Teldat Router

Bandwidth Reservation System

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Chapter 1
Introduction

1. Bandwidth Reservation System (BRS)

The Bandwidth Reservation System (BRS) is a feature that allows you to decide which packets to drop when demand (traffic) exceeds supply (throughput) on a network connection. **Teldat Router** does not use BRS until there are requests for more than 100 % of the available line bandwidth.

BRS reserves transmission bandwidth for a network connection. This reservation feature allocates minimum percentages of total connection bandwidth for specified classes of traffic. Table 1 shows the components of BRS classes.

These reserved percentages are a minimum slice of bandwidth for the network connection. If a network is operating to capacity, the router can only transmit a message if transmitting it does not exceed the bandwidth allocated for the class. When this happens, the router holds the transmission until other bandwidth transmissions have been satisfied. In the case of a light traffic path, a packet stream can use bandwidth exceeding its allowed minimum up to 100% if there is no other traffic.

Bandwidth reservation is really a safeguard. In general, a network should not attempt to use greater than 100% of its line speed. If it does, a faster line is probably needed. The bursty nature of traffic, however, can drive the requested transmission rate to exceed 100% for a short time. In these cases, bandwidth reservation is enabled and the higher priority traffic is ensured delivery (i.e., it is not discarded). If the traffic, over time, surpasses the line capacity, packets will begin to be discarded although in such a way that the bandwidth percentages assigned to the distinct classes are still fulfilled.

Bandwidth reservation is a feature that runs over the following data-link types:

- Frame Relay
- X.25 Line
- PPP Line
- ISDN Interface

Table 1

WAN Interface[1]	Class[2] A	Bandwidth[3] %	protocol, tag or filter[4]	priority level[5]
			protocol, tag or filter	priority level
			protocol, tag or filter	priority level
	Class B	Bandwidth %	protocol, tag or filter	priority level
			protocol, tag or filter	priority level
			protocol, tag or filter	priority level
	Class C	Bandwidth %	protocol, tag or filter	priority level
			protocol, tag or filter	priority level
			protocol, tag or filter	priority level

1. A X.25 Line, PPP Line, ISDN Interface or Frame Relay permanent virtual circuit.
2. BRS class.
3. Percent of the interface's bandwidth for this BRS class. Use the **ADD-CLASS** command.
4. Type of packet in the BRS class. Use the **ASSIGN** command.
5. Priority level for packets with a given protocol, TAG or filter. Use the **ASSIGN** command.

Note: For Frame Relay interfaces, a group of one or more Frame Relay circuits can have a different type of BRS Class, called a circuit class. The circuit class gets a reserved percentage of the bandwidth of the Frame Relay interface.

2. Priority Queuing

Bandwidth reservation allocates percentages of total connection bandwidth for specified traffic classes (defined by the user). A BRS class is a group of packets identified by the same name; for example, a class called “ipx” to designate all IPX packets.

With priority queuing, you can assign each bandwidth class one of the following priority level settings:

- `URGENT`
- `HIGH`
- `NORMAL (the default setting)`
- `LOW`

All packets assigned the Urgent priority are sent first within their class. These packets are followed by High, Normal, and then Low messages respectively. When all Urgent packets have been transmitted until all are sent (or until new Urgent messages are queued). Only when there are no Urgent, High, or Normal packets remaining are the Low priority packets transmitted. If no priority setting is assigned, the setting defaults to Normal.

You can also set the number of packets that can be queued for each priority level in each bandwidth class. The BRS **QUEUE-LENGTH** command sets the maximum number of output packets that can be queued in each BRS priority queue. It also sets the maximum number of output packets that can be queued in each BRS priority queue when the router input buffers are scarce.

> ***Caution: If you set the values for queue length too high, you may seriously degrade the performance of your router.***

You can set priority queue lengths for each type of WAN interface that BRS supports: X.25 Line, and Frame Relay.

The priority settings in one bandwidth class do not affect other bandwidth classes. No one bandwidth class has priority over the others. You can only map a network protocol (or several grouped protocols) or filters to a class.

3. Bandwidth Reservation With Priority Queuing

When you configure priority queuing without bandwidth reservation, the router delivers the highest priority traffic first. In instances of heavy high priority traffic, the router can never attend or give service to the lower priority levels. By combining priority queuing with bandwidth reservation, however, you can allocate packet transmission to all bandwidths.

WARNING: We recommend that prioritizing is only configured for very important traffic that is both sporadic and light such as alarms etc. If not, you run the risk of paralyzing traffic that has a lower priority.

4. Filtering and Bandwidth Reservation

Using bandwidth reservation, you can assign the following filters (via the assign command) to specific types of traffic:

- IP
- X28
- ARP
- SNA-X25
- BAN/ASRT
- TUNNELING-IP
- SDLC-IP
- RLOGIN-IP
- TELNET-IP
- NETBIOS
- SNA
- SNMP-IP
- MULTICAST-IP
- DLSW-IP
- XOT-IP

You can also assign tags in order to filter MAC frames (you need to have previously configured the MAC filter facility assigning the tag corresponding to a MAC filter):

- TAG1
- TAG2
- TAG3
- TAG4
- TAG5

You can additionally assign filter to the UDP or TCP ports. In order to do this, use the tags detailed below. The assignment between ports and tags is carried out within the Bandwidth Reservation configuration itself.

- UDP-TCP0
- UDP-TCP1
- UDP-TCP2
- UDP-TCP3
- UDP-TCP4
- UDP-TCP5
- UDP-TCP6
- UDP-TCP7
- UDP-TCP8
- UDP-TCP9

4.1. Filters and Tags for IP Multicast Addressing and MAC Addressing

The router handles MAC address filtering by a joint effort between bandwidth reservation and MAC Filtering (MCF) using tags. For example, a user with bandwidth reservation is able to categorize bridge traffic by assigning a tag to it.

You assign tags by creating a filter item in the MAC filtering configuration process and then assigning a tag to it. This tag is then used to set up a bandwidth class for all packets associated with this tag. Tag values must be in the range of 1 to 64.

> ***Note: Tags can only be applied to bridged packets, and ONLY the MAC Address fields of the packet can be used in applying the tag. Up to five tagged MAC filters can be set from 1 to 5. TAG1 is searched for first, then TAG2, and so on up to TAG5. A single MAC filter tag can consist of any number of MAC Addresses set in MCF.***

Once a tagged filter has been created in the MAC filtering configuration process, it is assigned a class and priority in the bandwidth reservation configuration process. The tag command is then used in the bandwidth reservation process to reference the tag.

Tags can also refer to "groups", as in the example of IP Tunnel. IP Tunnel endpoints can belong to any number of groups. Packets are assigned to a particular group through the tagging feature of MAC filtering.

Applying bandwidth reservation and queuing priority to tagged packets involves the following:

1. Use the MAC filtering configuration commands at the *filter Config>* prompt to set up tags for packets passing through the bridge.
2. Use the bandwidth reservation tag command to reference a tag for bandwidth reservation.
3. With the bandwidth reservation assign command, specify a class name for the tag. The assign command then prompts you for a queuing priority within that BRS class.

4.2. Filters for the TCP/UDP ports

Bandwidth Reservation permits you to create filter for the TCP/UDP ports. In this way, the traffic coming from or destined to a port or group of ports can have a specific class assigned. This means that a percentage of the bandwidth can be reserved for UDP or TCP traffic. E.g. if you create a filter for a range of ports from 20 to 21, you are filtering all the FTP traffic whether the router itself is the source or destination, as if it had simply been forwarded by it.

In order to create a TCP/UDP filter, use the **PUT-UDP-TCP-FILTER** command that permits you to assign a range of ports to each one of the ten tags available (UDP-TCP0 to UDP-TCP9).

Once the filter has been created, a class and a priority can be assigned through the **ASSIGN** command.

4.3. Order of Precedence

It is possible for a packet to fall under several filterable classes. For example, an IP Tunneled bridged packet for SNA with a filter for a MAC Address. The order for resolving the filtering priority for this packet goes as follows:

1. MAC Address match for bridging (IP/ASRT) tag 1 to tag 5
2. NETBIOS for bridging (IP/ASRT)
3. SNA for bridging (IP/ASRT)

4. IP tunneling (IP)
5. SDLC relay (IP)
6. Multicast (IP)
7. SNMP (IP)
8. Rlogin (IP)
9. Telnet (IP)
10. DLSw (IP)
11. XOT (IP)

5. Bandwidth Reservation Over Frame Relay

When you run bandwidth reservation over Frame Relay, there are two areas where you can allocate bandwidth : the circuit layer and the interface layer.

The per-circuit bandwidth allocation works similarly to X.25 Line. Packets are filtered and queued into BRS classes based on protocols and filters assigned to the configured per-circuit classes.

The actual amount of bandwidth available for bandwidth reservation depends upon how you configure the interface and circuit:

- If you enable Frame Relay CIR monitoring, the bandwidth available to the circuits is allocated strictly according to its Committed Information Rate (CIR), its Committed Burst Size (CBS), and its Excess Burst Size (EBS).
- If you disable CIR monitoring, up to 100 percent of the bandwidth of the interface may be available to a circuit.

Orphaned circuits and circuits without BRS explicitly enabled may use a default BRS queuing environment.

Each circuit also competes for bandwidth on the physical serial line. Bandwidth allocation at the physical interface segments the circuit into classes. The percentage of bandwidth allocated to each class of circuits is configurable. Orphaned circuits and circuits not assigned to a circuit class are put in the default circuit class.

To display reservation counters for the circuit classes for an interface, use the following bandwidth reservation monitoring commands:

- CLEAR-CIRCUIT-CLASS
- COUNTER-CIRCUIT-CLASS
- LAST-CIRCUIT-CLASS

The interface is the one shown in your prompt for the bandwidth monitoring commands. For example, BRS [i 5] > is the prompt for interface 5.

BRS classes are most useful when CIR monitoring is not enabled. If you do not want to use BRS classes, leave all circuits in the default class and do not create any other circuit classes.

5.1. Queuing Support

In those Frame Relay interfaces that do not have the Bandwidth Reservation facility enabled, the traffic from all the DLCIs is put into a single queue whose length is determined by the current availability of the buffers in the router. This characteristic permits the device to cope with heavy traffic bursts during a certain period of time without discarding frames.

When the Bandwidth Reservation is enabled, although neither class nor protocol has been configured, a queue exists for each DLCI whose lengths are determined in the Bandwidth Reservation default configuration.

Chapter 2
Configuration

1. Displaying the BRS Configuration Prompt

To access BRS configuration commands and to configure BRS on your router, do the following:

1. At the Config> prompt, enter **LIST DEVICES** to see a list of interfaces configured on the router. You use the interface number to configure an interface for bandwidth reservation.

2. At the Config> prompt, enter **FEATURE BANDWIDTH-RESERVATION**.

```
Config> FEATURE BANDWIDTH-RESERVATION
Bandwidth Reservation User Configuration
BRS Config>
```

3. At the BRS Config> prompt, enter **DEVICE** followed by the number of the interface you want to configure for BRS. For example, to configure interface 0 for BRS enter

```
BRS Config> DEVICE 0
BRS [i 0] Config>
```

4. At the BRS [i 0] Config> prompt, enter **ENABLE**.

```
BRS [i 0] Config> ENABLE
```

Please restart router for this command to take effect

5. For Frame Relay interfaces select PVCs using the **CIRCUIT** command. At the BRS [i 0] [dlci 16] Config> prompt, enter **ENABLE**. (This is the circuit prompt, and the circuit number is 16 in this example.)

```
BRS [i 0] Config> CIRCUIT
Circuit to reserve bandwidth [16]?16
BRS [i 0] [dlci 16] Config>
```

6. Restart your router.

7. Repeat steps 2 through 4 to configure BRS for the particular interface that you have enabled.

8. At the BRS [i 0][dlci 16] Config> prompt, configure the bandwidth reservation parameters for the selected interface by using the appropriate configuration commands discussed in this chapter. If this is a Frame Relay interface, configure circuit classes at this prompt.

9. For Frame Relay interfaces, select PVCs using the circuit command. At the BRS [i 0][dlci 16] Config> prompt configure the bandwidth reservation parameters for the selected circuit using configuration commands discussed in this chapter. (This is the circuit prompt, and the circuit number is 16 in this example).

10. Restart your router.

To return to the Config> prompt at any time, enter **EXIT** at the BRS Config>

IMPORTANT: The Bandwidth reservation system configuration must be carried out once the device's interfaces have been configured. However should you wish to make any subsequent changes in the interface configuration it is strongly recommended that as a general rule you eliminate any previously configured BRS. In order to do this, use the CLEAR-BLOCK command.

2. Configuration Commands

The following table describes the bandwidth reservation configuration commands. The commands marked by an asterisk are used only with Frame Relay. (The asterisk is not part of the command).

Bandwidth Reservation Configuration Commands

Command	Function
? (HELP)	Displays the bandwidth reservation configuration commands or lists options for specific commands (if available).
ADD-CIRCUIT-CLASS*	Sets the name of a circuit class and its percentage of bandwidth.
ADD-CLASS	Allocates a designated amount of bandwidth to a user-defined bandwidth class.
ASSIGN	Assigns a protocol or filter to reserved class.
ASSIGN-CIRCUIT*	Assigns a specified circuit to the specified circuit class.
CHANGE-CIRCUIT-CLASS*	Changes the percentage of the bandwidth to be used by the group of circuits assigned to the designated class.
CHANGE-CLASS	Changes the amount of bandwidth configured for a bandwidth class.
CIRCUIT	Selects the DLCI of a Frame Relay permanent virtual circuit.
CLEAR-BLOCK	Clears the current reservation configuration from configuration memory (Note: This command requires a router restart).
DEASSIGN	Restores a specified protocol or filter to its default class and priority.
DEASSIGN-CIRCUIT*	Deassigns the specified circuit from the circuit class to which it was assigned.
DEFAULT-CIRCUIT-CLASS*	Assigns the name of the default circuit class.
DEFAULT-CLASS	Sets the default class and priority to a desired value.
DEL-CIRCUIT-CLASS*	Deletes the specified circuit class.
DEL-CLASS	Deletes a previously configured bandwidth class from the specified interface.
DISABLE	Disables bandwidth reservation on the interface or Frame Relay circuit. (**Note:** This command requires a router restart).
ENABLE	Enables bandwidth reservation on the interface or Frame Relay circuit. (**Note:** This command requires a router restart).
DEVICE	Selects the serial interface that will run bandwidth reservation. Use this command to enable BRS on an interface. Note: You must enter this command BEFORE using any other configuration commands.
LIST	Displays the currently defined bandwidth classes by their guaranteed percentage rates and priority queuing values stored in the SRAM. Also displays the assigned protocols and filters.

	(For Frame Relay, this command provides two levels of information).
QUEUE-LENGTH	Sets maximum and minimum values for the number of packets in a priority queue.
SHOW	Displays the currently defined bandwidth classes stored in RAM. (For Frame Relay, this command provides two levels of information).
TAG	Assigns a class and priority to a filter that has been tagged during the configuration of the MAC filtering feature.
UNTAG	Removes the tag/tag name relationship and the tag name from the list of assignable filters.
PUT-UDP-TCP-FILTER	Associates a tag with a range of TCP/UDP ports in order to subsequently assign a class and priority through the **ASSIGN** command.
REMOVE-UDP-TCP-FILTER	Eliminates an association between a tag (UDP-TCP0 to UDP-TCP9) and a range of TCP/UDP ports.
EXIT	Exits from one BRS level to another or exits the bandwidth reservation configuration process.

Letters written in **bold type** are the minimum set of characters you must enter to use a command properly.

Except for the commands marked with an asterisk, which are only for Frame Relay, the commands in the above table are the same for configuring bandwidth reservation for Frame Relay, and X.25.

> ***Note: When you enter the CLEAR-BLOCK, DISABLE, ENABLE, LIST, and SHOW commands from within the BRS interface level, they affect or list the bandwidth reservation information configured for the selected interface. When you enter these commands from within the BRS circuit level, they affect only the FR bandwidth reservation information configured for the Permanent Virtual Circuit (PVC).***

Before using the bandwidth reservation commands, keep the following in mind:

- You must use the **DEVICE** command to select a serial interface **BEFORE** you use any other configuration commands. BRS configuration enforces this.
- The Class-name parameter is case-sensitive.
- To view the current class names, use the **LIST** or **SHOW** command.

2.1. ? (HELP)

Lists the available commands from the current prompt level. You can also enter **?** after a command to list its options.

Syntax:

```
BRS Config> ?
```

Example:

```
BRS Config> ?
DEVICE
LIST
EXIT
BRS Config>
```

2.2. ADD-CIRCUIT-CLASS

Use the **ADD-CIRCUIT-CLASS** command at the interface level to allocate a designated amount of bandwidth to be used by the group of Frame Relay circuit assigned to the circuit class.

Syntax:

```
BRS Config> ADD-CIRCUIT-CLASS <class-name> <%>
```

Example:

```
BRS Config> ADD-CIRCUIT-CLASS alpha 10
BRS Config>
```

Here *class-name* is the ASCII string assigned as the name of the circuit class, and % is a percentage of the bandwidth - between 1 and 100 - of the interface.

2.3. ADD-CLASS

Use the **ADD-CLASS** command to allocate a designated amount of bandwidth to a user-defined bandwidth class.

Syntax:

```
BRS Config> ADD-CLASS <class-name> <%>
```

Example:

```
BRS Config> ADD test 20
BRS Config>
```

Here *class-name* is the ASCII string assigned as the name of the bandwidth class, and % is a percentage of the bandwidth of the interface or Frame Relay circuit.

2.4. ASSIGN

Use the **ASSIGN** command to assign specified tags, protocol packets, or filters to a given class. The four priority types include:

- Urgent
- High
- Normal (the default priority)
- Low

Syntax:

```
BRS Config> ASSIGN <protocol> or <TAG> or <filter> <class-name>
```

Example:

```
BRS Config> ASSIGN SNA test
priority <URGENT/HIGH/NORMAL/LOW> [NORMAL]? low
BRS Config>
```

2.5. ASSIGN-CIRCUIT

Use the **ASSIGN-CIRCUIT** command at the interface level to assign the specified circuit (DLCI) to the specified circuit class.

Syntax:

```
BRS Config> ASSIGN-CIRCUIT <#> <class-name>
```

Example:

```
BRS Config> ASSIGN-CIRCUIT 16 pubs
BRS Config>
```

2.6. CHANGE-CIRCUIT-CLASS

Use the **CHANGE-CIRCUIT-CLASS** command at the interface level to change the percentage of the bandwidth to be used by the group of circuits assigned to the circuit class.

Syntax:

```
BRS Config> CHANGE-CIRCUIT-CLASS <class-name> <%>
```

Example:

```
BRS Config> CHANGE-CIRCUIT-CLASS alpha 20
BRS Config>
```

2.7. CHANGE-CLASS

Use the **CHANGE-CLASS** command to change the amount of bandwidth configured for a bandwidth class.

Syntax:

```
BRS Config> CHANGE-CLASS <class-name> or <class#> <%>
```

Example:

```
BRS Config> CHANGE test 10
BRS Config>
```

2.8. CIRCUIT

Selects the DLCI of a Frame Relay PVC to configure. You can issue this command only from the BRS interface configuration prompt (BRS [i #] Config>).

Syntax:

```
BRS [i #] Config> CIRCUIT <permanent-virtual-circuit #>
```

Example:

```
BRS [i #] Config> CIRCUIT 16
BRS [i #] Config>
```

When the Frame Relay circuit is enabled, you can use the following commands at the circuit prompt:

- ENABLE
- DISABLE
- ADD-CLASS
- DEL-CLASS
- CHANGE-CLASS
- DEFAULT-CLASS
- TAG
- UNTAG
- ASSIGN

- DEASSIGN
- QUEUE-LENGTH
- LIST
- SHOW
- CLEAR-BLOCK
- EXIT

2.9. CLEAR-BLOCK

Clears the current bandwidth reservation configuration from SRAM for the current interface or Frame Relay PVC. This command requires a router restart.

Syntax:

```
BRS Config> CLEAR-BLOCK
```

Example:

```
BRS Config> CLEAR-BLOCK
You are about to clear BRS configuration information
Are you sure you want to do this (Yes or No): y
BRS [i #] Config>
```

2.10. DEASSIGN

Use the **DEASSIGN** command to restore a specified protocol, TAG, or filter to its default class and priority.

Syntax:

```
BRS Config> DEASSIGN <protocol> or <TAG> or <filter>
```

Example:

```
BRS Config> DEASSIGN IP
BRS Config>
```

2.11. DEASSIGN-CIRCUIT

Use the **DEASSING-CIRCUIT** command at the interface level to deassign the specified circuit (DLCI) from the circuit class to which it was previously assigned.

Syntax:

```
BRS Config> DEASSIGN-CIRCUIT <permanent-virtual-circuit #>
```

Example:

```
BRS Config> DEASSIGN 16
BRS Config>
```

2.12. DEFAULT-CIRCUIT-CLASS

Use the **DEFAULT-CIRCUIT-CLASS** command at the interface level to select the name of the default circuit class.

Syntax:

```
BRS Config> DEFAULT-CIRCUIT-CLASS <class-name>
```

Example:

```
BRS Config> DEFAULT-CIRCUIT-CLASS group
BRS Config>
```

2.13. DEFAULT-CLASS

Sets the default class and priority to a desired value. If no value has been previously assigned, system default values are used. Otherwise, the last previously assigned value is used.

Syntax:

```
BRS Config> DEFAULT-CLASS <class-name>
```

Example:

```
BRS Config> DEFAULT-CLASS test
BRS Config>
```

2.14. DEL-CIRCUIT-CLASS

Use the **DEL-CIRCUIT-CLASS** command at the interface level to delete the specified bandwidth class.

Syntax:

```
BRS Config> DEL-CIRCUIT-CLASS <class-name>
```

Example:

```
BRS Config> DEL-CIRCUIT-CLASS group
BRS Config>
```

2.15. DEL-CLASS

Deletes a previously configured bandwidth class from the specified interface or Frame Relay circuit.

Syntax:

```
BRS Config> DEL-CLASS <class-name> or <class#>
```

Example:

```
BRS Config> DEL-CLASS IP
BRS Config>
```

2.16. DISABLE

Disables bandwidth reservation on the interface or Frame Relay circuit. This command requires a router restart. To verify that bandwidth reservation is disabled, enter **LIST**.

Syntax:

```
BRS Config> DISABLE
```

Example:

```
BRS Config> DISABLE
BRS Config>
```

2.17. ENABLE

Enables bandwidth reservation on the interface or Frame Relay circuit. This command requires a router restart.

Syntax:

```
BRS Config> ENABLE
```

Example:

```
BRS Config> ENABLE
BRS Config>
```

2.18. DEVICE

Selects the serial interface to which bandwidth reservation configuration commands are applied. Bandwidth reservation is supported Frame Relay, and X.25 interfaces.

> ***Note: To enter bandwidth reservation commands for a new interface, you must enter this command BEFORE using any other bandwidth reservation monitoring commands. If you have exited the bandwidth reservation monitoring prompt (BRS>) and want to return to monitor bandwidth reservation, you must again enter this command first.***

To configure bandwidth reservation on a particular interface, at the BRS Config> prompt, enter the number of the interface that supports the particular protocol or feature.

Syntax:

```
BRS Config> DEVICE <interface #>
```

Example:

```
BRS Config> DEVICE
BRS for which interface [0]?2
BRS [i 2] Config>
```

2.19. LIST

Displays currently defined bandwidth classes by their guaranteed percentage rates and priority queuing values stored in SRAM. This command also displays all assigned protocols and filters.

Syntax:

```
BRS Config> LIST
```

Example:

```
BRS Config> LIST
```

Depending on the prompt at which you enter LIST, various outputs appear. You can enter LIST from the following example prompts:

BRS Config>

BRS [i 2] Config> (for X25 interface 2)

BRS [i 1] Config> (for FR interface 1)

BRS [i 1] [dlci 17] Config> (for circuit 17 on FR interface 1)

For example, the following output appears when you enter LIST at the BRS Config> prompt:

Example:

```
BRS Config> LIST
Bandwidth Reservation is available for 2 interfaces.
 More ?
Interface  Type  State
---------  ----  -------
1          FR    Enabled
2          X25   Enabled
BRS Config>
```

We can see that BRS facilities are available for Frame Relay and X.25 interfaces.

The following output appears when you enter **LIST** at the BRS [i 2] Config>:

Example:

```
BRS [i 2] Config> LIST
BANDWIDTH RESERVATION listing from SRAM
Bandwidth Reservation is enabled
interface number 2
maximum queue length 10 minimum queue length 3
total bandwidth allocated 50%
total classes defined (counting one local and one default) 2

class LOCAL has 10% bandwidth allocated
protocols and filters cannot be assigned to this class

class DEFAULT has 40% bandwidth allocated
More ?
the following protocols and filters are assigned:
    Protocol IP with default priority
    Protocol X28 with default priority
    Protocol ARP with default priority
    Protocol SNA-X25 with default priority
    Protocol BAN/ASRT with default priority

assigned tags:
default class is DEFAULT with priority NORMAL
BRS [i 2] Config>
```

The above list appears by default when you enter the Bandwidth Reserve configuration for the first time for an already enabled X.25 interface. From the start there are always two classes available:

- the LOCAL class: this class can never be deleted and it cannot be assigned a bandwidth of less than 10% (it can be increased). This class is reserved for traffic generated locally in the device, in other words all the traffic that does not come from switching but is generated internally and mainly comes from routing protocols (RIP, OSPF), generation of maintenance packets, pings, etc. Neither protocols nor filters can be assigned to this class.
- the DEFAULT class: as the name indicates this is the default class where initially all the available protocols in the device are assigned and at first has 40% bandwidth allocated.

The rest of the values that appear are the ones used by default.

The following output appears when you enter **LIST** at the BRS [i 1] Config>:

Example:

```
BRS [i 1] Config> LIST
BANDWIDTH RESERVATION listing from SRAM
Bandwidth Reservation is enabled
interface number 1
maximum queue length 10 minimum queue length 3
total bandwidth allocated 20%
total circuit classes defined (counting one default) 2

class DEFAULT has 10% bandwidth allocated
the following circuits are assigned:
17
16
More?
default class is DEFAULT
BRS [i 1] Config>
```

The above list appears by default when you enter the Bandwidth Reserve configuration for the first time for an already enabled Frame Relay interface. From the start there is always one class available:

- the DEFAULT class: as the name indicates this is the default class. This is the class where initially all the circuits for which the Bandwidth Reserve is enabled are assigned. This type contains two circuits (17 and 16), and this means that the Bandwidth Reserve is enabled for these two circuits. The initial bandwidth assigned for this type is 10%.

The rest of the values that appear are the ones used by default.

The following output appears when you enter **LIST** at the BRS [i 1] [dlci 17] Config>:

Example:

```
BRS [i 1] [dlci 17] Config> LIST
BANDWIDTH RESERVATION listing from SRAM
Bandwidth Reservation is enabled
interface number 1 circuit number 17
maximum queue length 10 minimum queue length 3
total bandwidth allocated 100%
total circuit classes defined (counting one local and one default) 3

class LOCAL has 10% bandwidth allocated
protocols and filters cannot  be assigned to this class.

class DEFAULT has 5% bandwidth allocated
More?
the following protocols and filters are assigned:
    Protocol IP with default priority
    Protocol X28 with default priority
    Protocol ARP with default priority

class sna has 85% bandwidth allocated
the following protocols and filters are assigned:
    Protocol SNA-X25 with priority NORMAL
    Protocol X28 with priority NORMAL

assigned tags:

default class is DEFAULT with priority NORMAL
BRS [i 1] [dlci 17] Config>
```

When we make this list for the first time for circuit 17 (and once the Bandwidth Reserve is enabled), we should obtain a very similar one to the one in the X.25 interface example. From the start there are always two classes available:

- the LOCAL class: this class can never be deleted and it cannot be assigned a bandwidth of less than 10% (it can be increased). This class is reserved for traffic generated locally in the device, in other words all the traffic that does not come from switching but is generated internally and mainly comes from routing protocols (RIP, OSPF), generation of maintenance packets, pings, etc. Neither protocols nor filters can be assigned to this class.
- the DEFAULT class: as the name indicates this is the default class where initially all the available protocols in the device are assigned and at first has 40% bandwidth allocated.

The rest of the values that appear are the ones used by default. However, in the above list we can see that another type has been created, the SNA type and that various protocols have been assigned to it.

The **LIST** command is very similar to the show command. However, **SHOW** displays current settings from the active RAM.

Note. For Frame Relay, there are two levels of this command: the interface level and the circuit level.

2.20. QUEUE-LENGTH

Caution: Do not use this command unless it is essential to do so. TELDAT recommends the default values for queue length for most users. If you set the values for queue length too high, you may seriously degrade the performance of your router.

Sets the number of packets that the router can queue in each BRS priority queue. Each BRS class has a priority value that you assigned to its protocols, filters and tags. Each priority queue can hold the number of packets that you specify with this command.

This command sets the maximum number of output packets that can be queued in each BRS priority queue. It also sets the maximum number of output packets that can be queued in each BRS priority queue when the **Teldat Router** input buffers are scarce (in this case the value known as *queue minimum length* is applied).

If you issue **QUEUE-LENGTH** for a X.25 or PSL interface or a dial circuit, the command sets the queue length values for each priority queue of each BRS class that is defined for the interface.

If you issue **QUEUE-LENGTH** for a Frame Relay interface (at a prompt like this: BRS [i 0] Config>), the command sets the default queue length values for each priority queue of each BRS class that is defined for each permanent virtual circuit of the interface.

If you issue **QUEUE-LENGTH** for a Frame Relay PVC (at a prompt like this: BRS [i 0] [dlci 16] Config>), the command sets the queue length values for each priority queue of each BRS class that is defined for the PVC. These values override the default queue length values set for the Frame Relay interface.

WARNING: You must use this command in order to increase the size of the queues when, for example, the circuit is operating with some type of fragmentation.

Syntax:

```
BRS Config> QUEUE-LENGTH <maximum-length> <minimum-length>
```

Example:

```
BRS Config> QUEUE-LENGTH
BRS priority queue maximum length [10]?
BRS priority queue minimum length [3]?
BRS Config>
```

2.21. SHOW

Displays the currently defined bandwidth classes stored in RAM.

Syntax:

```
BRS Config> SHOW
```

Example:

```
BRS Config> SHOW
```

Depending on the prompt at which you enter **SHOW**, various outputs are displayed. You can enter **SHOW** from the following prompts:

BRS [i 2] Config> (for X.25 interface)

BRS [i 1] Config> (for FR interface 1)

BRS [i 1] [dlci 17] Config> (for circuit 17 on FR interface 1)

The following output appears when you enter **SHOW** at the BRS [i 2] Config>:

Example:

```
BRS [i 2] Config> SHOW
BANDWIDTH RESERVATION currently in RAM
interface number 2
maximum queue length 10 minimum queue length 3
2 current defined classes
class LOCAL
class DEFAULT
protocol and filter assignments:
  More?
Protocol/Filter  Class     Priority
---------------  -------   ----------
IP               DEFAULT   NORMAL
X28              DEFAULT   NORMAL
ARP              DEFAULT   NORMAL
SNA-X25  DEFAULT  NORMAL
BAN/ASRT       DEFAULT NORMAL
BRS [i 2] Config>
```

The above list appears by default when you enter the Bandwidth Reserve configuration for the first time for an already enabled X.25 interface.

The following output appears when you enter **SHOW** at the BRS [i 1] Config>:

Example:

```
BRS [i 1] Config> SHOW
BANDWIDTH RESERVATION currently in RAM
interface number 1
maximum queue length 10 minimum queue length 3
circuit assignments:
  more?
Circuit Class
---------      ------
17      DEFAULT
BRS [i 1] Config>
```

The above list appears by default when you enter the Bandwidth Reserve configuration for the first time for an already enabled X.25 interface.

The following output appears when you enter **SHOW** at the BRS [i 1] [dlci 17] Config>:

Example:

```
BRS [i 1] [dlci 17] Config> SHOW
BANDWIDTH RESERVATION currently in RAM
interface number 1 circuit number 17
maximum queue length 10 minimum queue length 3
3 current defined classes
class LOCAL
class DEFAULT
class SNA

protocol and filter assignments:

  More?
Protocol/Filter    Class     Priority
---------------    -------   ----------
IP                 DEFAULT   NORMAL
X28                DEFAULT   NORMAL
ARP                DEFAULT   NORMAL
SNA-X25            sna       NORMAL
BAN/ASRT           sna       NORMAL
BRS [i 2] Config>
```

In the above example you can see that a new class has been created, (as well as those created by default) sna class, to which two protocols with normal priority have been assigned.

2.22. TAG

Assigns a class and priority to a filter that has been tagged using the MAC filtering feature. The command requires a filter tag number (configured in Mac Filtering), to reference the tag in bandwidth reservation.

You can set up to five tagged MAC addresses 1 to 5. TAG1 is searched for first, then TAG2, and so on up to TAG5.

Any newly added address filter can then be assigned a tag (as any other protocol or filter) with the **ASSIGN** command.

Syntax:

```
BRS Config> TAG <tag #>
```

Example:

```
BRS Config> TAG 3
BRS Config>
```

2.23. UNTAG

Removes the tag/tag name relationship and the tag name from the list of assignable filters. A tag can only be removed if it is not assigned to any class.

Syntax:

```
BRS Config> UNTAG <tag #>
```

Example:

```
BRS Config> UNTAG 3
BRS Config>
```

2.24. PUT-UDP-TCP-FILTER

Assigns a TCP/UDP filter tag (UDP-TCP0 to UDP-TCP9) to a range of TCP/UDP ports. This subsequently permits you to assign a class and priority to the TCP/UDP filter through the **ASSIGN** command.

Syntax:

```
BRS Config> PUT-UDP-TCP-FILTER
```

Example:

```
BRS [i 1] [dlci 16] Config> PUT-UDP-TCP-FILTER
Lower Udp-tcp port number[1]? 20000
Higher Udp-tcp port number[65535]? 20020
BRS [i 1] [dlci 16] Config>
```

By executing this command, the filter for all the traffic destined or coming from any port pertaining to the 20000-20020 (inclusive) range is defined. If you wish to create a filter for the traffic corresponding to a unique port, you must introduce a range in which the lower port is equal to the higher port.

Once the filter has been created, you can assign a class and a priority through the **ASSIGN** command. For example:

```
BRS [i 1] [dlci 16] Config> ASSIGN UDP-TCP0 clase1
Priority <URGENT/HIGH/NORMAL/LOW>[NORMAL]?
BRS [i 1] [dlci 16] Config>
```

The tags are assigned in ascending order. You can consult the information through the **LIST** command:

```
BRS [i 1] [dlci 16] Config> LIST

bandwidth reservation is enabled
interface number 1 circuit number 16
maximum queue length 10 minimum queue length 3
total bandwidth allocated 60%
total classes defined (counting one local and one default) 3


class LOCAL has 10% bandwidth allocated
  protocols and filters cannot be assigned to this class.


class DEFAULT has 40% bandwidth allocated

  the following protocols and filters are assigned:
    protocol IP with default priority
    protocol X28 with default priority
    protocol ARP with default priority
    protocol SNA-X25 with default priority
    protocol BAN/ASRT with default priority

class clase1 has 10% bandwidth allocated
  the following protocols and filters are assigned:
    filter UDP-TCP0 with priority NORMAL
 logically set to tag  20000, 20020

assigned tags:
assigned udp-tcp ports:
  UDP-TCP0 represents udp-tcp port range 20000  20020


default class is DEFAULT with priority NORMAL
BRS [i 1] [dlci 16] Config>
```

2.25. REMOVE-UDP-TCP-FILTER

Eliminates the association between a TCP/UDP filter tag (UDP-TCP0 to UDP-TCP9) and a range of TCP/UDP ports.

Syntax:

```
BRS Config> REMOVE-UDP-TCP-FILTER
```

Example:

```
BRS [i 1] [dlci 16] Config> REMOVE-UDP-TCP-FILTER
Lower Udp-tcp port number[1]? 20000
Higher Udp-tcp port number[65535]? 20020
BRS [i 1] [dlci 16] Config>
```

2.26. EXIT

Use the exit command to return to the previous prompt.

Syntax:

```
BRS Config> EXIT
```

Example:

```
BRS Config> EXIT
Config>
```

Chapter 3
Monitoring

1. Displaying the BRS Prompt

To access bandwidth reservation monitoring commands and to monitor bandwidth reservation on your router, do the following:

1. At the + prompt, enter **FEATURE BANDWIDTH-RESERVATION**.

```
+FEATURE BANDWIDTH-RESERVATION
Bandwidth Reservation console
BRS>
```

2. At the BRS> prompt, enter **DEVICE** followed by the number of the interface that you want to monitor.

```
BRS> DEVICE 4
BRS [i 4]>
```

3. For Frame Relay PVCs, enter **CIRCUIT** to monitoring BRS for a particular PVC.

```
BRS [i 4]> CIRCUIT
Circuit number: [16]?
BRS [i 4] [dlci 16]>?
```

To return to the + prompt at any time, enter **EXIT**.

2. Monitoring Commands

The following table describes the bandwidth reservation monitoring commands. You enter the commands at the BRS> prompt.

Bandwidth Reservation Monitoring Commands

Command	Function
?(HELP)	Displays all the bandwidth reservation commands or lists subcommand options for specific commands (if available).
CIRCUIT	Selects the DLCI of a Frame Relay permanent virtual circuit (PVC). To monitor Frame Relay bandwidth reservation traffic, you must be at the circuit prompt level.
CLEAR	Clears the current reservation counters and stores them as **LAST** command counters. Counters are listed by class usage.
CLEAR-CIRCUIT-CLASS	Clears the reservation counters for all the circuit classes of the interface.
COUNTERS	Displays the current counters.
COUNTERS-CIRCUIT-CLASS	Displays the current counters for all the circuit classes of the interface.
DEVICE	Selects the serial interface that will run bandwidth reservation. **Note**: You must enter this command **BEFORE** you use any other bandwidth reservation monitoring commands.
LAST	Displays the last saved statistics.
LAST-CIRCUIT-CLASS	Displays the last saved statistics for all the circuit classes of the interface.
EXIT	Exits the bandwidth reservation monitoring process.

Letters written in **bold type** are the minimum set of characters you must enter to use a command properly.

2.1. ? (HELP)

Lists the commands that are available from the current prompt. You can also enter **?** after a command to list its options.

Syntax:

```
BRS> ?
```

Example:

```
BRS> ?
INTERFACE
EXIT
BRS>
```

2.2. CIRCUIT

Use the **CIRCUIT** command to select the DLCI of a Frame Relay PVC for monitoring. You can enter this command only from the BRS interface monitoring prompt (BRS [i #]>).

Syntax:

```
BRS [i #]> CIRCUIT <permanent-virtual-circuit #>
```

Example:

```
BRS [i #]> CIRCUIT 16
BRS [i 16]>
```

After you can selected the FR circuit, you can use the following commands at the circuit prompt:

- COUNTERS
- CLEAR
- LAST
- EXIT

2.3. CLEAR

Clears from RAM the current bandwidth reservation counters for the selected interface or Frame Relay circuit, and stores them as counters that you can display with the **LAST** command.

Syntax:

```
BRS> CLEAR
```

Example:

```
BRS> CLEAR
BRS>
```

2.4. CLEAR-CIRCUIT-CLASS

Enter **CLEAR-CIRCUIT-CLASS** at the BRS [i #]> prompt. It clears the current bandwidth reservation counters for the circuit classes of the selected Frame Relay interface. This command clears the counters from RAM and stores them as counters that you can display with **LAST-CIRCUIT-CLASS**.

Syntax:

```
BRS [i #]> CLEAR-CIRCUIT-CLASS
```

Example:

```
BRS [i #]> CLEAR-CIRCUIT-CLASS
BRS [i #]>
```

2.5. COUNTERS

Displays statistics describing bandwidth reservation traffic for the selected interface or Frame Relay circuit according to the configured classes.

Syntax:

```
BRS  [i #] [dlci #]> COUNTERS
```

Example:

```
BRS  [i 1] [dlci 17]> COUNTERS
Bandwidth Reservation Counters
Interface number 1 circuit number 17
Class       Pkt Xmit    Bytes Xmit    Bytes Ovfl
LOCAL       25          234           0
DEFAULT     190         7409          0
sna         4           513           0

TOTAL       119         8156          0
BRS  [i 1] [dlci 17]>
```

2.6. COUNTERS-CIRCUIT-CLASS

Enter **COUNTERS-CIRCUIT-CLASS** at the BRS [i #]> prompt. It displays statistics describing bandwidth reservation traffic for the circuit classes of the selected Frame Relay interface.

Syntax:

```
BRS  [i #]> COUNTERS-CIRCUIT-CLASS
```

Example:

```
BRS  [i #]> COUNTERS-CIRCUIT-CLASS
Bandwidth Reservation Circuit Class Counters
Interface 0
Class      Pkt Xmit    Bytes Xmit      Bytes Ovfl
DEFAULT    103         57692           0
new        2149        1730056         0
CLASS2     0           0               0
TOTAL      2252        1787748         0
BRS  [i #]>
```

2.7. DEVICE

Selects the serial interface to which bandwidth reservation monitoring commands are to be applied. Bandwidth reservation is supported on routers running Frame Relay, and X.25 interfaces.

> ***Note: To enter bandwidth reservation commands for a new interface, you must enter this command BEFORE using any other bandwidth reservation monitoring commands. If you have exited the bandwidth reservation monitoring prompt (BRS>) and want to return to monitor bandwidth reservation, you must again enter this command first.***

To monitor bandwidth reservation on a particular interface, at the BRS> prompt, enter the number of the interface.

Syntax:

```
BRS> DEVICE <interface #>
```

Example:

```
BRS> DEVICE 0
BRS [i 0]>
```

2.8. LAST

Displays the last saved bandwidth reservation statistics. The statistics are displayed in the same format as they are for the **COUNTERS** command.

Syntax:

```
BRS> LAST
```

Example:

```
BRS> LAST
BRS>
```

2.9. LAST-CIRCUIT-CLASS

Enter **LAST-CIRCUIT-CLASS** at the BRS [i #]> prompt. It displays the last saved bandwidth reservation statistics for the circuit classes of the selected Frame Relay interface. The statistics are displayed in the same format as they are for the **COUNTERS-CIRCUIT-CLASS** command.

Syntax:

```
BRS [i #]> LAST-CIRCUIT-CLASS
```

Example:

```
BRS [i #]> LAST-CIRCUIT-CLASS
BRS [i #]>
```

2.10. EXIT

Returns to the previous prompt level.

Syntax:

```
BRS> EXIT
```

Example:

```
BRS> EXIT
+
```