    virtual-edge-input-ip 222.222.222.222 vrf Mgmt-MPEG-video-intf-vrf input-port-number
222
  vcg vcg-vei
  vei-bundle 40000 input-port-number 33,44,66,77,222
active

```

10-6 UDP Port Mapping

Starting from Cisco IOS XE Fuji 16.9.1, 10-6 UDP port mapping feature is supported in the table-based configuration for VOD.

To be consistent and compatible with the existing configuration, this feature adds a 10-6 UDP port mapping method to identify that this LED supports the feature, and change UDP port number to an optional parameter in the table-based session configuration.

If table-based session is not configured and 10-6 UPD port mapping is enabled for the LED, then the system generates remap sessions configuration only. If table-based session is configured, user has the option to skip providing UDP port number if he/she wants the udp port number to be automatically generated by the system.

Restrictions for 10-6 UDP Port Mapping

In order to fit the output port number and program number in a 16-bit value to represent an UDP port number per VOD session, output port number must be configured in the range of 1 to 1024, and program number must be configured in the range of 1 to 63 per QAM channel. Due to this limitation, the configuration must follow this guideline, otherwise the UDP port mapping for table-based configuration will be rejected.

UDP port mapping feature supports remap sessions configuration for table-based protocol LED only.

Configuring 10-6 UDP Port Mapping

To configure the 10-6 UDP port mapping, perform the following steps:

```

cable video
logical-edge-device name[id id ]
protocol table-based
udp-port-mapping-method 10-6

```

If 10-6 mapping is used and no unicast remap session is configured for the VCG, table-based unicast remap sessions will be automatically created for each VCG with default setting and using the first input port configured on the VCG if any, otherwise it will use the input port from the LED. User doesn't need to explicitly provision the sessions.

Verifying 10-6 UDP Port Mapping Configuration

To verify if the 10-6 UDP port mapping is enabled, use **show cable video logical-edge-device** command as shown in the following example:

```

Router# show cable video logical-edge-device id 1
Logical Edge Device: LED_DVB
Id: 1
Protocol: Table-based
Service State: Active
Discovery State: Disable
10-6 UDP Port Mapping Enabled: Yes
Number of Virtual Carrier Groups: 3
Number of Share Virtual Edge Input: 3
Number of Physical Qams: 384
Number of Sessions: 0
No Reserve PID Range

Virtual Edge Input:
Input Port  VEI          Slot/Bay  Bundle  Gateway
ID          IP                   ID        ID      IP
-----

```

10-6 UDP Port Mapping Configuration Example

Below is an example of generated session CLI commands when LED detects a UDP port mapping method is 10-6 mapping, and no table-based session is configured for the VCG.

```

Router(config)# cable video
Router(config-video)# service-distribution-group SDG_DVB id 1
Router(config-video-sdg)# rf-port integrated-cable 8/0/0
Router(config-video)# service-distribution-group sg-1 id 2
Router(config-video-sdg)# rf-port integrated-cable 9/0/0
Router(config-video)# service-distribution-group sg-2 id 3
Router(config-video-sdg)# rf-port integrated-cable 7/0/0
Router(config-video)# virtual-carrier-group VCG_DVB id 1
Router(config-video-vcg)# virtual-edge-input-ip 174.103.1.1 input-port-number 2
Router(config-video-vcg)# encrypt
Router(config-video-vcg)# service-type narrowcast
Router(config-video-vcg)# rf-channel 0-4 tsid 100-104 output-port-number 10-14
Router(config-video)# virtual-carrier-group VCG_CLR id 2
Router(config-video-vcg)# virtual-edge-input-ip 174.104.1.1 input-port-number 3
Router(config-video-vcg)# service-type narrowcast
Router(config-video-vcg)# rf-channel 5-9 tsid 105-109 output-port-number 15-19
Router(config-video)# virtual-carrier-group vcg-1 id 3

```

```

Router(config-video-vcg)# virtual-edge-input-ip 174.101.1.1 input-port-number 1
Router(config-video-vcg)# service-type narrowcast
Router(config-video-vcg)# rf-channel 0-4 tsid 1-5 output-port-number 1-5
Router(config-video)# bind-vcg
Router(config-video-bd)# vcg VCG_DVB sdg SDG_DVB
Router(config-video-bd)# vcg vcg-1 sdg sg-1
Router(config-video-bd)# vcg VCG_CLR sdg sg-2
Router(config-video)# logical-edge-device LED_DVB id 1
Router(config-video-led)# protocol table-based
Router(config-video-led-protocol)# vcg VCG_DVB
Router(config-video-led-protocol)# vcg vcg-1
Router(config-video-led-protocol)# vcg VCG_CLR
Router(config-video-led-protocol)# virtual-edge-input-ip 10.1.1.1 input-port 4
Router(config-video-led-protocol)# virtual-edge-input-ip 10.2.2.2 input-port 5
Router(config-video-led-protocol)# virtual-edge-input-ip 10.3.3.3 input-port 6
Router(config-video-led-protocol)# vei-bundle 1 input-port 4, 5
Router(config-video-led-protocol)# vei-bundle 2 input-port 1, 3
Router(config-video-led-protocol)# udp-port-mapping-method 10-6
Router(config-video-led-protocol)# active
Router(config-video)# table-based
Router(config-video-tb)# vcg VCG_DVB
Router(config-video-tb-vcg)#rf-channel 0-4
Router(config-video-tb-vcg-sess)# session VCG_DVB input-port 2 num-sessions-per-qam 63
processing-type remap start-program 21 repeat
Router(config-video-tb)# vcg vcg-1
Router(config-video-tb-vcg)#rf-channel 0-4
Router(config-video-tb-vcg-sess)# session vcg-1 input-port 1 num-sessions-per-qam 63
processing-type remap start-program 21 repeat
Router(config-video-tb)# vcg VCG_CLR
Router(config-video-tb-vcg)#rf-channel 5-9
Router(config-video-tb-vcg-sess)#session VCG_CLR input-port 3 num-sessions-per-qam 63
processing-type remap start-program 21 repeat
Router(config-video-tb-vcg-sess)#session abc input-port 4 udp-port 1000 processing-type
passthru

```

Feature Information for Table Based Configuration

Table 16: Feature Information for Table Based Configuration

Feature Name	Releases	Feature Information
Table based configuration	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.



CHAPTER 11

Management IP Interface

The management interface is used for the video control plane messages, such as session creation and deletion, between the Logical Edge Devices (LED) and the external Edge Resource Manager (ERM) server.

Contents

- [Information About Management IP Interface](#) , on page 63
- [How to Configure the Management IP Interface](#), on page 63
- [Configuration Examples](#), on page 66
- [Feature Information for Management IP Interface](#), on page 67

Information About Management IP Interface

Video Logical Edge Device (LED) communicates with an external Edge Resource Manager (ERM) and a D6 server via the management interface. The physical interface for the connection is a front panel WAN port.

The following are the characteristics of the management interface:

- The management interface configuration is applied on both active and standby supervisor. However, only the active supervisor's management interface is connected to the external server.
- VirtualPortGroup interface must be configured prior to configuring the cable video management interface.
- Cable video management interface must be configured prior to configuring an LED that uses the management interface.

How to Configure the Management IP Interface

This section describes how to configure the management IP interface for the video session on Cisco cBR-8.

Configuring the Management IP Interface consists of the following three steps:

- [Configuring the VirtualPortGroup Interface](#), on page 64
- [Configuring the Cable Video Management Interface](#), on page 65
- [Configuring the LED Management Interface](#), on page 65

Configuring the VirtualPortGroup Interface

First step towards configuring the Management IP Interface is to configure a VirtualPortGroup interface. You can also configure secondary IP addresses on the VirtualPortGroup interface, similar to a gigabit Ethernet interface IP address configuration.

To configure the VirtualPortGroup interface, complete the following procedure:

```
configure terminal
interface VirtualPortGroup virtual port group number
ip address ip address subnet-mask
ip address ip address subnet-mask secondary
end
```

Verifying the VirtualPortGroup Interface Configuration

To verify the VirtualPortGroup interface configuration, use the **show run interface VirtualPortGroup** command as shown in the example below:

```
show run interface VirtualPortGroup 0
Building configuration...

Current configuration : 145 bytes
!
interface VirtualPortGroup0
 ip address 1.22.3.1 255.255.255.0 secondary
 ip address 1.22.2.1 255.255.255.0
 no mop enabled
 no mop sysid
end
```

The VirtualPortGroup interface is in a down state. The interface comes up after the cable video management interface is configured.

Verifying the VirtualPortGroup Interface State

To verify the VirtualPortGroup interface state, use the **show interfaces VirtualPortGroup** command as shown in the example below:

```
show interfaces VirtualPortGroup 0
VirtualPortGroup0 is up, line protocol is up
 Hardware is Virtual Port Group, address is badb.ad09.7077 (bia badb.ad09.7077)
 Internet address is 1.22.2.1/24
 MTU 1500 bytes, BW 2500000 Kbit/sec, DLY 1000 usec,
   reliability 255/255, txload 1/255, rxload 1/255
 Encapsulation ARPA, loopback not set
 Keepalive not supported
 ARP type: ARPA, ARP Timeout 04:00:00
 Last input never, output 00:24:14, output hang never
 Last clearing of "show interface" counters never
 Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
 Queueing strategy: fifo
 Output queue: 0/40 (size/max)
 5 minute input rate 0 bits/sec, 0 packets/sec
 5 minute output rate 0 bits/sec, 0 packets/sec
   0 packets input, 0 bytes, 0 no buffer
   Received 0 broadcasts (0 IP multicasts)
   0 runts, 0 giants, 0 throttles
   0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
   0 input packets with dribble condition detected
```

```

0 packets output, 0 bytes, 0 underruns
0 output errors, 0 collisions, 0 interface resets
0 unknown protocol drops
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier
0 output buffer failures, 0 output buffers swapped out

```

Troubleshooting Tips

- To check if the management interface IP route is up, use the following command:

```

show ip interface brief | include VirtualPortGroup 0
VirtualPortGroup0 1.22.2.1 YES NVRAM up up

```

- To ping the VirtualPortGroup interface, use the following command:

```

ping 1.22.2.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.22.2.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms

```

Configuring the Cable Video Management Interface

Before You Begin

VirtualPortGroup interface must be configured before configuring the cable video management.

To configure the cable video management interface, complete the following procedure:

```

configure terminal
cable video
mgmt-interface VirtualPortGroup virtual port group number
end

```

Verifying the Cable Video Management Interface Configuration

To verify the VirtualPortGroup interface configuration, use the **show run | include mgmt-intf** command as shown in the example below:

```

show run | include mgmt-intf
mgmt-intf VirtualPortGroup 0

```

Configuring the LED Management Interface

Before You Begin

- Cable video management interface must be configured before configuring an LED that uses the management interface.
- Management IP address and the VirtualPortGroup IP address must be in the same subnet. It is recommended that the management IP addresses (for LED with Protocol GQI, DVB, PME and D6) are configured starting at the VirtualPortGroup IP address plus 2 and incrementing or Broadcast address minus 3 and decrementing. Typically, the VirtualPortGroup IP address is network address plus 1. Then, network address plus 2 is used internally by cBR-8. If the VirtualPortGroup IP is the Broadcast address minus 1, then the Broadcast address minus 2 is used internally by cBR-8.

To configure the LED management interface, complete the following procedure:

```
configure terminal
cable video
logical-edge-device device name
protocol gqi
mgmt-ip management ip address
exit
```

Verifying the LED Management Interface Configuration

To verify the VirtualPortGroup interface state, use the **show run | begin logical-edge-device test** command as shown in the example below:

```
sh run | begin logical-edge-device test
logical-edge-device test id 2
protocol gqi
mgmt-ip 1.22.2.10
```

Troubleshooting Tips

To ping the management interface, use the following command:

```
video-LWR-S-C2# ping 1.22.2.10
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.22.2.10, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

Configuration Examples

This section provides configuration examples for the management IP interface.

Management IP Interface

The following example shows how to create a management IP interface:

```
configure terminal
interface VirtualPortGroup 0
ip address 1.23.2.1 255.255.255.0
cable video
mgmt-interface VirtualPortGroup 0
logical-edge-device test id 2
protocol gqi
mgmt-ip 1.23.2.10
exit
exit
```

Feature Information for Management IP Interface

Table 17: Feature Information for Management IP Interface

Feature Name	Releases	Feature Information
Management IP Interface	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.



CHAPTER 12

Video Encryption

The Cisco cBR-8 supports PowerKey and Privacy Mode Encryption (PME) encryption CA systems for Video On Demand (VOD) sessions to address security concerns. However, only one encryption type can be installed on the line card. There are two levels to the CA system. The lower level encrypts the actual data streams. The upper level specifies the control words that are used to encrypt the data streams.

- [Information About Encryption, on page 69](#)
- [How to Configure Encryption for the Data Stream, on page 70](#)
- [Configuration Examples for Encryption, on page 71](#)
- [Configuring Privacy Mode Encryption, on page 71](#)
- [Feature Information for Encryption, on page 74](#)

Information About Encryption

The encrypted sessions can be created on any QAM carriers on a line card. Only the Single Program Transport Stream (SPTS) VOD session can be encrypted. Encryption is not supported on the Pass-through, and Data-piping sessions.

The VOD session can be encrypted in any of the following types of encryption:

- PowerKey for video session management protocol GQI
- Privacy Mode Encryption (PME) for Table-based session
- Digital Video Broadcasting (DVB)

The scrambler mode varies based on the type of encryption, as given in the following table:

Table 18: Supported Encryption Types and Scrambler Modes

Encryption Type	Scrambler Mode
PowerKey	DES, 3DES
PME	DVS-042
DVB	DVB-CSA

Prerequisites for Encryption

You should configure the Virtual Carrier Group (VCG) to setup an encrypted session. For more details, see the [Configuring Virtual Carrier Group, on page 70](#).

How to Configure Encryption for the Data Stream

This section describes how to configure encryption for the video session on Cisco cBR-8.

- [Enforcing Data Stream Encryption Type, on page 70](#)
- [Configuring Virtual Carrier Group, on page 70](#)
- [Verifying Encryption Configuration, on page 71](#)

Enforcing Data Stream Encryption Type



Note Once the line card and VCG are configured for PowerKey encryption, further configuration of the Cisco cBR-8 is not required.

To configure the encryption type for a VOD session, perform the following steps:

Before You Begin

Configure the Virtual Carrier Group (VCG) to setup an encrypted session. For more details, see .

```
enable
configure terminal
cable video
encryption
linecard slot/bay ca-system [dvb | pme | powerkey] scrambler scrambler-type
exit
```

Configuring Virtual Carrier Group

To configure the Virtual Carrier Group (VCG) for setting up an encrypted session, perform the following steps:

```
enable
configure terminal
cable video
virtual-carrier-group name [id #]
rf-channel start-channel#-end-channel# tsid start-tsid-end-tsid output-port-number
start-number-end-num
virtual-edge-input ipaddr input-port-number #
encrypt
exit
```


Verifying Encryption Configuration

To verify the encryption configurations, use the following command:

```
show cable video encryption linecard [all | slot number]
```

Example 1:

```
Router#show cable video encryption linecard 7/0 Line card: 7/0
CA System Scrambler
=====
powerkey des
```

Example 2:

```
Router#show cable video encryption linecard all Line card: 7/0
CA System Scrambler
=====
powerkey des
```

Configuration Examples for Encryption

This section provides configuration examples for the Encryption feature.

Example: Enforcing Data Stream Encryption Type

The following is a sample in which the line card in slot 7 is configured for powerkey encryption.

```
Router(config)#cable video Router(config-video)#encryption
Router(config-video-encrypt)#linecard 7/0 ca-system powerkey scrambler des
```

Example: Configuring Virtual Carrier Group

The following is a sample in which the QAM channel from 64 to 158 are encryption capable if the virtual channels are successfully bound to a Service Distribution Group. The sessions created on those QAM carriers are encrypted using the scrambler installed on the line card.

```
Router(config)#cable video
Router(config-video)#virtual-carrier-group sdv-grp
Router(config-video-vcg)#rf-channel 64-158 tsid 64-158 output-port-number 64-158
Router(config-video-vcg)virtual-edge-input 14.1.1.1 input-port-number 1
Router(config-video-vcg)encrypt
Router(config-video-vcg)#exit
```

Configuring Privacy Mode Encryption

Only one device from the MSO site can communicate with the Encryption Renewal System (ERS) and obtain the latest ECM templates. The CEM communicates with the ERS and sends the ECM templates to the Cisco Edge QAM devices in the MSO site.

You can configure the following:

- VODS-ID—IDs assigned by CCAD or ARRIS to the MSO site. The configured VODS-ID on the Cisco cBR-8 and the CEM must be same.

- CEM IP—Interface IP of the Windows/Linux system through which the CEM can be reached by Cisco cBR-8.
- CEM Port—Port number on which the CEM listens for connections from the Cisco cBR-8.
- Management Interface—Source IP address of the Cisco cBR-8 virtual interface through which the connection must be established with the CEM server.



Note There can be only one entry for VODS-ID, CEM IP, CEM Port, and Management Interface IP. If you configure any new values for these parameters, the previous configuration is cleared. You can clear the configurations using the 'no' form of the command.

Configuring VODS-ID

To configure the VODS-ID of the CEM, perform the following steps:

```
enable
configure terminal
cable video
encryption
pme vodsid id
exit
```

Configuring CEM IP and Port

To configure the CEM IP and port of the CEM, perform the following steps:

```
enable
configure terminal
cable video
encryption
pme cem ip-address tcp_port
exit
```

Configuring Management IP

To configure the PME management IP address to establish CEM connection, perform the following steps:

Before You Begin

The virtual port group must be configured before configuring the management IP. For more information, see the *Configuring a VirtualPortGroup interface* section.

```
enable
configure terminal
cable video
encryption
pme mgmt-ip ip-address
exit
```

Verifying PME Connection Status

To verify the connection status between the Cisco Converged EdgeQAMManager (CEM) application and the Cisco cBR-8, use the following command:

```
show cable video encryption linecard [all | slot number]
```

This command displays the following information:

- VODS-ID—Specifies the configured VODS-ID on the CEM and Cisco cBR-8.
- CEM IP—Specifies the IP through which CEM can be reached by Cisco cBR-8.
- CEM Port—Specifies the port on which the CEM obtain connections from Cisco cBR-8.
- Local Mgmt IP—Specifies the Cisco cBR-8 interface through which the connection is established with the CEM.
- Local Port—Specifies the Local Port number assigned for the connection with the CEM.
- CEM Connection State—Specifies the status of the connection with the CEM (Connected (or) Not Connected).
- Count of ECMs recd—Specifies the count of ECMs received from the CEM.

Example:

This is a sample output of the show command that displays the connection status of PME.

```
Router#show cable video encryption pme status  
PME Connection Status:  
VODS-ID : 111  
CEM IP : 1.200.1.163  
CEM Port : 5000  
Local Mgmt IP : 1.24.2.6  
Local Port : 50394  
CEM Connection State : Connected Count of ECMs recd : 2
```

Verifying PME Version

To verify the version information of the PME module loaded in the chassis, use the following command:

```
show cablevideo encryption pme version
```

The version information is read from the IOS PME subsystem. The version information displays in MAJOR.MINOR version format.

Example:

This is a sample output of the show command that displays the version details of PME.

```
Router#show cable video encryption pme version  
PME Version: 1.0
```

Verifying PME Sessions on a Line Card

To verify the sessions that use the PME modules that are loaded on a specific line card, use the following command:

```
show cable video encryption pme linecard [slot | bay] session {1-65535 | all | summary}
```

Example 1:

This is a sample output of the show command that displays the session details that use PME modules.

```
Router#show cable video encryption pme linecard 7/0 session all Count of ECMG Streams: 4
===== ECMG Stream DATA =====
Stream
ID num EcmId CP# CwE CPDur NomCPD EcmRqst EcmRsp
-----
0020(0032) 0020(0032) 0002 0 0 40000 7 2
0021(0033) 0021(0033) 0002 0 0 40000 7 2
0040(0064) 0040(0064) 0002 0 0 40000 7 2
0041(0065) 0041(0065) 0002 0 0 40000 7 2
video-LWR-B-A7B#show cable video encryption pme linecard 7/0 session 32 Stream 32, session
7681 is active

Stream number = 32 Session number = 7681
ECM requests = 8 ECM replies = 2
ECM ID = 32 CryptoPeriod num = 2
CP duration = 0 Nominal duration = 40000
CA transfer mode = 1 Stream status = No Error Blob details

video-LWR-B-A7B#show cable video encryption pme linecard 7/0 session summary Currently
active streams:
Active = 4 ECM req/resp mismatch = 4
ECM req, all streams = 32 ECM resp, all streams = 8

Since last reset:
Sessions created = 4 Sessions deleted = 0
ECMs received = 2 ECMs discarded = 0
```

Feature Information for Encryption

Table 19: Feature Information for Encryption

Feature Name	Releases	Feature Information
Encryption	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.



CHAPTER 13

Global Video Configuration

You can perform some global configurations for provisioning the video services. These configurations have some default values. If you do not choose to change those values, the default values are used. The following sections describe the procedures for global configurations.

Contents

- [Configuring the Default ONID, on page 75](#)
- [Configuring the Default PSI interval, on page 75](#)
- [Configuring Video Session Timeouts, on page 76](#)
- [Configuration Examples, on page 76](#)
- [Feature Information for Global Video Configuration, on page 76](#)

Configuring the Default ONID

By default, the system ONID is 0, which is commonly used in North America. If the default value of the ONID is used, the TSID must be unique. You can change the default ONID. If you change the ONID, the TSID-ONID pair must be unique. The ONID must be in the range of 0 to 65535.

```
configure terminal
cable video
default-onid default onid number
```

Configuring the Default PSI interval

By default, the Program Specific Information (PSI) interval is 100 msec. You can change the default PSI interval. The PSI interval must be in the range of 40 to 1000.

```
configure terminal
cable video
default-psi-interval default-psi-interval msec
```

Configuring Video Session Timeouts

The default video session init timeout is 1000 msec, the idle session timeout is 250 msec, and the off session timeout is 60 seconds. You can change these default values. The following are the permissible ranges for the timeouts:

- Init session timeout—100 to 60000
- Idle session timeout—100 to 5000
- Off session timeout—1 to 1800

```
configure terminal
cable video
timeout init-session timeout msec
timeout idle-session timeout msec
timeout off-session timeout sec
```

Configuration Examples

This section provides examples for the global video configuration.

Example: Global Video Configuration

```
configure terminal
cable video
default-onid 10
default-psi-interval 50
timeout init-session 200 msec
timeout idle-session 250 msec
timeout off-session 500 sec
```

Feature Information for Global Video Configuration

Table 20: Feature Information for Global Video Configuration

Feature Name	Releases	Feature Information
Global Video Configuration	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.



CHAPTER 14

Advanced Video MPEG Features

Cisco cBR Series Converged Broadband Router supports the following video features.

- [Information about Advanced Video MPEG Features, on page 77](#)
- [How to Configure Advanced Video MPEG Features, on page 77](#)
- [Configuration Examples for Advanced Video MPEG Features, on page 78](#)
- [Feature Information for Advanced Video MPEG Features, on page 78](#)

Information about Advanced Video MPEG Features

Reserved Output PID Range

The reserved output PID range allows the user to specify a range of PIDs that will not be used as output for remapped sessions. A range of up to 4000 PIDs from 1-8190 can be reserved.

One continuous reserved PID range is supported for each chassis. Note that the protection is only good for future output remapped PIDs, so the reserved PID range is expected to be configured before any remapped sessions are created. Remapped PIDs within the reserved range that already exists will not be reallocated.

How to Configure Advanced Video MPEG Features

Configuring Reserved Output PID Range

To configure reserved output range, follow the steps below:

```
enable
configure terminal
cable video
reserve-pid-range start-pid-end-pid
```

Verifying Reserved Output PID Range Configuration

To verify the reserved output PID range configuration, use the **show cable video logical-edge-device id id reserve-pid-range** command as shown in the example below.

```
Router# show cable video logical-edge-device id 1 reserve-pid-range
Logical Edge Device: led1
Id: 1
Reserve PID Range: 1-4000
```

Configuration Examples for Advanced Video MPEG Features

This section provides configuration examples for the advanced video MPEG features:

Example: Configuring Reserved Output PID Range

The following example shows how to configure reserved output PID range.

```
enable
configure terminal
cable video
reserve-pid-range 4000-4100
```

Feature Information for Advanced Video MPEG Features

Table 21: Feature Information for Advanced Video MPEG Features

Feature Name	Releases	Feature Information
Advanced Video MPEG Features	Cisco IOS XE Everest 16.6.1	This feature was integrated on the Cisco cBR Series Converged Broadband Routers.



CHAPTER 15

Important Notes

The following are some important notes for Management IP Interface and Virtual Routing Interface.

- [Video Packet Routing Requirements, on page 79](#)

Video Packet Routing Requirements

A routing protocol, such as OSPF or IS-IS, must be enabled on the cBR-8 in order for video data packets from the head end to reach the virtual QAMs. On the cBR-8, enable a routing protocol as described in the routing configuration guide.

Once the routing protocol is set up correctly, the cBR-8 will advertise the internal static routes for the video data path to the head end.

The user needs to configure the Virtual Edge Input (VEI) with a routable IP address from within the customer's network. More information, see [Configuring Virtual Edge Input under Logical Edge Device](#).

