Configuration Guide to

VDSL2 and ADSL2/2+ NIM

ON

ISR4400 AND ISR4300 Routers

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1. Introduction to VDSL2 and ADSL 2/2+ NIM

The Cisco multimode VDSL2 and ADSL1/2/2+ NIM provides 1-port (2-pair) multimode VDSL2 and ADSl2+ WAN connectivity. In combination with ISR4400 and ISR4300 Routers, this NIM provides high-speed digital data transmission between customer premises equipment (CPE) and the central office (DSL access multiplexer [DSLAM]), usually located on the telephone company premises. 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). These NIMs can be plugged in to NIM slots and in SM slots using SM-X-NIM-ADPTR carrier cards.

Software Support:

All variants of xDSL NIMs (refer sec 1.1) supported on CISCO IOS-XE Software Release XE3.14 onwards.

Embedded Firmware:

39h is the DSL PHY firmware embedded in IOS-XE Software Release X3.14.

Platform Support:

Platform	Maximum number of NIMs	Split of on-board NIM slots and NIM slots on SM-X carrier card
ISR4451	5	3 NIM slots + 2 * 1 NIM slot on each SM adaptor (2 SM slots)
ISR4431	3	Only NIM slots. No SM slots supported.
ISR4351	5	3 NIM slots + 2 * 1 NIM slot on each SM adaptor (2 SM slots)
ISR4331	3	2 NIM slots + 1 * 1 NIM slot on SM adaptor (1 SM slot)
ISR4321	2	Only NIM slots. No SM slots supported.

1.1. Variants of xDSL NIMs

Below are 3 variants of VDSL2/ADSL2+ NIMs:

Table 1.1. xDSL SKUs

Product Number	Description with Capabilities

NIM-VAB-A	1-port (2-pair) VDSL2/ADSL2+ NIM over POTS
	• VDSL2 over POTS Band Plans
	  ○ VDSL2 profiles: 8a, 8b, 8c, 8d, 12a, 12b, 17a
	  ○ VDSL2 bonding (of pair 0 and pair 1)
	  ○ Profile 30a (over pair 1)
	  ○ Vectoring
	• ADSL1/2/2+ Annex A, ADSL2 Annex L, non-optimized ADSL2/2+ Annex M

NIM-VAB-M	1-port (2-pair) VDSL2/ADSL2+ NIM over POTS with Annex M
	• VDSL2 over POTS Band Plans
	  ○ VDSL2 profiles: 8a, 8b, 8c, 8d, 12a, 12b, 17a
	  ○ VDSL2 bonding (of pair 0 and pair 1)
	  ○ Profile 30a (over pair 1)
	  ○ Vectoring
	• ADSL2/2+ Annex M, non-optimized ADSL/ADSL2/2+ Annex A

NIM-VA-B	1-port (1-pair) VDSL2/ADSL2+ NIM over ISDN • ADSL1/2/2+ Annex B, non-optimized ADSL2/2+ Annex J • VDSL2 over ISDN Band Plans (8a to 17a) with Vectoring

1.2. DSL Feature Specifications

Table 1.2. DSL Specifications

DSL Specifications	
Multimode DSL (VDSL2 and	• Broadcom chipset • One RJ-14 VDSL2 interface • Independent module firmware subpackage loading • Dying gasp

ADSL2/2+)	• Support for double-ended line testing (DELT) diagnostics mode • VDSL2: o ITU G.993.2 (VDSL2) and ITU G.993.5 (VDSL2) o 997 and 998 band plans o VDSL2 profiles: 8a, 8b, 8c, 8d, 12a, 12b, and 17a o VDSL bonding, Profile 30a and Vectoring o U0 band support (25 to 276 kHz) o Ethernet packet transfer mode (PTM) based only on IEEE 802.3ah 64/65 octet encapsulation o TR114 o DPBO o INP • ADSL2/2+: o ADSL over POTS with Annex A and Annex B ITU G. 992.1 (ADSL), G.992.3 (ADSL2), and G.992.5 (ADSL2+) o ADSL over POTS with Annex M (extended upstream bandwidth) G.992.3 (ADSL2) and G.992.5 (ADSL2+) o G.994.1 ITU G.hs o Reach-extended ADSL2 (G.922.3) Annex L for increased performance on loop lengths greater than 16,000 feet from central office o T1.413 ANSI ADSL DMT issue 2 compliance o DSL Forum TR-067, and TR-100 conformity o Impulse noise protection (INP) and extended INP o Downstream power backoff (DPBO) o Asynchronous transfer mode (ATM) only o Maximum 8 PVCs per interface

2. Configuring DSL

By default operating mode auto in single-wire line 0 is enabled on the NIM.

controller VDSL 0/<slot>/<subslot>
operating mode auto

2.1. Configuring ADSL

controller VDSL 0/<slot>/<subslot>
operating mode <adsl1 or adsl2 or adsl2+>

2.2. Configuring VDSL2

2.2.1. VDSL2 Single-wire (8a to 17a)

Configuration of single-wire line 0 (pair 0) in VDSL2 mode:

controller VDSL 0/<slot>/<subslot>
operating mode VDSL2
line-mode single-wire line 0

Configuration of single-wire line 1 (pair 1) in VDSL2 mode:

controller VDSL 0/<slot>/<subslot>
operating mode VDSL2
line-mode single-wire line 1

2.2.2. VDSL2 30a profile

30a profile is supported only on line 1 (pair 1).

controller VDSL 0/<slot>/<subslot>
operating mode VDSL2
line-mode single-wire line 1 profile 30a

2.2.3. VDSL2 Bonding

Pair 0 and Pair 1 can be bonded in VDSL2 mode. You can configure bonding either in **auto** mode or **VDSL2**. The default configuration is **auto**.

controller vdsl 0/<slot>/<subslot>
operating mode VDSL2
line-mode bonding

2.3. DSL configuration restrictions

- ADSL mode is supported only on Pair 0.

The following restrictions are applicable to VDSL2 bonding on the xDSL NIMs:

- VDSL2 bonding is supported only on NIM-VAB-A and NIMVAB-M.
- 30a profile is supported only on NIM-VAB-A and NIM-VAB-M.
- Even though NIM-VAB-A and NIMVAB-M support bonding, bonding is not the default configuration. The ADSL mode and VDSL single-wire mode are supported in the default configuration. User should enable bonding using the **line-mode bonding** command.
- **no line-mode bonding** and **default line-mode bonding** commands change the configuration to 'single-wire' on Line 0, which is the default configuration.
- The line-mode configuration is removed from the Router whenever operating mode is changed and it should be configured again when the operating mode is re-configured.

2.4. DSL configuration examples

The following example shows how to enable VDSL2 bonding in auto mode:

```
Router# configure terminal
Router(config)# controller vdsl 0/1/0
Router(config-controller)# operating mode auto
Router(config-controller)# line-mode bonding
Router(config-controller)# exit
```

The following example shows how to enable VDSL2 bonding in VDSL2 mode:

```
Router# configure terminal
Router(config)# controller vdsl 0/1/0
Router(config-controller)# operating mode vdsl2
Router(config-controller)# line-mode bonding
Router(config-controller)# exit
```

The following example shows how to remove bonding:

```
Router# configure terminal
Router(config)# controller vdsl 0/1/0
Router(config-controller)# no line-mode bonding
Router(config-controller)# no operating mode
Router(config-controller)# exit
```

The following example shows how to enable profile 8a through 17a on line 0 in auto mode:

```
Router# configure terminal
Router(config)# controller vdsl 0/1/0
Router(config-controller)# line-mode single-wire line 0
Router(config-controller)# exit
```

The following example shows how to enable profile 30a on line 1:

```
Router# configure terminal
Router(config)# controller vdsl 0/1/0
Router(config-controller)# operating mode vdsl2
Router(config-controller)# line-mode single-wire line 1 profile 30a
Router(config-controller)# exit
```

The following example shows how to remove profile 30a from line 1:

```
Router# configure terminal
Router(config)# controller vdsl 0/1/0
Router(config-controller)# no line-mode single-wire line 1
Router(config-controller)# no operating mode vdsl2
Router(config-controller)# exit
```

3. Features supported in IOS-XE 3.14 over xDSL NIMs

3.1. Firmware upgrade and downgrade

This feature would help the users to get the DSL module firmware fixes immediately by moving to new module firmware, instead of waiting for the next IOS release to get the fixes. Fixes in module firmware would be posted on CCO as .pkg subpackage file.

Prerequisite:

Router should be booted up in packages.conf mode with the IOS-XE image (Super Package) during installation period so that as and when required firmware could be upgraded or downgraded without reloading the Router.

1. Copy IOS_XE image to **bootflash:mydir**
2. **request platform software package expand file boot flash:/mydir/<IOS-XE image>** to expand super package.
3. Go to Router rommon mode.
4. **boot bootflash:mydir/packages.conf**

Configuration guide for the above steps:
https://www.cisco.com/c/en/us/td/docs/Routers/access/4400/software/configuration/guide/isr4400swcfg/bm_isr_4400_sw_config_guide_chapter_0101.html#task_0161B70A83D146418D09E921700932F2

If the Router is NOT booted in packages.conf mode with the IOS-XE image, need to follow the above pre-requisite steps before proceeding with firmware upgrade/downgrade steps as listed below.

5. copy the firmware subpackage (NIM firmware .pkg file) to the folder **bootflash:/mydir**
6. **request platform software package install rp 0 file boot flash:/mydir/<firmware subpackage>**
7. **hw-module subslot x/y reload** to boot the module with the new firmware.
8. Verify that the module is booted up with the new firmware using **show platform software subslot x/y module firmware**.

Step 1: Copy IOS_XE image to bootflash:mydir

Router#**mkdir bootflash:mydir**
Create directory filename [mydir]?
Created dir bootflash:/mydir
Router#c
Router#**copy bootflash:isr4400-universalk9.03.14.00.S.155-1.S-std.SPA.bin bootflash:mydir/**
Destination filename [mydir/isr4400-universalk9.03.14.00.S.155-1.S-std.SPA.bin]?
Copy in
progress...CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
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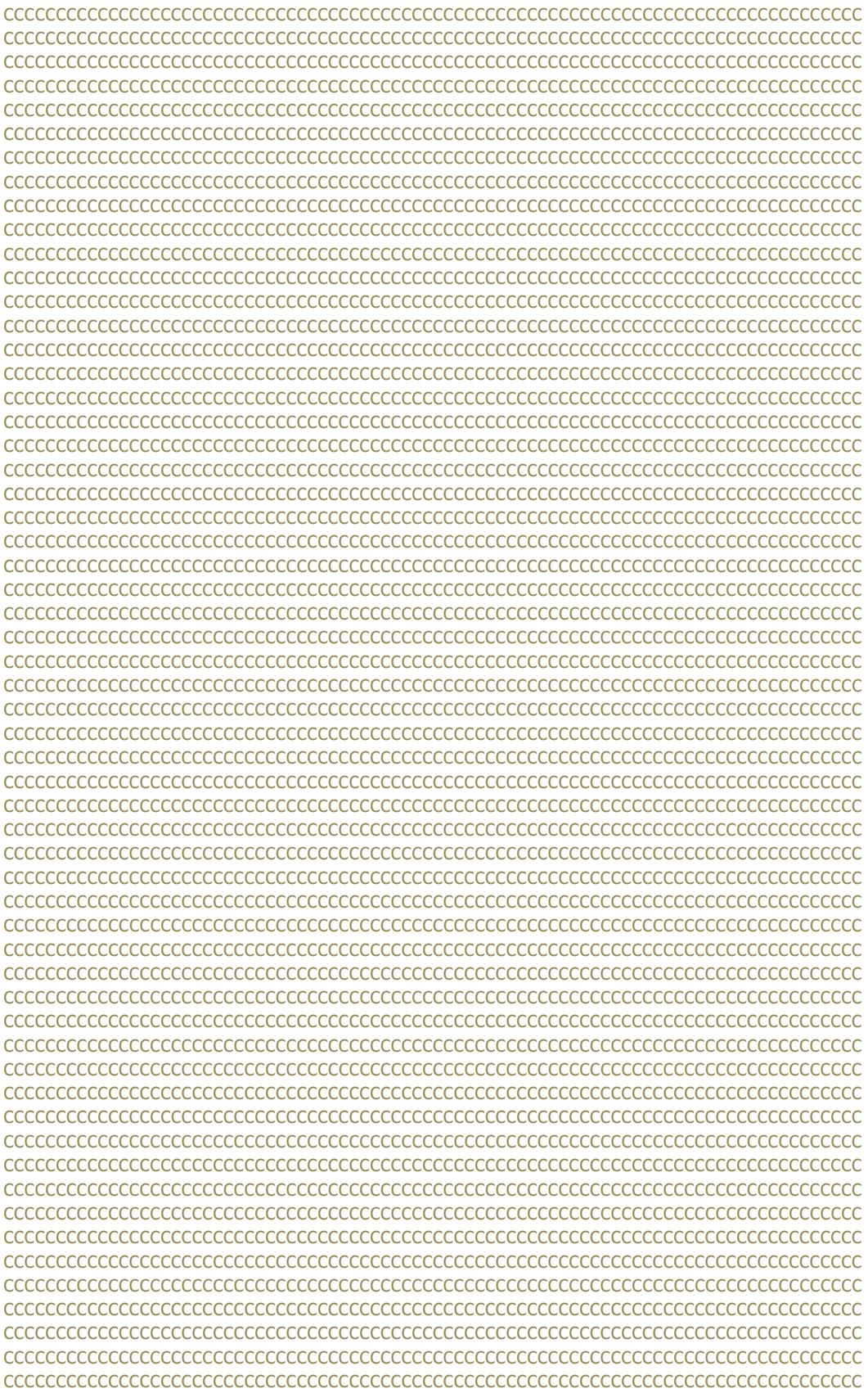


```
CCCCCCCCCCCCCCCCCCC
425288648 bytes copied in 44.826 secs (9487544 bytes/sec)
Router#
Router#
Router#dir bootflash:mydir
Directory of bootflash:/mydir/

632738  -rw-       425288648  Dec 12 2014 09:16:42 +00:00  isr4400-universalk9.03.14.00.S.155-1.S-
std.SPA.bin

7451738112 bytes total (474025984 bytes free)
Router#
```

Step 2: " request platform software package expand file bootflash:/mydir /<IOS-XE image>" to expand super package.

Router#**request platform software package expand file bootflash:/mydir/isr4400-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#
```

Step 3: Go to Router rommon mode.

Router#**reload**

```
Proceed with reload? [confirm]

*Dec 12 09:26:09.874: %SYS-5-RELOAD: Reload requested by console. Reload Reason: Reload
Command.Dec 12 09:26:25.156 R0/0: %PMAN-5-EXITACTION: Process manager is exiting: process exit with
reload chassis code


Initializing Hardware ...

System integrity status: 00000610

Rom image verified correctly

System Bootstrap, Version 15.3(3r)S1, RELEASE SOFTWARE
Copyright (c) 1994-2013  by cisco Systems, Inc.


Current image running: Boot ROM0

Last reset cause: LocalSoft

Cisco ISR4451-X/K9 platform with 4194304 Kbytes of main memory
```

Step 4: boot bootflash:mydir/packages.conf

rommon 1 > boot bootflash:mydir/packages.conf

File size is 0x000028f1

Located mydir/packages.conf

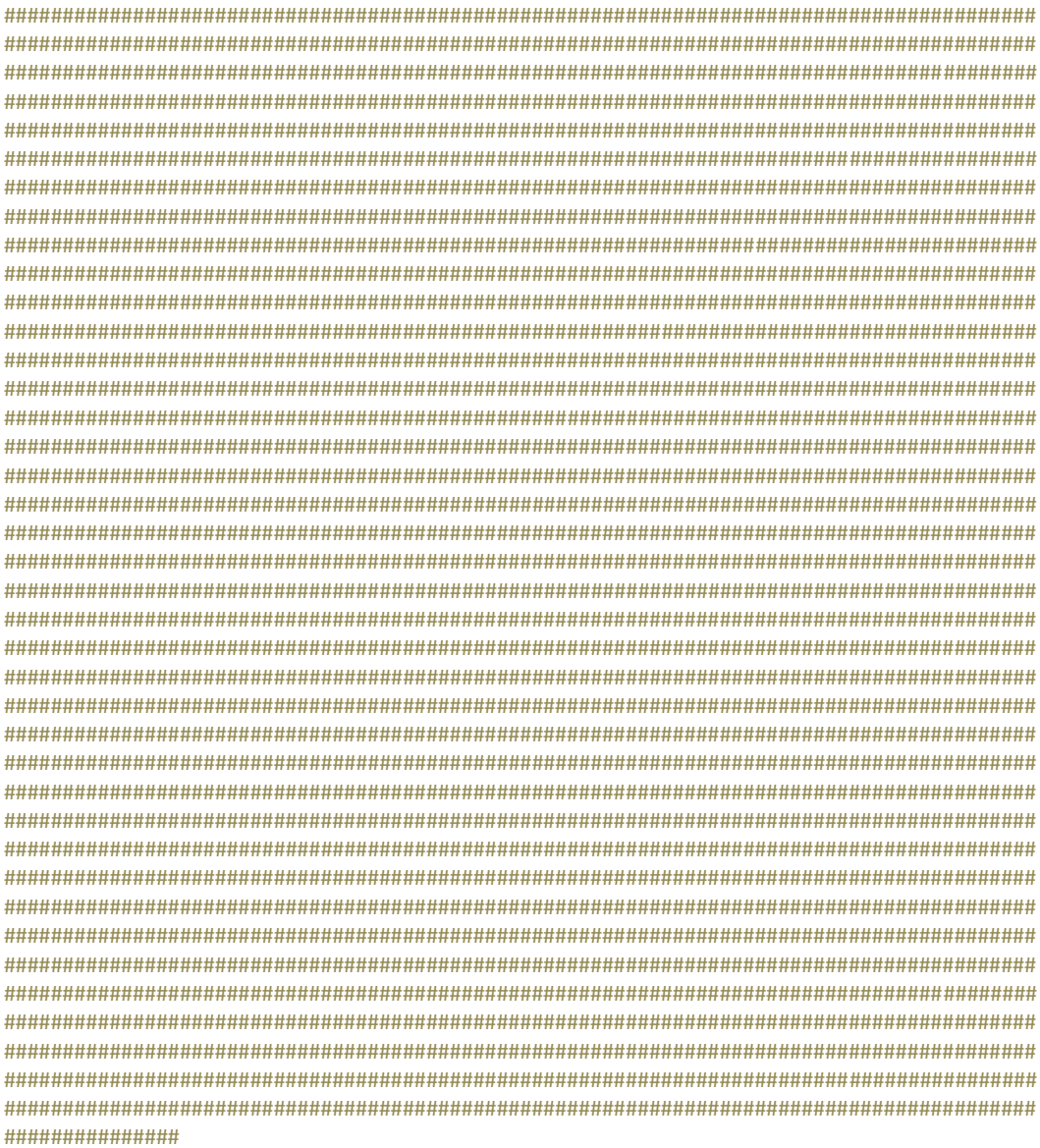
Image size
10481 inode num 632741, bks cnt 3 blk size 8*512

#

File size is 0x150ae3cc

Located mydir/isr4400-mono-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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http://www.cisco.com/wwl/export/crypto/tool/stqrg.html

If you require further assistance please contact us by sending email to
export@cisco.com.

cisco ISR4451-X/K9 (2RU) processor with 1681388K/6147K bytes of memory.
Processor board ID FTX1736AJUT
2 Ethernet interfaces
4 Gigabit Ethernet interfaces
2 ATM interfaces
32768K bytes of non-volatile configuration memory.
4194304K bytes of physical memory.
7393215K bytes of flash memory at bootflash:.

Press RETURN to get started!

*Dec 12 09:28:58.922: %IOS_LICENSE_IMAGE_APPLICATION-6-LICENSE_LEVEL: Module name = esg Next reboot level = appxk9 and License = appxk9
*Dec 12 09:28:58.943: %IOS_LICENSE_IMAGE_APPLICATION-6-LICENSE_LEVEL: Module name = esg Next reboot level = ipbasek9 and License = ipbasek9
*Dec 12 09:28:58.981: %ISR_THROUGHPUT-6-LEVEL: Throughput level has been set to 1000000 kbps
*Dec 12 09:29:13.302: %SPANTREE-5-EXTENDED_SYSID: Extended SysId enabled for type vlan
*Dec 12 09:29:14.142: %LINK-3-UPDOWN: Interface Lsmpi0, changed state to up
*Dec 12 09:29:14.142: %LINK-3-UPDOWN: Interface EOBC0, changed state to up
*Dec 12 09:29:14.142: %LINK-3-UPDOWN: Interface GigabitEthernet0, changed state to down
*Dec 12 09:29:14.142: %LINK-3-UPDOWN: Interface LIIN0, changed state to up
*Dec 12 09:28:51.438: %CMRP-3-PFU_MISSING:cmand: The platform does not detect a power supply in slot 1
*Dec 12 09:29:01.256: %CMLIB-6-THROUGHPUT_VALUE:cmand: Throughput license found, throughput set to 1000000 kbps
*Dec 12 09:29:03.223: %CPPHA-7-START:cpp_ha: CPP 0 preparing ucode
*Dec 12 09:29:03.238: %CPPHA-7-START:cpp_ha: CPP 0 startup init
*Dec 12 09:29:11.335: %CPPHA-7-START:cpp_ha: CPP 0 running init
*Dec 12 09:29:11.645: %CPPHA-7-READY:cpp_ha: CPP 0 loading and initialization complete
*Dec 12 09:29:11.711: %IOSXE-6-PLATFORM:cpp_cp: Process CPP_PFILTER_EA_EVENT__API_CALL__REGISTER
*Dec 12 09:29:16.280: %IOSXE_MGMTVRF-6-CREATE_SUCCESS_INFO: Management vrf Mgmt-intf created with ID 1, ipv4 table-id 0x1, ipv6 table-id 0x1E000001
*Dec 12 09:29:16.330: %LINEPROTO-5-UPDOWN: Line protocol on Interface Lsmpi0, changed state to up
*Dec 12 09:29:16.330: %LINEPROTO-5-UPDOWN: Line protocol on Interface EOBC0, changed state to up
*Dec 12 09:29:16.330: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0, changed state to down
*Dec 12 09:29:16.330: %LINEPROTO-5-UPDOWN: Line protocol on Interface LIIN0, changed state to up
*Dec 12 09:29:17.521: %SYS-5-LOG_CONFIG_CHANGE: Buffer logging disabled
*Dec 12 09:29:18.867: %SYS-5-CONFIG_I: Configured from memory by console
*Dec 12 09:29:18.870: %IOSXE_OIR-6-REMSPA: SPA removed from subslot 0/0, interfaces disabled
*Dec 12 09:29:18.870: %IOSXE_OIR-6-REMSPA: SPA removed from subslot 0/1, interfaces disabled
*Dec 12 09:29:18.871: %IOSXE_OIR-6-REMSPA: SPA removed from subslot 0/2, interfaces disabled

```
*Dec 12 09:29:18.873: %SPA_OIR-6-OFFLINECARD: SPA (ISR4451-X-4x1GE) offline in subslot 0/0
*Dec 12 09:29:18.874: %SPA_OIR-6-OFFLINECARD: SPA (NIM-VA-B) offline in subslot 0/1
*Dec 12 09:29:18.874: %SPA_OIR-6-OFFLINECARD: SPA (NIM-VAB-A) offline in subslot 0/2
*Dec 12 09:29:18.876: %IOSXE_OIR-6-INSCARD: Card (fp) inserted in slot F0
*Dec 12 09:29:18.876: %IOSXE_OIR-6-ONLINECARD: Card (fp) online in slot F0
*Dec 12 09:29:18.882: %IOSXE_OIR-6-INSSPA: SPA inserted in subslot 0/0
*Dec 12 09:29:18.884: %IOSXE_OIR-6-INSSPA: SPA inserted in subslot 0/1
*Dec 12 09:29:18.884: %IOSXE_OIR-6-INSSPA: SPA inserted in subslot 0/2
*Dec 12 09:29:18.935: %SYS-5-RESTART: System restarted --
Cisco IOS Software, ISR Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version 15.5(1)S, RELEASE
SOFTWARE (fc5)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2014 by Cisco Systems, Inc.
Compiled Thu 20-Nov-14 18:28 by mcpre
*Dec 12 09:29:18.895: %SPA-3-ENVMON_NOT_MONITORED:iomd:  Environmental monitoring is not
enabled for ISR4451-X-4x1GE[0/0]
*Dec 12 09:29:19.878: %LINK-5-CHANGED: Interface GigabitEthernet0, changed state to administratively
down
*Dec 12 09:29:22.419: %SPA_OIR-6-ONLINECARD: SPA (ISR4451-X-4x1GE) online in subslot 0/0
*Dec 12 09:29:22.610: %SYS-6-BOOTTIME: Time taken to reboot after reload =  194 seconds
*Dec 12 09:29:24.354: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/0, changed state to down
*Dec 12 09:29:24.415: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/2, changed state to down
*Dec 12 09:29:24.417: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/3, changed state to down
*Dec 12 09:29:30.919: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/0, changed state to up
*Dec 12 09:29:30.925: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/2, changed state to up
*Dec 12 09:29:30.936: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/3, changed state to up
*Dec 12 09:29:31.919: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0, changed
state to up
*Dec 12 09:29:31.930: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/2, changed
state to up
*Dec 12 09:29:31.936: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/3, changed
state to up
*Dec 12 09:29:34.147: %SSH-5-ENABLED: SSH 1.99 has been enabled
*Dec 12 09:30:29.152: %SPA_OIR-6-ONLINECARD: SPA (NIM-VA-B) online in subslot 0/1
*Dec 12 09:30:29.470: %SPA_OIR-6-ONLINECARD: SPA (NIM-VAB-A) online in subslot 0/2
*Dec 12 09:30:31.152: %LINK-3-UPDOWN: Interface Ethernet0/1/0, changed state to down
*Dec 12 09:30:31.152: %LINK-3-UPDOWN: Interface ATM0/1/0, changed state to down
*Dec 12 09:30:31.470: %LINK-3-UPDOWN: Interface Ethernet0/2/0, changed state to down
*Dec 12 09:30:31.470: %LINK-3-UPDOWN: Interface ATM0/2/0, changed state to down
*Dec 12 09:31:03.074: %CONTROLLER-5-UPDOWN: Controller VDSL 0/2/0, changed state to up
*Dec 12 09:31:05.075: %LINK-3-UPDOWN: Interface Ethernet0/2/0, changed state to up
*Dec 12 09:31:06.076: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/2/0, changed state
to up
*Dec 12 09:31:12.559: %CONTROLLER-5-UPDOWN: Controller VDSL 0/1/0, changed state to up
*Dec 12 09:31:20.188: %LINK-3-UPDOWN: Interface ATM0/1/0, changed state to up
*Dec 12 09:31:21.188: %LINEPROTO-5-UPDOWN: Line protocol on Interface ATM0/1/0, changed state to up
Router>
Router>en
Password:
Router#
Router#show controller vdsl 0/2/0
Controller VDSL 0/2/0 is UP

Daemon Status:              UP

                        XTU-R (DS)              XTU-C (US)
Chip Vendor ID:         'BDCM'                  'BDCM'
Chip Vendor Specific:   0x0000                  0xA41B
```

```
Chip Vendor Country:    0xB500                  0xB500
Modem Vendor ID:        'CSCO'                  '   '
Modem Vendor Specific:  0x4602                  0x0000
Modem Vendor Country:   0xB500                  0x0000
Serial Number Near:     FOC18426DQ8 4451-X/K15.5(1)S
Serial Number Far:
Modem Version Near:     15.5(1)S
Modem Version Far:      0xa41b

Modem Status(L1):       TC Sync (Showtime!)
DSL Config Mode:  VDSL2
Trained Mode(L1): G.993.2 (VDSL2) Profile 30a

TC Mode:            PTM
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 1:

                    XTU-R (DS)              XTU-C (US)
Trellis:            ON                      ON
SRA:                        disabled                disabled
SRA count:                  0                       0
Bit swap:           enabled                 enabled
Bit swap count:             9                       0
Profile 30a:                enabled
Line Attenuation:   3.5 dB          0.0 dB
Signal Attenuation:         0.0 dB          0.0 dB
Noise Margin:               30.9 dB                 12.4 dB
Attainable Rate:    200000 kbits/s          121186 kbits/s
Actual Power:               13.3 dBm                7.2 dBm
Per Band Status:            D1      D2      D3      U0      U1      U2      U3
Line Attenuation(dB):  0.9 1.5      5.5     N/A     0.1     0.9     3.8
Signal Attenuation(dB): 0.8         1.5     5.5     N/A     0.0     0.2     3.2
Noise Margin(dB):      31.1 31.0    30.9    N/A     12.3    12.4    12.5
Total FECC:         0                       0
Total ES:           0                       0
Total SES:          0                       0
Total LOSS:         0                       0
Total UAS:          51                      51
Total LPRS:         0                       0
Total LOFS:         0                       0
Total LOLS:         0                       0


                DS Channel1     DS Channel0     US Channel1     US Channel0
Speed (kbps):               NA          100014              NA          100014
SRA Previous Speed:         NA          0           NA          0
Previous Speed:             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        9.00               NA        0.00
Actual INP:         NA        4.00               NA        0.00

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

Router#
Router#
```

Step 5: Copy NIM firmware subpackage to the folder bootflash:/mydir

Router#**copy bootflash:isr4400-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg bootflash:mydir/**

```
Destination filename [mydir/isr4400-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg]?
Copy in
progress...CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCC
6640604 bytes copied in 1.365 secs (4864911 bytes/sec)
Router#
```

Step 6: " request platform software package install rp 0 file bootflash:/mydir/<firmware subpackage> "

Router#request platform software package install rp 0 file bootflash:mydir/isr4400-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg

```
--- Starting local lock acquisition on R0 ---
Finished local lock acquisition on R0

--- Starting file path checking ---
Finished file path checking

--- Starting image file verification ---
Checking image file names
Locating image files and validating name syntax
  Found isr4400-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg
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 isr4400-firmware_nim_xdsl.03.14.00.S.155-1.S-std.SPA.pkg
New files list:
  Added isr4400-firmware_nim_xdsl.2014-11-17_11.05_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
  Assembling CLI output libraries
  Assembling CLI input libraries
Skipping soft links for firmware upgrade
Skipping soft links for firmware upgrade
  Assembling Dynamic configuration files
  Applying interim IPC and database definitions
rsync: getaddrinfo: cc2-0 873: Name or service not known rsync error: error in socket IO (code 10) at
/auto/mcpbuilds19/release/03.14.00.S/BLD-V03_14_00_S_FC5/contrib/rsync/clientserver.c(104)
[sender=2.6.9]
rsync: getaddrinfo: cc2-0 873: Name or service not known rsync error: error in socket IO (code 10) at
/auto/mcpbuilds19/release/03.14.00.S/BLD-V03_14_00_S_FC5/contrib/rsync/clientserver.c(104)
[sender=2.6.9]
rsync: getaddrinfo: cc2-0 873: Name or service not known rsync error: error in socket IO (code 10) at
/auto/mcpbuilds19/release/03.14.00.S/BLD-V03_14_00_S_FC5/contrib/rsync/clientserver.c(104)
[sender=2.6.9]
  Replacing running software
  Replacing CLI software
  Restarting software
  Applying final IPC and database definitions
rsync: getaddrinfo: cc2-0 873: Name or service not known rsync error: error in socket IO (code 10) at
/auto/mcpbuilds19/release/03.14.00.S/BLD-V03_14_00_S_FC5/contrib/rsync/clientserver.c(104)
[sender=2.6.9]
  Generating software version information
  Notifying running software of updates
  Unblocking peer synchronization of operating information
Unmounting old packages
Cleaning temporary installation files
```

```
 Finished update running software

SUCCESS: Finished installing software.
Router#
Router#show platform software subslot 0/2 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: A2pv6F039h.d24o_rc1

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

Modem Up time
-----------------------------------------
0D 0H 25M 38S

Router#
```

Step 7: "hw-module subslot x/y reload " to boot the module with the new firmware.

```
Router#hw-module subslot 0/2 reload
Proceed with reload of module? [confirm]
Router#
*Dec 12 09:55:59.645: %IOSXE_OIR-6-SOFT_RELOADSPA: SPA(NIM-VAB-A) reloaded on subslot 0/2
*Dec 12 09:55:59.646: %SPA_OIR-6-OFFLINECARD: SPA (NIM-VAB-A) offline in subslot 0/2
*Dec 12 09:55:59.647: %CONTROLLER-5-UPDOWN: Controller VDSL 0/2/0, changed state to down
*Dec 12 09:57:22.514: new extended attributes received from iomd(slot 0 bay 2 board 0)
*Dec 12 09:57:22.514: %IOSXE_OIR-6-SOFT_RELOADSPA: SPA(NIM-VAB-A) reloaded on subslot 0/2
*Dec 12 09:57:22.515: %SPA_OIR-6-OFFLINECARD: SPA (NIM-VAB-A) offline in subslot 0/2
Router#
Router#
*Dec 12 09:58:35.471: %SPA_OIR-6-ONLINECARD: SPA (NIM-VAB-A) online in subslot 0/2
*Dec 12 09:58:37.470: %LINK-3-UPDOWN: Interface Ethernet0/2/0, changed state to down
*Dec 12 09:58:37.470: %LINK-3-UPDOWN: Interface ATM0/2/0, changed state to down
Router#
```

Step 8: Verify module is booted up with new firmware

```
Router#show platform software subslot 0/2 module firmware
Avg Load info
-----------------------------------------
0.84 0.23 0.08 1/45 598

Kernel distribution info
```

```
-------------------------------------------
Linux version 3.4.11-rt19 (sapanwar@blr-atg-001) (gcc version 4.6.2 (Buildroot 2011.11) ) #6 SMP PREEMPT
Mon Nov 17 10:51:41 IST 2014

Module firmware versions
-------------------------------------------
Modem Fw Version: 4.14L.04
Modem Phy Version: A2pv6F039n.d24o_rc1

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

Modem Up time
-------------------------------------------
0D 0H 0M 42S

Router#
```

3.2. 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.

Restrictions for Implementing ATM Dynamic Bandwidth

- This feature is supported only for ATM permanent virtual circuits (PVCs).
- The algorithm used to implement this feature is applied only when dynamic changes to ATM interface occur. It is applied at VC creation on Router bootup as well.
- If the ATM Dynamic Bandwidth feature is enabled/disabled after a change in total bandwidth, feature would not work until line toggles.

How to Enable ATM Dynamic Bandwidth

By default atm dynamic bandwidth feature is enabled.

If atm dynamic bandwidth is disabled, below are the steps to enable the feature.

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

Router(config)#int atm0/1/0
Router(config-if)#atm bandwidth dynamic
Router(config-if)#end
Router#

Sample configuration:

```
!
interface ATM0/1/0
 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 294kbps.

How to Disable ATM Dynamic Bandwidth

Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int atm0/1/0
Router(config-if)#no atm bandwidth dynamic
Router(config-if)#end
Router#

```
Router#sh run int atm0/1/0
Building configuration...

Current configuration : 110 bytes
!
interface ATM0/1/0
 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 0/1/0
0/1/0.1    1          8    37 PVC     MUX       UBR    1045          UP
Router#
```

Usage Guidelines

Dynamic bandwidth management is supported on all PVC service classes.

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:

- peak cell rate (PCR)—all supported Service classes
- sustainable cell rate (SCR)— VBR Service classes

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 re-created as follows:

- 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 re-created as UBR PVC 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 re-created with the configured PCR value.
- If the configured PCR value is greater than the calculated PCR value, the PVC is re-created 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 re-created 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 re-created 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
```

3.3. 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 Software Release XE3.14 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.

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 0/1/0
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 0/1/0
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 294kbps, 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
```

3.4. Multilink PPP (MLPPP) bundling

3.4.1. Multilink PPP Minimum Links Mandatory

3.4.2. MLPPP bundling of interfaces

3.4.3. ATM Multilink PPP Support on Multiple VCs

Reference doc : http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/wan_mlp/configuration/xe-3s/wan-mlp-xe-3s-book/wan_cfg_mlppp_conn_xe.html

http://www.cisco.com/en/US/docs/ios/atm/configuration/guide/atm_ml_ppp_mul_vc.html

3.5. ATM Routed Bridge Encapsulation (RBE)

Reference doc: http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/bbdsl/configuration/xe-3s/bba-xe-3s-book/bba-atm-rbe-xe.html

http://www.cisco.com/c/en/us/support/docs/long-reach-ethernet-lre-digital-subscriber-line-xdsl/asymmetric-digital-subscriber-line-adsl/12917-routed-bridged-encap.html

3.6. RBE Client Side Encapsulation with QoS

Reference doc:
http://www.cisco.com/c/en/us/td/docs/ios/12_4t/12_4t2/htrbeqos.html
http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/bbdsl/configuration/15-mt/bba-15-mt-book/bba-csencap-qos.html

http://www.cisco.com/c/en/us/td/docs/ios/12_4t/12_4t2/htrbeqos.html

3.7. ATM Cell Loss Priority (CLP) Bit Marking

Reference doc: http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/qos_mqc/configuration/xe-3s/qos-mqc-xe-3s-book/qos-atm-clp.html

3.8. ATM Cell Loss Priority (CLP) Setting

Reference doc: http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/qos_mqc/configuration/xe-3s/qos-mqc-xe-3s-book/qos-atm-clp.html

3.9. ATM OAM Loopback Mode Detection

Reference doc:
http://www.cisco.com/c/en/us/td/docs/ios/12_0s/feature/guide/lmd_oam.html

3.10. PPPoEoA over ATM AAL5Mux

Reference doc:
http://www.cisco.com/c/en/us/td/docs/ios/bbdsl/configuration/guide/bba_pppoeoa_aal5mux.html

3.11. ATM Conditional Debug Support

Reference doc: http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/atm/configuration/xe-3s/atm-xe-3s-book/atm-con-deb-supp-xe.html

3.12. PPP over ATM (IETF-Compliant)

Reference doc:
http://www.cisco.com/en/US/docs/ios/bbdsl/configuration/guide/bba_agg_ppp_atm.html

3.13. MQC Policy Map Support on Configured VC Range ATM

Reference doc: http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/atm/configuration/15-s/atm-15-s-book/atm-mqc-vcrange-atm.html

3.14. Default Route on a PPP Virtual Access Interface

3.15. Modular QoS CLI (MQC) Unconditional Packet Discard

Reference doc: http://www.cisco.com/en/US/docs/ios-xml/ios/qos_plcshp/configuration/15-1mt/qos-plcshp-mod-cli-upd.html

3.16. PPPoE spec conformance with PADT message

Reference doc:
http://www.cisco.com/en/US/docs/ios/12_2t/12_2t2/feature/guide/ftpppoec_support_TSD_Island_of_Content_Chapter.html

3.17. PPPoE enhancement with RFC 4638

Reference doc:
http://www.cisco.com/en/US/docs/ios/12_2t/12_2t2/feature/guide/ftpppoec_support_TSD_Island_of_Content_Chapter.html

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

3.19. QoS: PPPoE QoS Markings of .1P bits in S (AOL)

Reference doc: http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/qos_mqc/configuration/xe-3s/asr1000/qos-mqc-xe-3s-asr-1000-book/qos-pppgec.html

3.20. IP-to-ATM CoS

Reference doc: http://www.cisco.com/c/en/us/td/docs/ios/12_2/qos/configuration/guide/fqos_c/qcfipatm.html

3.21. LLQ (Low Latency Queueing)

Reference doc: http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/qos_conmgt/configuration/xe-3s/asr1000/qos-conmgt-xe-3s-asr1000-book/qos-conmgt-llq-pps.html

http://www.cisco.com/c/en/us/td/docs/ios/12_0s/feature/guide/fsllq26.htm

3.22. QoS on Dialer

Reference doc: http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/qos_conavd/configuration/15-mt/qos-conavd-15-mt-book/qos-conavd-dial.html

3.23. VC bundling

Reference doc: http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/atm/configuration/xe-3s/asr1000/atm-xe-3s-asr1000-book/atm-cfg-atm-xe.html

4. Show and Debug commands

```
Router#show controller vdsl 0/1/0
Controller VDSL 0/1/0 is UP

Daemon Status:        UP

XTU-R (DS)          XTU-C (US)
Chip Vendor ID:       'BDCM'              'BDCM'
Chip Vendor Specific:  0x0000              0x9186
Chip Vendor Country:   0xB500              0xB500
Modem Vendor ID:      'CSCO'              '    '
Modem Vendor Specific: 0x4602              0x0000
Modem Vendor Country:  0xB500              0x0000
Serial Number Near:    FOC18086ML0       15.5(201409
```

Serial Number Far:
Modem Version Near: 15.5(20140908:060834
Modem Version Far: 0x9186

Modem Status: TC Sync (Showtime!)
DSL Config Mode: AUTO
Trained Mode: G.993.2 (VDSL2) Profile 17a

TC Mode: PTM
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	OFF
SRA:	disabled	disabled
SRA count:	0	0
Bit swap:	enabled	enabled
Bit swap count:	0	0
Line Attenuation:	2.0 dB	0.0 dB
Signal Attenuation:	0.0 dB	0.0 dB
Noise Margin:	31.1 dB	0.0 dB
Attainable Rate:	139871 kbits/s	20001 kbits/s
Actual Power:	13.3 dBm	- 6.7 dBm

Per Band Status:	D1	D2	D3	U0	U1	U2	U3
Line Attenuation(dB):	2.1	2.3	1.9	N/A	0.0	0.0	N/A
Signal Attenuation(dB):	2.1	2.3	1.8	N/A	0.0	0.0	N/A
Noise Margin(dB):	32.3	30.6	30.5	N/A	0.0	0.0	N/A

Total FECC:	0	0
Total ES:	0	0
Total SES:	0	0
Total LOSS:	0	0
Total UAS:	79	79
Total LPRS:	0	0
Total LOFS:	0	0
Total LOLS:	0	0

	DS Channel1	DS Channel0	US Channel1	US Channel0
Speed (kbps):	0	49998	0	20001
SRA Previous Speed:	0	0	0	0
Previous Speed:	0	49998	0	20001
Reed-Solomon EC:	0	0	0	0
CRC Errors:	0	0	0	0

```
Header Errors:          0          0          0          0
Interleave (ms):     0.00         12.00       0.00          0.00
Actual INP:          0.00          5.01       0.00          0.00

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

Router#**show interface atm 0/2/0**

```
ATM0/2/0 is up, line protocol is up
  Hardware is NIM-VAB-A, address is 30f7.0d55.402e (bia 30f7.0d55.402e)
  MTU 1800 bytes, sub MTU 1800, BW 2679 Kbit/sec, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ATM, loopback not set
  Keepalive not supported
  Encapsulation(s): AAL5
  8 maximum active VCs, 0 current VCCs
  ATM Dynamic Bandwidth Enabled.
  VC Auto Creation Disabled.
  VC idle disconnect time: 300 seconds
  4 carrier transitions
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 128789 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 unknown protocol drops
     0 output buffer failures, 0 output buffers swapped out
```

Router#**show interface ethernet 0/1/0**

```
Ethernet0/1/0 is up, line protocol is up
  Hardware is NIM-VAB-A, address is 30f7.0d55.4026 (bia 30f7.0d55.4026)
  MTU 1500 bytes, BW 20001 Kbit/sec, DLY 400 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive not supported
  Full Duplex, 1000Mbps, media type is Internal
  output flow-control is unsupported, input flow-control is unsupported
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input never, output 00:00:27, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
```

```
Output queue: 0/40 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
  0 packets input, 0 bytes, 0 no buffer
  Received 0 broadcasts (0 IP multicasts)
  0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
  0 watchdog, 0 multicast, 0 pause input
  21 packets output, 9184 bytes, 0 underruns
  0 output errors, 0 collisions, 1 interface resets
  0 unknown protocol drops
  0 babbles, 0 late collision, 0 deferred
  0 lost carrier, 0 no carrier, 0 pause output
  0 output buffer failures, 0 output buffers swapped out
```

Router#**show atm vc**

```
Codes: DN - DOWN, IN - INACTIVE

        VCD /                                  Peak Av/Min Burst
Interface  Name      VPI   VCI Type    Encaps    SC    Kbps   Kbps Cells St
0/2/0.1    7         0   199 PVC     SNAP      UBR    2679          UP
                           (C)    UBR      0
0/2/0.2    8         0   200 PVC     SNAP      UBR    2679          UP
                           (C)    UBR      0
```

4.1 Module specific show commands

- 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 etc

- show platform hardware subslot <slot>/<subslot> module device help
    - Displays device information specific to the module (e.g. Phy, Non-Interface Registers)

- show platform hardware subslot <slot>/<subslot> module host-if status
    - Displays config and status for the host interface port(s) (i.e. 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) (i.e. ports connected to the backplane switch)
    -
- show platform hardware subslot <slot>/<subslot> module interface <interface name> status
    - Displays status, config & 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 0/1 module firmware**

```
Avg Load info
-------------------------------------------
1.00 0.87 0.46 1/45 603

Kernel distribution info
-------------------------------------------
Linux version 3.4.11-rt19 (gopasaha@blr-atg-001) (gcc version 4.6.2 (Buildroot 2011.11) ) #3 SMP PREEMPT Fri
Aug 22 14:25:19 IST 2014

Module firmware versions
-------------------------------------------
Modem Fw Version: 4.14L.04
Modem Phy Version: A2pv6F039h.d24o_rc1

Modem Up time
-------------------------------------------
0D 0H 8M 37S
```

Router#**show platform software subslot 0/1 module status**

```
Process and Memory
---------------------------------------
Mem: 42936K used, 76680K free, 0K shrd, 3156K buff, 9548K cached
CPU:   0% usr   0% sys   0% nic 100% idle   0% io   0% irq   0% sirq
Load average: 1.00 0.87 0.47 1/45 607
  PID  PPID USER     STAT   VSZ %MEM CPU %CPU COMMAND
  538   537 admin    S <   6016   5%   0   0% dslmgmt
  536     1 admin    S <   6016   5%   1   0% dslmgmt
  537   536 admin    S <   6016   5%   0   0% dslmgmt
  515   322 admin    S     4056   3%   1   0% tr64c -m 0
  521   520 admin    S     3932   3%   0   0% consoled
  323   322 admin    S     3832   3%   1   0% ssk
  322     1 admin    S     3600   3%   0   0% /bin/smd
  312   311 admin    S     2976   2%   1   0% /bin/swmdk
  313   311 admin    S     2976   2%   1   0% /bin/swmdk
  311   310 admin    S     2976   2%   0   0% /bin/swmdk
  310     1 admin    S     2976   2%   1   0% /bin/swmdk
  607   606 admin    R <   1680   1%   1   0% /usr/bin/top -b -n 1 -d 30
    1     0 admin    S     1676   1%   1   0% init
  520     1 admin    S     1676   1%   0   0% -/bin/sh -l -c consoled
  606   538 admin    S <   1672   1%   1   0% sh -c /usr/bin/top -b -n 1 -d 30
  362   322 admin    S     1552   1%   1   0% dhcpd
  516   322 admin    S     1480   1%   0   0% dsldiagd
  326   322 admin    S     1432   1%   1   0% dnsproxy
  510     2 admin    SW       0   0%   0   0% [dsl0]
  241     2 admin    SW       0   0%   0   0% [bcmsw_rx]
  145     2 admin    SW       0   0%   0   0% [mtdblock0]
```

```
 260    2 admin    SW       0   0%   1   0% [bcmsw_timer]
  12    2 admin    SW       0   0%   0   0% [kworker/u:1]
 206    2 admin    SW       0   0%   0   0% [bcmFlwStatsTask]
   5    2 admin    SW       0   0%   0   0% [kworker/u:0]
  10    2 admin    SW       0   0%   0   0% [kworker/0:1]
   8    2 admin    SW       0   0%   1   0% [kworker/1:0]
  50    2 admin    SW       0   0%   1   0% [bdi-default]
  69    2 admin    DW       0   0%   1   0% [skbFreeTask]
   9    2 admin    SW       0   0%   1   0% [ksoftirqd/1]
  88    2 admin    SW       0   0%   1   0% [fsnotify_mark]
   6    2 admin    SW       0   0%   0   0% [migration/0]
   7    2 admin    SW       0   0%   1   0% [migration/1]
  87    2 admin    SWN      0   0%   1   0% [kswapd0]
 156    2 admin    SW<      0   0%   0   0% [linkwatch]
 160    2 admin    SW<      0   0%   0   0% [deferwq]
  11    2 admin    SW<      0   0%   1   0% [khelper]
 152    2 admin    SW       0   0%   1   0% [kworker/1:1]
  48    2 admin    SW       0   0%   0   0% [sync_supers]
 261    2 admin    SW       0   0%   0   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]

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

00:08:47    CPU    %usr   %nice    %sys %iowait    %irq   %soft  %steal  %guest   %idle
00:08:47    all    0.22    0.00    2.51    0.00    0.00    0.16    0.00    0.00   97.10
00:08:47      0    0.25    0.00    3.21    0.00    0.00    0.32    0.00    0.00   96.22
00:08:47      1    0.20    0.00    1.82    0.00    0.00    0.01    0.00    0.00   97.98
Interrupts
---------------------------------------
           CPU0       CPU1
  0:       8373      11905   BCM63xx  IPI
  7:     517384     524820   BCM63xx  timer
  9:         12          0  BCM63xx_no_unmask  brcm_9
 10:       2133          0  BCM63xx_no_unmask  brcm_10
 13:          0        965  BCM63xx_no_unmask  serial
 21:          0          0  BCM63xx_no_unmask  brcm_21
 22:          0          0  BCM63xx_no_unmask  brcm_22
 31:       7665          0  BCM63xx_no_unmask  dsl
 34:          0          0  BCM63xx_no_unmask  brcm_34
 35:          1          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  235 0 2654 102409 0 0 174 0 0 0
```

```
cpu0 131 0 1695 50741 0 0 171 0 0 0
cpu1 104 0 959 51668 0 0 3 0 0 0
intr 1073428 20397 0 0 0 0 0 1042254 0 12 2134 0 0 965 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 7665 0 0 0 1 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 341901
btime 0
processes 614
procs_running 1
procs_blocked 0
softirq 1287199 0 1041570 4995 271 0 0 7187 214308 0 18868
KLM Module status
--------------------------------------
iptable_mangle 1168 0 - Live 0xc0369000
iptable_filter 848 0 - Live 0xc0362000
ip_tables 11528 2 iptable_mangle,iptable_filter, Live 0xc0359000
xt_multiport 1446 0 - Live 0xc034f000
xt_mark 813 0 - Live 0xc0348000
xt_mac 739 0 - Live 0xc0342000
xt_DSCP 1819 0 - Live 0xc033c000
xt_dscp 1187 0 - Live 0xc0335000
pwrmngtd 8147 0 - Live 0xc032e000 (P)
bcmvlan 90702 0 - Live 0xc030a000 (P)
p8021ag 5891 0 - Live 0xc02e0000 (P)
bcmarl 6338 0 - Live 0xc02d7000 (P)
nciTMSkmod 306764 0 - Live 0xc0280000 (P)
bcm_enet 200047 1 pwrmngtd, Live 0xc01e4000
adsldd 449136 0 - Live 0xc011b000 (P)
bcmxtmcfg 74872 1 adsldd, Live 0xc009a000 (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:          76536 kB
Buffers:           3176 kB
Cached:            9612 kB
SwapCached:           0 kB
Active:            5244 kB
Inactive:          9480 kB
Active(anon):      1940 kB
Inactive(anon):       0 kB
Active(file):      3304 kB
Inactive(file):    9480 kB
Unevictable:          0 kB
Mlocked:              0 kB
SwapTotal:            0 kB
SwapFree:             0 kB
Dirty:                0 kB
Writeback:            0 kB
AnonPages:         1936 kB
```

```
Mapped:          2768 kB
Shmem:              0 kB
Slab:           26324 kB
SReclaimable:     552 kB
SUnreclaim:     25772 kB
KernelStack:      704 kB
PageTables:       232 kB
NFS_Unstable:       0 kB
Bounce:             0 kB
WritebackTmp:       0 kB
CommitLimit:    59808 kB
Committed_AS:    4896 kB
VmallocTotal:  1032116 kB
VmallocUsed:      1536 kB
VmallocChunk:  1028232 kB
```

Router#**show platform hardware subslot 0/1 module interface ethernet 0/1/0 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 0/1 module interface atm 0/1/0 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 0/1 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 0/1 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 0/1 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 0/1 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 0/1 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 0/1 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 0/1 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 0/1 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 0/1 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 0/1 module interface ethernet 0/1/0 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

4.2 Useful CLIs for debugging issues related to packet flow specific to ATM PVC

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

Router#show platform hardware qfp active infrastructure bqs interface-string
ATM0/1/0.1.1.1004010  hierarchy detail
Interface: ATM0/1/0.1.1.1004010 QFP: 0.0 if_h: 33 Num Queues/Schedules: 5
  Queue specifics:
    Index 0 (Queue ID:0x448, Name: ATM0/1/0.1.1.1004010)
    PARQ Software Control Info:
      (cache) queue id: 0x00000448, wred: 0xe79955d0, qlimit (pkts ): 64
      parent_sid: 0x91, debug_name: ATM0/1/0.1.1.1004010
      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: ATM0/1/0.1.1.1004010)
      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: ATM0/1/0.1.1.1004010
        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: ATM0/1/0 UBR COS)
    PARQ Software Control Info:
      sid: 0x90, parent_sid: 0x7f
      evfc_fc_id: 0xffff, fc_sid: 0xffffff
      obj_id: 0x20, parent_obj_id: 0x1c, debug_name: ATM0/1/0 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: ATM0/1/0)
    PARQ Software Control Info:
      sid: 0x7f, parent_sid: 0x7c
      evfc_fc_id: 0x5100, fc_sid: 0xffffff
      obj_id: 0x1c, parent_obj_id: 0x17, debug_name: ATM0/1/0
      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: 0xffffff
    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 ATM0/1/0.1.1.1004010 path**

- **show platform hardware qfp active interface if-name atm0/1/0.1 statistics**

4.3 DSL debug commands

Router#debug vdsl ?

all Enable all VDSL debug options
controller VDSL controller
daemon VDSL daemon debug
ipc IPC message exchanges
mib debug MIB messages

4.4 Collecting training-log

To start training log collection

Router#***debug vdsl controller 0/1/0 training log***
VDSL Controller VDSL 0/1/0 - Training debugging is on

To stop training log collection

Router#***no debug vdsl controller 0/1/0 training log***
[VDSL_DIAG_LOG] recvd 158991 bytes, written 158991 bytes
[VDSL_DIAG_LOG]: File written sucessfully..
VDSL Controller VDSL 0/1/0 - Training debugging is off
Router#

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

Example:

```
Router#sh controller vdsl 0/1/0
Controller VDSL 0/1/0 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 0/1/0
Router(config-controller)#training log filename flash:mytraininglog_file
Router(config-controller)#exit

Router#show controller vdsl 0/1/0
Controller VDSL 0/1/0 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
```

5. Sample configurations

5.1 Sample MLPPP configs 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: Ethernet0/1/0, 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
```

5.2. 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
!
```

5.3. 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
 !
```

6 Known limitations/Restrictions

6.1 PVC under sub-interface only

In IOS-XE, ATM PVCs can be configured under ATM sub-interfaces only. PVC configuration is not allowed under the main ATM interface.

6.2 Maximum of 8 PVCs supported on a physical interface

Under a single physical interface, maximum of 8 PVCs can be configured. Under each sub-interface maximum of one PVC can be configured. Hence would be able to configure 8 sub-interfaces, with one PVC configured under each sub-interface.

6.3 MLPPP bundle across DSL interfaces

When MLPPP bundle is made across DSL interfaces, interleave delay of the lines should be same.

- Bundling of line 0 and line 1 in case of PTM bond
- Bundling of 2 or more dsl physical interfaces

Example: In the below PTM bond case, interleave delay for line 0 in upstream is 5ms whereas for line 1 it is 8ms. Due this difference, mlppp bundle between line 0 and line 1 would not work as the mlppp buffer overflow would occur. The same would be applicable in downstream direction as well if the interleave delay is different.

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

Daemon Status:        RUNNING

                    XTU-R (DS)          XTU-C (US)
Chip Vendor ID:       'BDCM'              'BDCM'
Chip Vendor Specific:  0x0000              0xA450
Chip Vendor Country:   0xB500              0xB500
Modem Vendor ID:      'CSCO'              'BDCM'
Modem Vendor Specific: 0x4602              0x0000
Modem Vendor Country:  0xB500              0xB500
Serial Number Near:    FOC18086MJP       15.5(201405
Serial Number Far:
Modem Version Near:    15.5(20140503:010710
Modem Version Far:     0xa450

Modem Status(L0):     TC Sync (Showtime!)
Modem Status(L1):     TC Sync (Showtime!)
DSL Config Mode:      AUTO
Trained Mode(L0):     G.993.2 (VDSL2) Profile 17a
Trained Mode(L1):     G.993.2 (VDSL2) Profile 17a

TC Mode:              PTM Bonded
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.02
Modem PHY Version:     A2pvbF039h.d24j12
```

Vendor Version: ^@*L^X^P

Line 0:

	XTU-R (DS)	XTU-C (US)
Trellis:	ON	OFF
SRA:	disabled	disabled
Bit swap:	enabled	enabled
Profile 30a:	disabled	
Bit swap count:	0	0
Line Attenuation:	1.3 dB	0.0 dB
Signal Attenuation:	0.0 dB	0.0 dB
Noise Margin:	0.0 dB	0.0 dB
Attainable Rate:	0 kbits/s	0 kbits/s
Actual Power:	0.0 dBm	13.0 dBm

Per Band Status:	D1	D2	D3	U0	U1	U2	U3
Line Attenuation(dB):	1.2	1.2	1.5	N/A	0.0	0.0	N/A
Signal Attenuation(dB):	1.2	1.2	1.5	N/A	0.0	0.0	N/A
Noise Margin(dB):	0.0	0.0	0.0	N/A	0.0	0.0	N/A

Total FECC:	0	0
Total ES:	0	0
Total SES:	0	0
Total LOSS:	0	0
Total UAS:	234	234
Total LPRS:	0	0
Total LOFS:	0	0
Total LOLS:	0	0

	DS Channel1	DS Channel0	US Channel1	US Channel0
Speed (kbps):	0	80032	0	54844
SRA Previous Speed:	0	80032	0	53873
Previous Speed:	0	0	0	0
Reed-Solomon EC:	0	0	0	0
CRC Errors:	0	0	0	0
Header Errors:	0	0	0	0
Interleave (ms):	**0.00**	**3.00**	**0.00**	**5.00**
Actual INP:	0.00	1.00	0.00	0.10

Line 1:

	XTU-R (DS)	XTU-C (US)
Trellis:	ON	OFF
SRA:	disabled	disabled
Bit swap:	enabled	enabled
Profile 30a:	disabled	

```
Bit swap count:         0                    0
Line Attenuation:       0.0 dB               0.0 dB
Signal Attenuation:     0.0 dB               0.0 dB
Noise Margin:           0.0 dB               0.0 dB
Attainable Rate:        0 kbits/s            0 kbits/s
Actual Power:           0.0 dBm              0.0 dBm
Per Band Status:        D1     D2     D3     U0     U1     U2     U3
Line Attenuation(dB):   0.0    0.0    0.0    0.0    0.0    0.0    0.0
Signal Attenuation(dB): 0.0    0.0    0.0    0.0    0.0    0.0    0.0
Noise Margin(dB):       0.0    0.0    0.0    0.0    0.0    0.0    0.0
Total FECC:             0                    0
Total ES:               0                    0
Total SES:              0                    0
Total LOSS:             0                    0
Total UAS:              0                    0
Total LPRS:             0                    0
Total LOFS:             0                    0
Total LOLS:             0                    0


                  DS Channel1    DS Channel0   US Channel1     US Channel0
Speed (kbps):           0          80032           0           53873
SRA Previous Speed:     0          80032           0           53873
Previous Speed:         0          0               0           0
Reed-Solomon EC:        0          0               0           0
CRC Errors:             0          0               0           0
Header Errors:          0          0               0           0
:       0.00            3.00       0.00            8.00
Actual INP:             0.00       1.00            0.00        0.10

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

Router#
```

6.4 ATM Virtual Circuit Bundles license requirement

As compared to T-train products, APP License is required to support this feature on this module in IOS-XE.

6.5 ATM Multilink PPP Support on Multiple VCs and MLPPP bundling of interfaces.

Below are the recommended configurations for the feature to work seamlessly.

1. It is recommended to have dynamic bandwidth enabled under ATM interface.
2. It is recommended not to configure “bandwidth x” under dialer interfaces. If configured, ensure that the configured bandwidth is always above dsl line rate.