



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.

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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 | | | | |

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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

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 <https://cfng.cisco.com/> 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 1: 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. |

