



Controlling Subscriber Bandwidth

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The Dynamic Subscriber Bandwidth Selection (DBS) feature enables wholesale service providers to sell different classes of service to retail service providers by controlling bandwidth at the ATM virtual circuit (VC) level. ATM quality of service (QoS) parameters from the subscriber domain are applied to the ATM PVC on which a PPP over Ethernet (PPPoE) or PPP over ATM (PPPoA) session is established.

Finding Feature Information

For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the [“Feature Information for Controlling Subscriber Bandwidth” section on page 15](#).

Use Cisco Feature Navigator to find information about platform support and Cisco IOS XE software image support. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.

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Prerequisites for Controlling Subscriber Bandwidth

A Cisco ASR 1000 series router must have the following shared port adapters (SPAs) installed to enable DBS:

- SPA-3XOC3-ATM-V2
- SPA-1XOC3-ATM-V2
- SPA-1XOC12-ATM-V2

Restrictions for Controlling Subscriber Bandwidth

The DBS feature does not support the following:

- Switched virtual circuits (SVC)
- ATM port adapters installed in a Cisco ASR 1000 series router
- When changing QoS values dynamically on a VC, there can be some duration (in milliseconds) during which traffic on the VC is dropped.

Information About Controlling Subscriber Bandwidth

Information about controlling subscriber bandwidth includes the following:

- [Traffic-Shaping Parameters, page 2](#)
- [Benefits of Controlling Subscriber Bandwidth, page 3](#)

Traffic-Shaping Parameters

Using DBS you can set the ATM permanent virtual circuit (PVC) traffic-shaping parameters to be dynamically changed based on the RADIUS profile of a PPPoE or PPPoA user logging in on the PVC. If the user is the first user on a given PVC, the RADIUS profile values override the default values of the PVC. If users already exist on the PVC, the new value overrides the existing configuration only if it is higher than the existing value. If multiple PPPoE sessions are allowed on a subscriber VC, the highest peak cell rate (PCR) and sustainable cell rate (SCR) of all the sessions are selected as the PCR and SCR, respectively, of the VC.

You can apply DBS QoS parameters per user as well as per domain. If you apply DBS QoS parameters under a domain profile, all users in that profile are assigned the same DBS QoS parameters. These parameters are assigned to the RADIUS profile for that domain. You can also apply distinctive DBS QoS parameters via the RADIUS user profile.

Traffic-shaping parameters can be locally configured by Cisco IOS command-line interface (CLI) in VC-mode, VC-class, range mode, or PVC-in-range mode. These parameters have a lower priority and are overridden by the shaping parameters specified in the domain service profile. Traffic-shaping parameters that are CLI-configured at the VC class interface or subinterface level are treated as the default QoS parameters for the PVCs to which they apply. These parameters are overridden by the domain service profile QoS parameters of the domain the user is logged in to. If no VC class is configured, the default is the unspecified bit rate (UBR).

When a network access server (NAS) sends a domain authorization request and receives an affirmative response from the RADIUS server, this response may include a “QoS-management” string via vendor-specific attribute (VSA) 26 for QoS management in the NAS. The QoS management values are configured as part of the domain service profile attributes on the RADIUS server. These values contain PCR and SCR values for a particular user or domain. If the QoS specified for a domain or user cannot be applied on the PVC to which the session belongs, the session is not established.

Changing PVC traffic parameters because of new simultaneous PPPoE sessions on the PVC does not cause existing PPPoE sessions that are already established to disconnect. Changing domain service profile QoS parameters on the RADIUS server does not cause traffic parameters to automatically change for PVCs that have existing sessions.

When you enter the **dbns enable** or **no dbns enable** command to configure or unconfigure DBS, existing sessions are not disconnected. If you have a session that has been configured for DBS and you configure the **no dbns enable** command on a VC, additional sessions that are configured will display DBS-configured QoS values until the first new session is up. After the first session is brought up, the VC has default and locally configured values. If you configure the **dbns enable** command after multiple sessions are already up on the VC, all sessions on that VC have DBS QoS parameters.

Benefits of Controlling Subscriber Bandwidth

DBS provides the following benefits:

- Wholesale service providers can provide different bandwidth options to their retail service provider customers, such as ISPs and enterprises.
- Subscribers can choose between enhanced and basic service, with a fixed billing plan for each service.

How to Control Subscriber Bandwidth

See the following sections for configuration tasks for the Dynamic Subscriber Bandwidth Selection feature. Each task in the list is identified as either required or optional.

- [Configuring DBS Under a VC Class](#) (optional)
- [Configuring DBS on a PVC](#) (optional)
- [Configuring DBS on a Range of PVCs](#) (optional)
- [Configuring DBS on a PVC Within a PVC Range](#) (optional)
- [Configuring the RADIUS Attributes for DBS](#) (optional)
- [Monitoring DBS, page 11](#) (optional)

Configuring DBS Under a VC Class

Perform the following task to configure DBS under a VC class.

SUMMARY STEPS

1. **enable**
2. **configure terminal**

3. **vc-class atm** *vc-class-name*
4. **dbs enable**

DETAILED STEPS

	Command	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	vc-class atm <i>vc-class-name</i> Example: Router(config)# vc-class atm class1	Creates an ATM VC class and enters ATM VC class configuration mode. <ul style="list-style-type: none"> • A VC class can be applied to an ATM interface, subinterface, or VC.
Step 4	dbs enable Example: Router(config-vc-class)# dbs enable	Applies DBS QoS parameters.

Configuring DBS on a PVC

Perform the following task to configure DBS for a PVC.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *number* [**point-to-point** | **multipoint**]
4. **pvc** *vpi/vci*
5. **dbs enable**
6. **protocol pppoe**

DETAILED STEPS

	Command	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none">Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface atm number [point-to-point multipoint] Example: Router(config)# interface atm 5/0.1 multipoint	Specifies an ATM interface or subinterface and enters interface configuration mode.
Step 4	pvc [name] vpi/vci Example: Router(config-if)# pvc 2/101	Specifies an ATM PVC and creates or assigns a name to an ATM PVC, and enters interface-ATM-VC configuration mode. Note The arguments <i>vpi</i> and <i>vci</i> cannot both be set to 0; if one is 0, the other cannot be 0.
Step 5	dbns enable Example: Router(config-if-atm-vc)# dbns enable	Applies DBS QoS parameters.
Step 6	protocol pppoe Example: Router(config-if-atm-vc)# protocol pppoe	Specifies PPPoE as the protocol of the ATM PVC.

Configuring DBS on a Range of PVCs

Perform this task to configure DBS for a range of PVCs.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm number [point-to-point | multipoint]**
4. **range [range-name] pvc start-vpilstart-vci end-vpilend-vci**
5. **dbns enable**

DETAILED STEPS

	Command	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none">Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface atm number [point-to-point multipoint] Example: Router(config)# interface atm 5/0.1 multipoint	Specifies an ATM interface or subinterface and enters interface configuration mode.
Step 4	Router(config-subif)# range [<i>range-name</i>] pvc <i>start-vpi/start-vci end-vpi/end-vci</i> Example: Router(config-subif)# range pvc 0/101 0/500 class-range pppoe	Defines a range of ATM PVCs and enables PVC range configuration mode.
Step 5	dbns enable Example: Router(config-if-atm-vc)# dbns enable	Applies DBS QoS parameters.

Configuring DBS on a PVC Within a PVC Range

Perform this task to configure DBS for a specific PVC within a range of PVCs.

SUMMARY STEPS

- enable**
- configure terminal**
- interface atm number** [**point-to-point** | **multipoint**]
- range** [*range-name*] **pvc** *start-vpi/start-vci end-vpi/end-vci*
- pvc-in-range** [*pvc-name*] [[*vpi*]/*vci*]
- dbns enable**

	Command	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface atm number [point-to-point multipoint] Example: Router(config)# interface atm 5/0.1 multipoint	Specifies an ATM interface or subinterface and enters interface configuration mode.
Step 4	range [range-name] pvc start-vpi/start-vci end-vpi/end-vci Example: Router(config-subif)# range pvc 0/101 0/500 class-range pppoe	Defines a range of ATM PVCs and enables PVC range configuration mode.
Step 5	in-range [pvc-name] [[vpi/]vci] Example: Router(config-if-atm-range)# pvc-in-range pvc1 3/104	Defines an individual PVC within a PVC range and enables PVC-in-range configuration mode.
Step 6	dbns enable Example: Router(config-if-atm-range-pvc)# dbns enable	Applies DBS QoS parameters.

Configuring the RADIUS Attributes for DBS

You can apply DBS QoS parameters per user as well as per domain. If you apply DBS QoS parameters under a domain profile, all users in that profile are assigned the same DBS QoS parameters. These parameters are assigned to the RADIUS profile for that domain. You can also apply distinctive DBS QoS parameters via the RADIUS user profile.

Configure the RADIUS attributes listed in this section in the user or domain profiles on the authentication, authorization, and accounting (AAA) server. The user or domain profile is downloaded from the AAA server as part of user authentication.

The QoS management string for DBS has the following syntax:

```
Cisco-Avpair = atm:peak-cell-rate=155000
Cisco-Avpair = atm:sustainable-cell-rate=155000
```

You must configure the PCR. Configuring the SCR is optional. If you configure only the PCR, the ATM service type is an unspecified bit rate (UBR). If you specify both the SCR and the PCR, the ATM service type is a variable bit rate nonreal-time (VBR-nrt) connection.

If the peak rate is greater than the maximum rate permitted on the ATM physical interface, the PCR applied on the ATM PVC is set to the maximum rate. If the specified PCR is less than the minimum rate, then the PCR applied on the ATM PVC is the minimum rate.

If the sustainable-cell-rate (in Kbps) applied exceeds the maximum for the interface, the session is rejected.

**Note**

DBS cannot change service categories such as from UBR to VBR-nrt. For details, see the table in [Configuring Dynamic Subscriber Services](#).

Verifying DBS

**Note**

The configuration examples in this section explain the PPPOE termination using a VPDN group.

Step 1 Enter the **show atm pvc vpi/vci** command to view details about ATM PVCs or VCs:

```
Router# show atm pvc 0/75

ATM1/0.4:VCD:1, VPI:0, VCI:75
UBR, PeakRate:149760
AAL5-LLC/SNAP, etype:0x0, Flags:0xC20, VCmode:0x0
OAM frequency:0 second(s), OAM retry frequency:1 second(s)
OAM up retry count:3, OAM down retry count:5
OAM Loopback status:OAM Disabled
OAM VC state:Not Managed
ILMI VC state:Not Managed
PA TxRingLimit:40 particles
PA Rx Limit:1600 particles
InARP frequency:15 minutes(s)
Transmit priority 4
InPkts:18, OutPkts:21, InBytes:1263, OutBytes:1476
InPRoc:18, OutPRoc:3
InFast:0, OutFast:0, InAS:0, OutAS:0
InPktDrops:0, OutPktDrops:0/0/0 (holdq/outputq/total)
CrcErrors:0, SarTimeOuts:0, OverSizedSDUs:0, LengthViolation:0,
CPIErrors:0
Out CLP=1 Pkts:0
OAM cells received:0
F5 InEndloop:0, F5 InSegloop:0, F5 InAIS:0, F5 InRDI:0
F4 InEndloop:0, F4 InSegloop:0, F4 InAIS:0, F4 InRDI:0
OAM cells sent:0
F5 OutEndloop:0, F5 OutSegloop:0, F5 OutRDI:0
F4 OutEndloop:0, F4 OutSegloop:0, F4 OutRDI:0
OAM cell drops:0
Status:UP
PPPOE enabled.
DBS enabled.
```

Step 2 Enter the **show atm pvc dbs** command to display information about ATM PVCs that have DBS QoS parameters applied:

```
Router# show atm pvc dbs
```


Interface	VCD / Name	VPI	VCI	Type	Encaps	SC	Peak Kbps	Avg/Min Kbps	Burst Cells
1/0.7 UP	3	0	75	PVC	MUX	VBR	2000	700	94

Step 3 Enter the **show running-config** command to verify that DBS QoS parameters have been applied. If you enter the **dbns enable** or the **no dbns enable** command, it appears in the output of the **show running-config** command. If you enter the **default dbns enable** command, it does not appear.

```
Router# show running-config

Building configuration...

Current configuration : 2902 bytes
!
version 12.2
no service single-slot-reload-enable
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname host1
!
aaa new-model
!
!
aaa authentication ppp default group radius
aaa authorization network default group radius
aaa session-id common
!
username usera password 0 password0
username lac password 0 password1
username lns password 0 password2
username nrpl password 0 password3
username user1 password 0 password4
username nrpl-3 password 0 password5
username xyz@abc.com password 0 password6
ip subnet-zero
!
!
ip host dirt 172.69.1.129
ip host boot 172.19.192.254
!
vpdn enable
!
vpdn-group lac
 request-dialin
  protocol l2f
  domain pepsi.com
  initiate-to ip 10.1.1.5
  local name lac
!
vpdn-group pppoe_terminate
 accept-dialin
  protocol pppoe
  virtual-template 1
 pppoe limit per-mac 2000
 pppoe limit per-vc 2000
!
!
!
!
!
```

```
!  
!  
!  
!  
vc-class atm pppoa  
    encapsulation aal5mux ppp Virtual-Template2  
    dbs enable  
!  
vc-class atm pppoe  
    dbs enable  
    protocol pppoe  
!  
interface Loopback1  
    no ip address  
!  
interface FastEthernet0/0  
    ip address 10.0.74.211 255.255.255.0  
    duplex half  
    no cdp enable  
!  
interface ATM1/0  
    no ip address  
    no ip route-cache  
    no ip mroute-cache  
    no atm ilmi-keepalive  
    atm voice aal2 aggregate-svc upspeed-number 0  
!  
interface ATM1/0.4 point-to-point  
    ip address 10.1.1.6 255.255.255.0  
    no ip route-cache  
    no ip mroute-cache  
    pvc 0/75  
        dbs enable  
        protocol pppoe  
!  
!  
interface ATM1/0.5 point-to-point  
    ip address 10.1.1.6 255.255.255.0  
    no ip route-cache  
    no ip mroute-cache  
    pvc 0/85  
!  
!  
interface ATM1/0.7 point-to-point  
    ip address 10.1.1.6 255.255.255.0  
    no ip route-cache  
    no ip mroute-cache  
    pvc 0/95  
        class-vc pppoa  
        ubr 5000  
!  
!  
interface ATM1/0.10 point-to-point  
    no ip route-cache  
    no ip mroute-cache  
    range pvc 0/101 0/500  
        class-range pppoe  
!  
    pvc-in-range 0/102  
        no dbs enable  
!  
!  
interface Virtual-Template1  
    ip unnumbered Loopback1
```

```
ip mtu 1492
no keepalive
peer default ip address pool local_pool
ppp authentication chap
!
interface Virtual-Template2
ip address negotiated
ip mtu 1492
peer default ip address pool local_pool
ppp authentication chap
!
interface Virtual-Template10
ip address 192.168.11.1 255.255.255.0
no keepalive
peer default ip address pool p3
ppp authentication chap
!
interface Virtual-Template11
ip address negotiated
no keepalive
ppp chap hostname host1
ppp chap password password1
!
ip local pool p3 192.168.0.0 192.170.12.250
ip local pool local_pool 150.10.3.1 150.10.10.250
ip default-gateway 10.0.74.1
ip classless
ip route 10.0.0.0 10.0.0.0 10.0.74.1
ip route 10.107.164.0 255.255.255.0 FastEthernet0/0
no ip http server
!
!
!
radius-server host 172.18.0.0 auth-port 1645 acct-port 1646
radius-server retransmit 3
radius-server key cisco
call rsvp-sync
!
!
mgcp profile default
!
!
gatekeeper
shutdown
!
!
line con 0
line aux 0
line vty 5 15
!
!
end
```

Monitoring DBS

Use the commands listed below to monitor DBS:

Command	Purpose
<code>debug atm events</code>	Displays the normal set of ATM events when a session comes up or goes down.
<code>debug atm errors</code>	Displays protocol errors and error statistics associated with VCs.
<code>debug atm status</code>	Displays changes in the status of a VC when a session comes up or goes down or when the VC configuration is changed.
<code>debug ppp authentication</code>	Displays authentication protocol messages, including Challenge Authentication Protocol (CHAP) packet exchanges and Password Authentication Protocol (PAP) exchanges.
<code>debug ppp error</code>	Displays protocol errors and error statistics associated with PPP connection negotiation and operation.
<code>debug ppp negotiation</code>	Enables debugging of PPP negotiation process.
<code>debug radius</code>	Displays detailed debugging information associated with RADIUS.
<code>debug vpdn event</code>	Displays Layer 2 tunneling protocol (L2TP) errors and events that are a part of normal tunnel establishment or shutdown for VPDNs.
<code>debug vpdn l2x-errors</code>	Displays Layer 2 forwarding protocol (L2F) and L2TP errors that prevent tunnel establishment or normal operation.
<code>debug vpdn l2x-events</code>	Displays L2F and L2TP events that are part of tunnel establishment or shutdown.
<code>debug vpdn pppoe-errors</code>	Displays PPPoE protocol errors that prevent a session from being established or errors that cause an established session to be closed.
<code>debug vpdn pppoe-events</code>	Displays PPPoE protocol messages about events that are part of normal session establishment or shutdown.
<code>show atm pvc</code>	Displays all ATM PVCs and traffic information.
<code>show atm pvc dbs</code>	Displays ATM PVCs that have DBS QoS parameters applied.
<code>show atm vc detailed</code>	Displays information about ATM PVCs and SVCs.
<code>show interfaces virtual-access</code>	Displays status, traffic data, and configuration information about a specified virtual access interface.

Configuration Examples for Controlling Subscriber Bandwidth

This section provides the following configuration examples:

- [Configuring DBS for a VC Class: Example, page 13](#)
- [Configuring DBS for a PVC: Example, page 13](#)
- [Configuring DBS for a Range of PVCs: Example, page 13](#)
- [Configuring DBS for a PVC Within a PVC Range: Example, page 13](#)
- [Configuring RADIUS Attributes: Examples, page 13](#)

Configuring DBS for a VC Class: Example

In the following example, DBS QoS parameters have been applied to a VC called “cisco”:

```
vc-class atm cisco
  dbs enable
```

Configuring DBS for a PVC: Example

In the following example, DBS QoS parameters have been applied on a PVC called “cisco”:

```
interface atm0/0/0.5 point-to-point
  ip address 10.0.0.0 255.255.255.0
  pvc cisco 0/100
  dbs enable
  protocol pppoe
```

Configuring DBS for a Range of PVCs: Example

In the following example, DBS QoS parameters have been applied on a range of PVCs. The range is named “cisco range” and has a *start-vpi* of 0, a *start-vci* of 50, an *end-vpi* of 0, and an *end-vci* of 70:

```
interface atm0/0/0.1 multipoint
  ip address 10.0.0.0 255.255.255.0
  range cisco pvc 0/50 0/70
  dbs enable
```

Configuring DBS for a PVC Within a PVC Range: Example

In the following example, DBS parameters have been applied on PVC 60, which is part of the PVC range called “cisco”:

```
interface atm0/0/0.1 multipoint
  range cisco pvc 0/50 0/70
  pvc-in-range 0/60
  dbs enable
```

Configuring RADIUS Attributes: Examples

The following example shows how to configure RADIUS attributes for a domain profile for DBS:

```
cisco.com Password = "cisco", Service-Type = Outbound
  Service-Type = Outbound,
  Cisco-Avpair = "vpdn:tunnel-id=tunnel133",
  Cisco-Avpair = "vpdn:tunnel-type=l2tp",
  Cisco-Avpair = "vpdn:l2tp-tunnel-password=password2",
  Cisco-Avpair = "vpdn:ip-addresses=172.16.0.0",
  Cisco-Avpair = "atm:peak-cell-rate=155000",
  Cisco-Avpair = "atm:sustainable-cell-rate=155000"
```

The following example shows how to configure RADIUS attributes for a user profile for DBS:

```
user1@cisco.com Password = "userpassword1", Service-Type = Outbound
  Service-Type = Outbound,
  Cisco-Avpair = "atm:peak-cell-rate=155000",
  Cisco-Avpair = "atm:sustainable-cell-rate=155000"
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
Cisco Subscriber Edge Services Manager	Cisco Subscriber Edge Services Manager
Access Point Name Manager	APN Manager Application Programming Guide
RADIUS configuration	“Configuring RADIUS” chapter of the Cisco IOS Security Configuration Guide
RADIUS attributes	“RADIUS Attributes” appendix to the Cisco IOS Security Configuration Guide
Broadband access aggregation concepts	“Understanding Broadband Access Aggregation” module
Tasks for preparing for broadband access aggregation	“Preparing for Broadband Access Aggregation” module
Broadband access commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	“Wide-Area Networking Commands” in the Cisco IOS Wide-Area Networking Command Reference

Standards

Standards	Title
None	—

MIBs

MIBs	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
None	—

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Controlling Subscriber Bandwidth

Table 1 lists the release history for this feature.

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



Note

Table 1 lists only the Cisco IOS XE software release that introduced support for a given feature in a given Cisco IOS XE software release train. Unless noted otherwise, subsequent releases of that Cisco IOS XE software release train also support that feature.

Table 1 Feature Information for Controlling Subscriber Bandwidth

Feature Name	Releases	Feature Configuration Information
Dynamic Subscriber Bandwidth Selection (DBS)	Cisco IOS XE Release 2.5	<p>This feature enables wholesale service providers to sell different classes of service to retail service providers by controlling bandwidth at the ATM virtual circuit (VC) level. ATM quality of service (QoS) parameters from the subscriber domain are applied to the ATM PVC on which a PPPoE or PPPoA session is established.</p> <p>The following sections provide information about this feature:</p> <ul style="list-style-type: none"> • “Information About Controlling Subscriber Bandwidth” section on page 2 • “How to Control Subscriber Bandwidth” section on page 3

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