

# Configuring and Troubleshooting ATM Connection Configurations and Cisco BPX 8600 Series Switches

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## Introduction

This document is a configuration guide for ATM connections for the Cisco BPX 8600 Series Switch Broadband Switch Module (BXM) using switch software release 8.4.x and later.

Configuring ATM connections on the Cisco BPX 8600 Series Switch has changed from switch software release 8.1.x to 9.2.x. The bulk of the changes occurred when the ATM Forum–compliant BXM card was introduced with switch software release 8.4. The predecessors to the BXM, the ASI and BNI cards used a proprietary ATM–like cell structure and policing mechanism. This document provides a broad overview of ATM service for 8.4.x and later networks using the BXM.

Since the Cisco WAN Manager (formerly SV+) Connection Manager values for ATM connections are restricted in range, they are not addressed in this document.

For additional information, see the References section of this document for:

- Leaky Bucket Colloquial, Industry Slang Terms
- Acronyms
- Concepts and Definition

## Prerequisites

## Requirements

There are no specific requirements for this document.

## Components Used

This document is not restricted to specific software and hardware versions.

## Conventions

For more information on document conventions, refer to the Cisco Technical Tips Conventions.

## Background Information

### Leaky Buckets

When a customer purchases a service from an ATM service provider, a traffic contract is agreed on. This traffic contract specifies the expected network quality of service when the user's traffic is compliant with the predetermined parameters such as:

- Peak Cell Rate (PCR)
- Cell Delay Variation Tolerance (CDVT)
- Sustainable Cell Rate (SCR)
- Maximum Burst Size (MBS)

Customer traffic compliance with the contract is performed at the ingress to the ATM network. Once the traffic is admitted to the ATM network, it expects to be transported to the destination.

The traffic contract is enforced by the Broadband Switch Module (BXM) Routing Control, Monitor, and Policing (RCMP) chip. This chip performs the traffic policing, or screening function for all ATM connections.

"Dual leaky bucket" is a colloquial term used to describe the algorithm used for conformance checking of cell flows against the set of parameters specified in the traffic contract. For additional definitions, see the Leaky Bucket Colloquial, Industry Slang Terms section.

The rate that cells flow into the network is determined by the "leak rate" using PCR or SCR parameters. Cell bursts are determined by the "bucket depth" using CDVT or MBS parameters.

The parameters for PCR, CDVT, SCR, and MBS are user-configurable using the **cnfcon** command and are used by switch software to derive Burst Tolerance (BT). Burst Tolerance is used to police the second leaky bucket. The relationship between BT and MBS is defined by  $BT = (MBS - 1) * (1/SCR - 1/PCR)$ .

The parameter values for PCR, CDVT, SCR, and MBS should directly reflect those values specified in the traffic contract. If the parameter values for PCR, CDVT, SCR, and MBS exceed the values specified in the traffic contract, the traffic in excess of the specific values may be discarded due to service provider policing.

For example, if a customer purchases a 10 Mbps CBR ATM service from a service provider, and they configure their equipment to provide 25 Mbps of CBR traffic to that service provider, then 15 Mbps of CBR traffic may be discarded by the service provider as non-compliant.

- The first leaky bucket screens for traffic contract compliance. If a cell does not meet the terms of the traffic contract, the cell is discarded. No Cell Loss Priority (CLP) tagging is performed at the first leaky bucket. The CLP setting of the ATM cell determines the priority of the cell through the network. The CLP setting is one bit in the ATM cell header that can either be a 0 or a 1. Cells with the CLP bit set to 0 have higher priority in the network than cells with the CLP bit set to 1.
- The second leaky bucket evaluates cells from the first leaky bucket to determine whether or not CLP tagging must be performed. A cell that is 'tagged' has the CLP bit set to 1.

Because CBR connections only have PCR and CDVT parameters, CBR traffic is policed only on the first Leaky Bucket. Another way to visualize the policing process is shown in the diagrams below. In the diagrams, **Incoming Data** represents ATM cells that come from customer premise equipment (CPE).

Cells that comply with the terms of the contract are shown as having tokens. Cells with tokens are allowed to pass through the first Leaky Bucket. Any cell that does not have a token (whether the CLP bit is set to 0 or 1) is not compliant.

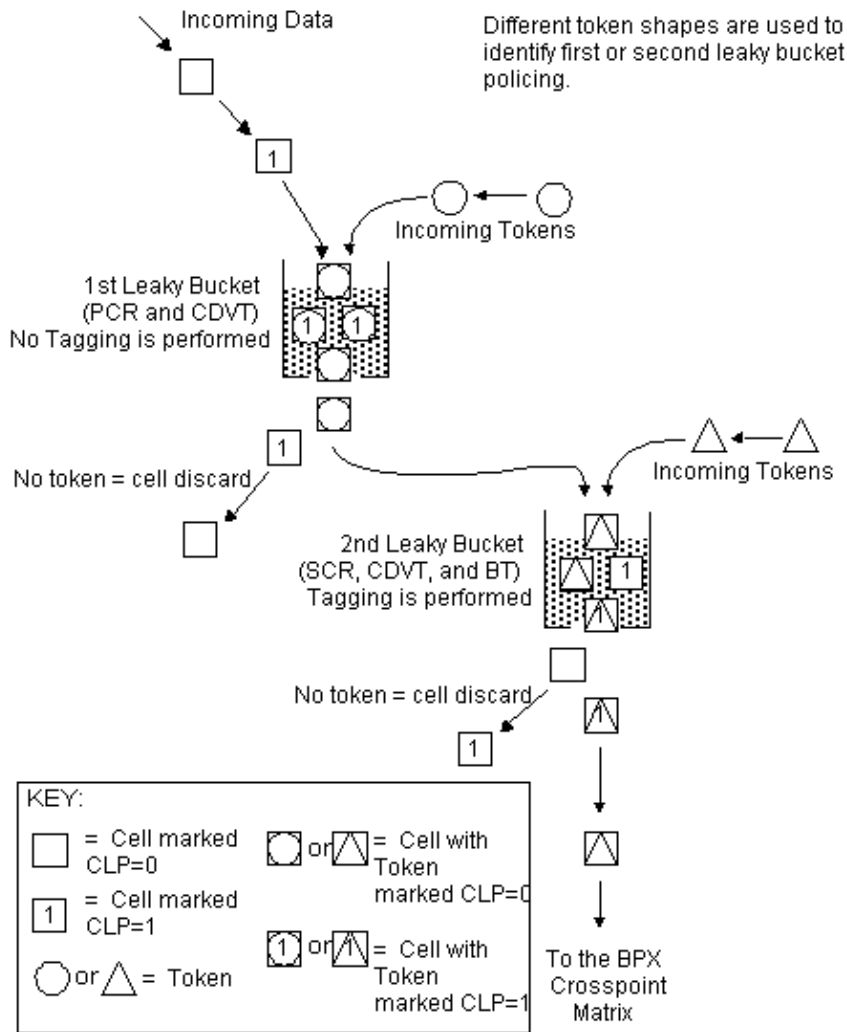
All cells that pass through the second Leaky Bucket are guaranteed transport through the WAN Switching network as CLP=0 or CLP=1 traffic. Unexpected congestion caused by trunk failures or other outage may occur, resulting in some ATM cells being dropped inside the WAN Switching network. Cells that are tagged CLP=1 will be discarded before cells that are tagged CLP=0.

Even for CLP=0 cells that have successfully passed the policing function and are allowed into the WAN Switching network, discards may occur due to unexpected congestion. Compliant cells can be discarded due to network events that are beyond customer and service provider control.

There is no 'credit' scheme for ATM policing. If data is transmitted continuously in excess of PCR for 10 hours and the connection is then idle for 14 hours, no extra 'credit' is allocated to the connection during those 14 idle hours to 'make up' for the earlier.

A common fallacy that has a negative impact on traffic throughput is the idea that manually setting the ATM cell CLP bit to 1 decreases the amount of time cells spend in the RCMP chip and increases their delivery rate to the network. Configuring the ATM cell CLP bit to 1 prior to entry to the Cisco BPX 8600 Series Switch only eliminates the requirement to evaluate the cell at the second Leaky Bucket. The ATM cell still traverses the BXM RCMP chip and does not get admitted to the network ahead of other traffic. ATM cells with the CLP bit set to 1 are more likely to be discarded in the network. Network discards typically occur at egress trunk queues or egress port queues.

## **Dual Leaky Bucket Functionality Based on ATM Traffic Management Specification Version 4.0**



## Policing Options

For CBR, VBR, and ABR ATM connection types, policing can be configured for Types 1, 2, 3, 4, or 5. The CBR, VBR, and ABR policing algorithms are summarized in this table.

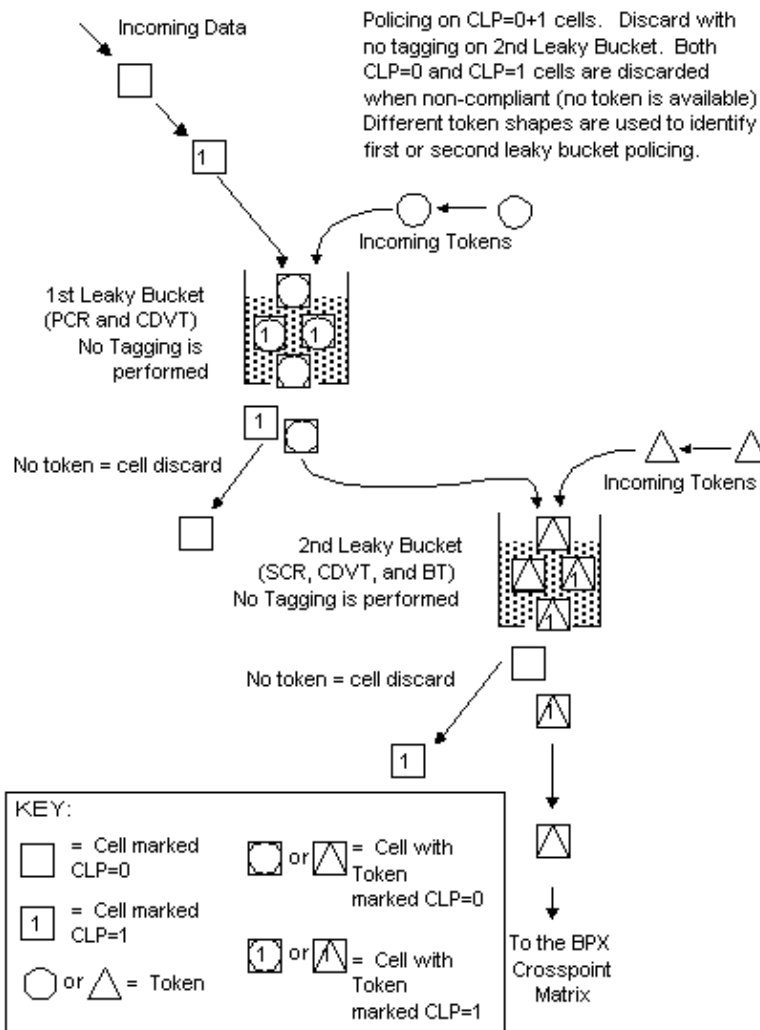
For UBR ATM connections, policing is configured using the CLP setting.

"cnfcon" Policing Type	Description	BPX BXM Connection Type	ATM TM 4.0 Conformance Definition
1	Policing and discards on both leaky buckets for CLP=0+1 traffic.	VBR, ABR	VBR.1
2	Policing and discards on the first leaky bucket for CLP=0+1 traffic; policing and discards on the second leaky bucket for CLP=0 traffic.	VBR, ABR	VBR.2
3	Policing and discards on the first leaky	VBR, ABR	VBR.3

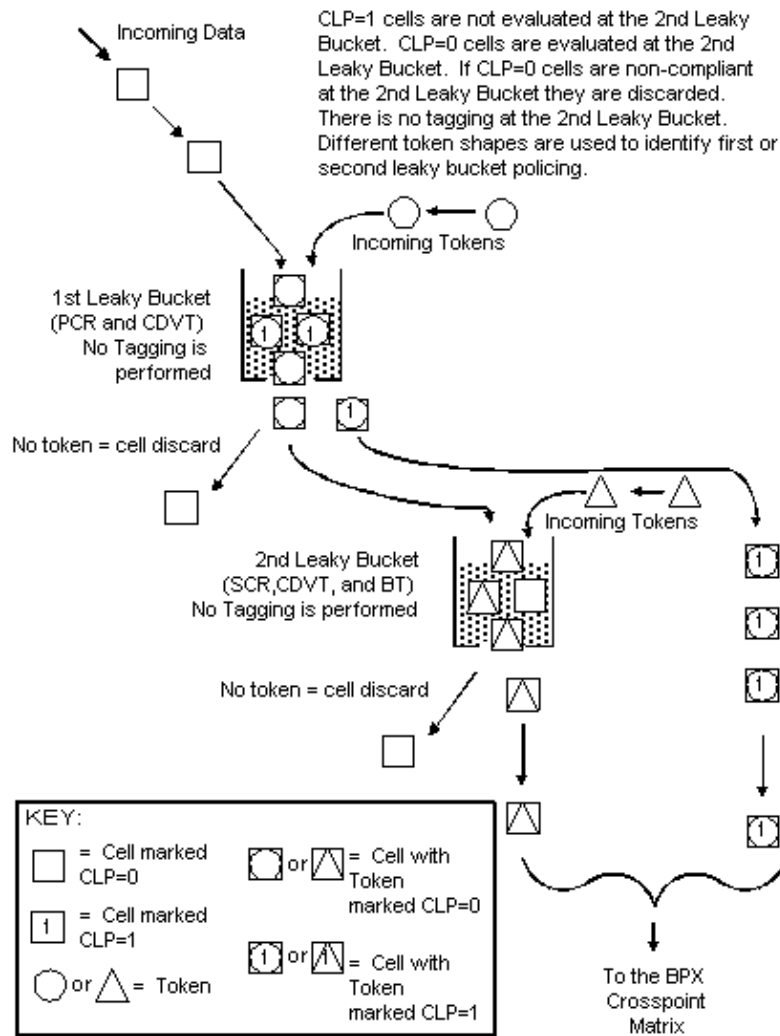
	bucket for CLP=0+1 traffic; policing and tagging on the second leaky bucket for CLP=0 traffic.		
4	Policing and discards on the first leaky bucket for CLP=0+1 traffic. No policing on the second leaky bucket.	CBR, VBR, ABR	CBR.1
5	Policing is disabled. Use only for troubleshooting as one misbehaving (non-compliant) connection can affect others.	CBR, VBR, ABR	

The policing types are illustrated in these five diagrams.

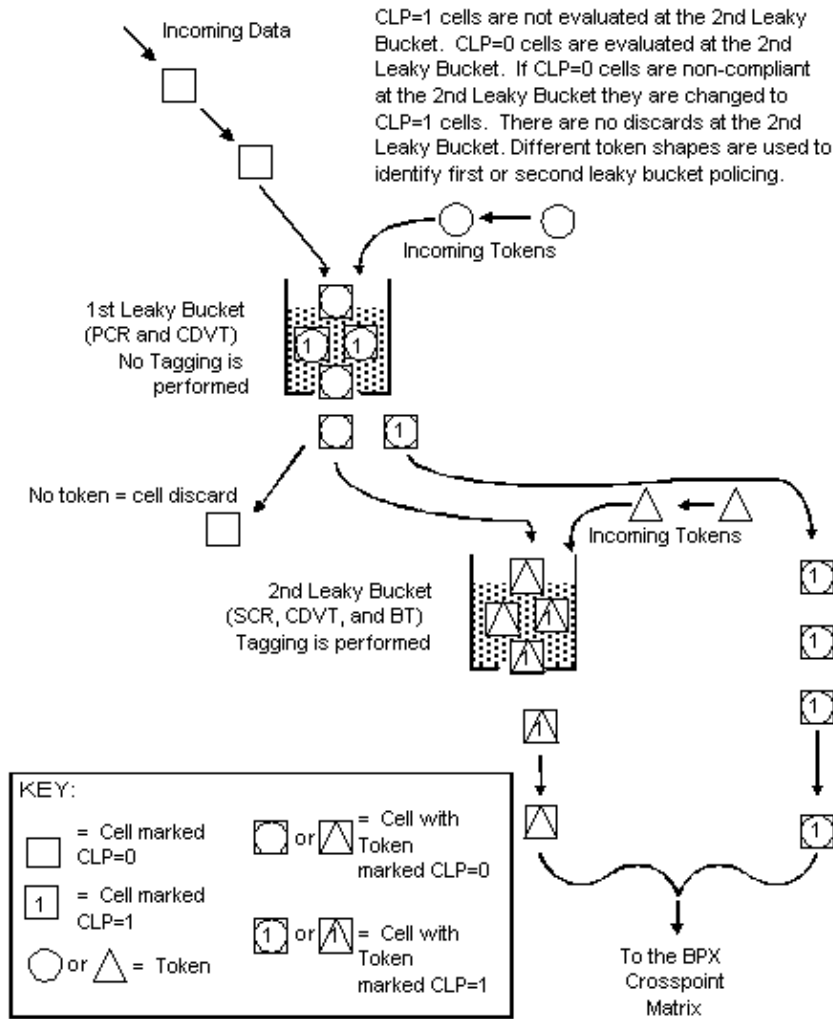
### Policing Option 1



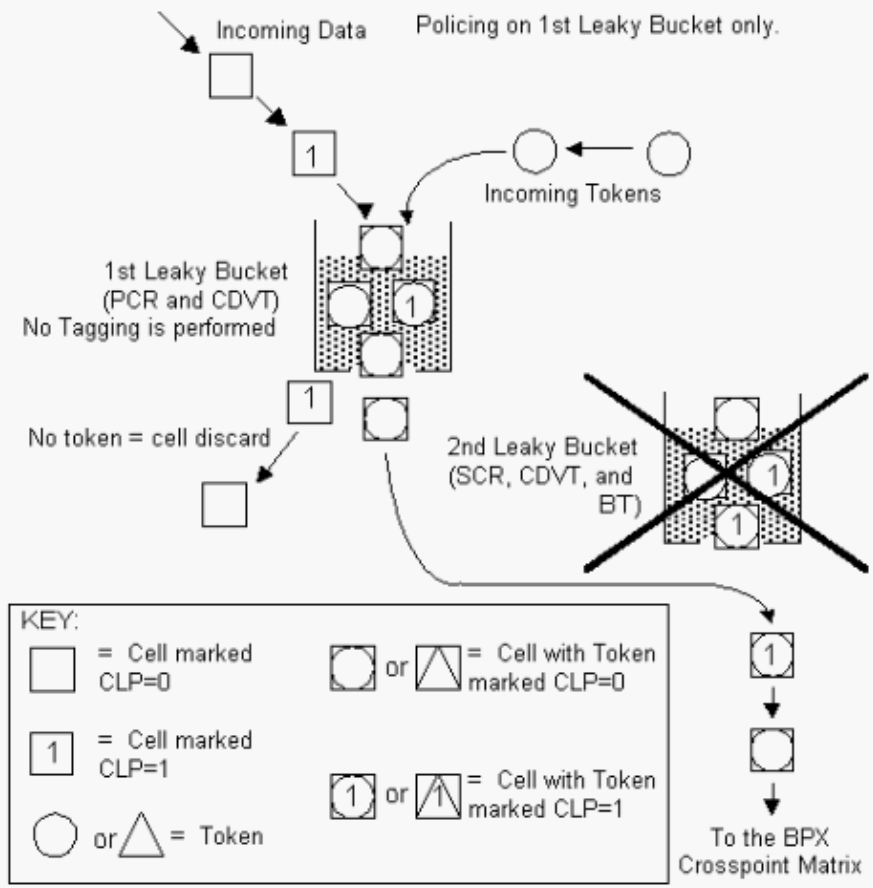
## Policing Option 2



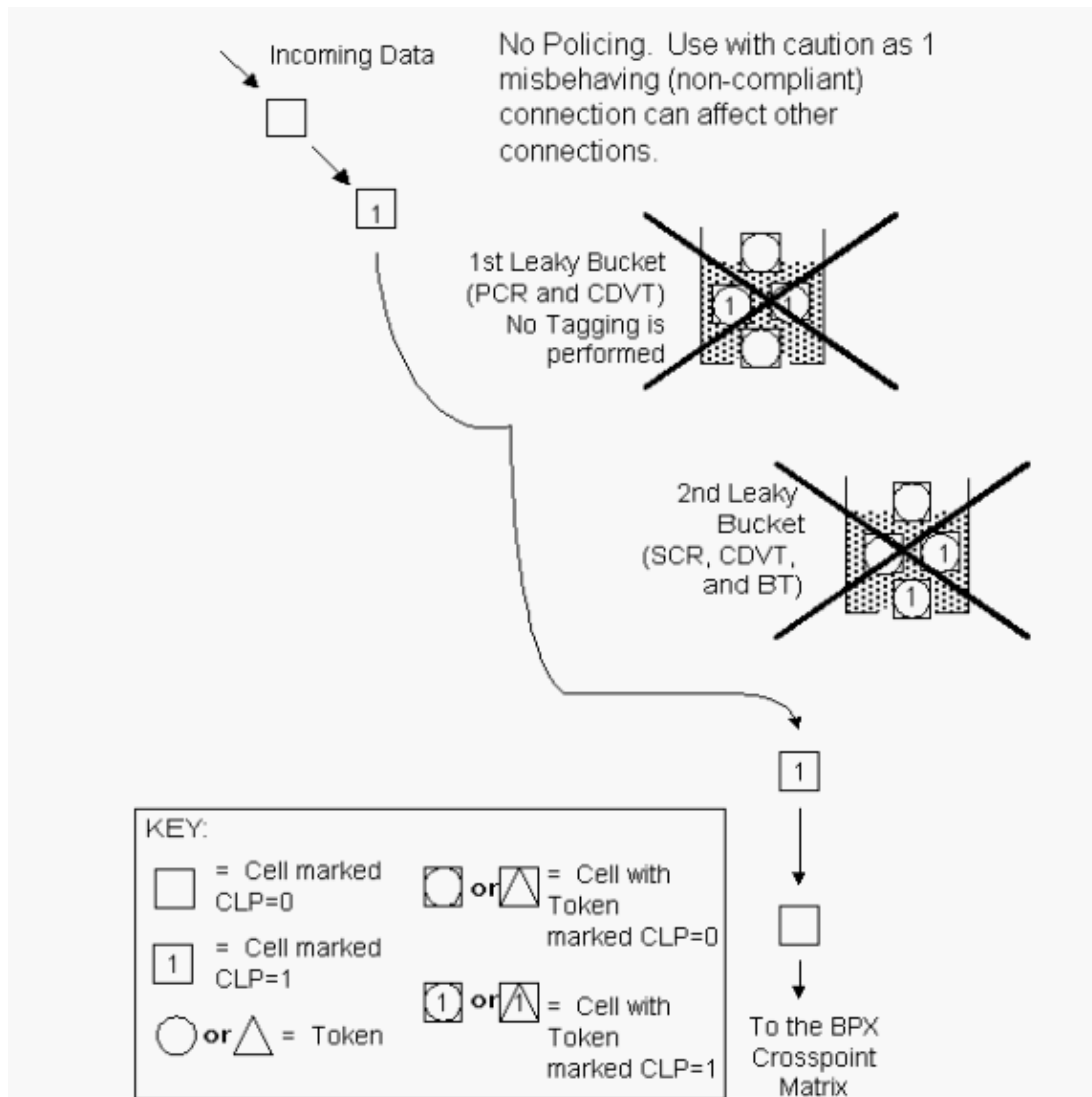
## Policing Option 3



#### Policing Option 4



**Policing Option 5**



## Troubleshoot Connections

To aid in troubleshooting, the BXM trunk offers **dspchstats** functionality similar to the BXM line.

BXM model F firmware introduces changes to the output of the **dspchstats** command.

Due to an enhancement request for the BXM model F, resource management (RM) cells in the `From Network` field are no longer registered or displayed. The `From Network` counter only registers and displays user data cells received from the crosspoint switch. RM cell discards have also been removed from the `TX Clp 0+1 Dscd` and the `TX Clp 0 Dscd` registers.

For switch software release 9.2.x and later, the `TX Clp 0+1 Dscd`, `TX Clp 0 Dscd`, and the `TX Clp 1 Dscd` counters have been removed from the **dspchstats** screen and replaced with these counters:

Oflw CLP0 Dscd	Receives CLP 0 user cells discarded due to a VC_Q overflow (Ingress).
Oflw CLP1 Dscd	Receives CLP 1 user cells discarded due to a VC_Q overflow (Ingress).
NCmp CLP0 Dscd	Non-Compliant CLP 0 user cells discarded by the policer (Ingress).

NCmp CLP1 Dscd	Non-Compliant CLP 1 user cells discarded by the policer (Ingress).
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The ingress virtual source/virtual destination allowed cell rate (Igr VSVD ACR) and egress virtual source/virtual destination allowed cell rate (Egr VSVD ACR) counters apply only to ABR connections that have VSVD enabled. To configure VSVD, refer to Available Bit Rate.

To obtain **dspchstats** information for a target connection, issue the **StrataCom-level dcct <connection\_number>** command and scroll to the last screen. Use the **This Chan** value to complete the **dspchstats <trunk\_slot.trunk\_port.This\_Chan>** command.

```
bpx01tor      VT      StrataCom      BPX 8620  9.2.23      Feb. 1 2000  19:18 EST
Slot: 3      Port: 0      VPI: 3 VCI: 1      LCON# 30  &310D3504VC# 30  &3216D9FC

Base XLT ptr : 310D38C8
Xlat ptr      : 31132F06
Cur,Nxt Indx : 7, 0
SEQ Number    : 4
State         : USED
Trunk         : 3(3.2.255)
De Trunk      : 255(3.2.255)
Out Trk Chan  : 0
This Chan   : 552
VPC(N) Conid : 4349
Master Node#  : 50
Mstr LCon Idx: 19
```

**Last Command: dcct 3.1.3.1**

```
bpx01tor      VT      StrataCom      BPX 8620  9.2.23      Feb. 1 2000  19:18 EST

Trk Channel Statistics for 3.2.552 Cleared: Feb. 1 2000  18:49 (|) Snapshot
PCR: 0/0 cps      Collection Time: 0 day(s) 00:28:30      Corrupted: NO
-----
Traffic      Cells      CLP      Avg CPS      %util      Chan Stat Addr: 30F68BD0
From Port    : 7023985      0      4106      0
To Network   : 7023986      ---     4106      0
From Network : 7023993      0      4106      0
To Port      : 7023993      0      4106      0

Rx Frames Rcv : 0 NonCmplnt Dscd: 0 Rx Q Depth : 0
Tx Q Depth    : 0 Rx CLP0 : 7023985 Rx Nw CLP0 : 7023993
Igr VSVD ACR : 0 Egr VSVD ACR : 0 Tx Clp0 Port : 7023993
Rx Clp0+1 Port: 7023985 NCmp CLP0 Dscd: 0 NCmp CLP1 Dscd: 0
Oflw CLP0 Dscd: 0 Oflw CLP1 Dscd: 0
```

**Last Command: dspchstats 3.2.552 1**

## Constant Bit Rate (CBR)

### CBR Introduction

CBR connections are used for delay- and jitter-sensitive Time Division Multiplex (TDM) traffic such as voice, video, and circuit emulation services in an ATM network. The CBR service category is used by connections that request a static amount of bandwidth that is continuously available during the connection lifetime. This amount of bandwidth is characterized by the Peak Cell Rate (PCR).

Due to the TDM nature of the traffic, CBR service is typically the most expensive service offered by commercial carriers. For WAN Switching equipment, CBR connections are the simplest to configure and

troubleshoot.

There is no ingress VC\_Queue used for CBR service; BXM QBINs are used. If VC Shaping (for example, traffic shaping) is enabled per line, egress VC\_Queues are used. For WAN switch software release 9.1 and 9.2, do not enable VC Shaping on trunks unless VC Shaping functionality has been verified.

CBR connections are policed on the first Leaky Bucket and, if traffic does not comply, it is discarded. All non-compliant cells (whether CLP=0 or CLP=1) are discarded at the first Leaky Bucket. As CBR service is guaranteed at PCR, the second Leaky Bucket is not used to evaluate CBR traffic. Please refer to the Policing Option 4 diagram for an illustration.

## Connection Parameters

The parameters listed here are in the order that they appear in the **cnfcon** display.

- *PCR(0+1)*: This is the Peak Cell Rate for all traffic: CLP=0 and CLP=1.
- *% Util*: This is the amount of time the connection is expected to be transmitting at PCR (0+1) into the network.
- *CDVT(0+1)*: This is the CDVT for all traffic: CLP=0 and CLP=1
- *Policing*: The algorithm used to determine conformance to traffic contract.
- *Trunk Cell Routing Restrict*: Whether switch software routes the connection across a non-cell-based trunk.

## Details

*PCR(0+1)*:  $PCR(0+1) * (\% Util) =$  the amount of bandwidth allocated in the network for a CBR connection. This is expressed in load units on a trunk and can be inspected using the **dspload** `<trunk_number>` command.

*% Util*: For CBR traffic, it is recommended to leave % Util at 100.

*CDVT(0+1)*: The amount of 'clumping' between ATM cells. Some routers require high Cell Delay Variation Tolerance (CDVT) values (250,000 microseconds) due to performance issues. For voice, video, or circuit emulation services CDVT values such as 5,000 microseconds or less is desired to ensure constant play-out of cells.

When a CBR connection is used to provide a Virtual Trunk, the CDVT should be configured to accommodate all traffic streams that use the Virtual Trunk (for example, CBR, VBR, ABR, and UBR). Configuring a CBR connection that carries a Virtual Trunk with a small CDVT value such as 500 microseconds may result in traffic drops on the different data streams that ride over the Virtual Trunk.

The load model does not use CDVT to calculate bandwidth through the network. If CDVT is configured to be the maximum of 250000 for 1000 connections, the actual load on the network is significantly understated.

*Policing*: Can only be configured to 4 (CBR.1) or 5 (disabled) for CBR connections. For troubleshooting, it is recommended to disable policing by selecting 5 from the **cnfcon** command. After policing has been disabled, always remember to re-enable policing since one misbehaving connection can affect all connections of the same type on a port.

*Trunk Cell Routing Restrict*: This setting determines whether the connection can be routed across a non-cell-based trunk such as an NTM. For example, if Trunk Cell Routing Restrict is set to Y, then the connection will not route across an NTM trunk. The default setting for the Trunk Cell Routing Restrict parameter can be set from **cnfnodeparm** *Trk Cell Rtnng Restrict* parameter 41. This parameter is not applicable

and is not displayed for local (for example, DACs–type) connections. For troubleshooting, verify the Trunk Cell Routing Restrict setting at both ends of a connection using the **dspchcnf** command.

## Screen Shots

This is a sample CBR connection with incoming traffic set to 1000 CPS, PCR of 500 CPS, and policing option 4. Note the *NonCmplnt Dscd* is approximately one–half the offered rate of traffic.

```
sbpx3      TN      StrataCom      BPX 8620  9.2.22      Mar. 4 2000  12:15 GMT

Conn: 1.3.1.100      sbpx1      1.6.1.100      cbr      Status:OK
-----
PCR(0+1)      % Util      CDVT(0+1)      Policing
500/500      100/100      1000/1000      4

Trunk Cell Routing Restrict: Y

Last Command: cnfcon 1.3.1.100
```

```
sbpx3      TN      StrataCom      BPX 8620  9.2.22      Mar. 4 2000  12:14 GMT

Channel Statistics for 1.3.1.100      Cleared: Mar. 4 2000  12:13 (-) Snapshot
PCR: 500/500 cps      Collection Time: 0 day(s) 00:00:16      Corrupted: NO
-----
Traffic      Cells      CLP      Avg CPS      %util      Chan Stat Addr: 30F68E08
From Port :      16738      0      999      199      OAM Cell RX: Clear
To Network :      8369      ---      499      99
From Network:      8369      0      499      99
To Port :      8369      0      499      99

Rx Frames Rcv :      0      NonCmplnt Dscd:      8365      Rx Q Depth :      0
Tx Q Depth :      0      Rx CLP0 :      16738      Rx NW CLP0 :      8369
Igr VSVD ACR :      0      Egr VSVD ACR :      0      Tx Clp0 Port :      8369
Rx Clp0+1 Port:      16738      NCmp CLP0 Dscd:      8365      NCmp CLP1 Dscd:      0
Oflw CLP0 Dscd:      0      Oflw CLP1 Dscd:      0

Last Command: dspchstats 1.3.1.100 1
```

This is a sample CBR connection with incoming traffic set to 1000 CPS, PCR of 500 CPS, and policing option 5.

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 4 2000 12:43 GMT

Conn: 1.3.1.100 sbpx1 1.6.1.100 cbr Status:OK

<u>PCR(0+1)</u>	<u>% Util</u>	<u>CDWT(0+1)</u>	<u>Policing</u>
500/500	100/100	10000/10000	5

Trunk Cell Routing Restrict: Y

Last Command: cnfcon 1.3.1.100

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 4 2000 12:42 GMT

Channel Statistics for 1.3.1.100 Cleared: Mar. 4 2000 12:42 ( ) Snapshot

PCR: 500/500 cps Collection Time: 0 day(s) 00:00:07 Corrupted: NO

<u>Traffic</u>	<u>Cells</u>	<u>CLP</u>	<u>Avg CPS</u>	<u>%Util</u>	<u>Chan Stat</u>	<u>Addr: 30F68ECB</u>
----------------	--------------	------------	----------------	--------------	------------------	-----------------------

From Port	: 7961	---	0	1000	200	OAM Cell RX: Clear
-----------	--------	-----	---	------	-----	--------------------

To Network	: 7961	---	0	1000	200	
------------	--------	-----	---	------	-----	--

From Network	: 7961	---	0	1000	200	
--------------	--------	-----	---	------	-----	--

To Port	: 7961	---	0	1000	200	
---------	--------	-----	---	------	-----	--

Rx Frames Rcv	: 0	NonCmplnt Dscd	: 0	Rx Q Depth	: 0	
---------------	-----	----------------	-----	------------	-----	--

Tx Q Depth	: 0	Rx CLP0	: 7961	Rx Nw CLP0	: 7961	
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Igr VSVD ACR	: 0	Egr VSVD ACR	: 0	Tx Clp0 Port	: 7961	
--------------	-----	--------------	-----	--------------	--------	--

Rx Clp0+1 Port	: 7961	NCmp CLP0 Dscd	: 0	NCmp CLP1 Dscd	: 0	
----------------	--------	----------------	-----	----------------	-----	--

Of1w CLP0 Dscd	: 0	Of1w CLP1 Dscd	: 0			
----------------	-----	----------------	-----	--	--	--

Last Command: dspchstats 1.3.1.100 1

## dspchstats Detail

For switch software release 9.2.x and later, the *Tx Clp 0+1 Dscd*, *TX Clp 0 Dscd*, and the *TX Clp 1 Dscd* counters have been removed from the **dspchstats** screen and replaced with these counters:

- *Of1w CLP0 Dscd*
- *Of1w CLP1 Dscd*
- *NCmp CLP0 Dscd*
- *NCmp CLP1 Dscd*

The counters for **dspchstats**, including the four fields added in switch software release 9.2.x, are described in this table.

Field Name	Description	Connection Type
<i>Rx Frames Rcv</i>	Number of ingress ATM SAR PDU frames received. This is calculated in the RCMP using the ATM cell PTI field EOF marker.	VBR/ABR/UBR. AAL5 is required as EOF marker is used.
<i>TX Q Depth</i>	Depth (in cells) of the connection Egress Queue Engine on the BXM.	All
<i>Igr VSVD ACR</i>	Ingress VSVD ACR. The allowed cell rate (in cells) for ingress ABR traffic. This is non-configurable and varies based on whether any congestion is experienced at	ABR only. Field is used for ABR standard and ABR Foresight.

	the <b>local</b> end. PCR>ACR>MCR. ACR=ICR at T <sub>0</sub>	
<i>Rx Clp0+1 Port</i>	Number of cells marked with CLP=0 and CLP=1 received at the port (for example, from CPE). This indicates whether cells are received with CLP=1 from the other device.	All
<i>Oflw CLP0 Dscd</i>	CLP=0 cells dropped due to ingress Queue Engine (QE) overflow. This statistic is derived from the difference between the number of CLP=0 cells that arrive at the QE and the number of departing CLP=0 cells. This is not reliable for ABR connections because RM cells are sourced/terminated to/from the data stream by the QE. The statistics used to derive this counter are collected from the QE for each connection.	All
<i>NonCmplnt Dscd</i>	All cells (CLP=0 and CLP=1 traffic) dropped due to policing at the ingress of the connection. The policing depends upon which option has been selected for the connection (policing option 1, 2, 3, 4 or 5). This statistic is collected from the RCMP.	All
<i>Rx CLP0</i>	The number of cells marked CLP=0 received at the port (for example, from CPE). This can be used to determine the number of cells that are received with CLP=1 from the other device.	All
<i>Egr VSVD ACR</i>	Egress VSVD ACR. The allowed cell rate for egress ABR traffic. This is non-configurable and varies based on whether the external device sends information to the BPX BXM port. PCR>ACR>MCR. ACR=ICR at T <sub>0</sub>	ABR only.
<i>NCmp CLP0 Dscd</i>	CLP=0 cells dropped due to policing at the ingress of the	All

	connection. The policing depends upon which option has been selected for the connection (policing option 1, 2, 3, 4 or 5). This statistic is collected from the RCMP.	
<i>Oflw CLP1 Dscd</i>	CLP=1 cells dropped due to ingress Queue Engine (QE) overflow. This statistic is derived from the difference between the number of CLP=1 cells that arrive at the QE and the number of departing CLP=1 cells. This is not reliable for ABR connections because RM cells are sourced/terminated to/from the data stream by the QE. The statistics used to derive this counter are collected from the QE for each connection whether it is CBR, VBR, ABR, or UBR.	All
<i>Rx Q Depth</i>	Depth (in cells) of ingress connection queue.	All
<i>Rx Nw CLP0</i>	Number of cells received from the network (trunk) with CLP=0.	All
<i>TX Clp0 Port</i>	Number of cells transmitted to the port (for example, from CPE) with CLP=0.	All
<i>NCmp CLP1 Dscd</i>	CLP=1 cells dropped due to policing at the ingress of the connection. The policing depends upon which option is selected for the connection (policing option 1, 2, 3, 4 or 5). This statistic is collected from the RCMP.	All

## Variable Bit Rate (VBR)

### Real Time and Non-real Time Connections

VBR connections are classified into real time and non-real time categories.

Real time VBR connections are used to transport delay sensitive applications that may also exhibit bursty behavior, such as Voice Activity Detection (VAD) voice and data traffic in an ATM network.

Non-real time VBR connections are used to transport bursty data that is not sensitive to variation in delay in

an ATM network. The amount of bandwidth required for VBR connections is characterized by PCR, SCR, and MBS.

Due to the delay-sensitive nature of the traffic, rt-VBR service is typically more expensive than nrt-VBR, ABR, and UBR service offered by commercial carriers. For WAN switching equipment, VBR connections are simple to configure and troubleshoot. There is no VC\_Queue used for VBR service except on the egress direction when traffic shaping is enabled. BXM QBINs are also used. VBR connections are policed on both Leaky Buckets.

## Connection Parameters

These parameters are in the order that they appear in the **cnfcon** display.

- *PCR(0+1)*: This is the Peak Cell Rate for all traffic (CLP=0 and CLP=1).
- *% Util*: This is the amount of time the connection is expected to be transmitting at PCR (0+1) into the network.
- *CDVT(0+1)*: This is the CDVT for all traffic (CLP=0 and CLP=1).
- *AAL5 FBTC*: ATM Adaptation Layer type 5 Frame-Based Traffic Control.
- *SCR*: This is the Sustainable Cell Rate for all traffic (CLP=0 and CLP=1).
- *MBS*: Maximum Burst Size
- *Policing*: The algorithm used to determine conformance to traffic contract.
- *Trunk Cell Routing Restrict*: Whether switch software routes the connection across a non-cell-based trunk.

## Details

*PCR(0+1)*:  $PCR(0+1) * (\% Util) =$  the amount of bandwidth allocated in the network for a VBR connection. This is expressed in load units on a trunk and can be inspected using the **dsplload** `<trunk_number>` command.

*CDVT(0+1)*: The amount of 'clumping' between ATM cells. Some routers require high CDVT values (250,000) due to performance issues. This type of bursty traffic is suitable for nrt-VBR connection types. For the voice, video, or circuit emulation services, carried by rt-VBR connections, CDVT values such as 10,000 or less are desired to ensure rapid play-out of cells.

*AAL5 FBTC*: If this option is enabled, it is assumed that the connection carries AAL5 frames. The term frame means the AAL5 PDU. AAL5 cells contain information to indicate the start and end of frame. FBTC enables Early Packet Discard (EPD) on all via trunks for a specific connection. EPD is a mechanism to discard all the ATM cells associated with a frame before they are admitted to the network. Without EPD, parts of an ATM frame may be transmitted through the network consuming bandwidth and resources. EPD is configured using thresholds based on connection Queue depth. If Queue depth exceeds the configured threshold (CLP Low), the new data frame is not accepted when the Start-of-Frame AAL5 cell arrives. For VBR traffic, EPD is allowed for rt-VBR and is configured per port using the **cnfportq** `<slot_number.port_number>` command.

For purposes of this document, AAL5 FBTC is turned off to accommodate the traffic provided by the test set. The test set generates a constant stream of AAL1 traffic (no EOF flag). This traffic type causes inconsistent discards when AAL5 FBTC is Enabled. For AAL5 traffic, it is recommended to Enable AAL5 FBTC.

*SCR*: The sustained cell rate used with the maximum burst size for policing on the second Leaky Bucket. SCR is used as the average rate for traffic and service contracts are typically sold using the SCR as the defined rate. The service is typically guaranteed by configuring PCR to be greater than SCR as PCR is used to reserve network resources.

**MBS:** The maximum burst of cells that may be transmitted at the peak rate and not discarded or tagged. MBS is determined using burst tolerance, SCR, and the configured policing option.

**Policing:** Can be configured to 1 (VBR.1), 2 (VBR.2), 3 (VBR.3), 4 (CBR.1), or 5 (disabled) for VBR connections. For VBR traffic, valid policing types are 1, 2, 3, and 5. Policing types can be selected based on level of service. For VBR service advertising guaranteed SCR, policing option 3 is the most beneficial to the customer. Policing type 3 tags all cells above SCR (evaluated at the second leaky bucket) and only discards at the first leaky bucket. Policing types 1 and 2 support discards at the second leaky bucket, but policing type 2 avoids reevaluating CLP=1 cells. For troubleshooting, it is recommended to disable policing by selecting 5 using the **cnfcon** command. After policing has been disabled, always re-enable policing since one misbehaving connection can affect all connections of the same type on a port.

## Screen Shots

Sample rt-VBR connection with incoming traffic set to 1000 CPS (AAL1), PCR of 1000 CPS, and policing option 3.

```
sbpx3      TN      StrataCom      BPX 8620  9.2.22      Mar. 4 2000  12:34 GMT

Conn: 1.3.1.100      sbpx1      1.6.1.100      rt-vbr      Status:OK
  PCR(0+1)      % Util      CDVT(0+1)      AAL5 FBTC      SCR
  1000/1000      100/100      250000/250000      n      1000/1000

  MBS      Policing
  1000/1000      3
```

Trunk Cell Routing Restrict: Y

Last Command: cnfcon 1.3.1.100

```
sbpx3      TN      StrataCom      BPX 8620  9.2.22      Mar. 4 2000  12:35 GMT

Channel Statistics for 1.3.1.100      Cleared: Mar. 4 2000  12:35      (-)      Snapshot
PCR: 1000/1000 cps      Collection Time: 0 day(s) 00:00:06      Corrupted: NO
  Traffic      Cells      CLP      Avg CPS      %util      Chan Stat Addr: 30F68E08
From Port      :      6519      0      1020      102      OAM Cell RX: Clear
To Network      :      6519      ---      1020      102
From Network:      6519      0      1020      102
To Port      :      6519      0      1020      102

Rx Frames Rcv :      0      NonCmpInt Dscd:      0      Rx Q Depth      :      0
Tx Q Depth      :      0      Rx CLP0      :      6519      Rx Nw CLP0      :      6519
Igr VSVD ACR      :      0      Egr VSVD ACR      :      0      TX Clp0 Port      :      6519
Rx Clp0+1 Port:      6519      Ncmp CLP0 Dscd:      0      Ncmp CLP1 Dscd:      0
Oflw CLP0 Dscd:      0      Oflw CLP1 Dscd:      0
```

Last Command: dspchstats 1.3.1.100 1

Sample nrt-VBR connection with incoming traffic set to 1000 CPS (AAL1), PCR of 1000 CPS, and policing option 3.

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 4 2000 12:27 GMT

Conn: 1.3.1.100 sbpx1 1.6.1.100 nrt-vbr Status:OK

PCR(0+1)	% Util	CDVT(0+1)	AAL5 FBTC	SCR
1000/1000	100/100	250000/250000	n	1000/1000

MBS	Policing
1000/1000	3

Trunk Cell Routing Restrict: Y

Last Command: cnfcon 1.3.1.100

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 4 2000 12:25 GMT

Channel Statistics for 1.3.1.100 Cleared: Mar. 4 2000 12:24 (-) Snapshot

PCR: 1000/1000 cps Collection Time: 0 day(s) 00:00:11 Corrupted: NO

Traffic	Cells	CLP	Avg CPS	%util	Chan Stat Addr: 30F68EC8
From Port	11664	0	999	99	OAM Cell RX: Clear
To Network	11664	---	999	99	
From Network	11664	0	999	99	
To Port	11664	0	999	99	

Rx Frames Rcv :	0	NonCmplnt Dscd:	0	Rx Q Depth :	0
Tx Q Depth :	0	Rx CLP0 :	11664	Rx Nw CLP0 :	11664
Igr VSVD ACR :	0	Egr VSVD ACR :	0	TxClp0 Port :	11664
Rx Clp0+1 Port:	11664	NCmp CLP0 Dscd:	0	NCmp CLP1 Dscd:	0
Oflw CLP0 Dscd:	0	Oflw CLP1 Dscd:	0		

Last Command: dspchstats 1.3.1.100 1

This is a sample rt-VBR connection with incoming traffic at 1000 CPS (AAL1), PCR of 500 CPS, and policing option of 3. Note the *NonCmplnt Dscd* and *NCmp CLP0 Dscd* fields indicate CLP=0 discards at the first leaky bucket.

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 4 2000 12:36 GMT

Conn: 1.3.1.100 sbpx1 1.6.1.100 nrt-vbr Status:OK

PCR(0+1)	% Util	CDVT(0+1)	AAL5 FBTC	SCR
500/500	100/100	250000/250000	n	500/500

MBS	Policing
1000/1000	3

Trunk Cell Routing Restrict: Y

Last Command: cnfcon 1.3.1.100

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 4 2000 12:37 GMT

Channel Statistics for 1.3.1.100 Cleared: Mar. 4 2000 12:35 (|) Snapshot  
PCR: 500/500 cps Collection Time: 0 day(s) 00:02:16 Corrupted: NO

Traffic	Cells	CLP	Avg CPS	%util	Chan Stat Addr: 30F68E08
From Port :	137002	0	1000	200	OAM Cell RX: Clear
To Network :	126841	---	926	185	
From Network:	126841	0	926	185	
To Port :	126841	0	926	185	

Rx Frames Rcv :	0	<b>NonCmplnt Dscd:</b>	<b>10161</b>	Rx Q Depth :	0
Tx Q Depth :	0	Rx CLP0 :	137002	Rx NW CLP0 :	126841
Ign VSVD ACR :	0	Egr VSVD ACR :	0	Tx CLP0 Port :	126841
Rx CLP0+1 Port:	137002	<b>NCmp CLP0 Dscd:</b>	<b>10161</b>	NCmp CLP1 Dscd:	0
Oflw CLP0 Dscd:	0	Oflw CLP1 Dscd:	0		

Last Command: dspchstats 1.3.1.100 1

This is a sample nrt-VBR connection with incoming traffic at 1000 CPS (AAL1), PCR of 500, and policing of 3. Note the *NonCmplnt Dscd* and *NCmp CLP0 Dscd* fields indicate CLP=0 discards at the first leaky bucket.

```
sbpx3      TN      StrataCom      BPX 8620  9.2.22   Mar. 4 2000  12:29 GMT
```

```
Conn: 1.3.1.100      sbpx1      1.6.1.100      nrt-vbr      Status:OK
```

```
PCR(0+1)    % Util    CDVT(0+1)    AALS FBTC    SCR  
500/500     100/100    250000/250000    n            500/500
```

```
MBS         Policing  
1000/1000   3
```

```
Trunk Cell Routing Restrict: Y
```

```
Last Command: cnfcon 1.3.1.100 500/500 * * * 500/500 * * Y
```

```
sbpx3      TN      StrataCom      BPX 8620  9.2.22   Mar. 4 2000  12:30 GMT
```

```
Channel Statistics for 1.3.1.100      Cleared: Mar. 4 2000  12:24  ( ) Snapshot  
PCR: 500/500 cps      Collection Time: 0 day(s) 00:05:54      Corrupted: NO
```

```
Traffic      Cells      CLP      Avg CPS      %util      Chan Stat Addr: 90F68ECB  
From Port   :      354268      0      999      199      OAM Cell RX: Clear  
To Network  :      301301      ---      850      170  
From Network:      301300      0      850      170  
To Port     :      301300      0      850      170
```

```
Rx Frames Rcv :      0      NonCmpInt Dscd:      52965      Rx Q Depth   :      0  
Tx Q Depth   :      0      Rx CLP0      :      354268      Rx Nw CLP0   :      301300  
Ign VSVD ACR :      0      Egr VSVD ACR :      0      Tx Clp0 Port :      301300  
Rx Clp0+1 Port:      354268      NCmp CLP0 Dscd:      52965      NCmp CLP1 Dscd:      0  
OTLW CLP0 Dscd:      0      OTLW CLP1 Dscd:      0
```

```
Last Command: dspchstats 1.3.1.100 1
```

## Available Bit Rate (ABR)

### ABR Introduction

ABR connections are used for bursty, non-real time traffic such as file transfer in an ATM network. The ABR service category is used by connections that do not require a static amount of bandwidth that is continuously available during the connection lifetime. For ABR service, available bandwidth varies in the network, and feedback is used to control the source rate in response to bandwidth changes. The feedback is conveyed to the source through specific Resource Management (RM) cells.

ABR connections use peak cell rate (PCR) and minimum cell rate (MCR) to vary the source rate as necessary. For WAN Switching equipment, ABR connections are complex to configure and troubleshoot. There is a VC\_Queue and QBIN used for ABR service. ABR connections are policed using the generic algorithm illustrated in the Dual Leaky Bucket diagram.

Two types of ABR connections can be configured on WAN switches; ABR standard (abrstd) and ABR with Foresight (abrfst). Both ABR connection types use compliant ATM cells, but they use different mechanisms to implement traffic management.

ABR standard is the default ABR connection type when neither Foresight nor ABR standard with virtual source/virtual destination (VS/VD) have been enabled using **cnfswfunc**. ABR standard with VS/VD builds on the ABR standard connection by adding virtual endpoints for increased congestion control. ABR standard connection parameters are a subset of the ABR standard with VS/VD parameters, and are not addressed separately.

The Foresight or ABR standard with VS/VD feature only needs to be enabled on one BPX to propagate to all nodes. These are the only two software features that behave like system parameters configurable using the

**cnfsysparm** command. The Foresight software feature is billable and the ABR standard with VS/VD software feature is offered free of charge.

There are significant differences between ABR standard with VS/VD and Foresight connection parameters and performance measurements. The summary of differences is discussed in the Summary of ABR Connection Configuration Parameter Differences table.

## Resource Management (RM) Cells

RM cells are used to provide network feedback to the end-system. RM cells are used only for ABR connections. CBR, VBR, and UBR connections do not use RM cells.

RM cells for an ABR Standard (ABRSTD) connection are generated differently than the RM cells for an ABR with Foresight connection. See the Summary of ABR Connection Configuration Parameter Differences table for more information. Using RM cells for feedback results in increased values for the To Network and From Network fields in the **dspchstats** screen for switch software release 9.1.x and earlier. For information on later releases, refer to Changes for BXM Model F Firmware and Switch Software Release 9.2.x. The end-system Customer Premise Equipment (CPE) is expected to adapt to variation in network resources as communicated by RM cells. CPE adaptation is required to minimize cell loss. RM cells do not go through the VC-Queue, and are served directly by the QBIN.

For ABR standard with VS/VD (ABRSTD VS/VD) connections that have asymmetrical load, rate-based RM cells can present a problem as a different rate of BRM cells is generated for every FRM cell. Increasing the OOR RM cells on *ABR standard with VS/VD* connections (**cnfcon Nrm** value) mitigates this problem.

It is important to note that ABRSTD VS/VD connections generate RM cells from both endpoints towards the opposite end point. The RM cells generated using the default connection parameters add overhead of 6%. This percentage is calculated by adding the 3% overhead generated from each connection terminating point. The additional 6% of RM cells consume some of the allocated bandwidth budget for the connection and reduce the amount of available bandwidth for user traffic. For example, an ABRSTD connection with a PCR of 1000 cells per second (CPS) and all other parameters left to default limit the user traffic to approximately 940 CPS. The available bandwidth for user traffic may vary due to the granularity of the BXM. The equation used to calculate user traffic throughput for an ABRSTD VS/VD connection with a PCR of 1000 CPS is:

- $1000 \text{ CPS} - (1000 \text{ CPS} * 6\%) = 1000 - 60 = 940 \text{ CPS}$

If user traffic is required to run at a PCR of 1000 CPS, the connection PCR must be increased by at least 7% to allow user traffic to reach peak throughput. For example, if the peak user traffic throughput required is 1000 CPS and RM cell overhead is 6%, then the connection PCR should be configured for 1064 CPS. The equation used to calculate user traffic throughput of 1000 CPS for an ABRSTD VS/VD connection is:

- $\text{PCR}_{(\text{user cells and RM cells})} = \text{PCR}_{(\text{user cells})} / 94\% = 1000 / 0.94 = 1064 \text{ CPS}$

The percentage of RM cells with respect to user cells is controlled by two PVC parameters (RTRM and RNRM are variables):

<i>Trm</i>	If <i>Trm</i> = 100, then every 100 milliseconds (msec) an FRM cell is generated. TRM is time-based FRM cell generation that is most effective for low speed connections.	Can be one of 8 distinct values based on the following formula:  $Trm = 100 / 2^{RTRM}$ msec. Where
------------	---	--

		RTRM is between 0 and 7.
<i>Nrm</i>	If <i>Nrm</i> = 32, then for every 32 user data cells, an FRM cell is generated. NRM is rate-based FRM cell generation that is most effective for high speed connections.	Can be one of 8 distinct values based on the following formula:  $Nrm = 2 * 2^{RNRM}$ cells. Where RNRM is between 0 and 7.

If *Trm* is set to 100 msec, then one RM cell is generated every 100 msec when user traffic is present. An interval rate of 100 msec equates to an RM cell rate of 10 CPS. If *Nrm* is set to 32 cells, then one RM cell is generated for every 32 user data cells. The Broadband Switch Module (BXM) uses either the *Nrm* or *Trm* threshold based on the quantity of user traffic. For the values specified in the table, the *Trm* is the dominate factor for user data rates up to 320 CPS. At a user data rate of 320 CPS, *Nrm* also generates RM cells at 10 CPS. As the user data cell rate increases over 320 CPS, *Nrm* becomes the dominate factor and governs RM cell generation.

RM cell generation is equivalent for *Trm* and *Nrm* at 320 user data cells per second. The equation used to calculate equivalent RM cell generation for *Trm* and *Nrm* is provided here given these assumptions:

- A default *Trm* value of 100 msec gives an RM cell rate of 10 CPS.
- A default *Nrm* value generates RM cells at 10 CPS when the user data traffic reaches 320 CPS.

$$\text{User traffic rate} = 32 \text{ (user cells per RM cell)} * 10 \text{ RM CPS (default Trm rate)} = 320 \text{ (user data cells per second)}$$

The examples above utilize the Cisco default values for TRM and NRM. Each default value was chosen based on the ATM Forum recommendation.

## Connection Parameters

The parameters that are listed here are in the order that they appear in the **cnfcon** display.

- *PCR(0+1)*: This is the Peak Cell Rate for all traffic: CLP=0 and CLP=1.
- *% Util*: This is the amount of time the connection is expected to transmit at PCR (0+1) into the network.
- *MCR*: Minimum Cell Rate
- *CDVT(0+1)*: This is the CDVT for all traffic: CLP=0 and CLP=1
- *AAL5 FBTC*: ATM Adaptation Layer type 5 Frame-Based Traffic Control.
- *VSVD\**: Virtual Source Virtual Destination
- *FCES*: Flow Control External Segment
- *SCR*: This is the Sustainable Cell Rate for all traffic: CLP=0 and CLP=1
- *MBS*: Maximum Burst Size
- *Policing*: The algorithm used to determine conformance to traffic contract.
- *VC Qdepth*: Virtual Connection Queue Depth. Used only for VSVD connections.
- *CLP Hi*: Cell Loss Priority Tag High Threshold
- *CLP Lo/EPD*: Cell Loss Priority Tag Low Threshold/Early Packet Discard
- *EFCT*: Explicit Forward Congestion Indication
- *ICR*: Initial Cell Rate
- *ADTF*: ACR Decrease Time Factor
- *Trm*: Terminal RM cells

- *RIF*: Rate Increase Factor
- *RDF*: Rate Decrease Factor
- *Nrm\**: Maximum Number of cells between RM–cell generation
- *FRTT\**: Fixed Round–Trip Time
- *TBE\**: Transient Buffer Exposure
- *Trunk Cell Routing Restrict*: Whether switch software routes the connection across a non–cell–based trunk.

◆ \* ABR standard (abrstd) with VS/VD connections only. Not displayed for **abrfst** connections.

## Details

*PCR (0+1)*: This is the Peak Cell Rate for all traffic: CLP=0 and CLP=1.

*% Util*: This is the amount of time the connection is expected to transmit at PCR (0+1) into the network.

*MCR*: (*MCR (0+1)*) \* (% Util) is the amount of bandwidth allocated in the network for an ABR connection. This is expressed in load units on a trunk and can be inspected using the **dsplload <trunk\_number>** command.

*CDVT(0+1)*: The amount of 'clumping' between ATM cells. Some routers require high CDVT values (250,000) due to performance issues.

*AAL5 FBTC*: If this option is enabled, it is assumed that the connection carries AAL5 frames. The term frame means the AAL5 PDU. AAL5 cells contain information to indicate the start and end of frame. Frame–Based Traffic Control (FBTC) enables Early Packet Discard (EPD) on all trunks for a specific connection. EPD is a mechanism to discard all the ATM cells associated with a frame before they are admitted to the network. Without EPD, parts of an ATM frame may be transmitted through the network consuming bandwidth and resources. EPD is configured using thresholds based on connection Queue depth. If Queue depth exceeds the configured threshold, the new data frame is not accepted when the Start–of–Frame AAL5 cell arrives. For ABR traffic, EPD is configured per port using the **cnfportq <slot\_number.port\_number>** command.

When enabled, FBTC uses the *CLP Lo/EDP* value for ABR connections.

For purposes of this paper, AAL5 FBTC is turned off to accommodate the traffic provided by the test set. The test set generates a constant stream of ATM Adaptation Layer (AAL1) traffic (no EOF flag). This traffic type causes inconsistent discards when AAL5 FBTC is Enabled. For AAL5 traffic, it is recommended to Enable AAL5 FBTC.

*VSVD\**: This option allows the BXM to provide virtual management endpoints in a network. It cannot be configured for abrfst–type connections.

*FCES*: This option allows the BXM to provide congestion information to non–Cisco products using a standard interface. FCES extends ABR flow control to the external segment.

**Note**: Do not enable if the attached equipment does not support FCES.

*SCR*: This is the Sustainable Cell Rate for all traffic: CLP=0 and CLP=1.

*MBS*: The maximum burst of cells that may be transmitted at the peak rate and not be discarded or tagged. MBS is determined using burst tolerance, SCR, and the configured policing option.

*Policing*: Can only be configured to 1–4 (ABR.1) or 5 (disabled) for ABR connections. For troubleshooting, it is recommended to disable policing by selecting 5 from the **cnfcon** command.

*VC Qdepth*: Connection threshold that allows the maximum number of cells queued per VC. This buffer is provided after cells have been through the policing stage. Separate VC\_Queues are provided using the Schedule and ABR Engine (SABRE) chip for ABR connections. These VC\_Queues are provided in addition to connection queues used for the CBR, VBR, and UBR traffic types.

*CLP Hi*: Connection threshold that indicates when CLP=1 cells will start being discarded. This is performed in the VC\_Queue after policing. CLP Hi is expressed as the percentage of VC\_Queue depth.

*CLP Lo/EDP*: Connection threshold that indicates when CLP=1 cells will stop being discarded. If FBTC is enabled, it is the EDP threshold setting. This is performed in the VC Queue after policing. CLP Lo/EDP is expressed as the percentage of VC\_Queue depth.

*EFCI*: Connection threshold that uses the EFCI bit in the data cell to indicate congestion for abrfst connections. EFCI uses the CI bit in the RM cell to indicate congestion for abrst connections. It is recommended to set EFCI threshold lower than CLP Lo/EPD. EFCI is expressed as the percentage of VC\_Queue depth.

*ICR*: Rate at which connection is allowed to transmit at if connection is idle.

*ADTF*: ADTF is the idle time-out factor in milliseconds. If no RM cell is received within the time specified, the connection rate is ramped down to ICR. The BXM currently only supports these ADTF values:

- 62.5 msec
- 125 msec
- 250 msec
- 500 msec
- 1 sec
- 2 sec
- 4 sec
- 8 sec

*Trm*: Refer to the summary table.

*RIF*: Refer to the summary table.

*RDF*: Refer to the summary table.

*Nrm\**: Refer to the summary table.

*FRTT\**: Refer to the summary table.

*TBE\**: Refer to the summary table.

\* ABR standard (abrst) with VS/VD connections only. Not displayed for abrfst connections.

## Summary of ABR Connection Configuration Parameter Differences

ABR Standard with VS/VD	ABR with Foresight
TRM is the minimum FRM interval. If TRM=100, then every 100 milliseconds an FRM are generated.	Minimum rate adjust interval for RM cells (40 milliseconds). On BXM cards Foresight RTD is not supported.

RIF is an integer value. A large RIF means a small rate of increase. $ACR_1 = ACR_0 + (ACR_0/RIF)$	RIF is a decimal value. Switch software calculates the RIF based on PCR.
RDF is an integer value based on ACR. A large RDF means a slower rate of decrease. $ACR_1 = ACR_0 - (PCR/RDF)$	RDF is a percentage based on ACR. If RDF=93%, then 93% of the ACR is the current rate decrease factor.
NRM is the RM cell generation rate (for example, the number of RM cells in a block of cells). The default is 32 or 6% (for example, out of every 32 cells, an RM cell is issued).	Not applicable per connection. Use <b>cnffstparm</b> .
FRTT is the Fixed Round Trip Time in microseconds. To disable, use a value of 0.	Not applicable per connection. Use <b>cnffstparm</b> .
TBE is the Transient Buffer Exposure. The negotiated number of cells (0 – 1,048,320 cells) that the network would like to limit the source to sending during startup periods, before the first RM cell returns.	Not applicable per connection. Use <b>cnffstparm</b> .

## Summary of Differences Between ABR Standard With VS/VD and ABR With Foresight

ABR Standard With VS/VD	ABR With Foresight
FRM cells. The SABRE chip uses the CI bit of the FRM to generate the BRM.	No FRM cells. BCM cells are generated by destination every Rate Adjust Interval. The SABRE chip uses the EFCI bit of the data cell to set the CI bit of the BCM.
More overhead due to rate-based congestion control mechanism.	Less overhead due to the time-based congestion control mechanism.
RM cells typically increase the <b>dspchstats To Network and From Network</b> cell counts by 6%. These fields have higher cell counts than the 'From Port' and 'To Port'. For networks with limited resources, the connection PCR may need to be increased to account for the additional 6% of RM cells	RM cells typically increase the <b>dspchstats To Network and From Network</b> cell counts.

Quicker response to Rate Adjust messages (ATM Forum is rate-based so RM cells are released in accordance with the rate).	Slower response to the Rate Adjust messages. Rate adjustment is time based ( <b>cnfstparm</b> command).
Explicit Rate congestion control provides an accurate and immediate new rate.	Rates are adjusted by <i>rate up</i> and <i>rate down</i> parameters ( <b>cnfstparm</b> command).
TBE, FRTT, ICR, CRM improve avoidance of transient cell loss (initial start up of traffic flow).	Ignores ERS
Distributes buffers at each of the VS/VD loops for greater efficiency.	Relies on a few large buffers

## Screen Shots

This is a sample **abrfst** connection with incoming traffic at 1000 CPS, PCR of 1000, and a policing option of 3.

```
Conn: 1.3.1.100      sbpx1      1.6.1.100      abrfst      Status:OK
PCR(0+1)           % Util      MCR            ODVT(0+1)   AAL5 FBTC    FCES
1000/1000          100/100    50/50          250000/250000  n            n

SCR                MBS         Policing       VC Qdepth   CLP Hi CLP Lo/EDP   EFCI
1000/1000          1000/1000  3              16000/16000 80/80       35/35        20/20

ICR                ADF Trm       RIF           RDF
100/100            1000 100         10            93
```

Trunk Cell Routing Restrict: Y

Last Command: cnfcon 1.3.1.100

```
sbpx3      TN      StrataCom      BPX 8620  9.2.22      Mar. 6 2000  12:40 GMT
```

```
Channel Statistics for 1.3.1.100      Cleared: Mar. 6 2000 12:40 (/) Snapshot
MCR: 50/50 cps      Collection Time: 0 day(s) 00:00:05      Corrupted: NO
```

```
Traffic      Cells      CLP      Avg CPS      %util      Chan Stat Addr: 30F68BD0
From Port   :      5155      0      1000      2000      DAM Cell RX: Clear
To Network  :      5150      ---      1000      2000
From Network:      5149      0      999      1998
To Port     :      5095      0      989      1978
```

```
Rx Frames Rcv :      0 NonCmplnt Dscd:      0 Rx Q Depth   :      5840
Tx Q Depth    :      0 Rx CLP0      :      5155 Rx Nw CLP0   :      5149
Igr VSVD ACR :      1000 Egr VSVD ACR :      0 Tx Clp0 Port :      5095
Rx Clp0+1 Port:      5155 NCmp CLP0 Dscd:      0 NCmp CLP1 Dscd:      0
Of1w CLP0 Dscd:      0 Of1w CLP1 Dscd:      0
```

Last Command: dspchstats 1.3.1.100 1

This is a sample **abrfst** connection with incoming traffic at 1000 CPS, PCR of 500, and a policing option of 3. Note the *NonCmplnt Dscd*, *NCmp CLP0 Dscd*, *Igr VSVD ACR*, and *Rx Q Depth*.

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 6 2000 12:44 GMT

```
Conn: 1.3.1.100 sbpx1 1.3.1.100 abrfst Status:OK
PCR(0+1) % Util MCR CDVT(0+1) AAL5 FBTC FCES
500/500 100/100 50/50 250000/250000 n n

SCR MBS Policing VC Qdepth CLP Hi CLP Lo/EDP EFCI
500/500 1000/1000 5 16000/16000 80/80 35/35 20/20

ICR ADTF Trm RIF RDF
100/100 1000 100 10 93
```

Trunk Cell Routing Restrict: Y

Last Command: cnfcon 1.3.1.100

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 6 2000 12:43 GMT

```
Channel Statistics for 1.3.1.100 Cleared: Mar. 6 2000 12:43 (-) Snapshot
MCR: 50/50 cps Collection Time: 0 day(s) 00:00:18 Corrupted: NO
Traffic Cells CLP Avg CPS %util Chan Stat Addr: 30F68BD0
From Port : 18214 0 1000 2000 OAM Cell RX: Clear
To Network : 9098 --- 499 998
From Network: 9098 0 499 998
To Port : 8907 0 489 978

Rx Frames Rcv : 0 NonCmplnt Dscd: 9105 Rx Q Depth : 7877
Tx Q Depth : 0 Rx CLP0 : 18214 Rx Nw CLP0 : 9098
Igr VSVD ACR : 500 Egr VSVD ACR : 0 Tx Clp0 Port : 8907
Rx Clp0+1 Port: 18214 NCmp CLP0 Dscd: 9105 NCmp CLP1 Dscd: 0
Oflw CLP0 Dscd: 0 Oflw CLP1 Dscd: 0
```

Last Command: dspchstats 1.3.1.100 1

This is a sample **abrfst** connection with incoming traffic at 1000 CPS, PCR of 500, and a policing option of 5. Note the *Oflw CLP0 Dscd*, *NonCmplnt Dscd*, *NCmp CLP0 Dscd*, *Igr VSVD ACR*, and *Rx Q Depth*.

sbpx3 TN StrataCom BPX B620 9.2.22 Mar. 6 2000 17:31 GMT

```
Conn: 1.3.1.100 sbpx1 1.6.1.100 abrfst Status:OK
  PCR(0+1) % Util MCR CDVT(0+1) AAL5 FBTC FCES
  500/500 100/100 50/50 250000/250000 n n

  SCR MBS Policing VC Qdepth CLP Hi CLP Lo/EDP EFCI
  500/500 1000/1000 5 16000/16000 80/80 35/35
  20/20

  ICR ADTF Trm RIF RDE
  50/50 1000 100 10 93
```

Trunk Cell Routing Restrict: Y

Last Command: crfcon 1.3.1.100

sbpx3 TN StrataCom BPX B620 9.2.22 Mar. 6 2000 17:32 GMT

```
Channel Statistics for 1.3.1.100 Cleared: Mar. 6 2000 17:31 (/) Snapshot
MCR: 50/50 cps Collection Time: 0 day(s) 00:00:56 Corrupted: NO
  Traffic Cells CLP Avg CPS %util Chan Stat Addr: 90F68BD0
From Port : 56708 0 999 1998 OAM Cell RX: Clear
To Network : 27737 --- 489 978
From Network: 28327 0 499 998
To Port : 27737 0 489 978

Rx Frames Rcv : 0 NonCmpInt Dscd: 0 Rx Q Depth : 16384
Tx Q Depth : 0 Rx CLP0 : 56708 Rx Nw CLP0 : 28327
Igr VSVD ACR : 500 Egr VSVD ACR : 0 Tx CLP0 Port : 27737
Rx CLP0+1 Port: 56708 NCmp CLP0 Dscd: 0 NCmp CLP1 Dscd: 0
OT1W CLP0 Dscd: 29561 OT1W CLP1 Dscd: 0
```

This is a sample **abrst**d connection with incoming traffic at 1000 CPS, PCR of 1000, and a policing option of 3.

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 6 2000 12:35 GMT

```
Conn: 1.3.1.100 sbpx1 1.6.1.100 abrstd Status:OK
  PCR(0+1) % Util MCR CDVT(0+1) AALS FBTC VSVD FCES
  1000/1000 100/100 50/50 250000/250000 n y n

  SCR MBS Policing VC Qdepth CLP Hi CLP Lo/EDP EFCI
  1000/1000 1000/1000 3 16000/16000 80/80 35/35 20/20

  ICR ADTF Trm RIF RDF Nrm FRIT TBE
  100/100 1000 100 128 16 32 0 1048320
```

Trunk Cell Routing Restrict: Y

Last Command: crfcon 1.3.1.100

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 6 2000 12:36 GMT

```
Channel Statistics for 1.3.1.100 Cleared: Mar. 6 2000 12:33 (-) Snapshot
MCR: 50/50 cps Collection Time: 0 day(s) 00:02:35 Corrupted: NO
  Traffic Cells CLP Avg CPS %util Chan Stat Addr: 30F68BD0
From Port : 155190 0 1000 2000 GAM Cell RX: Clear
To Network : 155041 --- 999 1998
From Network: 155041 0 999 1998
To Port : 145351 0 936 1872

Rx Frames Rcv : 0 NonCmplnt Dscd: 0 Rx Q Depth : 14901
Tx Q Depth : 0 Rx CLP0 : 155190 Rx Nw CLP0 : 155041
Igr VSVD ACR : 1000 Egr VSVD ACR : 0 Tx Clp0 Port : 145351
Rx Clp0+1 Port: 155190 NCmp CLP0 Dscd: 0 NCmp CLP1 Dscd: 0
Oflw CLP0 Dscd: 0 Oflw CLP1 Dscd: 0
```

Last Command: dspchstats 1.3.1.100 1

This is a sample **abrstd** connection with incoming traffic at 1000 CPS, PCR of 500, and a policing option of 3. Note the *NonCmplnt Dscd*, *NCmp CLP0 Dscd*, *Igr VSVD ACR*, and *Rx Q Depth*.

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 6 2000 12:38 GMT

```
Conn: 1.3.1.100 sbpx1 1.6.1.100 abrstd Status:OK
-----
PCR(0+1) % Util MCR CDVT(0+1) AAL5 FBTC VSVD FCES
500/500 100/100 50/50 250000/250000 n y n

SCR MBS Policing VC Qdepth CLP Hi CLP Lo/EDP EFCI
500/500 1000/1000 3 16000/16000 80/80 35/35 20/20

ICR ADTF Irm RIF RDF Nrm FRIT TBE
100/100 1000 100 128 16 32 0 1048320
```

Trunk Cell Routing Restrict: Y

Last Command: cnfcon 1.3.1.100

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 6 2000 12:37 GMT

```
Channel Statistics for 1.3.1.100 Cleared: Mar. 6 2000 12:37 (|) Snapshot
MCR: 50/50 cps Collection Time: 0 day(s) 00:00:05 Corrupted: NO
-----
Traffic Cells CLP Avg CPS %util Chan Stat Addr: 30F68BD0
From Port : 5158 0 999 1998 OAM Cell RX: Clear
To Network : 2418 --- 468 936
From Network: 2496 0 488 966
To Port : 2418 0 468 936

Rx Frames Rcv : 0 NonCmplnt Dscd: 257B Rx Q Depth : 16384
Tx Q Depth : 0 Rx CLP0 : 5158 Rx Nw CLP0 : 2496
Ign VSVD ACR : 500 Egr VSVD ACR : 0 Tx Clp0 Port : 2418
Rx Clp0+1 Port: 5158 NCmp CLP0 Dscd: 257B NCmp CLP1 Dscd: 0
Oflw CLP0 Dscd: 318 Oflw CLP1 Dscd: 0
```

Last Command: dspchstats 1.3.1.100 1

## Changes for BXM Model F Firmware and Switch Software Release 9.2.x

BXM model F firmware introduces changes to the output of the **dspchstats** command. BXM model F firmware is available for registered Cisco.com users.

Due to an enhancement request for the BXM model F, RM cells in the *From Network* field are no longer registered or displayed. The *From Network* counter only registers and displays user data cells received from the crosspoint switch. RM cell discards have also been removed from the *Tx Clp 0+1 Dscd* and the *TX Clp 0 Dscd* registers.

For switch software release 9.2.x and later, the *TX Clp 0+1 Dscd*, *TX Clp 0 Dscd*, and the *TX Clp 1 Dscd* counters have been removed from the **dspchstats** screen and replaced with these counters:

<i>Oflw CLP0 Dscd</i>	Receive CLP 0 user cells discarded due to a
<i>Oflw CLP1 Dscd</i>	VC_Q overflow (Ingress). Receive CLP 1 user cells discarded due to a
<i>NCmp CLP0 Dscd</i>	VC_Q overflow (Ingress). Non-Compliant CLP 0 user cells discarded by
<i>NCmp CLP1 Dscd</i>	the policer (Ingress). Non-Compliant CLP 1 user cells discarded by
	the policer (Ingress).

```
sbpx1 TN StrataCom BPX 8620 9.2.31 July 13 2000 08:46 GMT
Channel Statistics for 1.6.1.100 Cleared: July 13 2000 07:46 (\) Snapshot
MCR: 500/500 cps Collection Time: 0 day(s) 00:03:55 Corrupted: NO
```

```

Traffic      Cells      CLP      Avg CPS      %util      Chan Stat Addr: 30F68BD0
From Port : 116432      0      495      99      OAM Cell RX: Clear
To Network : 124195      ---      528      105
From Network: 116433      0      495      99
To Port : 116433      0      495      99
Rx Frames Rcv : 0      NonCmplnt Dscd: 0      Rx Q Depth : 0
TX Q Depth : 0      Rx CLP0 : 116432      Rx Nw CLP0 : 116433
Igr VSVD ACR : 535      Egr VSVD ACR : 0      TX Clp0 Port : 116433
Rx Clp0+1 Port: 116432      NCmp CLP0 Dscd: 0      NCmp CLP1 Dscd: 0
Oflw CLP0 Dscd: 0      Oflw CLP1 Dscd: 0
Last Command: dspchstats 1.6.1.100 1

```

## Unspecified Bit Rate (UBR)

### UBR Introduction

UBR connections are used for bursty data, non-real time traffic (low priority file transfer) in an ATM network. The UBR service category is used by connections that do not require a static amount of bandwidth that is continuously available during the connection lifetime. There is no network bandwidth guaranteed for UBR service. UBR traffic is transported through the WAN Switching network on a best effort basis. Due to the best effort delivery of UBR traffic, it is typically the least expensive service offered by commercial carriers.

For WAN Switching equipment, UBR connections are simple to configure and troubleshoot. There is no VC\_Queue used for UBR service; only the BXM ABR QBIN. Since UBR traffic uses the same QBIN as ABR traffic and can be misconfigured, the two traffic types should not be mixed on the same BXM port.

UBR traffic must be configured for CLP=Y (UBR.2) if the ABR QBIN is shared with ABR traffic. Otherwise, UBR traffic looks like ABR traffic and can "starve out" the ABR traffic in the QBINs. UBR connections are policed using the Dual Leaky Bucket algorithm with the second leaky bucket sustainable cell rate (SCR) value hard coded in the BXM to 0. Only the first leaky bucket parameters can be configured for UBR connections.

### Connection Parameters

These parameters are in the order that they appear in the **cnfcon** display.

- *PCR(0+1)*: This is the Peak Cell Rate for all traffic (CLP=0 and CLP=1).
- *% Util*: This is the amount of time the connection is expected to be transmitting at PCR (0+1) into the network.
- *CDVT(0+1)*: This is the cell delay variation tolerance (CDVT) for all traffic (CLP=0 and CLP=1).
- *AAL5 FBTC*: ATM Adaptation Layer type 5 Frame-Based Traffic Control.
- *CLP Setting*: Cell Loss Priority Setting. Can be set to Yes (UBR.2) or No (UBR.1). The tagging limit is only the first 50 cells per second that are not tagged.
- *Trunk Cell Routing Restrict*: Whether switch software routes the connection across a non-cell-based trunk.

### Details

*PCR(0+1)*:  $(PCR (0+1)) * (\% Util) =$  the amount of bandwidth allocated in the network for a UBR connection. This is expressed in load units on a trunk and can be inspected using the **dsplload** **<trunk\_number>** command.

*% Util*: UBR traffic is treated with low priority as the default % utilization setting is 1%. Therefore, minimum network bandwidth and resources are reserved for UBR connections.

*CDVT(0+1)*: The amount of 'clumping' between ATM cells. Some routers require high CDVT values (250,000) due to performance issues. For voice, video, or circuit emulation services, CDVT values of 10,000 or less are desired to ensure rapid play-out of cells.

**AAL5 FBTC**: If this option is enabled, it is assumed that the connection carries AAL5 frames. The term 'frame' means the AAL5 PDU. AAL5 cells contain information to indicate the start and end of the frame. FBTC enables Early Packet Discard (EPD) on all trunks for a specific connection. EPD is a mechanism to discard all the ATM cells associated with a frame before they are admitted to the network. Without EPD, parts of an ATM frame may be transmitted through the network consuming bandwidth and resources. EPD is configured using thresholds based on connection Queue depth. If Queue depth exceeds the configured threshold, the new data frame is not accepted when the Start-of-Frame AAL5 cell arrives. For UBR traffic, EPD is configured per port using the **cnfportq <slot\_number.port\_number>** command.

For purposes of this document, AAL5 FBTC is turned off to accommodate the traffic provided by the test set. The test set is generating a constant stream of AAL1 traffic (no EOF flag). This traffic type will cause inconsistent discards when AAL5 FBTC is Enabled. For AAL5 traffic, you should enable AAL5 FBTC.

*CLP Setting*: If set to No, all cells that are compliant with the first leaky bucket are allowed into the network. This can be a problem if ABR and UBR connections share the same port and the Policing Options are similar. If ABR policing is set to 3, and UBR CLP is set to N (UBR.1), ABR and UBR traffic 'appears' the same to the network, and low priority UBR traffic is treated the same as higher priority ABR traffic. If ABR and UBR connections must share the same port, set CLP to Yes for the UBR connections.

If set to Yes, then all CLP=1 cells that are compliant with the first Leaky Bucket are admitted to the network and all CLP=0 cells that are compliant with the first Leaky Bucket are evaluated at the second Leaky Bucket (see Policing Option 3). Since SCR is hardcoded in the BXM to 0, the second Leaky Bucket is essentially always full, and all the CLP=0 cells are "tagged" (CLP is set to 1). This allows the network to recognize UBR cells as lower priority cells and available for discard in the event of network congestion.

## Screen Shots

This is a sample UBR connection with incoming traffic at 1000 CPS, PCR of 1000, and CLP=Y.

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 6 2000 12:48 GMT

Conn: 1.3.1.100 sbpx1 1.6.1.100 ubr Status:OK  
PCR(0+1) % Util CDVT(0+1) AAL5 FBTC CLP Setting  
1000/1000 1/1 250000/250000 n y

Trunk Cell Routing Restrict: Y

Last Command: cnfcon 1.3.1.100

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 6 2000 12:49 GMT

Channel Statistics for 1.3.1.100 Cleared: Mar. 6 2000 12:48 ( \ ) Snapshot  
PCR: 1000/1000 cps Collection Time: 0 day(s) 00:00:07 Corrupted: NO

Traffic	Cells	CLP	Avg CPS	%util	Chan Stat Addr: 30F68BD0
From Port :	7846	0	1000	100	DAM Cell RX: Clear
To Network :	7846	---	1000	100	
From Network:	7845	7450	1000	100	
To Port :	7845	7450	1000	100	

Rx Frames Rcv :	0	NonCmplnt Dscd:	0	Rx Q Depth :	0
Tx Q Depth :	0	Rx CLP0 :	7846	Rx Nw CLP0 :	395
Igr VSVD ACR :	0	Egr VSVD ACR :	0	Tx Clp0 Port :	395
Rx Clp0+1 Port:	7846	NCmp CLP0 Dscd:	0	NCmp CLP1 Dscd:	0
Oflw CLP0 Dscd:	0	Oflw CLP1 Dscd:	0		

Last Command: dspchstats 1.3.1.100 1

This is a sample UBR connection with incoming traffic at 1000 CPS, PCR of 500, and CLP=Y. Note the *NonCmplnt Dscd*, *NCmp CLP0 Dscd*, *Igr VSVD ACR*, and *Rx Q Depth*. The results are the same for CLP=N.

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 6 2000 12:49 GMT

Conn: 1.3.1.100 sbpx1 1.6.1.100 ubr Status:OK  
PCR(0+1) % Util CDVT(0+1) AAL5 FBTC CLP Setting  
500/500 1/1 250000/250000 n y

Trunk Cell Routing Restrict: Y

Last Command: cnfcon 1.3.1.100

sbpx3 TN StrataCom BPX 8620 9.2.22 Mar. 6 2000 12:50 GMT

Channel Statistics for 1.3.1.100 Cleared: Mar. 6 2000 12:49 ( - ) Snapshot  
PCR: 500/500 cps Collection Time: 0 day(s) 00:00:07 Corrupted: NO

Traffic	Cells	CLP	Avg CPS	%util	Chan Stat Addr: 30F68BD0
From Port :	7862	0	1000	200	DAM Cell RX: Clear
To Network :	3931	---	500	100	
From Network:	3931	3535	500	100	
To Port :	3931	3535	500	100	

Rx Frames Rcv :	0	NonCmplnt Dscd:	3931	Rx Q Depth :	0
Tx Q Depth :	0	Rx CLP0 :	7862	Rx Nw CLP0 :	396
Igr VSVD ACR :	0	Egr VSVD ACR :	0	Tx Clp0 Port :	396
Rx Clp0+1 Port:	7862	NCmp CLP0 Dscd:	3931	NCmp CLP1 Dscd:	0
Oflw CLP0 Dscd:	0	Oflw CLP1 Dscd:	0		

Last Command: dspchstats 1.3.1.100 1

## References

### Leaky Bucket Colloquial, Industry Slang Terms

Colloquial, Industry Slang Term	Definition
Dual Leaky Bucket	The algorithm used for conformance checking of cell flows against the set of parameters specified in the traffic contract.
First Leaky Bucket	Screens for traffic contract compliance. If a cell does not meet the terms of the traffic contract, the cell is discarded.
Second Leaky Bucket	Evaluates cells from the first leaky bucket to determine whether CLP tagging must be performed. A cell that is 'tagged' has the CLP bit set to 1.
Leak Rate	<del>The rate that cells flow into the network.</del>
Bucket Depth	Function that determines cell bursts.

### Acronyms

Acronym	Definition
AAL	ATM Adaptation Layer (traffic types are AAL1 for circuit emulation and AAL5 for data).
ABR	Available Bit Rate (ABR standard and ABR Foresight types).
ACR	<del>Allowed Cell Rate.</del>
ADTF	<del>ACR Decrease Time Factor.</del>
ATM	Asynchronous Transfer Mode. International standard for cell relay in which multiple service types (such as voice, video, or data) are conveyed in fixed-length (53-byte) cells. Fixed-length cells allow cell processing to occur in hardware, thereby reducing transit delays.
Bc	<del>committed Burst size.</del>
Be	<del>excess Burst size.</del>
BCM	Backward Congestion Management (cell type used for ABR Foresight connections).
BRM	Backward Resource Management (cell type used for ABR standard connections).
CBR	<del>Constant Bit Rate (no VC_Queue only QBIN).</del>
CCR	<del>Current Cell Rate.</del>
CDF	<del>Cell Decrease Factor.</del>

CDVT	Cell Delay Variation Tolerance. This is a mandatory parameter for any ATM connection type (CBR, VBR, ABR, and UBR).
CI	<del>Congestion Indication.</del>
CLP	Cell Loss Priority (equivalent to FR Discard Eligibility bit).
CLR	<del>Cell Loss Ratio.</del>
CPE	Customer Premise Equipment (for example, Cisco 7200 router)
CRM	Missing RM Cell count (CRM limits the number of FRM sent in the absence of received BRM).
CTD	<del>Cell Transfer Delay.</del>
EFCI	Explicit Forward Congestion Indication (equivalent to FR FECN; configured per port queue for the BXM).
Egr	<del>Egress.</del>
EOF	<del>End Of Frame.</del>
EPD	Early Packet Discard (part of FBTC; per-VC parameter; only apply to AAL5 traffic as AAL5 traffic has an EOF cell).
ER	<del>Explicit Rate.</del>
ERS	<del>Explicit Rate Stamping.</del>
FBTC	Frame-Based Traffic Control (entire AAL Protocol Data Unit or 'frame' is discarded).
FCES	Flow Control External Segment (must be enabled on both ends of a connection or not at all. Available only for ABR Standard with VS/VD or ABR ForesSight connections).
FECN	<del>Forward Explicit Congestion Notification.</del>
FGCRA	Frame-Generic Cell Rate Algorithm (proprietary extension to GCRA used for ASI cards).
FR	<del>Frame Relay.</del>
FRTT	<del>Fixed Round-Trip Time.</del>
GCRA	Generic Cell Rate Algorithm (ATM Traffic Management Specification Version 4.0 policing algorithm).
GFC	<del>Generic Flow Control (field of ATM UNI cell).</del>
IBS	<del>Initial Burst Size (equivalent to Frame Relay Cmax).</del>
ICR	<del>Initial Cell Rate (equivalent to Frame Relay QIR).</del>
Igr	Ingress (ingress is always with respect to the backplane).
IISP	

	Interim Inter-Switch Protocol (interim protocol to PNNI).
ILMI	Interim Local Management Interface (equivalent to FR LMI on ATM UNI).
MBS	<del>Maximum Burst Size (equivalent to FR Be).</del>
MCR	<del>Minimum Cell Rate (equivalent to FR MIR).</del>
NNI	<del>Network Node Interface.</del>
NRM	Maximum Number of cells between RM-cell generation.
nrt-VBR	<del>Non-real time VBR.</del>
Oflw	<del>Overflow.</del>
OOD	<del>Out-Of-Rate (applies to RM cell generation).</del>
PCR	Peak Cell Rate (equivalent to Frame Relay PIR). This is a mandatory parameter for any ATM connection type (CBR, VBR, ABR, and UBR).
PDU	<del>Protocol Data Unit.</del>
PNNI	Private Network Node Interface (used for Network-to-Network communication).
PPD	Partial Packet Discard (part of FBTC; per-VC parameter; only apply to AAL5 traffic as AAL5 traffic has an EOF cell).
PTI	Payload Type Indicator (ATM cell field used to specify AAL1 or AAL5 traffic types and congestion).
OAM	<del>Operations, Administration and Maintenance.</del>
QE	Queue Engine. BXM subsystem that manages all VC and Class of Service queues (QBINS) and maintains connection and port statistics.
RCMP	Routing Control, Monitor, and Policing subsystem (BXM policing function) that resides on a chip developed by PMC/Sierra. The RCMP implements the Dual Leaky Bucket algorithm, manages ATM layer OAM flows, and determines the connection ID from Cell Header.
RDF	<del>Rate Decrease Factor.</del>
RIF	<del>Rate Increase Factor.</del>
RM	Resource Management cells (apply only to ABR connections).
RR	<del>Relative Rate.</del>
rt-VBR	Real time VBR (ATM trunk QBIN type used for VAD voice).
SAR	Segmentation And Reassembly (one of the two sublayers in the ATM Adaptation Layer. The SAR sublayer divides information to be carried by the

	ATM layer into segments suitable for carrying in the 48–octet information field of the ATM cell and vice versa).
SCR	Sustainable Cell Rate (equivalent to FR CIR).
STI	StrataCom Trunk Interface (proprietary ATM–like cell used on legacy cards such as the ASI, BNI, ALM, and BTM).
TBE	Transient Buffer Exposure.
TDM	Time Division Multiplex.
TRM	Terminal RM.
UBR	Unspecified Bit Rate (traffic type that uses ABR queues. This is due to inherent unfairness in queuing design that do not configure UBR and ABR connections over the same port).
UNI	User Network Interface.
UPC	Usage Parameter Control.
VAD	Voice Activity Detection (used to reduce bandwidth required for voice traffic).
VBR	Variable Bit Rate.
VC	Virtual Connection.
VCC	Virtual Channel Connection (connection with the format x.x.x.x).
VPC	Virtual Path Connection (connection with the format x.x.x.*).
VS/VD	Virtual Source/Virtual Destination (ABR connections only).

## Concepts and Definitions

- **Congestion** is the increase in cell rate to the network until throughput is negatively impacted. Congestion results in discarded traffic. For WAN Switching equipment, congestion indicators are set in the:
  - ◆ VC\_Queue (EFCI bit)
  - ◆ Port Queue (EFCI bit)
  - ◆ Trunk Queue (EFCI bit)

Congestion occurs on WAN Switching network trunks that route more connections than they have bandwidth to support.
- **Foresight** is a Cisco, proprietary, closed–loop, congestion–prevention algorithm for Available Bit Rate (ABR) traffic. Foresight increases or decreases the service rate for a VC\_Queue to control the speed (or rate) of a connection.
- **Overbooking** is the practice of routing more connections over a trunk than a trunk can support by adjusting one or more connection parameters.

For example, a T3 (44.736 Mbps) trunk can be overbooked by reducing the %util parameter on all connections routed over the T3 trunk. Overbooking allows carriers to route many times the traffic supported by a T3 over the T3 trunk. For example, carriers may route 60 Mbps of connection

bandwidth over a 44.736 Mbps (T3) trunk.

Overbooking results in network congestion if all connections routed over the T3 trunk are in use and actively transmitting data at the same time.

- **Policing** is the function implemented at the 'edge' of the WAN Switching network in BXM line cards that enforces the compliance of every ATM connection to the negotiated traffic contract. Policing is often used as a substitute for Usage Parameter Control (UPC).

Policing is independent of the congestion-related discards that may happen to a connection once it has been admitted into the network.

- **PTI Field** is the 3-bit field of an ATM cell that is used to indicate data or management cell payload type, cell congestion, and EOF of an AAL5 PDU.
- **QBIN** is a shared class-of-service FIFO buffer that services ATM and legacy connections like CBR, VBR, ABR/UBR. For example, all CBR connections on a BXM virtual interface (VI) share the same QBIN. There are 16 QBINs per VI.
- **Token Bucket** is a formal definition of a rate of transfer. It has three components: a burst size, a mean rate, and a time interval (Tc). A token bucket is used to manage a device that regulates the flow's data.
- **VC\_Queue** is a FIFO buffer that is created for each connection when the connection is added. VC\_Queue has configurable thresholds for EFCI, CLP Hi, CLP Lo. For ABR connections, cells move from VC\_Queues to QBINs at the Allowed Cell Rate as determined by the ATM Forum ABR algorithm or the Cisco Foresight algorithm.
- **VS/VD** is an ATM Forum standard-based closed-loop congestion prevention algorithm for ABR traffic.
- **Usage Parameter Control (UPC)** is implemented in the BPX BXM card as specified by ATM Traffic Management Specification Version 4.0. UPC represents a set of actions taken by the network to monitor and control traffic offered by the end user.

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## Related Information

- **BPX 8600 Architecture and Performance**
- **Virtual Trunking and Traffic Shaping on BPX 8600 Series**
- **BPX Congestion Avoidance**
- **Cisco BPX 8680 IP+ATM Wide-Area Switch**
- **SONET Automatic Protection Switching (APS) on the BPX 8600 Series**
- **Policing and Shaping Overview**
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