Configuring VDSL2 and ADSL2/22 Plus for Cisco C1100 Series ISRs

VDSL2 and ADSL2/2+ Cisco C1100 Series Integrated Services Router provide highly reliable WAN connections for remote sites. These interfaces offer cost-effective virtualized WAN connections in both point-to-point and point-to-multipoint designs.

Organization needs high speed digital data transmission to operate between their data equipment and central office, usually located at the telecom service provider premises. The Cisco multimode VDSL2 and ADSL1/2/2+ provides 1-port (2-pair) multimode VDSL2 and ADSL2+ WAN connectivity. This connectivity in combination with Cisco C1100 Series Integrated Service Routers, provides high-speed digital data transmission between customer premises equipment (CPE) and the central office.

This capability enables service providers and resellers to offer additional services, such as business-class security, voice, video, and data; differentiated classes of service (QoS), and managed network access over existing telephony infrastructure. These value-added features, along with the flexible manageability and reliability of Cisco IOS Software, provide the mission-critical networking features that businesses expect.

The following table describes the VDSL2 and ADSL2/2+ Variants:

Product Number	Description

C1117-4P - Annex A	1-port (2-pair) VDSL2/ADSL2+ over POTS
	
	• VDSL2 over POTS Band Plans
	
	    • VDSL2 profiles: 8a, 8b, 8c, 8d, 12a, 12b, 17a
	
	    • Vectoring
	
	• ADSL1/2/2+ Annex A, ADSL2 Annex L, non-optimized ADSL2/2+ Annex M

C1117-4PM - Annex M	1-port (2-pair) VDSL2/ADSL2+ over POTS with Annex M • VDSL2 over POTS Band Plans • VDSL2 profiles: 8a, 8b, 8c, 8d, 12a, 12b, 17a

Product Number	Description
	• Vectoring • Optimized ADSL2/2+ Annex M • ADSL/ADSL2/2+ Annex A
C1116-4P - Annex B/J	1-port (1-pair) VDSL2/ADSL2+ over ISDN • ADSL1/2/2+ Annex B, non-optimized ADSL2/2+ Annex J • VDSL2 over ISDN Band Plans (8a to 17a) with Vectoring

For more information on DSLAM interoperability, refer to the Cisco Multimode VDSL2 and ADSL2/2 Network Interface Module Datasheet.

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DSL Feature Specifications

Table 1: DSL Feature Specifications

Multimode DSL (VDSL2 and ADSL2/2+)	• Broadcom chipset • One RJ-14 VDSL2 interface • Independent module firmware subpackage loading • Dying gasp • Support for double-ended line testing (DELT) diagnostics mode

Table 2: VDSL2 Feature Specifications

VDSL2	• ITU G.993.2 (VDSL2) and ITU G.993.5 (VDSL2) • 997 and 998 band plans • VDSL2 profiles: 8a, 8b, 8c, 8d, 12a, 12b, and 17a • Vectoring • U0 band support (25 to 276 kHz) • Ethernet packet transfer mode (PTM) based only on IEEE 802.3ah 64/65 octet encapsulation

Table 3: ADSL2/2+ Feature Specifications

ADSL2/2+	• ADSL over POTS with Annex A and Annex B ITU G. 992.1 (ADSL), G.992.3 (ADSL2), and G.992.5 (ADSL2+) • ADSL over POTS with Annex M (extended upstream bandwidth) G.992.3 (ADSL2) and G.992.5 (ADSL2+) • G.994.1 ITU G.hs • Reach-extended ADSL2 (G.922.3) Annex L for increased performance on loop lengths greater than 16,000 feet from central office • T1.413 ANSI ADSL DMT issue 2 compliance • DSL Forum TR-067, and TR-100 conformity • Impulse noise protection (INP) and extended INP • Downstream power backoff (DPBO) • Asynchronous transfer mode (ATM) only • Maximum 8 PVCs per interface

Configuring DSL

Cisco C1100 Series Integrated Services Routers (ISRs) support asymmetric digital subscriber line (ADSL) 1/2/2+ and very high speed digital subscriber line 2 (VDSL2) transmission modes, also called multimode.

Configuring ADSL

Perform the below mentioned steps to configure a DSL controller.

Configuring Auto Mode

Procedure

	Command or Action	**Purpose**
Step 1	**enable** **Example:** `router> enable`	Enables privileged EXEC mode.
Step 2	**configure terminal** **Example:** `router# configure terminal`	Enters global configuration mode.
Step 3	**controller VDSL** *slot/subslot/port* **Example:** `router(config-controller)# controller vdsl 0/3/0`	Enters configuration mode for the VDSL controller.
Step 4	**operating mode** *auto* **Example:** `router(config-controller)# operating mode auto`	Configures the auto operating mode, which is the default configuration.
Step 5	**end** **Example:** `router(config-controller)# end`	Exits controller configuration mode.

Configuring ADSL1 and ADSL2/2+ plus Annex A and Annex M Mode

Procedure

	Command or Action	**Purpose**
Step 1	**enable** **Example:** `router> enable`	Enables privileged EXEC mode.
Step 2	**configure terminal** **Example:** `router# configure terminal`	Enters global configuration mode.
Step 3	**controller VDSL** *slot/subslot/port* **Example:** `router(config-controller)# controller vdsl 0/3/0`	Enters configuration mode for the VDSL controller.

	Command or Action	Purpose
Step 4	**operating mode** {*adsl1*	*adsl2 annex a*	*annex m*	*adsl2+ annex a*	*annex m]*} **Example:** `router(config-controller)# operating mode adsl2+ annex m`	Configures the operating mode. • ADSL1—Configures operation in ITU G.992.1 Annex A full-rate mode. • ADSL2—Configures operation in ADSL2 operating mode-ITU G.992.3 Annex A, Annex L, and Annex M. If an Annex operating mode is not chosen, Annex A, Annex L, and Annex M are enabled. The final mode is decided by negotiation with the DSL access multiplexer (DSLAM). • ADSL2+—Configures operation in ADSL2+ mode-ITU G.992.5 Annex A and AnnexM. If an Annex A operating mode is not chosen, both Annex and Annex M is enabled. The final mode is decided by negotiation with DSLAM. • Annex A and M—(Optional) If the annex option is not specified, both Annex A and Annex M are enabled. The final mode is decided by negotiation with the Digital Synchronous Line Access Multiplexer (DSLAM).
Step 5	**end** **Example:** `router(config-controller)# end`	Exits controller configuration mode.

Configuring VDSL2

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `router> enable`	Enables privileged EXEC mode.
Step 2	**configure terminal** **Example:** `router# configure terminal`	Enters global configuration mode.
Step 3	**controller VDSL** *slot/subslot/port* **Example:**	Enters configuration mode for the VDSL controller.

	Command or Action	Purpose
	`router(config-controller)# controller vdsl 0/3/0`	
Step 4	**operating mode** *mode* **Example:** `router(config-controller)# operating mode vdsl2`	Configures the operating mode. The operating mode is VDSL2. Enables 8a through 17a profile.
Step 5	**end** **Example:** `router(config-controller)# end`	Exits controller configuration mode.

Examples of DSL Interface Configuration

In Cisco IOS XE, ATM PVCs can be configured under ATM sub-interfaces only. PVC configuration is not allowed under the main ATM interface. You can configure 8 point to point sub-interfaces either with one PVC configured under each point to point sub-interface or single multi-point sub-interface.

You do not need to configure the **tx-ring-limit** command in the Cisco C1100 Series Integrated Services Routers, if you are migrating from classic Cisco IOS and using **tx-ring-limit** command to reduce the latency. Because the DSL modules buffers have been fine tuned for the optimal performance and latency.

The following example shows how to configure ATM interface:

```
interface ATM0/3/0
 no ip address
 no atm oversubscribe
 no atm enable-ilmi-trap
 no shut


interface ATM0/3/0.1 point-to-point
 ip address 192.0.2.1 255.255.255.0
 no atm enable-ilmi-trap
 pvc 1/77
 vbr-rt 400 400
```

The following example shows how to configure Ethernet interface.

```
interface Ethernet0/3/0
 ip address 192.0.2.1 255.255.255.0
 load-interval 30
 no negotiation auto
```

If the trained mode is VDSL2 or VDSL2+, the TC mode should be in Packet Transfer Mode (PTM). In this case, the PTM Ethernet interface is in the **up** state. All other upper layer parameters such as PPP, IP, and so on should be configured under the Ethernet interface. If the trained mode is ADSL, ADSL2, or ADSL2+, the TC mode should be ATM and all the upper layer parameters should be configured under the ATM Permanent Virtual Circuit (PVC). If you change the operating mode between ADSL and VDSL, you need not to reboot the router in order to activate the corresponding Ethernet or ATM interfaces. In case of PTM mode, check with your ISP if they are expecting Dot1q tag configuration on the CPE. ISP should provide Dot1q tag value.

```
Router(config)#interface Ethernet0.835

Router(config-subif)#encapsulation dot1Q 835

Router(config-subif)#pppoe-client dial-pool-member 1
```

Features Supported in xDSL

ATM Conditional Debug Support

Most ATM debugging commands are implemented either at the system level or at the interface level. The ATM Conditional Debug Support feature allows debugging to be limited specifically to an ATM interface, to a virtual channel identifier (VCI), or to a virtual path identifier/virtual channel identifier (VPI/VCI) pair, through use of the debug condition interface command.

For more information on configuring ATM conditional debug support feature, see the ATM Conditional Debug Support document.

ATM OAM Loopback Mode Detection

The Loopback Mode Detection Through OAM feature allows you to enable automatic detection of when a peer ATM interface is in loopback mode. When loopback is detected on an interface where end-to-end F5 Operation, Administration, and Maintenance (OAM) is enabled, the impacted permanent virtual circuit (PVC) is moved to a DOWN state, and traffic is suspended. When the loopback condition in the peer ATM interface is removed, the PVC is moved back to an UP state.

For more information on configuring ATM OAM Loopback Mode Detection, see the Loopback Mode Detection through OAM document.

ATM Oversubscription for DSL

The ATM Oversubscription for DSL feature enables users to improve network utilization of otherwise underutilized shared networks by leveraging statistical multiplexing on ATM networks. Instead of supporting only unconditional reservation of network bandwidth to VBR PVCs, the Router offers PVC oversubscription to statistically guarantee bandwidth to VBR PVCs.

In Cisco IOS XE Release 3.14.0S or later, the ATM Oversubscription feature enables you to specify the amount of oversubscription (oversubscription factor) equal to twice the line rate. Following are the features of oversubscription:

- Oversubscription is allowed on VBR-rt and VBR-nrt.

- Under no over subscription condition, PVCs can be configured up to line rate. For example, if the line rate is 1000 Kbps. The SCR or PCR of a VBR PVC cannot be more than 1000 Kbps if there are no other PVCs. If there is a CBR PVC with PCR of 500Kbps, then the maximum SCR or PCR allowed on the VBR PVC is 500 Kbps.

- When over-subscription is enabled, multiple VBR-rt or VBR-nrt PVCs are allowed to be configured even if the sum of their SCRs exceeds the actual bandwidth available over the physical line. Suppose oversubscription is enabled and over subscription factor of 2 is set for a line rate of 1000k sum of SCRs of VBR-rt and VBR-nrt can be less than or equal to 2000k, this is excluding CBR PVCs bandwidth.

- If the user configures VBR-rt or VBR-nrt more than the configured oversubscription factor then PVC will be configured for the bandwidth available. If there is no oversubscription bandwidth left then VC will be downgraded to UBR. For example for line rate of 1000k, with oversubscription factor 2: PVC1 is vbr-rt 400k 400k, PVC2 is vbr-nrt 1600k 1600k and PVC3 is vbr-rt 500k 500k. In this case the PVC1 and PVC2 will be configured to given pcr and scr, PVC3 will be downgraded to UBR class.

- If there is no bandwidth left, then some PVCs may be downgraded to UBR class.

- PCR & SCR of VBR PVC can never exceed the line rate even if there is enough available bandwidth for the configured PCR and SCR.

Oversubscription of the ATM interfaces is enabled by default and is subject to infinite oversubscription factor which is not supported on DSL NIM. User must enable oversubscription factor.

The following configuration enables the oversubscription 2. The only oversubscription factor supported is 2.

```
Router(config)#interface atm 0/3/0
Router(config-if)#atm oversubscription factor 2
Router(config-if)#exit
```

To disable oversubscription of the interface, use the no atm oversubscribe command.

For example, the following configuration disables oversubscription of the ATM 0/1/0 interface:

```
Router(config)#interface atm 0/3/0
Router(config-if)#no atm oversubscribe
Router(config-if)#exit
```

Example:

Below is the example for the sum of pvc rates less than the line rate of 1561kbps.

```
Router#show atm pvc
     VCD /              Peak Av/Min Burst
Interface Name VPI VCI Type Encaps SC Kbps Kbps Cells St

0/3/0.1 2     0 32 PVC SNAP CBR 300 UP
                (C) CBR 300
0/3/0.2 3     0 33 PVC SNAP CBR 100 UP
                (C) CBR 100
0/3/0.3 4     0 34 PVC SNAP VBR 400 200 10 UP
                (C) VBR 400 200 10
0/3/0.4 5     0 35 PVC SNAP VBR 600 300 10 UP
                (C) VBR 600 300 10
0/3/0.5 6     0 36 PVC SNAP VBR 300 150 10 UP
                (C) VBR 300 150 10
0/3/0.6 7     0 37 PVC SNAP VBR 700 450 10 UP
                (C) VBR 700 450 10
0/3/0.7 8     0 38 PVC SNAP UBR 1561 UP
                (C) UBR 0
0/3/0.8 1     0 39 PVC SNAP UBR 1000 UP
                (C) UBR 1000
```

When line rate gets downgraded to 294 kbps, CBR and VBR PVC rates gets adjusted dynamically as below.

```
Router#show atm pvc

     VCD /              Peak Av/Min Burst
Interface Name VPI VCI Type Encaps SC Kbps Kbps Cells St
```

```
0/3/0.1 2     0 32 PVC SNAP CBR 294 UP
                 (C) CBR 300
0/3/0.2 3     0 33 PVC SNAP UBR 294 UP
                 (C) CBR 100
0/3/0.3 4     0 34 PVC SNAP VBR 294 200 10 UP
                 (C) VBR 400 200 10
0/3/0.4 5     0 35 PVC SNAP VBR 294 294 1 UP
                 (C) VBR 600 300 10
0/3/0.5 6     0 36 PVC SNAP VBR 94 94 1 UP
                 (C) VBR 300 150 10
0/3/0.6 7     0 37 PVC SNAP UBR 294 UP
                 (C) VBR 700 450 10
0/3/0.7 8     0 38 PVC SNAP UBR 294 UP
                 (C) UBR 0
0/3/0.8 1     0 39 PVC SNAP UBR 294 UP
                 (C) UBR 1000
```

ATM Routed Bridge Encapsulation (RBE)Concept

ATM routed bridge encapsulation (RBE) is used to route IP over bridged RFC 1483 Ethernet traffic from a stub-bridged LAN.

For more information on configuring ATM RBE, see the Providing Connectivity Using ATM Routed Bridge Encapsulation over PVCs document.

Default Route on a PPP Virtual Access Interface

If a Virtual-Template (VT) interface is configured to obtain its IP address by IPCP, the dynamically created Virtual-Access (VA) interface gets the IP address after PPP negotiation. Since the Virtual-access is created dynamically, we cannot configure mappings on the dynamic interface. Also, there is no way to configure a static route through the virtual-access interface; we need to insert a default route via the next-hop address for the virtual-access and this is achieved using "ppp ipcp route default".

For more information on the usage of the command, see the ppp ipcp default route command document.

Dynamic Bandwidth Change for ATM PVCs

The ATM Dynamic Bandwidth for ATM PVCs over DSL feature provides the ability to configure Cisco IOS-XE software to automatically adjust PVC bandwidth in response to changes in the total available interface bandwidth. This feature eliminates the manual intervention every time DSL line rate changes, and allows the available bandwidth to be used effectively at all times.

It is recommended to enable ATM Dynamic Bandwidth feature on ATM interfaces. For more information on enabling the ATM Dynamic Bandwidth feature, refer the section "Enabling ATM Dynamic Bandwidth" .

✎

Note

- When there is a change in line condition or DSL line flaps, ATM interface Bandwidth gets updated after line condition is stable. PVC Service Class bandwidth and Multilink Bundle bandwidth (if MLPPP is configured) gets adjusted dynamically. As a result, traffic flows according to the adjusted bundle bandwidth.

- When "bandwidth x" is configured under dialer and there is a change in line condition or DSL line flaps, ATM interface Bandwidth gets updated after line condition is stable. PVC Service Class bandwidth gets adjusted dynamically, but Multilink Bundle bandwidth (if MLPPP is configured) does not get updated dynamically because of fixed dialer bandwidth configuration. Because of this, throughput might not be achieved as expected. It is recommended not to configure "bandwidth x" under dialer interface for MLP ATM configurations to be in sync with ATM interface/Service Class bandwidth.

Enabling ATM Dynamic Bandwidth

By default ATM dynamic bandwidth feature is enabled. If ATM dynamic bandwidth is disabled, perform the below steps to enable the feature:

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int atm0/3/0
Router(config-if)#atm bandwidth dynamic
Router(config-if)#end
Router#
```

Sample configuration:

```
!
interface ATM0/3/0
 no ip address
 load-interval 30
 no atm enable-ilmi-trap
!
```

Show atm pvc output with atm dynamic bandwidth enabled.

Example 1:

```
Router#show atm pvc
       VCD /                 Peak Av/Min Burst
Interface Name VPI VCI Type Encaps SC Kbps Kbps Cells St
0/1/0.1 1 8 37 PVC MUX UBR 1045 UP
               (C) UBR 0
Router#
```

Example 2:

```
Router#show atm pvc
     VCD /                 Peak Av/Min Burst
Interface Name VPI VCI Type Encaps SC Kbps Kbps Cells St
0/3/0.1 2 0 32 PVC SNAP CBR 294 UP
                 (C) CBR 300
```

Note (C) is the configured rates.

In example 2, CBR PVC was configured with PCR as 300 kbps. Due to line rate change, PCR rate has dynamically changed to 294 kbps.

Disabling ATM Dynamic Bandwidth

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int atm0/3/0
Router(config-if)#no atm bandwidth dynamic
Router(config-if)#end
Router#
Router#sh run int atm0/3/0
Building configuration...

Current configuration : 110 bytes
!
interface ATM0/3/0
 no ip address
 load-interval 30
 no atm bandwidth dynamic
 no atm enable-ilmi-trap
end

Router#
```

Show atm pvc output with atm dynamic bandwidth feature disabled:

```
Router#show atm pvc | sec 0/3/0
0/1/0.1 1 8 37 PVC MUX UBR 1045 UP
Router#
```

How the ATM Dynamic Bandwidth Feature Works

When the total available bandwidth on a DSL interface changes, all of the PVCs configured under the ATM sub-interface(s) are re-created.

If necessary and applicable for a particular PVC based on its service class, new values are applied for the following parameters when PVCs are re-created:

- PCR—peak cell rate

- SCR—sustainable cell rate

The following steps are performed by the Cisco IOS-XE software to determine what value should be assigned to a parameter when a PVC is re-created in response to a change in total available bandwidth:

- A value is calculated for the parameter. The calculation takes into account the configured value for the parameter, the active value for the parameter (if it is different from the configured value), and the change in total available bandwidth.

- The calculated value is compared to the configured value of the parameter and to the maximum available cell rate, and a new value is determined. The new value is applied when the PVC is re-created.

The following sections describe how the new parameter values are determined when a PVC is re-created for supported QoS classes:

CBR PVCs

When the total available bandwidth changes, PVCs configured with CBR service class are recreated as follows:

- If the configured PCR value is less than the calculated PCR value, the PVC is recreated with the configured PCR value.

- If the configured PCR value is greater than the calculated PCR value, the PVC is recreated with the calculated value with no change in class.

- If there is no bandwidth left for the CBR PVC, then CBR PVCs will be downgraded to UBR class with a PCR value equal to the maximum available rate.

VBR PVCs

When the total available bandwidth changes, PVCs configured with VBR service class are re-created as follows:

- If the configured PCR value is less than the calculated PCR value, the PVC is recreated with the configured PCR value.

- If the configured PCR value is greater than the calculated PCR value, the PVC is recreated with a new PCR value. The new PCR value will be the lower of the following values:

  - The calculated PCR value

  - The maximum available cell rate

- If the configured SCR value is less than the calculated PCR value, the PVC is re-created with the configured SCR value.

- If the configured SCR value is greater than the calculated PCR value, the PVC is recreated with a new SCR value. The new SCR value will be the lower of the following values:

  - The calculated PCR value

  - The maximum available cell rate

UBR PVCs

When the total available bandwidth changes, PVCs configured with UBR service class are re-created as follows:

- If the PCR configuration is set to the default, the PVC is re-created with a PCR value equal to the new line rate.

- If the configured PCR value is less than the calculated PCR value, the PVC is re-created with the configured PCR value.

- If the configured PCR value is greater than the calculated PCR value, the PVC is recreated with a new PCR value. The new PCR value will be the lower of the following values:

  - The calculated PCR value

• New line rate

Example:

Below is the example for the sum of pvc rates less than the line rate of 1561kbps.

```
Router#show atm pvc
    VCD /                    Peak Av/Min Burst
Interface Name VPI VCI Type Encaps SC Kbps Kbps Cells St

0/3/0.1 2    0 32 PVC SNAP CBR 300 UP
                  (C) CBR 300
0/3/0.2 3    0 33 PVC SNAP CBR 100 UP
                  (C) CBR 100
0/3/0.3 4    0 34 PVC SNAP VBR 400 200 10 UP
                  (C) VBR 400 200 10
0/3/0.4 5    0 35 PVC SNAP VBR 600 300 10 UP
                  (C) VBR 600 300 10
0/3/0.5 6    0 36 PVC SNAP VBR 300 150 10 UP
                  (C) VBR 300 150 10
0/3/0.6 7    0 37 PVC SNAP VBR 700 450 10 UP
                  (C) VBR 700 450 10
0/3/0.7 8    0 38 PVC SNAP UBR 1561 UP
                  (C) UBR 0
0/3/0.8 1    0 39 PVC SNAP UBR 1000 UP
                   (C) UBR 1000
```

When line rate gets downgraded to 687kbps, CBR and VBR PVC rates gets adjusted dynamically as below.

```
Router#show atm pvc
VCD / Peak Av/Min Burst
Interface Name VPI VCI Type Encaps SC Kbps Kbps Cells St

0/3/0.1 2    0 32 PVC SNAP CBR 300 UP
                  (C) CBR 300
0/3/0.2 3    0 33 PVC SNAP CBR 100 UP
                  (C) CBR 100
0/3/0.3 4    0 34 PVC SNAP VBR 287 200 10 UP
                  (C) VBR 400 200 10
0/3/0.4 5    0 35 PVC SNAP VBR 87 87 1 UP
                  (C) VBR 600 300 10
0/3/0.5 6    0 36 PVC SNAP UBR 687 UP
                  (C) VBR 300 150 10
0/3/0.6 7    0 37 PVC SNAP UBR 687 UP
                  (C) VBR 700 450 10
0/3/0.7 8    0 38 PVC SNAP UBR 687 UP
                  (C) UBR 0
0/3/0.8 1    0 39 PVC SNAP UBR 687 UP
                  (C) UBR 1000
```

Upgrading the Firmware on DSL Interface

To upgrade the firmware on a DSL interface, perform these steps:

Before you begin

When you boot the router in packages.conf mode with the Cisco IOS XE image (super package) during the installation period, you can upgrade or downgrade the firmware without reloading the router.

If you do not boot the router in packages.conf mode with the Cisco IOS XE image, you must follow the prerequisites given below, before proceeding with the firmware upgrade:

- Copy the firmware subpackage into bootflash:/mydir.

- Type the **request platform software package expand file** command *boot flash:/mydir/<IOS-XE image>* to expand the super package.

- Type the **reload** command to load the module with the new firmware

- Boot the router with *packages.conf*.

- Copy the firmware subpackage to the folder *bootflash:mydir/*.

- Issue **request platform software package install** *rp 0 file bootflash:/mydir/<firmware subpackage>* .

- Reload the hardware module subslot to boot the module with the new firmware.

- Verify that the module is booted up with the new firmware using the **show platform software subslot 0/3 module firmware** command.

Procedure

	Command or Action	**Purpose**
Step 1	copy Cisco IOS XE image into bootflash: **mydir**. **Example:** `Router# mkdir bootflash:mydir`	Creates a directory to save the expanded software image. You can use the same name as the image to name the directory.
Step 2	**request platform software package expand file** *bootflash:/mydir /<IOS-XE image* to expand super package. **Example:** `Router#  request platform software package expand file bootflash:/mydir/c1100-universalk9.03.14.00.S.155-1.S-std.SPA.bin`	Expands the platform software package to super package.
Step 3	**reload**. **Example:** `Router# reload` `rommon >`	Enables ROMMON mode, which allows the software in the super package file to be activated.
Step 4	**boot bootflash:mydir/ /packages.conf**. **Example:** `rommon 1 > boot bootflash:mydir/packages.conf`	Boots the super package by specifying the path and name of the provisioning file: packages.conf.
Step 5	**copy** firmware subpackage to the folder **bootflash:mydir/**. **Example:** `Router#copy bootflash:c1100-universalk9.03.14.00.S.155-1.S-std.SPA.bin`	Copies the firmware subpackage into bootflash:mydir.

	Command or Action	Purpose
	`bootflash:mydir/`	
Step 6	**request platform software package install** *rp 0 file bootflash:/mydir/<firmware subpackage>.* **Example:** Router#**request platform software package install rp 0 file bootflash:mydir/c1100-universalk9.03.14.00.S.155-1.S-std.SPA.bin**	Installs the software package.
Step 7	**hw-module subslot x/y reload** to boot the module with the new firmware. **Example:** Router#**hw-module subslot 0/3 reload**	Reloads the hardware module subslot and boots the module with the new firmware.
Step 8	**show platform software subslot 0/3 module firmware** to verify that the module is booted up with the new firmware. **Example:** Router# **show platform software subslot 0/3 module firmware** Pe	Displays the version of the newly installed firmware.

The following example shows how to perform firmware upgrade in a router module:

```
Router#mkdir bootflash:mydir
Create directory filename [mydir]?
Created dir bootflash:/mydir
Router#c
Router#copy bootflash:c1100-universalk9.03.14.00.S.155-1.S-std.SPA.bin bootflash:mydir/
Destination filename [mydir/c1100-universalk9.03.14.00.S.155-1.S-std.SPA.bin]?
Copy in progress...CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCC 425288648 bytes copied in 44.826 secs (9487544 bytes/sec)
Router#
Router#
Router#dir bootflash:mydir
Directory of bootflash:/mydir/
632738 -rw- 425288648 Dec 12 2014 09:16:42 +00:00
c1100-universalk9.03.14.00.S.155-1.S-std.SPA.bin
7451738112 bytes total (474025984 bytes free)
Router#

Router#request platform software package
expand file bootflash:/mydir/c1100-universalk9.03.14.00.S.155-1.S-std.SPA.bin
Verifying parameters
Validating package type
Copying package files
SUCCESS: Finished expanding all-in-one software package.

Router#reload
```

```
System configuration has been modified. Save? [yes/no]: yes
Building configuration...

[OK]
Proceed with reload? [confirm]
Rom image verified correctly

System Bootstrap, Version C900-1100-20170915-SDR52-Micron-Toshiba, DEVELOPMENT SOFTWARE
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Current image running: Boot ROM1

Last reset cause: LocalSoft
C1111-8PLTEEAWR platform with 4194304 Kbytes of main memory


rommon 1  boot bootflash:mydir/packages.conf

File size is 0x000028f1 Located mydir/packages.conf Image size 10481 inode num 632741, bks
 cnt 3 blk size 8*512 # File size is 0x150ae3cc Located mydir/
c1100-universalk9.03.14.00.S.155-1.S-std. SPA.pkg Image size 353035212 inode num 356929,
bks cnt 86191 blk size 8*512
###################################################################
#################################################################### Boot image size =
353035212 (0x150ae3cc) bytes Package header rev 1 structure detected Calculating SHA-1
hash...done validate_package: SHA-1 hash: calculated
8e966678:8afb08f4:8a88bb8f:fe591121:8bddf4b3 expected
8e966678:8afb08f4:8a88bb8f:fe591121:8bddf4b3 RSA Signed RELEASE Image Signature Verification
 Successful. Package Load Test Latency : 3799 msec Image validated Dec 12 09:28:50.338 R0/0:
 %FLASH_CHECK-3-DISK_QUOTA: Flash disk quota exceeded [free space is 61864 kB] - Please
clean up files on bootflash.

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 of U.S. laws governing Cisco cryptographic products may be found at:

Router>
Router>en
Password:

Router#
Router show controller vdsl 0/3/0
Controller VDSL 0/3/0 is UP

Daemon Status:          UP

                        XTU-R (DS)              XTU-C (US)
Chip Vendor ID:         'BDCM'                  'BDCM'
Chip Vendor Specific:   0x0000                  0xA3A3
Chip Vendor Country:    0xB500                  0xB500
Modem Vendor ID:        'CSCO'                  'BDCM'
Modem Vendor Specific:  0x4602                  0x0000
```

```
Modem Vendor Country:    0xB500                      0xB500
Serial Number Near:                     C1117-4P16.6.201707
Serial Number Far:
Modem Version Near:      16.6.20170704:13462
Modem Version Far:       0xa3a3

Modem Status:            TC Sync (Showtime!)
DSL Config Mode:         AUTO
Trained Mode:            G.992.5 (ADSL2+) Annex A

TC Mode:                 ATM
Selftest Result:         0x00
DELT configuration:      disabled
DELT state:              not running

Failed full inits:       0
Short inits:             0
Failed short inits:      0

Modem FW  Version:       4.14L.04
Modem PHY Version:       A2pv6F039t.d26d

Line 0:

                         XTU-R (DS)              XTU-C (US)
Trellis:                 ON                      ON
SRA:                     disabled                disabled
SRA count:               0                       0
Bit swap:                enabled                 enabled
Bit swap count:          0                       325
Line Attenuation:         1.0 dB                  3.2 dB
Signal Attenuation:       1.9 dB                  2.7 dB
Noise Margin:            12.5 dB                 11.4 dB
Attainable Rate:         27580 kbits/s            1257 kbits/s
Actual Power:             6.3 dBm                12.0 dBm
Total FECC:              0                       0
Total ES:                0                       0
Total SES:               0                       0
Total LOSS:              0                       0
Total UAS:               81                      81
Total LPRS:              0                       0
Total LOFS:              0                       0
Total LOLS:              0                       0


                 DS Channel1    DS Channel0    US Channel1    US Channel0
Speed (kbps):            NA         25004             NA           1111
SRA Previous Speed:      NA             0             NA              0
Previous Speed:          NA             0             NA              0
Total Cells:             NA     120724290             NA        5356209
User Cells:              NA             0             NA              0
Reed-Solomon EC:         NA             0             NA              0
CRC Errors:              NA             0             NA              0
Header Errors:           NA             0             NA              0
Interleave (ms):         NA          7.00             NA           5.41
Actual INP:              NA          1.29             NA           1.56

Training Log :  Stopped
Training Log Filename : flash:vdsllog.bin


Router#
Router#
```

```
Router# copy bootflash: c1100-firmware_c1100_vadsl2017-07-07_23.01.SSA.pkg
bootflash:mydir/ Destination filename
[mydir/c1100-firmware_c1100_vadsl2017-07-07_23.01.SSA.pkg]?
Copy in progress...CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC 6640604 bytes copied in 1.365 secs (4864911
bytes/sec)
Router#
```

```
Router#request platform software package install rp 0 file
bootflash: c1100-firmware_c1100_vadsl2017-07-07_23.01_.SSA.pkg

--- Starting local lock acquisition on R0 --- Finished local lock acquisition on R
--- Starting file path checking --- Finished file path checking --- Starting image file
verification

--- Checking image file names Locating image files and validating name syntax Found Verifying
image file locations Inspecting image file types Processing image file constraints Creating
candidate provisioning file Finished image file verification --- Starting candidate package
set construction --- Verifying existing software set Processing candidate provisioning
file Constructing working set for candidate package set Constructing working set for running
package set Checking command output Constructing merge of running and candidate packages
Checking if resulting candidate package set would be complete Finished candidate package
set construction --- Starting ISSU compatiblity verficiation --- Verifying image type
compatibility Checking IPC compatibility with running software Checking candidate package
set infrastructure compatibility Checking infrastructure compatibility with running software
Checking package specific compatibility Finished ISSU compatiblity verficiation --- Starting
impact testing --- Checking operational impact of change Finished impact testing ---
Starting list of software package changes --- Old files list: Removed
c1100-firmware_c1100_vadsl2017-07-07_23.01_.SSA.pkg New files list: Added
c1100-firmware_c1100_vadsl2017-07-07_23.01_.SSA _39n.SSA.pkg Finished list of software
package changes --- Starting commit of software changes --- Updating provisioning rollback
files Creating pending provisioning file Committing provisioning file Finished commit of
software changes --- Starting analysis of software changes --- Finished analysis of software
changes --- Starting update running software --- Blocking peer synchronization of operating
information Creating the command set placeholder directory Finding latest command set
Finding latest command shortlist lookup file Finding latest command shortlist file
Router#
```

```
Router#
Router#show platform software subslot 0/3 module firmware

Avg Load info
-------------------------------------------
1.83 1.78 1.44 3/45 607
Kernel distribution info
-------------------------------------------
Linux version 3.4.11-rt19 (sapanwar@blr-atg-001) (gcc version 4.6.2 (Buildroot 2011.11) )
#3 SMP PREEMPT Fri Nov 7 09:26:19 IST 2014
Module firmware versions
-------------------------------------------
Modem Fw Version: 4.14L.04
Modem Phy Version: A2pv6F039t.d24o_rc1
Boot Loader: Secondry
-------------------------------------------
Version: 1.1
Modem Up time
-------------------------------------------
0D 0H 25M 38S
Router#
```

IP to ATM CoS, Per-VC WFQ and CBWFQ QoS: PPPoE QoS Markings of .1P Bits in S (AOL)

IP to ATM CoS support for a single ATM VC allows network managers to use existing features, such as committed access rate (CAR) or policy-based routing (PBR), to classify and mark different IP traffic by modifying the IP Precedence field in the IP version 4 (IPv4) packet header. Subsequently, Weighted Random Early Detection (WRED) or distributed WRED (DWRED) can be configured on a per-VC basis so that the IP traffic is subject to different drop probabilities (and therefore priorities) as IP traffic coming into a router competes for bandwidth on a particular VC.

For more information, see the Configuring IP to ATM CoS document.

Low Latency Queueing

Low Latency Queuing (LLQ) allows delay-sensitive data such as voice to be dequeued and sent first (before packets in other queues are dequeued), giving delay-sensitive data preferential treatment over other traffic. The **priority** command is used to allow delay-sensitive data to be dequeued and sent first. LLQ enables use of a single priority queue within which individual classes of traffic can be placed. For more details on configuring LLQ, see the following documents:

Low Latency Queueing with Priority Percentage Support

Configuring Low Latency Queueing

Modular QoS CLI (MQC) Unconditional Packet Discard

The Modular QoS CLI (MQC) Unconditional Packet Discard feature allows customers to classify traffic matching certain criteria and then configure the system to unconditionally discard any packets matching that criteria. The Modular QoS CLI (MQC) Unconditional Packet Discard feature is configured using the Modular Quality of Service Command-Line Interface (MQC) feature. Packets are unconditionally discarded by using the new **drop** command within the MQC.

For more information on configuring Modular QOS CLI unconditional packet discard feature, see the Modular QoS CLI Unconditional Packet Discard document.

MQC Policy Map Support on Configured VC Range ATM

The Modular Quality of Service Command Line Interface (MQC) Policy Map support on Configured VC Range ATM feature extends the functionality for policy maps on a single ATM VC to the ATM VC range.

For more information on configuring MQC Policy Map Support on Configured VC Range ATM, see the MQC Policy Map on Configured VC Range ATM document.

Multilink PPP (MLPPP) bundling

This feature describes how to configure Multilink PPP over broadband interfaces. Configuring Multilink PPP over broadband includes configuring Multilink PPP over ATM (MLPoA), Multilink PPP over Ethernet (MLPoE), Multilink PPP over Ethernet over ATM (MLPoEoA), and so on.

For more information on Multilink PPP bundles and to configure Multilink PPP minimum links, Bundling and Multilink PPP support on multiple VC's , see the following documents:

Configuring Multilink PPP Connections for Broadband and Serial Topologies

ATM Multilink PPP Support on Multiple VCs

PPPoE Enhancement with RFC 4638

The PPP over Ethernet Client feature provides PPP over Ethernet (PPPoE) client support on routers on customer premises.

For more information on configuring PPP over Ethernet feature, see the PPP over Ethernet Client document.

PPPoEoA over ATM AAL5Mux

The PPPoEoA over ATM AAL5MUX feature enables PPP over Ethernet (PPPoE) over ATM adaptation layer 5 (AAL5)-multiplexed permanent virtual circuits (PVCs), reducing logical link control (LLC) and Subnetwork Access Protocol (SNAP) encapsulation bandwidth usage and thereby improving bandwidth usage for the PVC.

For more information on configuring PPPoEoA over ATm AAL5MUX feature, see How to Configure PPPoEoA over ATM AAL5MUX at PPPoEoA over ATM AAL5Mux.

PPP Over ATM (IETF-Compliant)

PPP over ATM enables a high-capacity central site router with an ATM interface to terminate multiple remote PPP connections. PPP over ATM provides security validation per user, IP address pooling, and service selection capability.

For more information on configuring PPP over ATM for different encapsulation types, see the following documents:

Providing Protocol Support for Broadband Access Aggregation of PPP over ATM Sessions

Configuring PPP over ATM with NAT

PPPoE Specification Conformance with PADT Message

The PPP over Ethernet Client feature provides PPP over Ethernet (PPPoE) client support on routers on customer premises.

For more information on configuring PPP over Ethernet feature, see the PPP over Ethernet Client document.

QoS on Dialer

QOS on dialer interfaces feature provides support for Point-to-Point Protocol over Ethernet (PPPoE) and Point-to-Point Protocol over Asynchronous Transfer Mode (PPPoA) configurations on dialer interfaces. The feature provides support for Modular QoS CLI (MQC)-based queuing and shaping that supports per-customer quality of service (QoS). For more details on configuring QOS on dialer, see the Shaping on Dialer Interfaces document.

QoS: PPPoE QoS Markings of .1P Bits

The 802.1P CoS Bit Set for PPP and PPPoE Control Frames feature provides the ability to set user priority bits in the IEEE 802.1Q tagged frame to allow traffic prioritization. This capability enables a way to provide best effort quality of service (QoS) or class of service (CoS) at layer 2 without requiring reservation setup.

For more information on configuring PPPoE QOS Markings of 802.1P bits feature, see the 802.1P CoS Bit Set for PPP and PPPoE Control Frames document.

RBE Client Side Encapsulation with QoS

The RBE client side encapsulation with QoS feature provides secure connectivity to an ATM bridged network in which previously a broadband access server would not forward Address Resolution Protocol (ARP) requests or perform proxy ARP, and would respond to ARPs for its own IP address only. This feature combines RBE with QoS policy-based routing to provide security to the entire network. RBE was developed to address known issues with RFC1483 bridging such as broadcast storms and security.

For more information on configuring ATM RBE with QOS, see the following documents:

RBE Client Side Encapsulation with QoS and the Command References

RBE Client Side Encapsulation with QoS

VC Bundling

APP License is required to support this feature on this module in Cisco IOS XE.

```
Router(config)#license boot level appxk9
```

ATM VC bundle management allows you to define an ATM VC bundle and add VCs to it. You can configure multiple Permanent Virtual Circuits (PVC) that have different QoS characteristics between two end devices. Each VC of a bundle has its own ATM traffic class and ATM traffic parameters. You can apply attributes and characteristics to discrete VC bundle members, or you can apply them collectively at the bundle level.

For more details on configuring VC Bundling, see the Configuring ATM document.

Show and Debug Commands

Verifies that the configuration is set properly.

```
Router#show controller vdsl 0/3/0
Controller VDSL 0/3/0 is UP

Daemon Status:         UP

                       XTU-R (DS)              XTU-C (US)
Chip Vendor ID:        'BDCM'                  'BDCM'
Chip Vendor Specific:  0x0000                  0xA3A3
Chip Vendor Country:   0xB500                  0xB500
Modem Vendor ID:       'CSCO'                  'BDCM'
Modem Vendor Specific: 0x4602                  0x0000
Modem Vendor Country:  0xB500                  0xB500
Serial Number Near:              C1117-4P16.6.201707
Serial Number Far:
Modem Version Near:    16.6.20170704:13462
```

```
Modem Version Far:      0xa3a3

Modem Status:           TC Sync (Showtime!)
DSL Config Mode:        AUTO
Trained Mode:           G.992.5 (ADSL2+) Annex A

TC Mode:                ATM
Selftest Result:        0x00
DELT configuration:     disabled
DELT state:             not running

Failed full inits:      0
Short inits:            0
Failed short inits:     0

Modem FW  Version:      4.14L.04
Modem PHY Version:      A2pv6F039t.d26d

Line 0:

                        XTU-R (DS)              XTU-C (US)
Trellis:                ON                      ON
SRA:                    disabled                disabled
SRA count:              0                       0
Bit swap:               enabled                 enabled
Bit swap count:         0                       100
Line Attenuation:        1.0 dB                  3.2 dB
Signal Attenuation:      1.9 dB                  2.6 dB
Noise Margin:           12.4 dB                 11.2 dB
Attainable Rate:        27576 kbits/s            1253 kbits/s
Actual Power:            6.3 dBm                12.0 dBm
Total FECC:             0                       0
Total ES:               0                       0
Total SES:              0                       0
Total LOSS:             0                       0
Total UAS:              81                      81
Total LPRS:             0                       0
Total LOFS:             0                       0
Total LOLS:             0                       0


                DS Channel1    DS Channel0   US Channel1      US Channel0
Speed (kbps):           NA          25004            NA             1111
SRA Previous Speed:     NA              0            NA                0
Previous Speed:         NA              0            NA                0
Total Cells:            NA       37914565            NA          1674506
User Cells:             NA              0            NA                0
Reed-Solomon EC:        NA              0            NA                0
CRC Errors:             NA              0            NA                0
Header Errors:          NA              0            NA                0
Interleave (ms):        NA           7.00            NA             5.41
Actual INP:             NA           1.29            NA             1.56

Training Log :  Stopped
Training Log Filename : flash:vdsllog.bin


Router#show platform software subslot 0/3 module firmware

Avg Load info
-------------------------------------------
2.00 1.88 1.19 1/46 598

Kernel distribution info
-------------------------------------------
```

```
Linux version 3.4.11-rt19 (pavrao@bgl-ads-1863) (gcc version 4.6.2 (Buildroot 2011.11) )
#3 SMP PREEMPT Tue Jun 27 18:47:55 IST 2017

Module firmware versions
----------------------------------------
Modem Fw Version: 4.14L.04
Modem Phy Version: A2pv6F039t.d26d


Boot Loader: Secondry
----------------------------------------
Version: 1.1


Modem Up time
----------------------------------------
0D 0H 13M 47S


Router#show platform software subslot 0/3 module status
Process and Memory
--------------------------------------
Mem: 43020K used, 76596K free, 0K shrd, 3200K buff, 9668K cached
CPU:   0% usr   4% sys   0% nic  95% idle   0% io   0% irq   0% sirq
Load average: 2.00 1.90 1.24 1/46 602
  PID  PPID USER      STAT    VSZ %MEM CPU %CPU COMMAND
  518   322 admin     S      6092  5%   0   0% dslmgmt
  538   537 admin     S      6092  5%   0   0% dslmgmt
  537   518 admin     S      6092  5%   0   0% dslmgmt
  516   322 admin     S      4056  3%   1   0% tr64c -m 0
  323   322 admin     S      3948  3%   1   0% ssk
  521   519 admin     S      3932  3%   1   0% consoled
  322     1 admin     S      3596  3%   1   0% /bin/smd
  312   311 admin     S      2976  2%   0   0% /bin/swmdk
  311   310 admin     S      2976  2%   0   0% /bin/swmdk
  313   311 admin     S      2976  2%   0   0% /bin/swmdk
  310     1 admin     S      2976  2%   0   0% /bin/swmdk
  602   601 admin     R      1680  1%   0   0% /usr/bin/top -b -n 1 -d 30
    1     0 admin     S      1676  1%   0   0% init
  519     1 admin     S      1676  1%   0   0% -/bin/sh -l -c consoled
  601   538 admin     S      1672  1%   0   0% sh -c /usr/bin/top -b -n 1 -d 30
  363   322 admin     S      1552  1%   0   0% dhcpd
  517   322 admin     S      1480  1%   0   0% dsldiagd
  326   322 admin     S      1432  1%   0   0% dnsproxy
  511     2 admin     SW        0  0%   1   0% [dsl0]
  241     2 admin     SW        0  0%   0   0% [bcmsw_rx]
  145     2 admin     SW        0  0%   1   0% [mtdblock0]
  260     2 admin     SW        0  0%   1   0% [bcmsw_timer]
  206     2 admin     SW        0  0%   1   0% [bcmFlwStatsTask]
    5     2 admin     SW        0  0%   0   0% [kworker/u:0]
    9     2 admin     SW        0  0%   1   0% [ksoftirqd/1]
   10     2 admin     SW        0  0%   0   0% [kworker/0:1]
    8     2 admin     SW        0  0%   1   0% [kworker/1:0]
  156     2 admin     SW<       0  0%   0   0% [linkwatch]
   50     2 admin     SW        0  0%   1   0% [bdi-default]
   69     2 admin     DW        0  0%   1   0% [skbFreeTask]
   87     2 admin     SWN       0  0%   1   0% [kswapd0]
   88     2 admin     SW        0  0%   1   0% [fsnotify_mark]
    7     2 admin     SW        0  0%   1   0% [migration/1]
  152     2 admin     SW        0  0%   1   0% [kworker/1:1]
  329     2 admin     DW        0  0%   0   0% [Avs65_Task]
  160     2 admin     SW<       0  0%   0   0% [deferwq]
   11     2 admin     SW<       0  0%   1   0% [khelper]
   12     2 admin     SW        0  0%   1   0% [kworker/u:1]
   48     2 admin     SW        0  0%   0   0% [sync_supers]
  261     2 admin     SW        0  0%   1   0% [bcmsw]
   52     2 admin     SW<       0  0%   1   0% [kblockd]
```

```
    2    0 admin    SW       0   0%   1   0% [kthreadd]
    3    2 admin    SW       0   0%   0   0% [ksoftirqd/0]
    4    2 admin    SW       0   0%   0   0% [kworker/0:0]
   89    2 admin    SW<      0   0%   1   0% [crypto]
    6    2 admin    SW       0   0%   0   0% [migration/0]

Processors utilization
--------------------------------------
Linux 3.4.11-rt19 ((none))      01/01/70        _mips_   (2 CPU)

00:14:47    CPU   %usr   %nice   %sys %iowait    %irq   %soft  %steal  %guest   %idle
00:14:47    all   0.13   0.00    1.42   0.00    0.00    0.17    0.00    0.00   98.28
00:14:47      0   0.13   0.00    1.52   0.00    0.00    0.28    0.00    0.00   98.07
00:14:47      1   0.13   0.00    1.32   0.00    0.00    0.06    0.00    0.00   98.49
Interrupts
--------------------------------------
          CPU0      CPU1
  0:      8608      9201  BCM63xx  IPI
  7:    881960    881466  BCM63xx  timer
  9:         0         0  BCM63xx_no_unmask  brcm_9
 10:      1780         0  BCM63xx_no_unmask  brcm_10
 13:         0       717  BCM63xx_no_unmask  serial
 21:         0         0  BCM63xx_no_unmask  brcm_21
 22:         0         0  BCM63xx_no_unmask  brcm_22
 31:     33832         0  BCM63xx_no_unmask  dsl
 34:         0         0  BCM63xx_no_unmask  brcm_34
 35:         0         0  BCM63xx_no_unmask  brcm_35
 39:         0         0  BCM63xx_no_unmask  brcm_39
 89:         0         0  BCM63xx_no_unmask  brcm_89
 91:         0         0  BCM63xx_no_unmask  brcm_91
ERR:         0
System status
--------------------------------------
cpu  237 0 2521 174333 0 0 305 0 0 0
cpu0 118 0 1350 86981 0 0 249 0 0 0
cpu1 118 0 1170 87352 0 0 55 0 0 0
intr 1817730 17926 0 0 0 0 0 1763474 0 0 1781 0 0 717 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
33832 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
ctxt 616258

btime 0

processes 609

procs_running 1

procs_blocked 0

softirq 2174222 0 1762914 3274 270 0 0 32104 349576 0 26084

KLM Module status

--------------------------------------

iptable_mangle 1168 0 - Live 0xc0371000

iptable_filter 848 0 - Live 0xc036a000

ip_tables 11528 2 iptable_mangle,iptable_filter, Live 0xc0361000

xt_multiport 1446 0 - Live 0xc0357000
```

```
xt_mark 813 0 - Live 0xc0350000

xt_mac 739 0 - Live 0xc034a000

xt_DSCP 1819 0 - Live 0xc0344000

xt_dscp 1187 0 - Live 0xc033d000

pwrmngtd 8147 0 - Live 0xc0336000 (P)

bcmvlan 90718 0 - Live 0xc0312000 (P)

p8021ag 5891 0 - Live 0xc02e8000 (P)

bcmarl 6338 0 - Live 0xc02df000 (P)

nciTMSkmod 306764 0 - Live 0xc0288000 (P)

bcm_enet 199999 1 pwrmngtd, Live 0xc01ec000

adsldd 458747 0 - Live 0xc0120000 (P)

bcmxtmcfg 75415 1 adsldd, Live 0xc009b000 (P)

pktflow 85993 2 bcmarl,bcm_enet, Live 0xc0067000 (P)

bcm_bpm 9827 0 [permanent], Live 0xc0045000 (P)

bcm_ingqos 8159 0 - Live 0xc003a000 (P)

chipinfo 1325 0 - Live 0xc0031000 (P)

System Memory status

--------------------------------------

MemTotal:        119616 kB

MemFree:          76496 kB

Buffers:           3220 kB

Cached:            9732 kB
SwapCached:           0 kB
Active:            5300 kB
Inactive:          9572 kB
Active(anon):      1924 kB
Inactive(anon):       0 kB
Active(file):      3376 kB
Inactive(file):    9572 kB
Unevictable:          0 kB
Mlocked:              0 kB
SwapTotal:            0 kB
SwapFree:             0 kB
Dirty:                0 kB
Writeback:            0 kB
AnonPages:         1976 kB
Mapped:            2764 kB
Shmem:                0 kB
Slab:             26208 kB
SReclaimable:       556 kB
SUnreclaim:       25652 kB
KernelStack:        752 kB
PageTables:         252 kB
```

```
NFS_Unstable:          0 kB
Bounce:                0 kB
WritebackTmp:          0 kB
CommitLimit:       59808 kB
Committed_AS:       4888 kB
VmallocTotal:    1032116 kB
VmallocUsed:        1544 kB
VmallocChunk:    1028200 kB
```

Module Specific Show Commands

Command	Purpose
show platform software subslot *slot*/*subslot* **module firmware**	Displays firmware version, CFE version, build label of both module (base board).
show platform software subslot *slot*/*subslot* **module status**	Displays CPU utilization, memory utilization, firmware status, and so on.
show platform hardware subslot *slot*/*subslot* **module device help**	Displays device information specific to the module (for example, Phy, Non-Interface Registers).
show platform hardware subslot *slot*/*subslot* **module host-if status**	Displays configuration and status for the host interface port(s) (that is, ports connected to the backplane switch) of baseboard.
show platform hardware subslot *slot*/*subslot* **module host-if statistics**	Displays link statistics for the host interface port(s) (that is, ports connected to the backplane switch).
show platform hardware subslot *slot*/*subslot* **module interface** *interface name* **status**	Displays status, configuration and IID for specified user-visible interface.
show platform hardware subslot *slot*/*subslot* **module interface** *interface name* **statistics**	Displays link statistics including FC info for specified user-visible interface.

```
Router#show platform software subslot 0/3 module firmwareAvg Load info
-------------------------------------------
2.00 1.88 1.19 1/46 598

Kernel distribution info
-------------------------------------------
Linux version 3.4.11-rt19 (pavrao@bgl-ads-1863) (gcc version 4.6.2 (Buildroot 2011.11) )
#3 SMP PREEMPT Tue Jun 27 18:47:55 IST 2017

Module firmware versions
-------------------------------------------
Modem Fw Version: 4.14L.04
Modem Phy Version: A2pv6F039t.d26d

Boot Loader: Secondry
-------------------------------------------
Version: 1.1

Modem Up time
-------------------------------------------
```

```
0D 0H 13M 47S


Router#show platform software subslot 0/3 module status
Process and Memory
--------------------------------------
Mem: 43020K used, 76596K free, 0K shrd, 3200K buff, 9668K cached
CPU:   0% usr   4% sys   0% nic  95% idle   0% io   0% irq   0% sirq
Load average: 2.00 1.90 1.24 1/46 602
  PID  PPID USER     STAT    VSZ %MEM CPU %CPU COMMAND
  518   322 admin    S      6092   5%   0   0% dslmgmt
  538   537 admin    S      6092   5%   0   0% dslmgmt
  537   518 admin    S      6092   5%   0   0% dslmgmt
  516   322 admin    S      4056   3%   1   0% tr64c -m 0
  323   322 admin    S      3948   3%   1   0% ssk
  521   519 admin    S      3932   3%   1   0% consoled
  322     1 admin    S      3596   3%   1   0% /bin/smd
  312   311 admin    S      2976   2%   0   0% /bin/swmdk
  311   310 admin    S      2976   2%   0   0% /bin/swmdk
  313   311 admin    S      2976   2%   0   0% /bin/swmdk
  310     1 admin    S      2976   2%   0   0% /bin/swmdk
  602   601 admin    R      1680   1%   0   0% /usr/bin/top -b -n 1 -d 30
    1     0 admin    S      1676   1%   0   0% init
  519     1 admin    S      1676   1%   0   0% -/bin/sh -l -c consoled
  601   538 admin    S      1672   1%   0   0% sh -c /usr/bin/top -b -n 1 -d 30
  363   322 admin    S      1552   1%   0   0% dhcpd
  517   322 admin    S      1480   1%   0   0% dsldiagd
  326   322 admin    S      1432   1%   0   0% dnsproxy
  511     2 admin    SW        0   0%   1   0% [dsl0]
  241     2 admin    SW        0   0%   0   0% [bcmsw_rx]
  145     2 admin    SW        0   0%   1   0% [mtdblock0]
  260     2 admin    SW        0   0%   1   0% [bcmsw_timer]
  206     2 admin    SW        0   0%   1   0% [bcmFlwStatsTask]
    5     2 admin    SW        0   0%   0   0% [kworker/u:0]
    9     2 admin    SW        0   0%   1   0% [ksoftirqd/1]
   10     2 admin    SW        0   0%   0   0% [kworker/0:1]
    8     2 admin    SW        0   0%   1   0% [kworker/1:0]
  156     2 admin    SW<       0   0%   0   0% [linkwatch]
   50     2 admin    SW        0   0%   1   0% [bdi-default]
   69     2 admin    DW        0   0%   1   0% [skbFreeTask]
   87     2 admin    SWN       0   0%   1   0% [kswapd0]
   88     2 admin    SW        0   0%   1   0% [fsnotify_mark]
    7     2 admin    SW        0   0%   1   0% [migration/1]
  152     2 admin    SW        0   0%   1   0% [kworker/1:1]
  329     2 admin    DW        0   0%   0   0% [Avs65_Task]
  160     2 admin    SW<       0   0%   0   0% [deferwq]
   11     2 admin    SW<       0   0%   1   0% [khelper]
   12     2 admin    SW        0   0%   1   0% [kworker/u:1]
   48     2 admin    SW        0   0%   0   0% [sync_supers]
  261     2 admin    SW        0   0%   1   0% [bcmsw]
   52     2 admin    SW<       0   0%   1   0% [kblockd]
    2     0 admin    SW        0   0%   1   0% [kthreadd]
    3     2 admin    SW        0   0%   0   0% [ksoftirqd/0]
    4     2 admin    SW        0   0%   0   0% [kworker/0:0]
   89     2 admin    SW<       0   0%   1   0% [crypto]
    6     2 admin    SW        0   0%   0   0% [migration/0]

Processors utilization
--------------------------------------
Linux 3.4.11-rt19 ((none))     01/01/70       _mips_  (2 CPU)

00:14:47     CPU    %usr   %nice    %sys %iowait    %irq   %soft   %steal  %guest   %idle
00:14:47     all    0.13    0.00    1.42    0.00    0.00    0.17    0.00    0.00   98.28
00:14:47       0    0.13    0.00    1.52    0.00    0.00    0.28    0.00    0.00   98.07
```

```
00:14:47      1    0.13   0.00   1.32   0.00   0.00   0.06   0.00   0.00  98.49
Interrupts
-------------------------------------
          CPU0      CPU1
  0:       8608      9201   BCM63xx  IPI
  7:     881960    881466   BCM63xx  timer
  9:          0         0   BCM63xx_no_unmask  brcm_9
 10:       1780         0   BCM63xx_no_unmask  brcm_10
 13:          0       717   BCM63xx_no_unmask  serial
 21:          0         0   BCM63xx_no_unmask  brcm_21
 22:          0         0   BCM63xx_no_unmask  brcm_22
 31:      33832         0   BCM63xx_no_unmask  dsl
 34:          0         0   BCM63xx_no_unmask  brcm_34
 35:          0         0   BCM63xx_no_unmask  brcm_35
 39:          0         0   BCM63xx_no_unmask  brcm_39
 89:          0         0   BCM63xx_no_unmask  brcm_89
 91:          0         0   BCM63xx_no_unmask  brcm_91
ERR:          0
System status
-------------------------------------
cpu  237 0 2521 174333 0 0 305 0 0 0
cpu0 118 0 1350 86981 0 0 249 0 0 0
cpu1 118 0 1170 87352 0 0 55 0 0 0
intr 1817730 17926 0 0 0 0 0 1763474 0 0 1781 0 0 717 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
33832 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
ctxt 616258

btime 0

processes 609

procs_running 1

procs_blocked 0

softirq 2174222 0 1762914 3274 270 0 0 32104 349576 0 26084

KLM Module status

-------------------------------------

iptable_mangle 1168 0 - Live 0xc0371000

iptable_filter 848 0 - Live 0xc036a000

ip_tables 11528 2 iptable_mangle,iptable_filter, Live 0xc0361000

xt_multiport 1446 0 - Live 0xc0357000

xt_mark 813 0 - Live 0xc0350000

xt_mac 739 0 - Live 0xc034a000

xt_DSCP 1819 0 - Live 0xc0344000

xt_dscp 1187 0 - Live 0xc033d000

pwrmngtd 8147 0 - Live 0xc0336000 (P)

bcmvlan 90718 0 - Live 0xc0312000 (P)

p8021ag 5891 0 - Live 0xc02e8000 (P)
```

```
bcmarl 6338 0 - Live 0xc02df000 (P)

nciTMSkmod 306764 0 - Live 0xc0288000 (P)

bcm_enet 199999 1 pwrmngtd, Live 0xc01ec000

adsldd 458747 0 - Live 0xc0120000 (P)

bcmxtmcfg 75415 1 adsldd, Live 0xc009b000 (P)

pktflow 85993 2 bcmarl,bcm_enet, Live 0xc0067000 (P)

bcm_bpm 9827 0 [permanent], Live 0xc0045000 (P)

bcm_ingqos 8159 0 - Live 0xc003a000 (P)

chipinfo 1325 0 - Live 0xc0031000 (P)

System Memory status

--------------------------------------

MemTotal:         119616 kB

MemFree:           76496 kB

Buffers:            3220 kB

Cached:             9732 kB
SwapCached:            0 kB
Active:             5300 kB
Inactive:           9572 kB
Active(anon):       1924 kB
Inactive(anon):        0 kB
Active(file):       3376 kB
Inactive(file):     9572 kB
Unevictable:           0 kB
Mlocked:               0 kB
SwapTotal:             0 kB
SwapFree:              0 kB
Dirty:                 0 kB
Writeback:             0 kB
AnonPages:          1976 kB
Mapped:             2764 kB
Shmem:                 0 kB
Slab:              26208 kB
SReclaimable:        556 kB
SUnreclaim:        25652 kB
KernelStack:         752 kB
PageTables:          252 kB
NFS_Unstable:          0 kB
Bounce:                0 kB
WritebackTmp:          0 kB
CommitLimit:       59808 kB
Committed_AS:       4888 kB
VmallocTotal:    1032116 kB
VmallocUsed:        1544 kB
VmallocChunk:    1028200 kB


Router#show platform hardware subslot 0/3 module interface ethernet 0/3/0 statistics
Mode: PTM IID : 1
```

```
Queue Stats LP HP
Throttles 0 0
Enables 0 0
Throttles Ref 0 0
Enables Ref 55 55
Throttled 0 0
Tx Packets 14 0
Tx Bytes 6046 0
Tx Q Drops 0 0
Rx Packets 0 NA
Rx Bytes 0 NA
Rx Q Drops 0 NA
Max Q Depth 400 400
Q Depth 0 0
XON Q Depth 25 25
XOFF Q Depth 35 35

End of XDSL Interface Statistics


Router#show platform hardware subslot 0/3 module interface atm 0/3/0 statistics
Mode: ATM IID:3 PVC:8/37
=============================================

Queue Stats LP HP
Throttles 0 0
Enables 0 0
Throttles Ref 0 0
Enables Ref 1543 1543
Throttled 0 0
Tx Packets 7306 0
Tx Bytes 277628 0
Tx Q Drops 0 0
Rx Packets 0 NA
Rx Bytes 0 NA
Rx Q Drops 0 NA
Max Q Depth 400 400
Q Depth 0 0
XON Q Depth 96 96
XOFF Q Depth 100 100

End of XDSL Interface Statistics


Router#show platform hardware subslot 0/3 module device help
help The current information
conn Conn mgr details
rp RP details
rgmii BCM switch port RGMII details
mips BCM switch port MIPS details
steering Steering driver details
dma BCM switch and xtm DMA details


Router#show platform hardware subslot 0/3 module device conn
Connection Manager Statistics
Total number of packets used by NGIO is: 1 (2 Kbytes)
Processing statistics, processed: 427
Queue depth: current: 0 max: 5
handler (ms): min/avg/max: 0/0/0
NGIO (ms): min/avg/max: 0/0/10
statistics per invocation: avg: 1 max: 6
Corrupted packet Overrun: errors 0
Corrupted packet Underrun errors: 0
packet out of memory errors: 0
```

```
                local remote
              pkts in pkts out errors   pkts in pkts out errors
Control Point: 0: Last update was 280 ms ago
SAP     7: 0 0 0 0 0 0
SAP     6: 0 0 0 0 0 0
SAP     5: 0 0 0 0 0 0
SAP     4: 0 0 0 0 0 0
SAP     3: 0 0 0 0 0 0
SAP     2: 14 85 0 68 13 0
SAP     1: 12 873 0 872 12 0
SAP     0: 402 328 0 326 401 0
Total : 428 1286 0 1266 426 0
Heartbeats Local Remote
State: HB_INACTIVE HB_ACTIVE
   in 184 28
   out 28 184
  acks in 28 183
  acks out 184 28
   lost 0 0
  resets 0 0
Grand Total: 428 1286 0 1266 426 0


Router#show platform hardware subslot 0/3 module device rp
Reliable Protocol Statistics
link 0 packets in 435
link 0 packets out 1346
link 0 acks in 1342
link 0 acks out 435
link 0 retries 2
link 0 timeouts 0
link 0 delete errors 0
link 0 errors 0
link 0 transmit errors 0
link 0 revision errors 0
link 0 duplicates 0
link 0 out of sequence 0
link 0 out of window 0
link 0 current queue depth 0
link 0 max queue depth 14
link 0 processed 435
link 0 delivered 435
link 0 minimum latency(ms) 0
link 0 maximum latency(ms) 120
link 0 average latency(ms) 3


Router#show platform hardware subslot 0/3 module device rgmii
RGMII Tx Stats
-----------------------------------------
1762802 tx_octets_lo, 0 tx_octets_hi
0 tx_drop_pkts, 273 tx_qos_pkts
11 tx_bcast_pkts, 272 tx_mcast_pkts
14152 tx_ucast_pkts, 0 tx_col
0 tx_single_col, 0 tx_multi_col
0 tx_defer, 0 tx_late_col
0 tx_excess_col, 0 tx_framein_disc
0 tx_pause_pkts, 102618 tx_qos_octets_lo
0 tx_qos_octets_hi
RGMII Rx Stats
-----------------------------------------
7103314 rx_octets_lo, 0 rx_octets_hi
0 rx_undersize_pkts, 0 rx_pause_pkts
0 rx_oversize_pkts, 0 rx_jabber
0 rx_align_err, 0 rx_fcs_err
```

```
7103314 rx_good_octets_lo, 0 rx_good_octets_hi
0 rx_drop_pkts, 14092 rx_ucast_pkts
0 rx_mcast_pkts, 2 rx_bcast_pkts
0 rx_fragments, 0 rx_excess_frame_disc
0 rx_symbol_err, 9 rx_qos_pkts
4055 rx_qos_octets_lo, 0 rx_qos_octets_hi


Router#show platform hardware subslot 0/3 module device dma
BCMSW DAM info
--------------------------------------
== dma controller registers ==
controller config: 00000003
ch: config:int stat:int mask
rx:00000001:00000000:00000007
tx:00000000:00000007:00000000

== sram contents ==
ch: bd base: status:current bd content
rx:078ec000:0000000b:08402000:07b37060
tx:07ae2000:0000004a:003c6110:05e96002

== MIPS and MISC registers ==
CP0 cause: 00000000
CP0 status: 10008d01
XTM Rx DMA info
--------------------------------------

Ch 0, NumRxBds: 776, HeadIdx: 1, TailIdx: 1, AssignedBds: 776
DMA cfg: 0x00000001, intstat: 0x00000000, intmask: 0x00000007

Ch 1, NumRxBds: 16, HeadIdx: 1, TailIdx: 1, AssignedBds: 16
DMA cfg: 0x00000001, intstat: 0x00000000, intmask: 0x00000007
XTM Tx Bonding DMA info
--------------------------------------
No Bonding Information
XTM Tx DMA info
--------------------------------------

Ch 0, NumTxBds: 400, HeadIdx: 3, TailIdx: 3, FreeBds: 400
BD RingOffset: 0x00000003, Word1: 0x01bd60f3

Ch 1, NumTxBds: 400, HeadIdx: 0, TailIdx: 0, FreeBds: 400
BD RingOffset: 0x00000000, Word1: 0x00000000


Router#show platform hardware subslot 0/3 module device mips
MIPS Tx Stats
-----------------------------------------
7112517 tx_octets_lo, 0 tx_octets_hi
0 tx_drop_pkts, 11 tx_qos_pkts
2 tx_bcast_pkts, 0 tx_mcast_pkts
14161 tx_ucast_pkts, 0 tx_col
0 tx_single_col, 0 tx_multi_col
0 tx_defer, 0 tx_late_col
0 tx_excess_col, 0 tx_framein_disc
0 tx_pause_pkts, 4997 tx_qos_octets_lo
0 tx_qos_octets_hi
MIPS Rx Stats
-----------------------------------------
1780378 rx_octets_lo, 0 rx_octets_hi
0 rx_undersize_pkts, 0 rx_pause_pkts
0 rx_oversize_pkts, 0 rx_jabber
0 rx_align_err, 0 rx_fcs_err
1780378 rx_good_octets_lo, 0 rx_good_octets_hi
```

```
0 rx_drop_pkts, 14223 rx_ucast_pkts
272 rx_mcast_pkts, 12 rx_bcast_pkts
0 rx_fragments, 0 rx_excess_frame_disc
0 rx_symbol_err, 273 rx_qos_pkts
102618 rx_qos_octets_lo, 0 rx_qos_octets_hi


Router#show platform hardware subslot 0/3 module device steering
Steering drv Data path stats
Mode: PTM, IID:1
25 low_watermark, 35 high_watermark
0 FcDrops
----Egress path----
Tx Priority queue :0
11 RxPkts, 4711 RxBytes, 11 TxPkts, 4711 TxBytes, 0 RxDroppedPkts, 0 RxDroppedBytes
0 TxDroppedPkts, 0 TxDroppedBytes
Tx Priority queue :1
0 RxPkts, 0 RxBytes, 0 TxPkts, 0 TxBytes, 0 RxDroppedPkts, 0 RxDroppedBytes
0 TxDroppedPkts, 0 TxDroppedBytes
----Ingress path----
0 RxPkts, 0 RxBytes
0 RxDroppedPkts, 0 RxDroppedBytes
0 TxPkts, 0 TxBytes
0 TxDroppedPkts, 0 TxDroppedBytes
Steering drv Control path stats
1973 pkt2Linux, 225957 pktBytes2Linux
0 pktDrops, 0 pktCpDrops


Router#show platform hardware subslot 0/3 module host-if statistics
Data path counters
Mode: PTM IID : 1 Module Datapath Enabled

----- Egress path -----
Enet counters
   14795 RxPkts, 7187018 RxBytes, 0 RxErrs, 0 RxDropped
Steering counters
 Tx Priority queue :0
   13 RxPkts, 5601 RxBytes, 0 RxDroppedPkts
   13 TxPkts, 5601 TxBytes, 0 TxDroppedPkts
Tx Priority queue :1
   0 RxPkts, 0 RxBytes, 0 RxDroppedPkts
   0 TxPkts, 0 TxBytes, 0 TxDroppedPkts
NGIO Flow Control Msgs
   LP XON 51 XOFF 0, HP XON 51 XOFF 0, DroppedFCMsgs 0
   Low Watermark 25 High Watermark 35
XTM counters
   5 TxPkts, 2225 TxBytes, 0 TxErrs, 0 TxDropped

----- Ingress path -----
XTM counters
   0 RxPkts, 0 RxBytes, 0 RxErrs, 0 RxDropped
Steering counters
   0 RxPkts, 0 RxBytes, 0 RxDroppedPkts
   0 TxPkts, 0 TxBytes, 0 TxDroppedPkts
Enet counters
   15162 TxPkts, 2119357 TxBytes, 0 TxErrs, 0 TxDropped
Steering drv Control path stats
 2531 pkt2Linux, 289693 pktBytes2Linux
 0 pktDrops, 0 pktCpDrops


Router#show platform hardware subslot 0/3 module host-if status
Host Module L2 info:
CP_MAC: 30.f7.0d.55.40.ac
```

```
FFP_DP_MAC: 30.f7.0d.55.40.a9
FFP_FC_MAC: 30.f7.0d.55.40.a9
Module_MAC: d0.72.dc.93.f5.4b
CP VLAN ID: 2351
FFP DP VLAN ID: 2350
FFP HP1 VLAN ID: 2350
FFP HP2 VLAN ID: 2350
FC VLAN ID: 2350
Max CP MTU : 2048


Router#show platforrm hardware subslot 0/3 module interface ethernet 0/3/0 status
PTM Interface IID:1
Channel Status:ENABLE

-------End of XDSL Interface Status----------
```

Other useful CLIs for debugging issues related to packet flow:

- **show platform hardware backplaneswitch-manager rp active ffp statistics**

- **show platform hardware backplaneswitch-manager rp active subslot** *subslot* **GE0 statistics**

- **Show platform hardware qfp act infra bqs queue out default interface** *interface name*

- **show platform hardware qfp active interface if-name** *interface name*

- **show platform hardware qfp active interface if-name** *interface name* **statistics**

- **show platform hardware qfp active statistics drop**

- **show platform hardware qfp active interface statistics clear**

Packet Flow Specific to ATM PVC Related Show and Debug Commands

```
Router#show platform software atm F0 pvc
Forwarding Manager ATM PVC Information
Interface VCD ID Ing-ID Eg-ID VC State AOM ID
ATM0/3/0.1 1 0x1004010 0 0 0x1248 378


Router#show platform hardware qfp active infrastructure bqs interface-string
ATM0/3/0.1.1.1004010 hierarchy detail
Interface: ATM0/3/0.1.1.1004010 QFP: 0.0 if_h: 33 Num Queues/Schedules: 5
Queue specifics:
Index 0 (Queue ID:0x448, Name: ATM0/3/0.1.1.1004010)
PARQ Software Control Info:
(cache) queue id: 0x00000448, wred: 0xe79955d0, qlimit (pkts ): 64
parent_sid: 0x91, debug_name: ATM0/3/0.1.1.1004010
sw_flags: 0x08000011, sw_state: 0x00000c01, port_uidb: 65503
orig_min : 0 , min: 0
min_qos : 0 , min_dflt: 0
orig_max : 0 , max: 0
max_qos : 0 , max_dflt: 0
share : 1
plevel : 0, priority: 65535
defer_obj_refcnt: 0
ifm_h: 36, qos_h: 0x00000000, parent_obj_h: 0x00000024
ifh 33 queue_type 0(NONE)
qm_obj: 0x00007f81b81c9fa0
subdevice_id : 0
```

```
Statistics:
tail drops (bytes): 0 , (packets): 0
total enqs (bytes): 103686 , (packets): 6098
queue_depth (pkts ): 0
Schedule specifics:
Index 0 (SID:0x91, Name: ATM0/3/0.1.1.1004010)
PARQ Software Control Info:
sid: 0x91, parent_sid: 0x90
evfc_fc_id: 0x5200, fc_sid: 0xfffff
obj_id: 0x24, parent_obj_id: 0x20, debug_name: ATM0/3/0.1.1.1004010
num_entries (active): 1, num_children (max): 1
presize_hint: 0
sw_flags: 0x0842002a, sw_state: 0x00000801
orig_min : 0 , min: 0
min_qos : 0 , min_dflt: 1045000
orig_max : 0 , max: 1045000
max_qos : 0 , max_dflt: 1045000
share : 1
plevel: 0, service_fragment: False, port_uidb: 65503
priority: 0, defer_obj_refcnt: 0
ifm_h: 36, qos_h: 0x00000000, parent_obj_h: 0x00000020
ifh 33 queue_type 0(NONE)
qm_obj: 0x00007f81b81ca0f0
subdevice_id : 0
REM Schedule Info:
Cntl=0x0 (FC_Enabled) Aggregate State=0x0 (XON XON XON)
HP2, priority level 1. Enforced State=XON (XON)
Bytes Left=2147483647, Paks Left=2147483647
Rvd Flow-On Msgs=0, Rvd Flow-Off Msgs=0
Rvd Refresh Msgs=370, Refresh xon_mismatch=0 xoff_mismatch=0
HP1, priority level 2. Enforced State=XON (XON XON)
Bytes Left=0, Paks Left=0
Rvd Flow-On Msgs=0, Rvd Flow-Off Msgs=0
Rvd Refresh Msgs=0, Refresh xon_mismatch=0 xoff_mismatch=0
LP, normal priority. Enforced State=XON (XON XON XON)
Bytes Left=2147483647, Paks Left=2147483647
Rvd Flow-On Msgs=0, Rvd Flow-Off Msgs=0
Rvd Refresh Msgs=370, Refresh xon_mismatch=0 xoff_mismatch=0
Schedule specifics:
Index 1 (SID:0x90, Name: ATM0/3/0 UBR COS)
PARQ Software Control Info:
sid: 0x90, parent_sid: 0x7f
evfc_fc_id: 0xffff, fc_sid: 0xfffff
obj_id: 0x20, parent_obj_id: 0x1c, debug_name: ATM0/3/0 UBR COS
num_entries (active): 1, num_children (max): 1
presize_hint: 0
sw_flags: 0x08520022, sw_state: 0x00000801
orig_min : 0 , min: 0
min_qos : 0 , min_dflt: 0
orig_max : 0 , max: 0
max_qos : 0 , max_dflt: 0
share : 1
plevel: 0, service_fragment: False, port_uidb: 65504
priority: 0, defer_obj_refcnt: 0
ifm_h: 32, qos_h: 0x00000000, parent_obj_h: 0x0000001c
ifh 0 queue_type 0(NONE)
qm_obj: 0x00007f81b81caa20
subdevice_id : 0
Schedule specifics:
Index 2 (SID:0x7f, Name: ATM0/3/0)
PARQ Software Control Info:
sid: 0x7f, parent_sid: 0x7c
evfc_fc_id: 0x5100, fc_sid: 0xfffff
obj_id: 0x1c, parent_obj_id: 0x17, debug_name: ATM0/3/0
```

```
num_entries (active): 2, num_children (max): 2
presize_hint: 0
sw_flags: 0x0842002a, sw_state: 0x00000801
orig_min : 0 , min: 1097000
min_qos : 0 , min_dflt: 1097000
orig_max : 0 , max: 1097000
max_qos : 0 , max_dflt: 1097000
share : 1
plevel: 0, service_fragment: False, port_uidb: 65525
priority: 0, defer_obj_refcnt: 0
ifm_h: 28, qos_h: 0x00000000, parent_obj_h: 0x00000017
ifh 11 queue_type 0(NONE)
qm_obj: 0x00007f81b81cb0b0
subdevice_id : 0
REM Schedule Info:
Cntl=0x0 (FC_Enabled) Aggregate State=0x0 (XON XON XON)
HP2, priority level 1. Enforced State=XON (XON)
Bytes Left=0, Paks Left=0
Rvd Flow-On Msgs=0, Rvd Flow-Off Msgs=0
Rvd Refresh Msgs=0, Refresh xon_mismatch=0 xoff_mismatch=0
HP1, priority level 2. Enforced State=XON (XON XON)
Bytes Left=0, Paks Left=0
Rvd Flow-On Msgs=0, Rvd Flow-Off Msgs=0
Rvd Refresh Msgs=0, Refresh xon_mismatch=0 xoff_mismatch=0
LP, normal priority. Enforced State=XON (XON XON XON)
Bytes Left=0, Paks Left=0
Rvd Flow-On Msgs=0, Rvd Flow-Off Msgs=0
Rvd Refresh Msgs=0, Refresh xon_mismatch=0 xoff_mismatch=0
Schedule specifics:
Index 3 (SID:0x7c, Name: Licensed Shaper)
PARQ Software Control Info:
sid: 0x7c, parent_sid: 0x0
evfc_fc_id: 0xffff, fc_sid: 0xfffff
obj_id: 0x17, parent_obj_id: 0x0, debug_name: Licensed Shaper
num_entries (active): 5, num_children (max): 5
presize_hint: 2
sw_flags: 0x0802208a, sw_state: 0x00000001
orig_min : 0 , min: 400000000
min_qos : 0 , min_dflt: 400000000
orig_max : 0 , max: 400000000
max_qos : 0 , max_dflt: 400000000
share : 1
plevel: 0, service_fragment: False, port_uidb: 0
priority: 0, defer_obj_refcnt: 0
ifm_h: 23, qos_h: 0x00000000, parent_obj_h: 0x00000000
ifh 0 queue_type 0(NONE)
qm_obj: 0x00007f81b81cbf20
subdevice_id : 0
```

- **show platform hardware qfp active interface platform ATM0/3/0.1.1.1004010 path**

- **show platform hardware qfp active interface if-name atm0/3/0.1 statistics**

Collecting DSL Training Logs

Perform the following steps to collect the DSL training logs:

```
Router#debug vdsl controller 0/3/0 training log
VDSL Controller VDSL 0/3/0 - Training debugging is on
```

Perform the following steps to stop collecting the training logs:

```
Router#no debug vdsl controller 0/3/0 training log
[VDSL_DIAG_LOG] recvd 158991 bytes, written 158991 bytes
[VDSL_DIAG_LOG]: File written sucessfully..
VDSL Controller VDSL 0/3/0 - Training debugging is off
Router#
```

By default training log is collected in the file, **flash:vdsllog.bin_***slot-subslot*.

Example:

```
Router#sh controller vdsl 0/3/0
Controller VDSL 0/3/0 is UP
Daemon Status: UP

        XTU-R (DS) XTU-C (US)
Chip Vendor ID: 'BDCM' 'BDCM'
Chip Vendor Specific: 0x0000 0x544D
Chip Vendor Country: 0xB500 0xB500
Modem Vendor ID: 'CSCO' 'BDCM'
Modem Vendor Specific: 0x4602 0x544D
Modem Vendor Country: 0xB500 0xB500
Serial Number Near: FOC18426DR9 4351/K9 15.5(201412
Serial Number Far:
Modem Version Near: 15.5(20141202:161930
Modem Version Far: 0x544d

Modem Status: TC Sync (Showtime!)
DSL Config Mode: AUTO
Trained Mode: G.992.5 (ADSL2+) Annex A

TC Mode: ATM

Selftest Result: 0x00
DELT configuration: disabled
DELT state: not running

Failed full inits: 0
Short inits: 0
Failed short inits: 0

Modem FW Version: 4.14L.04
Modem PHY Version: A2pv6F039h.d24o_rc1

Line 0:
        XTU-R (DS) XTU-C (US)
Trellis: ON ON
SRA: disabled disabled
SRA count: 0 0
Bit swap: enabled enabled
Bit swap count: 669 383
Line Attenuation: 3.5 dB 1.7 dB
Signal Attenuation: 3.1 dB 0.0 dB
Noise Margin: 9.4 dB 5.9 dB
Attainable Rate: 15912 kbits/s 1379 kbits/s
Actual Power: 18.0 dBm 12.2 dBm
Total FECC: 176 176
Total ES: 43 0
Total SES: 0 0
Total LOSS: 0 0
Total UAS: 50 50
Total LPRS: 0 0
Total LOFS: 0 0
```

```
Total LOLS: 0 0

        DS Channel1 DS Channel0 US Channel1 US Channel0
Speed (kbps): NA 13073 NA 1045
SRA Previous Speed: NA 0 NA 0
Previous Speed: NA 0 NA 0
Total Cells: NA 1479777783 NA 2179031143
User Cells: NA 388927 NA 6870
Reed-Solomon EC: NA 176 NA 176
CRC Errors: NA 47 NA 0
Header Errors: NA 335 NA 0
Interleave (ms): NA 1.99 NA 1.94
Actual INP: NA 0.15 NA 0.77

Training Log : Stopped
Training Log Filename : flash:vdsllog_0-1.bin
```

User can modify the file in which training logs be stored before starting the training log collection procedure by configuring **training log filename flash:**_user-filename_.

Example:

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#controller vdsl 0/3/0

Router(config-controller)#training log filename flash:mytraininglog_file

Router(config-controller)#exit

Router#show controller vdsl 0/3/0
Controller VDSL 0/3/0 is UP
Daemon Status: UP
XTU-R (DS) XTU-C (US)
Chip Vendor ID: 'BDCM' 'BDCM'
Chip Vendor Specific: 0x0000 0x544D
Chip Vendor Country: 0xB500 0xB500
Modem Vendor ID: 'CSCO' 'BDCM'
Modem Vendor Specific: 0x4602 0x544D
Modem Vendor Country: 0xB500 0xB500
Serial Number Near: FOC18426DR9 4351/K9 15.5(201412
Serial Number Far:
Modem Version Near: 15.5(20141202:161930
Modem Version Far: 0x544d

Modem Status: TC Sync (Showtime!)
DSL Config Mode: AUTO
Trained Mode: G.992.5 (ADSL2+) Annex A

TC Mode: ATM
Selftest Result: 0x00
DELT configuration: disabled
DELT state: not running

Failed full inits: 0
Short inits: 0
Failed short inits: 0

Modem FW Version: 4.14L.04
Modem PHY Version: A2pv6F039h.d24o_rc1

Line 0:

        XTU-R (DS) XTU-C (US)
```

```
Trellis: ON ON
SRA: disabled disabled
SRA count: 0 0
Bit swap: enabled enabled
Bit swap count: 669 383
Line Attenuation: 3.5 dB 1.7 dB
Signal Attenuation: 3.1 dB 0.0 dB
Noise Margin: 8.8 dB 5.9 dB
Attainable Rate: 15464 kbits/s 1379 kbits/s
Actual Power: 18.0 dBm 12.2 dBm
Total FECC: 176 176
Total ES: 43 0
Total SES: 0 0
Total LOSS: 0 0
Total UAS: 50 50
Total LPRS: 0 0
Total LOFS: 0 0
Total LOLS: 0 0

        DS Channel1 DS Channel0 US Channel1 US Channel0
Speed (kbps): NA 13073 NA 1045
SRA Previous Speed: NA 0 NA 0
Previous Speed: NA 0 NA 0
Total Cells: NA 1484200375 NA 2179384795
User Cells: NA 388991 NA 6938
Reed-Solomon EC: NA 176 NA 176
CRC Errors: NA 47 NA 0
Header Errors: NA 335 NA 0
Interleave (ms): NA 1.99 NA 1.94
Actual INP: NA 0.15 NA 0.77

Training Log : Stopped
Training Log Filename : flash:mytraininglog_file
```

Sample Configurations

Sample MLPPP Configurations and Show Commands

```
!
interface Ethernet0/3/0
no ip address
load-interval 30
no negotiation auto
pppoe enable
pppoe-client dial-pool-number 2
!
!
interface Dialer2
bandwidth 55000
ip address negotiated
encapsulation ppp
load-interval 30
dialer pool 1
dialer-group 1
ppp authentication chap
ppp chap hostname cisco
ppp multilink
ppp multilink endpoint string mlpp
!
```

```
Router#show pppoe session
    1 client sessions
Uniq ID PPPoE RemMAC Port VT VA State
N/A 268 a44c.119d.d671 Et0/3/0 Di2 Vi2 UP
    c067.af94.c2a8 UP
Router#


Router#show ppp multilink active
Virtual-Access3
Bundle name: cisco1/mlpp/cisco/mlpp
Remote Username: cisco1
Remote Endpoint Discriminator: [1] mlpp
Local Username: cisco
Local Endpoint Discriminator: [1] mlpp
Bundle up for 05:40:46, total bandwidth 89000, load 196/255
Receive buffer limit 24384 bytes, frag timeout 1000 ms
Bundle is Distributed
Dialer interface is Dialer1
  0/0 fragments/bytes in reassembly list
  0 lost fragments, 0 reordered
  0/0 discarded fragments/bytes, 0 lost received
  0xD received sequence, 0xC2AE3 sent sequence
Platform Specific Multilink PPP info
  NOTE: internal keyword not applicable on this platform
  Interleaving: Disabled, Fragmentation: Disabled
Member links: 2 (max 16, min not set)
  Vi1, since 05:40:46, 206250 weight, 1496 frag size
  Vi2, since 05:40:41, 127500 weight, 1496 frag size


Router#show platform hardware qfp active feature mlp client bundle Virtual-Access3
Bundle Interface: Virtual-Access3
Bundle State: Up
Platform Interface Handle: 35
QFP Interface Handle: 26
QFP Interface uIDB Handle: Rx 65510, Tx 65510
Shadow Base: 0x020E19D0, Size: 1160
Num Links: 2, Next Link: 2, Enabled Links Mask: 0x0003
Tx Channel: 0x32, Tx Queue ID: 0x451, Tx Flow Control SID: 0x9f
Max Frags: 0x0, Lost Fragment Timeout: 1000
Max Frag Size: 65535, Frag Delay: 30
RX Class Buffer Size: 24384
MRRU: 1524, Peer MRRU: 1524
Bundle Bandwidth: 89000 kbps
RX Classes: 1, TX Classes: 1
Bundle Flags: 0x00000011, RX DP Flags: 0x04, TX DP Flags: 0x20
Outstanding datapath proxy requests:
  Bundle Create: 0, Update: 0, Remove: 0
  Links Add: 0, Delete: 0
Member Link Interfaces:
 Interface: EVSI20
  Platform Interface Handle: 20
  QFP Interface Handle: 17
  QFP Interface uIDB Handle: Rx 65519, Tx 65519
  Shadow Base: 0x02075CA0, Size: 218
  TX Chan: 52, P1 Queue ID: 1107, P2 Queue ID: 0
  Link Bandwidth: 55000 kbps, Link Weight: 206250, Link Qlimit: 2286
  Link Optimal Frag Size: 1496, Max Frag Size: 65535
  Rewrite Len w/ PID: 2 Rewrite Len w/o PID: 0
  Rewrite String: 00, 3d
  Outstanding datapath proxy requests:
  Links Add: 0, Update: 0, Delete: 0
 Interface: EVSI21
```

```
     Platform Interface Handle: 21
     QFP Interface Handle: 18
     QFP Interface uIDB Handle: Rx 65518, Tx 65518
     Shadow Base: 0x01D48550, Size: 218
     TX Chan: 51, P1 Queue ID: 1109, P2 Queue ID: 0
     Link Bandwidth: 34000 kbps, Link Weight: 127500, Link Qlimit: 2286
     Link Optimal Frag Size: 1496, Max Frag Size: 65535
     Rewrite Len w/ PID: 2 Rewrite Len w/o PID: 0
     Rewrite String: 00, 3d
     Outstanding datapath proxy requests:
      Links Add: 0, Update: 0, Delete: 0


Router#show platform hardware qfp active feature mlp datapath bundle Virtual-Access3 detail
QFP: 0.0 - Bundle Rx Interface: Virtual-Access3, State: UP
 Rx Bundle uIDB: 65510
  Num Links: 2, Num Classes: 1, MRRU: 1524
  Defined Links: 0x0003, Enabled Links: 0x0003
  Config Flags: 0x04 (EVSI, MCMP: Disabled, Strict Seq Check: Enabled)
  Buffer Limit: 24384 bytes per class, Lost Frag Timeout: 1000 ms
  Stats Non-MLP Encapped Rx: 0 packets
    Meta Packet Drop: 0, Attn Sync Drop: 0
    No Buffer: 0, Invalid Class: 0
    Hit Buffer Limit: 0, Rx Pkt Exceeds MRRU: 0
    Lost Frag Timeout: 0
 Reassembly QID: 0x000003F8, Qlimit: 2000, Qdepth: 0
 Bundle SB: 0x33445150, SB Size: 144
Rx Classes:
 Class: 0
  Expected Seq Number: 0x00000D, In Order/In Sync Links: 0x0003/0x0003
  Stats Rx Buffered: 0/0 fragments/bytes
    Rx Fragmented: 0 fragments
    Rx Unfragmented: 13 packets
    Rx Post Reassembly: 13 packets
    Rx Discarded: 0/0 fragments/bytes
    Rx NULL Frags: 0, Rx Lost: 0
    Rx Out of Order: 0, Rx Rcv'd Lost: 0
  Reorder/Reassembly Stats:
    Reassembly Packet: 0/0 fragments/bytes
    Staged Packets: 0 (S1-empty,S2-empty)
    Inflight Packets: 0
  Class SB: 0x3334D910, SB Size: 272
Rx Member Links:
 Member Link Interface: EVSI20, State: UP
  Rx Link uIDB: 65519, Link ID: 0, Link Mask: 0x0001
   Config Flags: 0x01 (EVSI)
    Class Link Buffered Fragments
     0       0
    Link SB: 0x33470430, SB Size: 32
  Member Link Interface: EVSI21, State: UP
    Rx Link uIDB: 65518, Link ID: 1, Link Mask: 0x0002
      Config Flags: 0x01 (EVSI)
      Class Link Buffered Fragments
      0       0
     Link SB: 0x33470410, SB Size: 32
QFP: 0.0 - Bundle Tx Interface: Virtual-Access3, State: UP
 Tx Bundle uIDB: 65510
  Num Links: 2, Num Classes: 1, Peer MRRU: 1524
  Member Links Defined: 0x0003 Enabled: 0x0003 Congested(HP/LP): 0x0000/0x0000
  Bundle Equal Cost Frag Size: 1496
  Config Flags: 0x20 (EVSI, MCMP: Disabled, MCMP Encap Seq: No,
    Interleave: Disabled, Fragmentation: Disabled
    NCP MLP Encaped: Yes, NCP Tx Link ID: 0)
    EVSI First Member Link Encap Type: 1, EVSI L2 Overhead: 20
  Bundle Flow Control SID: 0x9F, SID Update In Prog: No, Bundle Flags: 0x01
```

```
        Flow Control Timer: Stopped, Xoff Timer Tics: 0, Check Interval: 4572
        MLP FC: Xon, SW FC: Full-Xon, HW FC: Full-Xon
        HW FC Full Xoff Events: 6410, HW FC LP Xoff Events: 0
       Bundle Load Cycle ID (HP/LP): 0/2594, Next Tx Link ID (HP/LP): 0/1
     Link Link Queue Cycle ID Cycle Tx Bytes Queue Depth
      ID Weight Limit HP/LP HP/LP HP(agg)/LP
      0 206250 9 0/2594 0/98444 0/0
      1 127500 9 0/2594 0/98314 0/0
     Stats Non-MLP Encapped Tx: 2 packets
        Non-MLP Priority Interleaved: 0 packets
        Tx Drop: 0, Tx ESS Packet Drop: 0
        Invalid Class: 0
       Bundle SB: 0x34F6C800, SB Size: 256
     Tx Classes:
      Class: 0
        Next Send Seq Number: 0x976A97
        Stats Tx Pre Frag Packets: 127363735 packets
           Tx Fragmented: 0 fragments
           Tx Unfragmented: 127363735 packets
           Tx Frag Interleaved: 0 fragments
           Tx Unfrag Interleaved: 0 packets
        Class SB: 0x3334DD20, SB Size: 64
    Tx Member Links:
      Member Link Interface: EVSI20, Parent: Ethernet0/3/0, State: UP
       Tx Link uIDB: 65519, Link ID: 0, Link Mask: 0x0001
         Config Flags: 0x01 (EVSI)
         EVSI Parent Encap Type: 1, EVSI L2 Overhead: 20
         Link Weight: 206250, Frag Size: 1496
         P1 Tx QID: 0x00000453, Qdepth: 0
         P2 Tx QID: 0x00000000, Qdepth: 0
         Default Tx QID: 0x00000452, Qdepth: 0
    L2 Rewrite String: 003D
          Rewrite length w/ PID: 2, Length w/o PID: 0
       Link SB: 0x34FAB0C0, SB Size: 144
      Member Link Interface: EVSI21, Parent: Ethernet0/3/0, State: UP
       Tx Link uIDB: 65518, Link ID: 1, Link Mask: 0x0002
         Config Flags: 0x01 (EVSI)
         EVSI Parent Encap Type: 1, EVSI L2 Overhead: 20
         Link Weight: 127500, Frag Size: 1496
         P1 Tx QID: 0x00000455, Qdepth: 0
         P2 Tx QID: 0x00000000, Qdepth: 0
         Default Tx QID: 0x00000454, Qdepth: 0
         L2 Rewrite String: 003D
           Rewrite length w/ PID: 2, Length w/o PID: 0
         Link SB: 0x34FAB030, SB Size: 144
```

Sample PPPoA Configuration

```
interface ATM0/2/0.1 point-to-point
 ip unnumbered Loopback0
 no atm enable-ilmi-trap
 pvc 71/200
  oam-pvc 0
  encapsulation aal5mux ppp dialer
  dialer pool-member 151
!
interface Dialer151
 ip address negotiated
 encapsulation ppp
 load-interval 30
 dialer pool 151
 ppp chap hostname BBIP45687587@adslmax.bt.com
```

```
 ppp chap password 0 cisco1
!
dialer-list 1 protocol ip permit
!
```

Sample PPPoEoA Configuration

```
interface ATM0/1/0
 no ip address
 no atm enable-ilmi-trap
!
interface ATM0/1/0.10 point-to-point
 no atm enable-ilmi-trap
 cdp enable
 pvc 22/62
  ubr 1045
  encapsulation aal5mux pppoe-client
  pppoe-client dial-pool-number 120
 !
!
interface Dialer120
 mtu 1492
 ip address negotiated
 ip nat outside
  encapsulation ppp
 load-interval 30
 dialer pool 120
 dialer-group 1
 ppp mtu adaptive
 ppp chap hostname test@cisco.com
 ppp chap password 0 cisco
 ppp ipcp address required
 ppp link reorders
 !
```