Advanced MPEG Features

This document provides information on the support for advanced MPEG features and how to configure Cisco cBR series routers to avail the support.

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.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://tools.cisco.com/ITDIT/CFN/. An account on http://www.cisco.com/ is not required.

Advanced MPEG Features

Information About Advanced MPEG Features

The Cisco cBR-8 router supports the following advanced MPEG features:

- PID filtering
- Program filtering
- Custom PID remapping
- Multiprogram Transport Stream (MPTS) remuxing
- Enhanced input source switching

Overview of PID Filtering, Program Filtering, and PID Remapping

In a broadcast video environment, PID and program filtering allow you to filter PIDs and programs from a MPTS pass-through stream in the table-based video configuration mode. You can filter up to 32 PIDs and 16 programs for each input stream. PID filtering is supported for both unicast and multicast sessions.

Custom PID remapping allows you to specify remap rules for all four types of processing types—data piping, pass-through, remap, and remux sessions. You can remap both referenced PIDs (PIDs that are part of PMT) and unreferenced PIDs in an input stream.

When remapping referenced ES PIDs of a program on remap or remux session, the corresponding PMT is updated. In case of pass-through sessions, the output retains the pass-through PMT.

Rules for Configuring PID Filtering and PID Remapping

PID filter and remap rules are available in the cable video section of the **sh run | s cable video** command.

- You can specify filter rules for each video session. The key used to apply the remap rules is the combination of vcg, rf-channel, and input stream information.
- For unicast streams, the input stream information is the VEI IP address and the UDP port number.
- For ASM multicast streams, the input stream information is the group IP address.
- For SSM multicast streams, the input stream information is the source IP and the group IP address.
- You can configure up to 32 remap rules for each video session.

Benefits of Using PID Filtering and PID Remapping

Using PID filter and remap rules provide the following benefits:

- Specify PID remapping at the QAM channel level.
- Remap referenced and unreferenced PIDs from data, MPTS, or SPTS streams.
- Block all unreferenced PIDs from data stream or MPTS stream.
- Block specific unreferenced PIDs from data stream or MPTS stream.
- Block PMT PIDs in SPTS and MPTS streams.
- Remap PIDs from data streams as PMT PIDs for the services configured on the QAM channel.
- Insert PAT from an external data stream. *(also blocking the internally generated PAT by edge device being played out)*

Restrictions for PID Remapping

- Only 32 remap rules are allowed for each input stream on a rf-channel. This number of remap rules is inclusive of the specified filter rules.
- For a given RF channel there cannot be remap rules with the same output PIDs.

- For a given input stream on a rf-channel, there cannot be two rules with same input PID remapped to different output PIDs.
- The output PID value in a remap rule can be in a range between 0 to 8190.
- The PMT of remap and remux sessions cannot be remapped.
- When remapping referenced PID for a passthru session, the output PMT retains old value of the referenced PID. For remap session, the output PMT reflects the new value of the referenced PID.

Remapping PAT or SI from External Data Stream

Using remap rules, you can remap a PID that contains Program Allocation Table (PAT) or Service Information (SI) PIDs, on a rf-channel.

When an input stream on a rf-channel contains a rule to remap a data PID to PAT, the internally generated PAT playout is stopped. The PAT playout is dependent on the PID that carries the PAT.

SI PIDs and other data PIDs are remapped as usual.

Blocking Unreferenced PIDs

PIDs that are not part of any program are unreferenced PIDs. You can block unreferenced PIDs on a QAM channel. To block unreferenced PIDs, follow the steps as shown below:

```
Router(config)#cable video
Router(config-video)#filter pid vcg vcg1
Router(cable-video-filter)#rf-channel 20-21
Router(cable-video-filter-ch)#block-unref-pids
```

Overview of Enhanced Input Source Switching

Enhanced input source switching includes the following features:

- Manual switch—You can manually switch to a backup source.

Note The source from which you switch must be active.

- Program Clock Reference (PCR) based switch—You can choose automatic source switching, which is based on the bit rate of PCR PID. For example, when the PCR PID bit rate becomes 0 or the stream does not get PCR for three seconds, the source automatically switches to the backup or the next source.

Benefits of Using Enhanced Input Source Switching

Using enhanced input source switching provides the following benefits:

- In a multicast enviroment, monitor the bit rate of PCR PID. Initiate redundancy by switching to a backup source when the bitrate reaches 0. This is applicable for SPTS streams only.

Note Redundancy support for multicast ASM stream to switch to a backup port instead of a backup source is not supported.

- Support for manually switching to a backup source.

Overview of MPTS Remuxing

In table-based broadcast applications, MPTS remuxing allows you to choose specific programs from MPTS sessions using the program number. You can choose multiple programs from the same MPTS stream on a rf-channel. The programs that you do not choose are dropped. The program PIDs are automatically remapped at the output.

The input MPTS stream can be unicast or multicast stream. You can clone multicast sources across rf-channels. You cannot replicate unicast sources. You can map same input programs to different output programs on different rf-channels.

How to Configure Advanced MPEG Features

Configuring PID Filtering

To configure PID filtering for unicast stream, follow the steps below:

```
cable video
filter pid vcg vcg name
rf-channel range
vei-ip ip address udp-port udp port number
pid range
```

To configure PID filtering for ASM multicast stream, follow the steps below:

```
cable video
filter pid vcg vcg name
rf-channel range
asm-multicast group ip address
pid range
```

To configure PID filtering for SSM multicast stream, follow the steps below:

```
cable video
filter pid vcg vcg name
rf-channel range
ssm-multicast source ip address group ip address
pid range
```

Configuring Program Filtering

To configure program filtering for unicast stream, follow the steps below:

```
cable video
filter program vcg vcg name
rf-channel range
vei-ip ip address udp-port udp port number
program range
```

To configure PID filtering for ASM multicast stream, follow the steps below:

```
cable video
filter program vcg vcg name
rf-channel range
asm-multicast group ip address
program range
```

To configure PID filtering for SSM multicast stream, follow the steps below:

```
cable video
filter program vcg vcg name
rf-channel range
ssm-multicast source ip address group ip address
program range
```

Configuring PID Remapping

To configure custom PID remapping for unicast stream, follow the steps below:

```
cable video
remap pid vcg vcg name
rf-channel range
vei-ip ip address udp-port udp port number
program range range
```

To configure custom PID remapping for ASM multicast stream, follow the steps below:

```
cable video
remap pid vcg vcg name
rf-channel range
asm-multicast group ip address
program range range
```

To configure custom PID remapping for SSM multicast stream, follow the steps below:

```
cable video
remap pid vcg vcg name
rf-channel range
ssm-multicast source ip address group ip address
program range range
```

Configuring Remapping Data PID to PAT PID

To configure remapping data PID to PAT PID for unicast stream, follow the steps below:

```
Router(config)#cable video
Router(config-video)#remap pid vcg vcg1
Router(config-video-remap)#rf-channel 10
```

```
Router(config-video-remap-ch)#vei-ip 174.1.1.1 udp-port 49152
Router(config-video-remap-ch-ucast)#pid 6000 0
```

To configure remapping data PID to PAT PID for ASM multicast stream, follow the steps below:

```
Router(config)#cable video
Router(config-video)#remap pid vcg vcg1
Router(config-video-remap)#rf-channel 10-20
Router(config-video-remap-ch)#ssm-multicast 198.51.100.1 198.51.100.2
Router(config-video-remap-ch-mcast)# pid 6000 0
```

To configure remapping data PID to PAT PID for SSM multicast stream, follow the steps below:

```
Router(config)#cable video
Router(config-video)#remap pid vcg vcg1
Router(config-video-remap)#rf-channel 30
Router(config-video-remap-ch)#asm-multicast 198.51.100.1
Router(config-video-remap-ch-mcast)# pid 6000 0
```

Configuring Enhanced Input Source Switching

To manually switch to a backup source, follow the steps below:

```
Router# cable video source-switch from-group 203.0.113.1 from-source 203.0.113.3
Router# cable video source-switch to-group 203.0.113.1 to-source 203.0.113.2
```

To enable PCR PID based source switch, follow the steps below:

```
Router(config)#cable video
Router(config-video)#pcr-based-source-switch
```

To disable PCR PID based source switch, follow the steps below:

```
Router(config)#cable video
Router(config-video)#no pcr-based-source-switch
```

Configuring MPTS Remuxing

To configure MPTS remuxing for multicast sessions, follow the steps below:

```
Router(config)#cable video
Router(config-video)#table-based
Router(config-video-tb)#vcg <vcg-name>
Router(config-video-tb-vcg)#rf-channel <channel-num>
Router(config-video-tb-vcg-sess)# session <session-name> multicast-label <multicast_label>
 processing-type <remap | data | passthru|remux> input-program-num <num> output-program-num
 <num>
```

To configure MPTS remuxing for unicast sessions, follow the steps below:

```
Router(config)#cable video
Router(config-video)#table-based
Router(config-video-tb)#vcg <vcg-name>
Router(config-video-tb-vcg)#rf-channel <start-channel>-<end-channel>
Router(config-video-tb-vcg-sess)# session <session-name> input-port <vei-number>
start-udp-port <udp-port-number> processing-type <remap | data | passthru|remux>
input-program-num <num> output-program-num <num>
```

Verifying PID Filtering, Program Filtering, and PID Remapping

You can view the PID remaps, the PID filters, and the program filters using the session detail command as shown below:

```
Router(config-video-remap-ch-mcast)#$sion log id 1 session-id 1048583
Session Name         : ssml.1.2
Session Id           : 1048583
Creation Time        : Wed Dec 20 16:22:41 2017

Output Port          : 122
TSID                 : 122
ONID                 : 0
Number of Sources    : 1
    Source IP        : 192.0.2.254
    Group IP         : 192.0.2.255
    UDP Port         : 0
Config Bitrate       : Not specified
Jitter               : 100 ms
Processing Type      : Passthru
Stream Rate          : VBR
Program Number       : -
Idle Timeout         : 4500 msec
Init Timeout         : 5000 msec
Off Timeout          : 60 sec
Encryption Type      : CLEAR
Encryption Status    : -

PID Filter
1000 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018

Program Filter
10 11 12 13 14 15 16 17 18 19 20 21

PID Remap
20 → 30 34 → 134 35 → 135 36 → 136 37 → 137 38 → 138
```

Verifying MPTS Remuxing

To see the remux sessions along with input and output program numbers, use the **show cable video session** as shown below:

```
Router# show cable video session log id 1
Total Sessions = 4


Session    Output    Frequency    Streaming   Session Session Source                 UDP
  Input    Output   Input       Output  Input    Output   Encrypt  Encrypt  LOW  PMV  SESSION
Id         Port      Hz           Type        Type    Ucast Dest IP/Mcast IP (S,G)    Port
  Program  Program  State       State   Bitrate  Bitrate  Type     Status   LAT  NUM  NAME
-------------------------------------------------------------------------------------------------
2097152    142       567000000    Remux       SSM     175.2.5.6,232.5.6.7            0
  1        100      ACTIVE-PSI  ON      78099327 17115419  CLEAR   -        N    -
SESS_PME2.1.7.338
2097153    163       567000000    Remux       SSM     175.6.1.13,232.2.1.6           0
  2        200      ACTIVE-PSI  ON      78099327 17115419  CLEAR   -        N    -
SESS_PME3.1.7.497
2097154    184       567000000    Remux       SSM     175.2.6.7,232.5.6.15           0
  3        300      ACTIVE-PSI  ON      78099327 17115419  CLEAR   -        N    -
SESS_PME4.1.7.656
2097155    230       567000000    Remux       SSM     175.7.2.2,232.2.6.7            0
  4        400      ACTIVE-PSI  ON      78099327 17115419  CLEAR   -        N    -
SESS_PME6.1.7.978
```

To see the remux processing type, follow the steps below:

```
Router# show cable video session log id 1 summary
Video Session Summary For Video
```

```
Active      : 6    Init      : 0      Idle       : 0
Off         : 6    Blocked   : 0      PSI-Ready  : 6
UDP         : 0    ASM       : 0      SSM        : 12
Remap       : 0    Data      : 0      Passthru   : 0
Remux       : 12   Pending   : 0      Encrypted  : 0
Low Latency : 0

Total Sessions: 12
Total Input Bitrate: 467067498 BPS
Total Output Bitrate: 99841084 BPS
```

Note The input and output bitrates shown for the remux ression is for the whole stream. The bitrates do not correspond to individual programs.

To see the list of input programs, remapped output programs, and the enabled output programs, follow the steps as shown below:

```
cable video
  multicast-uplink VirtualPortGroup0 access-list all-multicasts
  use-pcr-fo
  mgmt-intf VirtualPortGroup 0
  service-distribution-group sdg1 id 1
    rf-port integrated-cable 7/0/0
  virtual-carrier-group vcg1 id 1
    encrypt
    service-type narrowcast
    rf-channel 20-22 tsid 20-22 output-port-number 20-22
  bind-vcg
    vcg vcg1 sdg sdg1
  logical-edge-device led1 id 1
    protocol table-based
      virtual-edge-input-ip 203.0.113.1 input-port-number 1
      vcg vcg1
      active
  table-based
    vcg vcg1
      rf-channel 20
        session 20_pass group 203.0.113.1 source 203.0.113.2 processing-type passthru
  remap pid vcg vcg1
    rf-channel 20
      ssm-multicast 203.0.113.1 203.0.113.2
        pid 20 30
        pid 34-38 134-138
  filter pid vcg vcg1
    rf-channel 20
      ssm-multicast 203.0.113.1 203.0.113.2
        pid 1000-1020
  filter program vcg vcg1
    rf-channel 20
      ssm-multicast 203.0.113.1 203.0.113.2
        program 10-20
```

Troubleshooting Tips for Possible Configuration Errors

Troubleshooting tips for possible configuration errors:

- If a specific PID remap, PID filter or program filter rule is not applied, check the session detail command output if the PID rule is present as part of the session.
- If the PID remap, PID filter, or program filter rule is not present in the session detail command output, check if the VCG, the rf-channel, and the input information matches the session for which the remap rule should be applied.
- Make sure that the session is either a pass-through or a data-piping session.
- For multicast-based PID rules, check if the active source has the rule applied.

Configuration Examples for Advanced MPEG Features

Example 1: PID Filter—Table-based Unicast Session Configuration

Consider the below table-based unicast session on a input port number 1 with vei-ip 198.51.100.1

```
logical-edge-device led1 id 1
    protocol table-based
       virtual-edge-input-ip 198.51.100.1 input-port-number 1
       vcg vcg1
       active


table-based
    vcg vcg1
       rf-channel 2
           session unicast input-port 1 start-udp-port 49152 processing-type passthru
```

The corresponding filter rule is shown below:

```
filter pid vcg vcg1
     rf-channel 2
         vei-ip 198.51.100.1 udp-port 49152
            pid 120
            pid 20-30
```

Example 2: PID Filter—Table-based ASM Multicast Session Configuration

Consider a table-based ASM multicast session replicated on rf-channel 30-40.

```
table-based
    vcg vcg1
       rf-channel 2
           session asml group 198.51.100.2 processing-type passthru
```

You can specify PID rule for the session on each rf-channel a group of rf-channels as shown below:

```
filter pid vcg vcg1
    rf-channel 2
      asm-multicast 198.51.100.2
          pid 1000
          pid 1002-1020
```

Example 4: Program Filter—Table-based Unicast Session Configuration

Consider the below table-based unicast session on a input port number 1 with vei-ip 198.51.100.1

```
logical-edge-device led1 id 1
    protocol table-based
       virtual-edge-input-ip 198.51.100.1 input-port-number 1
       vcg vcg1
       active


table-based
    vcg vcg1
       rf-channel 2
           session unicast input-port 1 start-udp-port 49152 processing-type passthru
```

The corresponding filter rule is shown below:

```
filter program vcg vcg1
     rf-channel 2
         vei-ip 198.51.100.1 udp-port 49152
            program 10
            program 20
            program 30-40
```

Example 5: Program Filter—Table-based ASM Multicast Session Configuration

Consider a table-based ASM multicast session replicated on rf-channel 30-40.

```
table-based
    vcg vcg1
       rf-channel 2
           session asml group 198.51.100.2 processing-type passthru
```

You can specify PID rule for the session on each rf-channel a group of rf-channels as shown below:

```
filter program vcg vcg1
    rf-channel 2
      asm-multicast 198.51.100.2
          program 10-20
```

Example 6: Program Filter—Table-based SSM Multicast Session Configuration

Consider a SSM multicast stream as shown below:

```
table-based
    vcg vcg1
       rf-channel 2
          session ssml group 198.51.100.3 source 198.51.100.6 processing-type passthru
```

One of the remap rules is applied depending on the source and group match as shown below:

```
filter program vcg vcg1
    rf-channel 2
       ssm-multicast 198.51.100.200 198.51.100.254
          program 10-20
       ssm-multicast 198.51.100.201 198.51.100.254
          program 10-20
       ssm-multicast 198.51.100.203 198.51.100.254
          program 10-20
```

Example 7: PID Remap—Table-based Unicast Session Configuration

Consider the below table-based unicast session on a input port number 1 with vei-ip 198.51.100.1

```
table-based
    vcg vcg1
       rf-channel 20
           session unicast input-port 1 start-udp-port 49152 processing-type passthru
```

The corresponding remap assuming 32 input unreferenced PIDs is shown below:

```
remap pid vcg vcg1
     rf-channel 20
         vei-ip 198.51.100.1 udp-port 49152
            pid 100 200
            pid 101 201
            pid 102-130 202-230
            pid 131 240
```

Example 8: PID Remap—Table-based ASM Multicast Session Configuration

Consider a table-based ASM multicast session replicated on rf-channel 30-40.

```
table-based
    vcg vcg1
       rf-channel 2
           session asm_multi group 198.51.100.2 processing-type data
```

You can specify PID rule for the session on each rf-channel a group of rf-channels as shown below:

```
remap pid vcg vcg1
    rf-channel 30
      asm-multicast 198.51.100.2
          pid 1000 8189
    rf-channel 31-40
      asm-multicast 198.51.100.2
          pid 1000 8189
```

Example 9: PID Remap—Table-based SSM Multicast Session Configuration

Consider a SSM multicast stream as shown below:

```
table-based
    vcg vcg1
       rf-channel 30-40
          session ssm_multi group 198.51.100.3 source 198.51.100.6 processing-type data
```

One of the remap rules is applied depending on the source and group match as shown below:

```
remap pid vcg vcg1
    rf-channel 30-35
       ssm-multicast 198.51.100.200 198.51.100.254
          pid 1000 8190
       ssm-multicast 198.51.100.201 198.51.100.254
          pid 2000 8190
       ssm-multicast 198.51.100.203 198.51.100.254
          pid 1860 8190
```

Feature Information for Advanced MPEG Features

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://cfnng.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 Advanced MPEG Features

Feature Name	Releases	Feature Information
Advanced MPEG Features	Cisco IOS-XE Release 16.8.1	This feature was introduced into Cisco IOS-XE Release 16.8.1 on theCisco cBR Series Converged Broadband Routers.