31 Managing Frame Relay

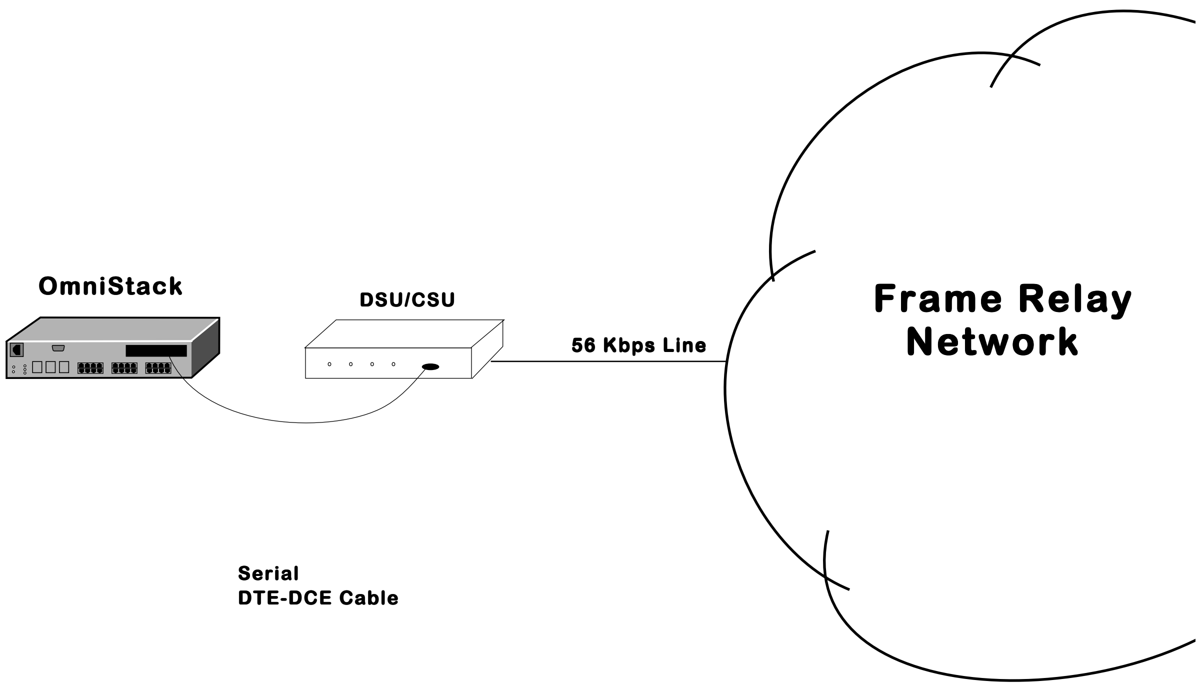
The WAN Switching submodule (OSWSM) family supports Frame Relay on universal serial, T1 or E1 ports. Management, data handling, compression, and multi-protocol encapsulation are compatible with current Frame Relay standards, such as RFC 1490 and FRF.9. The OSOSWSM supports all three major DLCMI management protocols.

OSWSM frame relay extends the power and flexibility of LAN switching over large geographic distances using a Frame Relay network or a leased line, such as a T1. In a Frame Relay network configuration, the OSOSWSM provides a cost effective link supporting multiple virtual circuits. In a leased line configuration, the OSOSWSM provides dedicated bandwidth to a single remote site.

VLAN architectures are preserved and consistent on both sides of a WAN link. The OSOSWSM supports frame relay trunking, so VLAN Groups on one side of a Frame Relay link are compatible with those on the other side. In addition, the OSOSWSM is capable of Frame Relay IP and IPX routing and complies with Inverse Address Resolution Protocol (InARP) RFC 1293.

In a typical configuration, the OSWSM occupies one slot in an OmniStack. (The front panel of an OmniStack is divided into several areas labeled **S1**, **S2**, **S3**, etc. These areas relate to the conceptual division of the switch into several modules, or slots.)

Since it is compatible with OmniStack any-to-any switching and VLAN architecture, you can switch other topologies in the LAN to Frame Relay. The following diagram shows a typical OSOSWSM setup using a 56 Kbps Frame Relay line (up to 2 Mbps access rates are supported).



Typical OSWSM Frame Relay Setup Using Serial Ports

The OSWSM supports automatic detection of cable types attached to universal serial ports. It also supports three types of DLCMI management: LMI Rev. 1.0, ANSI T1.617 Annex D, and CCITT/ITU-T Q.933 Annex A.

Software in the switch allows you to configure access rate, clocking, DLCMI type, compression, and congestions controls, such as the Committed Information Rate (CIR). Additional software commands allow you to view the status of the Frame Relay connection at the OSOSWSM board, port, or virtual circuit level. Extensive statistics are provided at each level, including a breakdown of traffic by frame type (Ethernet, IP, IPX, or BPDU) at the virtual circuit level.

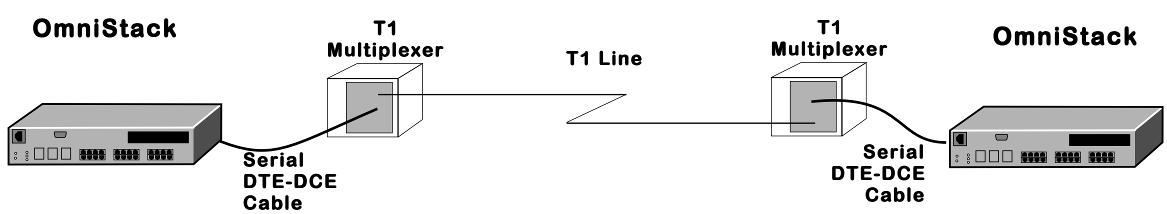
The OSWSM is designed to require as little configuration as possible. It senses the cable type installed and automatically maps virtual circuits to virtual ports as soon as you plug in the cable. The OSWSM supports 256 Permanent Virtual Circuits (PVCs), which is equivalent to the number of virtual ports allowed in an OmniStack.

In addition, you can set up a default bridging and a default routing Group. virtual circuits are automatically assigned to these Groups as soon as they are configured or learned, which means Frame Relay frames can be bridged or routed without user-configuration.

Back-to-Back Frame Relay Configurations

Frame Relay switching modules may be connected “back-to-back” without an intervening Frame Relay network or switch. Such connections are made by using private leased lines, such as T1 lines, instead of public Frame Relay networks usually over large geographic distances.

No special user configuration is necessary for back-to-back connections. The OSWSM software automatically detects that a Frame Relay Logical DCE (i.e., Frame Relay switch) is not present and that there is another Frame Relay Logical DTE (i.e., another OSWSM, FRAD, bridge/router) on the other end of the WAN connection. The OSWSM then automatically brings up a Permanent Virtual Circuit identified with a DLCI of 32, which is the same value IBM uses in this scenario. The OSWSM does not bring up PVC DLCI 32 until it knows that it has established communication with another DTE device rather than a Frame Relay switch.



Back-to-Back Frame Relay Configuration Using Serial Ports

Universal Serial Port Cable Interfaces

The OSWSM automatically senses the cable type that you plug into one of its universal serial ports. It can sense whether the cable type is DCE or DTE and whether it is one of the following interfaces:

- RS-232
- RS-449
- RS-530
- V.35
- X.21 (European)

All cable types, except RS-232, are capable of access rates from 9.6 Kbps to 2 Mbps. The RS-232 cable is not compatible with speeds greater than 64 Kbps. Each cable type is illustrated and described in Appendix D, "Custom Cables."

The OSWSM serial port is normally considered a physical DTE device. It is possible to turn it into a physical DCE device simply by plugging in a DCE cable. The OSWSM board internally senses whether a DCE or DTE cable is connected.

DTE/DCE Type and Transmit/Receive Pins

The RS-232 protocol, which is employed at the physical level for all cable types, always defines Transmit and Receive pins in relation to the DTE. So, the type of cable you attach (DCE or DTE) determines the direction of data flow on your connector's Transmit and Receive pins.

If the OSWSM serial port is a physical DTE, which is probably the most common configuration, then data is received on Receive pins and transmitted on Transmit pins. If you are using a OSWSM port as a physical DCE, then data is *transmitted* on the Receive pins and *received* on the Transmit pins.

"Physical" and "Logical" Devices

This chapter refers to "physical" and "logical" DTE (Data Terminal Equipment) and DCE (Data Communication Equipment) devices. A physical device operates on the network layer, and is normally an actual piece of hardware, such as a OSWSM or CSU/DSU. Physical devices may further be differentiated as DTE and DCE devices. A physical DTE device would be a piece of hardware, such as a OSWSM, that does not control the access rate for virtual circuits. The physical DTE device is a conduit for data traffic but not a controller of data traffic. A physical DCE device is hardware, such as a CSU/DSU, that does control access rates of Frame Relay traffic. Normally physical DTE and DCE devices are directly connected to one another.

Logical devices operate on the Frame Relay protocol layer, and are sometimes referred to as "Frame Relay logical" devices. Logical devices can also be broken down into DTE and DCE devices. Logical DTE devices, again like the OSWSM, do not have direct control over the Frame Relay network and the various congestion and control parameters that govern it. Logical DTE devices do not control such actions as bringing up and tearing down virtual circuits; they act upon updates and commands generated by the Frame Relay network. Logical DCE devices, such as a Frame Relay switch, have a large span of control over Frame Relay network traffic. They bring up and tear down virtual circuits, set congestion control bits in packets, and communicate status to logical DTE devices.

Compression

Data compression allows you to get more data through the Frame Relay pipeline, further enhancing cost benefits. A typical data compression ratio on the OSWSM board at the hardware level is 4:1. In addition, the compression processor (STAC 9705) has its own DRAM that can store up to 100 virtual circuits (on a 4-port OSWSM) without performance degradation. An 8-port OSWSM can store up to 200 virtual circuits without performance degradation. Support for more than 100 compressed VCs (or 200 VCs on an 8-port OSWSM) is possible through swapping within memory, but compression performance may decrease at these levels.

The OSWSM will only compress data if you enable Compression Negotiation through software and the Bridge/Router on the other end of the Frame Relay virtual circuit supports standard FRF.9 compression. (An OmniStack-to-OmniStack connection would support compression.) Negotiation is necessary because if compressed data is sent to a Bridge/Router that does not support compression, then this Bridge/Router will not recognize the data and will automatically drop the unrecognizable frames.

If you enable Compression Negotiation, the OSWSM will query the Frame Relay device on the other end of the circuit (according to FRF.9 specifications) to see if it supports compression. If it does, then the OSWSM compresses all data except DLCMI (management) data. If it doesn't, then data on that virtual circuit is sent uncompressed. See *Setting Configuration Parameters* on page 31-19 for information on enabling compression.

♦ Note ♦

Compression is not supported on OmniStack OSWSM modules.

Virtual Circuits and DLCIs

The OSWSM supports Permanent Virtual Circuits (PVCs), but not Switched Virtual Circuits (SVCs). Most service carriers do not currently offer SVCs. PVCs are either static (configured) or dynamic (learned). Static PVCs are user-configured and consist of Management, or Control, PVCs and any configured Data PVCs. Management VCs are used by the OSWSM to communicate with the Frame Relay network. Dynamic PVCs are usually data circuits, which are controlled by the Frame Relay network and not configured in advance. A logical Frame Relay DTE device like the OSWSM does not create or control dynamic data VCs. It is only informed of their status through periodic Status updates from the Frame Relay network.

Each virtual circuit is locally defined by a Data Link Connection Identifier (DLCI). The Frame Relay network assigns the DLCIs and informs the OSWSM about them.

DLCI numbers from 0 to 15 and 992 to 1023 are reserved for Control VCs. If you are using Annex A or Annex D as your DLCMI, the management control VC will be assigned DLCI 0. If you are using the LMI Revision 1.0 DLCMI, then the management control VC will be assigned DLCI 1023.

DLCI numbers from 16 to 991 are reserved for Data VCs.

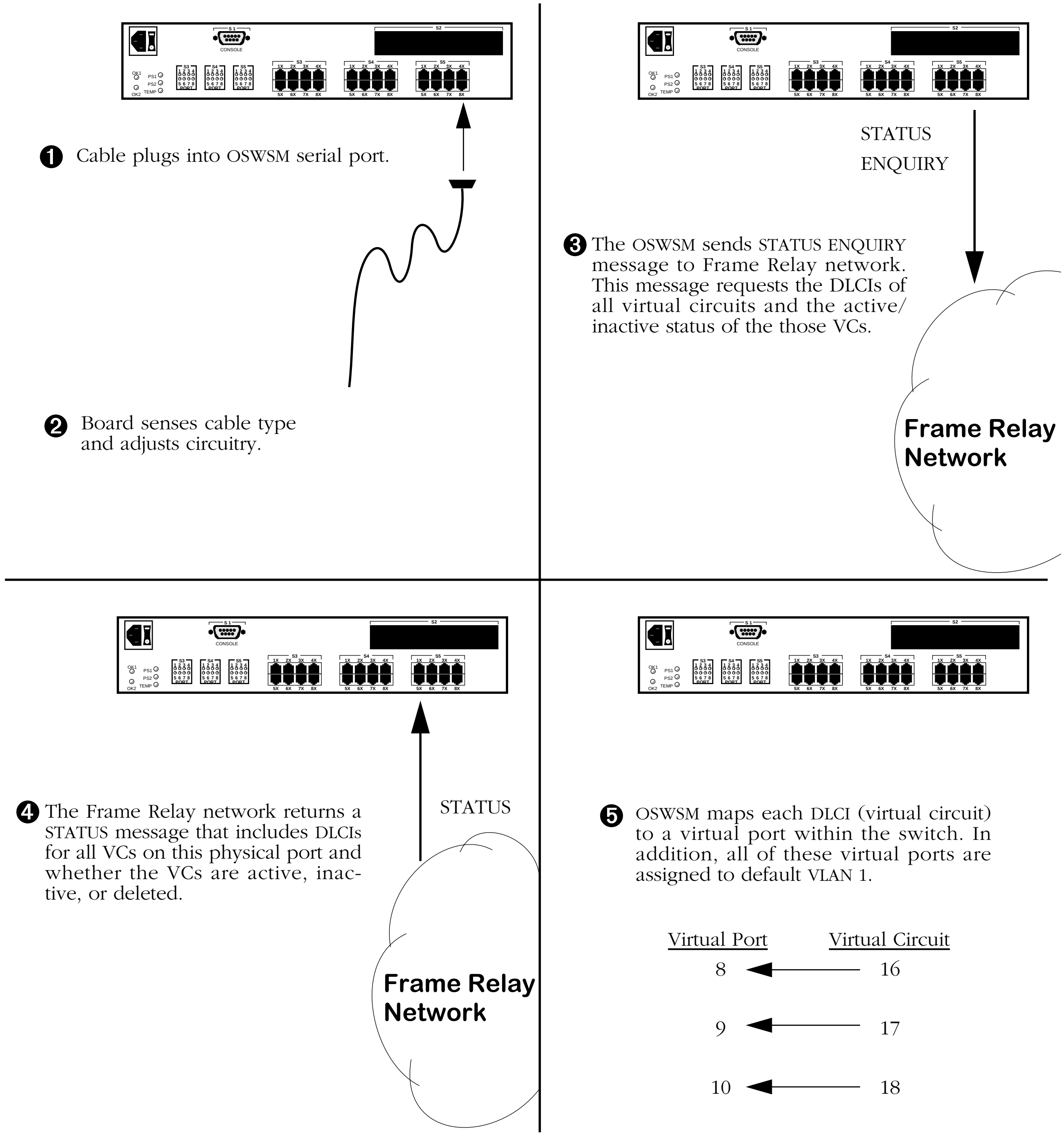
You may have up to 256 virtual circuits and up to 128 virtual ports on a OSWSM.

A VC may or may not have the same DLCI on each side of a WAN link. For example, if a OSWSM physical port contains three Frame Relay VCs on its local network with DLCIs 16, 17, and 18, these same VCs on the other side of the Frame Relay network might be 30, 31, and 32. The two sets of DLCIs are technically part of the same virtual circuits, but their values may or may not be different. DLCIs are only significant locally.

At any one time, a virtual circuit will be active, inactive or deleted. If a virtual circuit is Active it can transmit and receive data. If it is Inactive, the Frame Relay network still sees the virtual circuit, but there is a problem with it and it is discarding data. If the virtual circuit is Deleted, then the virtual circuit is not transmitting or receiving data and no DLCI exists for it.

OSWSM Self-Configuration and Virtual Circuits

The following diagram summarizes the self-configuration features of the OSWSM. This example assumes no configuration parameters are entered for the OSWSM. Default bridging is set up on Group 1, and no Routing or Trunking are configured.



OSWSM Initial Port and Virtual Circuit Configuration

After mapping virtual circuits to virtual ports, the OSWSM is ready to send data. STATUS ENQUIRIES are repeated periodically by the OSWSM. The intervals between STATUS ENQUIRES can be configured through software. See *Setting Configuration Parameters* on page 31-19 for information on setting these parameters.

Congestion Control

Use of Frame Relay lines tends to be "bursty," with heavy use at times and light use at others. During heavy periods of congestion, data may be discarded. However, Frame Relay uses several software-configurable parameters and techniques to control congestion and to avoid data loss on the network during these heavy periods. These software parameters are set on a VC-by-VC basis. This section describes these parameters.

♦ **Note** ♦

The parameters in this section describe how the Frame Relay network handles congestion. The OSWSM supports these parameters, but they must match those used by your Frame Relay service provider.

Regulation Parameters

The **Committed Information Rate (CIR)**, which is also referred to as "VC Throughput," is the minimum bandwidth a virtual circuit will provide under normal circumstances. Frames transmitted within the CIR are not tagged by the Frame Relay network as being eligible for discard. Frames transmitted above the CIR are tagged for discard, but they will normally only be discarded if the virtual circuit or network becomes congested. For example, if the CIR is 16 Kbps and you have a 56 Kbps line, then this virtual circuit will always get at least 16 of the available 56 Kbps. The extra 40 Kbps (56-16=40) is normally available to this virtual circuit as long as it is not being used by other virtual circuits and depending on how you have configured the **Committed Burst Size (Bc)** and **Excess Burst Size (Be)**, which are described below.

The CIR is normally a rate given by your service provider. Your service provider may not allow a CIR, in which case your CIR would be 0 (no committed data rate for the virtual circuit).

The **Committed Burst Size (Bc)** is the amount of data that the network will guarantee to transfer under normal conditions. The data may or may not be contiguous and is expressed in kilobits. This number is related to your CIR. In fact, the CIR is Bc divided by Tc where Tc is the time interval used to express the CIR. If Tc is equal to 1 second (a typical value for Tc) and your Bc is 16 kilobits, then your CIR is equal to 16 Kbps. So in many cases the Committed Burst rate will be the same number as the CIR expressed as a *quantity* of data (kilobits) rather than a data *rate* (kilobits per second).

The **Excess Burst Size (Be)** is the amount of data over-and-above the Committed Burst Size (Bc) that the network will transmit as long as excess bandwidth is available on the virtual circuit. The number is also expressed in kilobits. Data at this level is not guaranteed transfer. Any data exceeding the Committed Burst Size may be part of the Excess Burst Size. If there is no bandwidth available on the virtual circuit or if the network is congested, the first data to be dropped is part of this Excess Burst data.

The Excess Burst Size is related to the Committed Burst Size and the access rate of the Frame Relay line. The Excess Burst Size plus the Committed Burst Size should be less than or equal to the access rate of the Frame Relay line. So, if you have a 56 Kbps line and the Committed Burst size is 16 kilobits, then the Excess Burst Size could range from 0 to 40 kilobits.

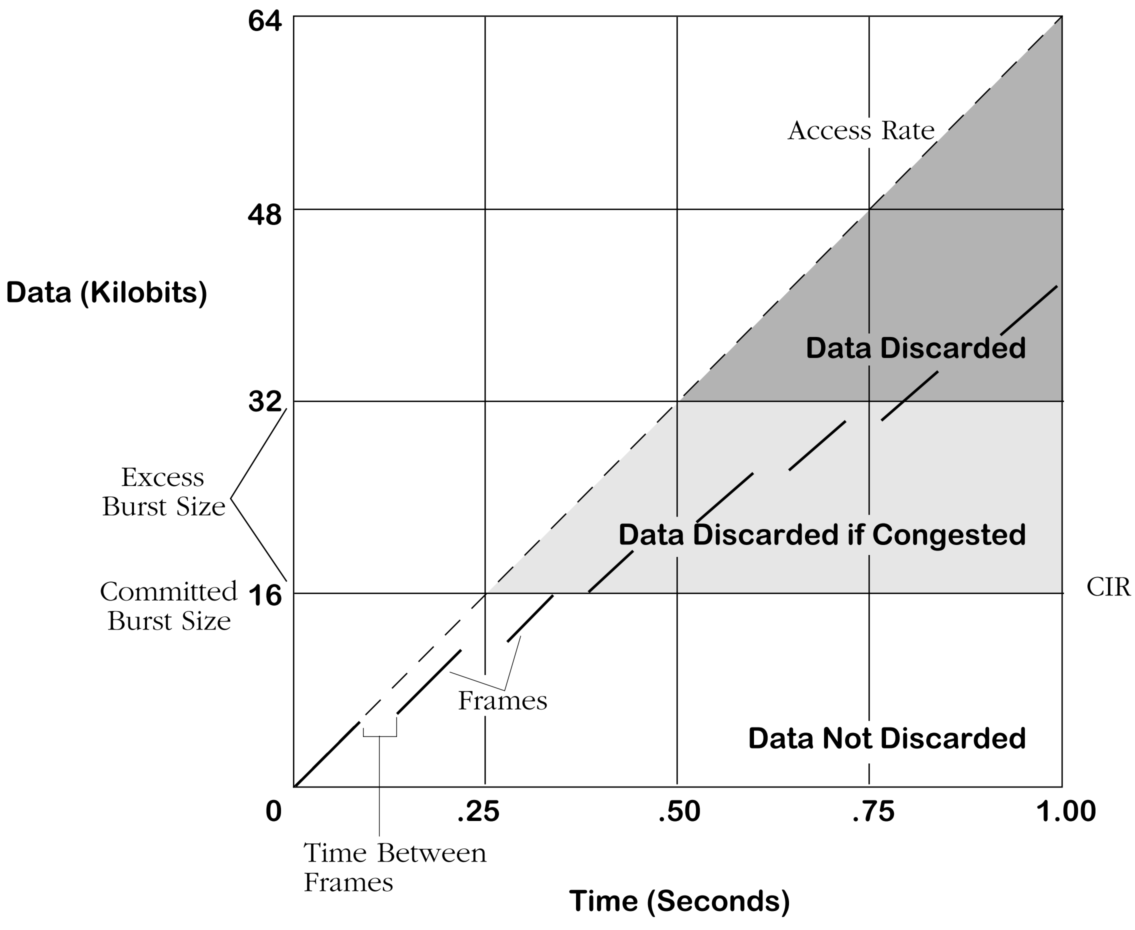
By default all of these congestion control parameters are set to zero (0), meaning that congestion control is disabled and data flows at the access rate for learned virtual circuits. Congestion control is not enabled until you set one or more of these parameters to a non-zero number.

Discard Eligibility (DE) Flag

The Frame Relay network keeps track of data that is eligible for discard by using a single bit within each frame. When the data rate exceeds the CIR, frames are tagged (i.e., the DE bit is set to 1). If congestion in the network nears saturation, those frames tagged with the DE bit will be dropped before untagged frames. Unless totally congested, data below the CIR level on all virtual circuits is usually guaranteed delivery. Normally, frames are not dropped on an entire Frame Relay connection, but only those frames that exceed the pre-defined CIR level.

Interaction Among Congestion Parameters

The following example helps illustrate the interaction among congestion regulation parameters. A Frame Relay line has an access rate of 64 Kbps. The guaranteed Committed Information Rate (CIR) is 16 Kbps. The Committed Burst Size is 16 Kilobits and the Excess Burst Size is also 16 Kilobits. These parameters mean that any data exceeding 16 Kilobits (within a Tc sample period) normally will be tagged with a Discard Eligibility flag and could be discarded if congestion occurs on the virtual circuit. In addition, since the Excess Burst Size is 16 kilobits, any frames sent exceeding 32 Kbps will have a higher probability of being discarded. The following graph illustrates this example.



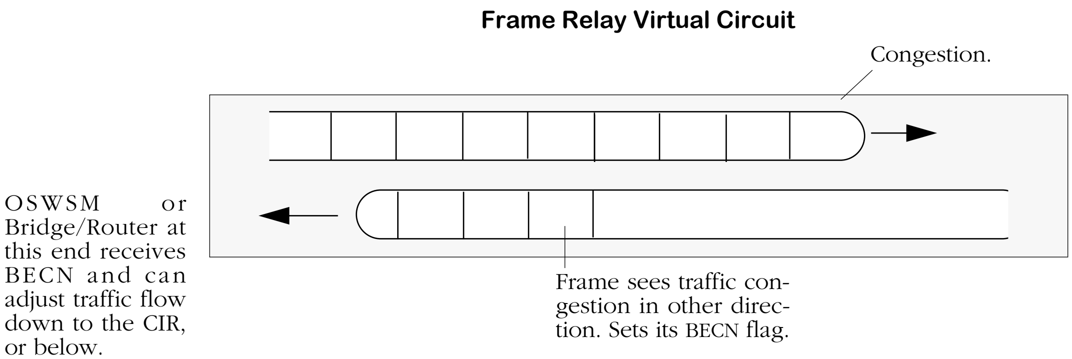
Effect of Congestion Control Parameters on Data

Frames are shown as broken lines below the Access Rate line. The space between frames indicates the delay between the transmission of each frame. For each second, frames sent within the white zone below the diagonal Access Rate line get through. The shaded area just above the white area contains frames that are stamped for Discard Eligibility that will get through as long as the VC is not congested. The darkest shaded area shows frames that may not get through because they exceed the Excess Burst Size allowed in one second.

Notification By BECN

Each data link header contains a congestion control flag called BECN (Backwards Explicit Congestion Notification), which is usually pronounced "beckon." Normally this flag is turned off. As with other WAN packet-based networks, frames in Frame Relay may build up in queues at certain points. When a queue is full, due to congestion, frames will be dropped. The senders of this data (Bridge/Router or OSWSM) may not be aware of the congestion. Frame Relay uses a congestion notification technique to notify the Bridge/Router that traffic is jammed further down the circuit.

When a frame on one side of the bi-directional virtual circuit sees data congested on the other side, the Frame Relay network sets the frame's BECN flag On. Any subsequent frames that see the congestion also have their BECN flag set On. These BECN frames continue down the virtual circuit until they reach the Bridge/Router or OSWSM on the other end. The receiving OSWSM sees the BECN flags and adjusts data flow in the opposite direction. Normally the OSWSM will slow the speed of data down to the CIR. If the BECNs persist, then data flow is stepped down even further. Data flow will gradually increase back up to the normal rate as soon as BECNs or FECNs (see below) are no longer received.

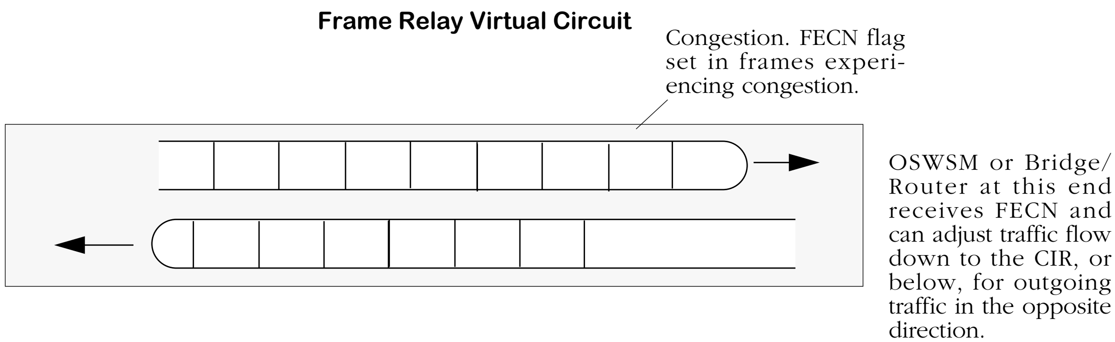


Congestion Notification Using a BECN

BECN notification only works if traffic flows in both directions. If traffic in the uncongested direction did not exist then there would be no frames for the Frame Relay network to set BECN flags on.

Notification By FECN

Frame Relay headers also contain a congestion control bit called FECN (Forwards Explicit Congestion Notification), which is usually pronounced "Feckon." Like BECN, the FECN bit also notifies a OSWSM or Bridge/Router of congestions problems. However, it is set by the Frame Relay network in frames that are actually experiencing congestion. When the OSWSM receives frames with their FECN bit set, it knows that congestion is already occurring on the virtual circuit in the direction that these FECN frames are travelling. The OSWSM reacts by reducing the data flow down to the CIR for data in the opposite direction. If the FECNs persist, then data flow is stepped down even further. Data flow will gradually increase back up to the normal rate as soon as FECNs or BECNs are no longer received.



Congestion Notification Using a FECN

Frame Formats Supported

Frames coming in from the Frame Relay network are not translated, but they are manipulated to be compatible for transport over the switch's VBUS. Incoming frames must contain RFC 1490 headers. The following standard 1490 frame types are supported:

- BPDU
- Ethernet 802.3
- Token Ring 802.5 (see Note below)
- FDDI (see Note below)
- IP Routed
- ARP/InARP Routed
- IPX Routed
- Compressed (which decompresses to one of the above supported formats)

♦ Note ♦

Source Routing is not supported on Token Ring and FDDI frames.

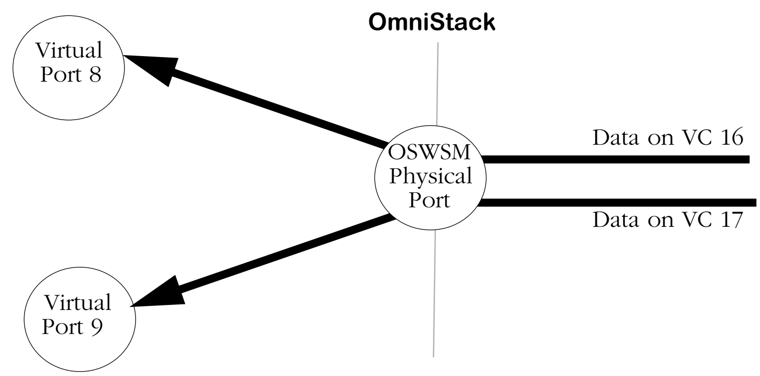
All other frames types from the network are discarded at the physical port level.

Frames coming from the switch to the Frame Relay network are optionally translated if they are a non-Ethernet frame (e.g., FDDI and Token Ring) for a Bridged VLAN. In this case, the frame is translated to an Ethernet frame before it is sent to the Frame Relay interface. Frames from non-Ethernet interfaces can also be sent as is without translation. This translation, which is called Default Bridging Mode, can be configured at the service or port level. In addition, BPDU and Routed frames (IP, ARP, InARP, IPX) are accepted.

Bridging Services

All Frame Relay Virtual Circuits (VCs) belong to a service, whether it be a Bridge, Router, or Trunk service. By default, a virtual circuit belongs to a bridge service. No configuration is necessary for a VC to support bridging on Group 1. However, configuration is necessary for a VC to support Frame Relay Routing, Trunking, or Bridging on a Group other than Group 1.

For bridging there is a one-to-one map between Frame Relay virtual circuits and switch virtual ports. When data is received from a virtual circuit at the physical port level it automatically maps to the corresponding virtual port. For example, if Frame Relay virtual circuit 16 maps to virtual port 8, then all incoming data on this circuit would be incoming data on switch virtual port 8. And if virtual circuit 17 maps to virtual port 9, then all incoming data would be on virtual port 9.



One-to-One Mapping Between Virtual Ports and Virtual Circuits

Frame Relay bridging uses standard Spanning Tree as defined in 802.1d. Typically, one bridge port within the WAN will act as the designated root bridge (and may be the actual root bridge) and maintain a single path through the Frame Relay network. To avoid duplication and loops, some paths will not be allowed.

As far as Spanning Tree is concerned, the virtual ports that map off a Frame Relay physical port are LAN ports. Each port will come up as default bridging on VLAN 1.

A unique aspect of Frame Relay bridging is that MAC addresses must be learned for each DLCI and for each virtual port. So, although the virtual circuits map directly to virtual ports, the bridge must still learn their MAC addresses separately. Also, Frame Relay BPDUs do not have MAC addresses.

One of the disadvantages of bridging in Frame Relay is that broadcasts must be sent across all virtual circuits that are associated with a given physical port for a given group. This requirement can create duplication across the Frame Relay network. At the extreme, on a full T1 line with 96 virtual circuits defined, 96 copies of each broadcast would have to be sent for the same Group. When using access rates at the higher end of the Frame Relay spectrum, you could separate virtual circuits into separate Groups to decrease the size of each broadcast domain. Or, you could use a Routing (IP or IPX) or Trunking configuration to more efficiently manage the data flow.

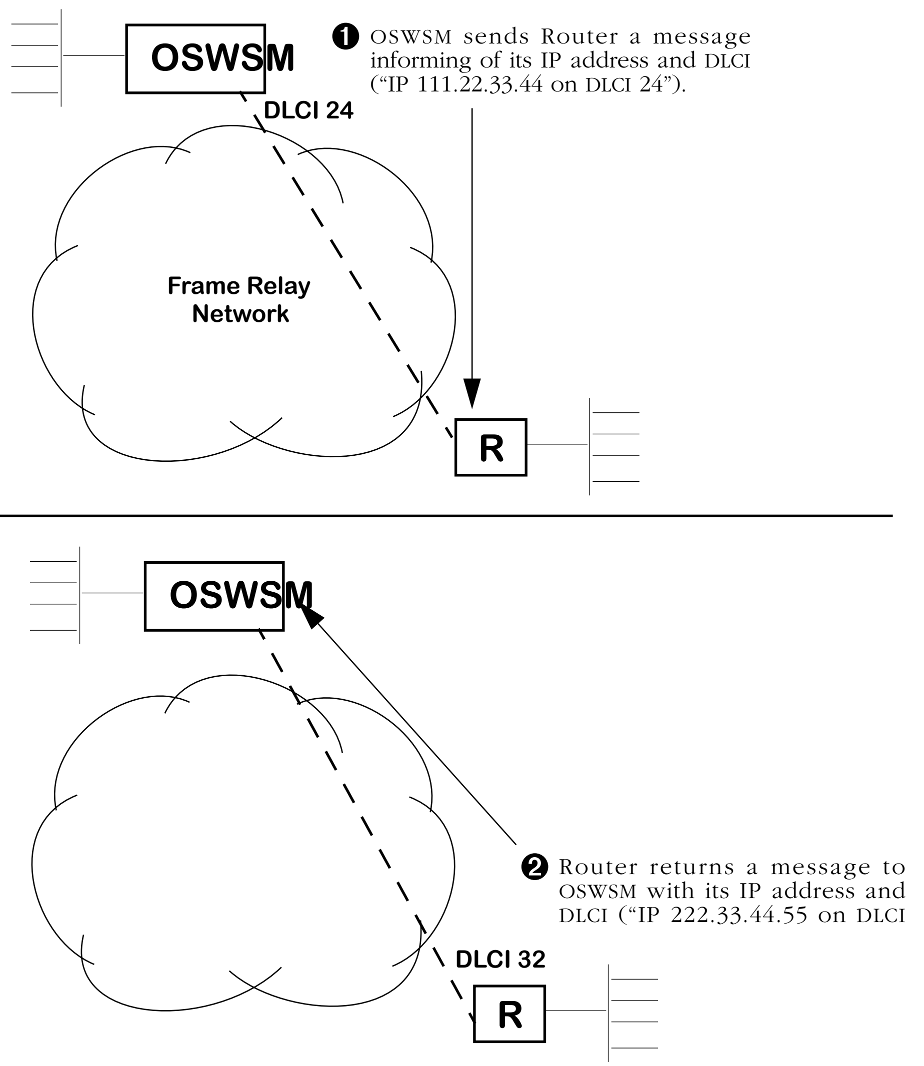
The configuration of bridging services is described in *Configuring a Bridging Service* on page 31-49.

Frame Relay IP Routing

Frame Relay routing is different than standard LAN IP Routing. In normal LAN IP Routing MAC addresses are used as source and destination addresses. In Frame Relay IP Routing, no MAC addresses are included in a routed frame. In fact, the only address in a routed Frame Relay frame is the DLCI, or virtual circuit identifier. The DLCI is the main indentifier for source and destination addresses.

Because Frame Relay uses 10-bit DLCIs as the main addressing units, routed Frame Relay frames require less overhead than LAN IP frames, which use LAN standard 48-bit addresses. However, due to the nature of DLCIs on a WAN, Frame Relay routing requires a special version of the IP protocol. The DLCI for a single VC may or may not be different on both sides of a Frame Relay connection. That's why Frame Relay uses the Inverse Address Resolution Protocol (InARP) to resolve DLCI issues and to automatically learn the IP addresses of remote routers.

The InARP protocol ensures that before any data passes between two Frame Relay routers, those routers notify each other of their IP addresses and associated DLCIs. So, the first communication over a routed Frame Relay network is normally initiated by InARP.

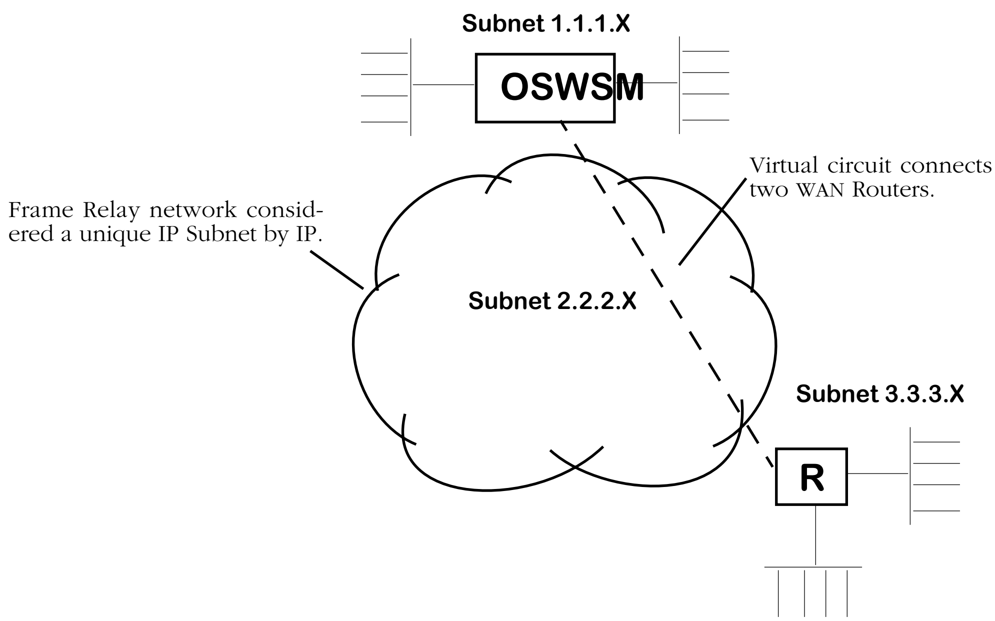


Frame Relay InARP Protocol

An InARP message is sent between the two routers indicating their IP addresses and associated VC. Once they know each other's IP address and the DLCI of the VC on each end of the link (the same VC may have a different DLCIs on each end), then they can begin normal routing of RIP frames, etc.

The Frame Relay Subnet and "Split Horizon"

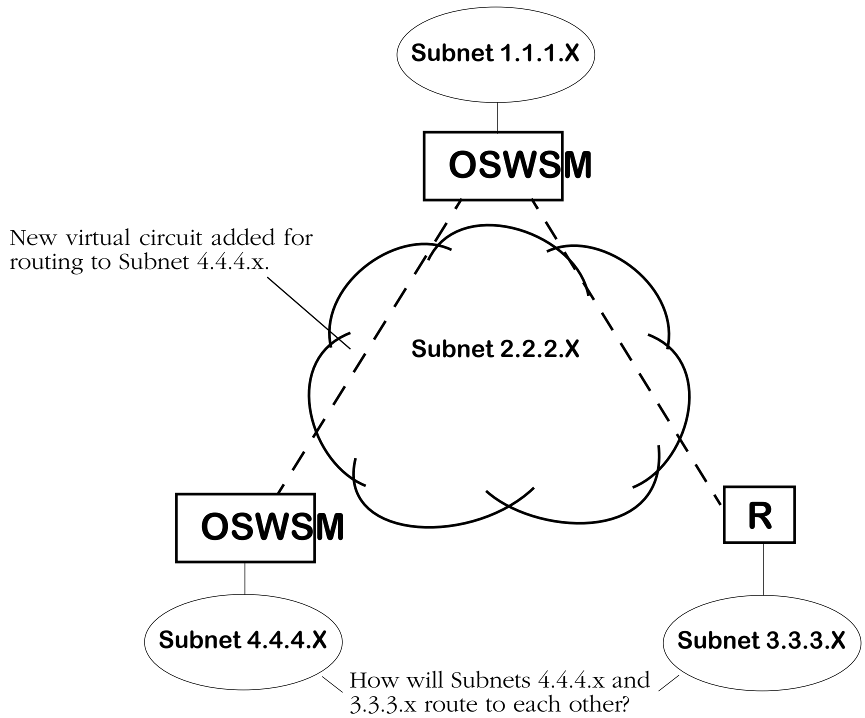
The IP protocol must account for the Frame Relay network in making routing decisions. After all, the WAN network is more than just a single cable, or even several cables, attaching two routers. The solution is to assign the Frame Relay network a unique IP subnet.



Frame Relay Network Is an IP SubNet

In the configuration shown above, one virtual circuit connects the OSWSM router on IP Subnet 1.1.1.x and the other router on IP Subnet 3.3.3.x. The Frame Relay network, for routing purposes, is considered to be IP Subnet 2.2.2.x. Routing decisions are straightforward in this setup. But if another Router and another IP Subnet were added, a special routing technique must be devised.

If an additional Router and Subnet were added to the network and a new VC was added to connect the new location, then much of the WAN routing load would fall on the OSWSM attached to Subnet 1.1.1.x.



Adding A New Router Raises New Questions

The new OSWSM attached to Subnet 4.4.4.x connects to the WAN through the addition of a new virtual circuit connecting directly to the OSWSM attached to Subnet 1.1.1.x. However, for the new OSWSM to route to Subnet 3.3.3.x it must go through the OSWSM router attached to Subnet 1.1.1.x. This is okay for the initial routed path decision. But IP will try to find the most efficient route between Subnet 4.4.4.x and 3.3.3.x. Unfortunately the most efficient route—which would be a direct path between the two routers—is not possible because no WAN link exists between the two.

Frame Relay routing allows the new Subnet, 4.4.4.x, and Subnet 3.3.3.x to route through the OSWSM router attached to Subnet 1.1.1.x. Normal IP would have a problem with this solution because it does not allow "backtracking" through IP Subnets, which is exactly what must be done in this case. Routed frames actually pass through the Frame Relay Network Subnet 2.2.2.x twice—once to get the OSWSM Router attached to Subnet 1.1.1.x and another time to get to the Router attached to either Subnet 4.4.4.x or 3.3.3.x.

Standard routing uses a technique called "split horizon" that prevent loops through the same Subnet from occurring. *Frame Relay enhances split horizon to account for the nature of virtual circuits*. Loops through a LAN Subnet are inefficient, but Frame Relay routing makes allowances to compensate for the fact that a WAN does not enjoy the same flexibility with router connections as a LAN.

♦ Note ♦

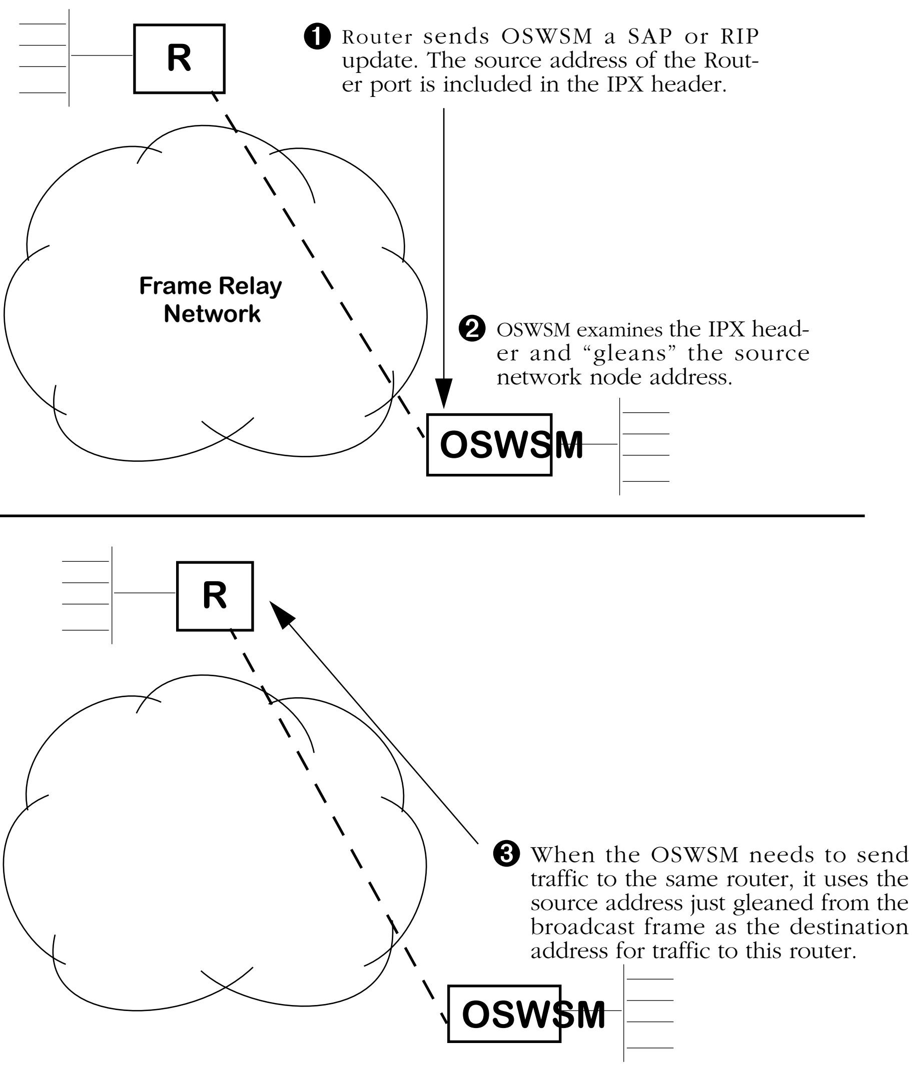
Backtracking in InARP is allowed only through the IP Subnet defined for the Frame Relay network.

The configuration of OSWSM routing services is described in *Configuring a WAN Routing Service* on page 31-51.

Frame Relay IPX Routing

Frame Relay IPX and IP routing differ in the way they determine the address of a router at each end of a virtual circuit. Instead of using Inverse ARP, IPX uses a process called "gleaning" to determine routing information. In gleaning, the IPX routing protocol on one end of a virtual circuit obtains the network node number for the router at other end of the virtual circuit.

A OSWSM or router continuously receives RIP and SAP updates on a given virtual circuit. When it receives the first such broadcast, the IPX process looks at, or gleans, the source address from the frame's IPX header. When the router needs to send traffic on that router later, it uses the source address it just obtained as the destination address for that router. The following diagram illustrates IPX Gleaning.



IPX Gleaning

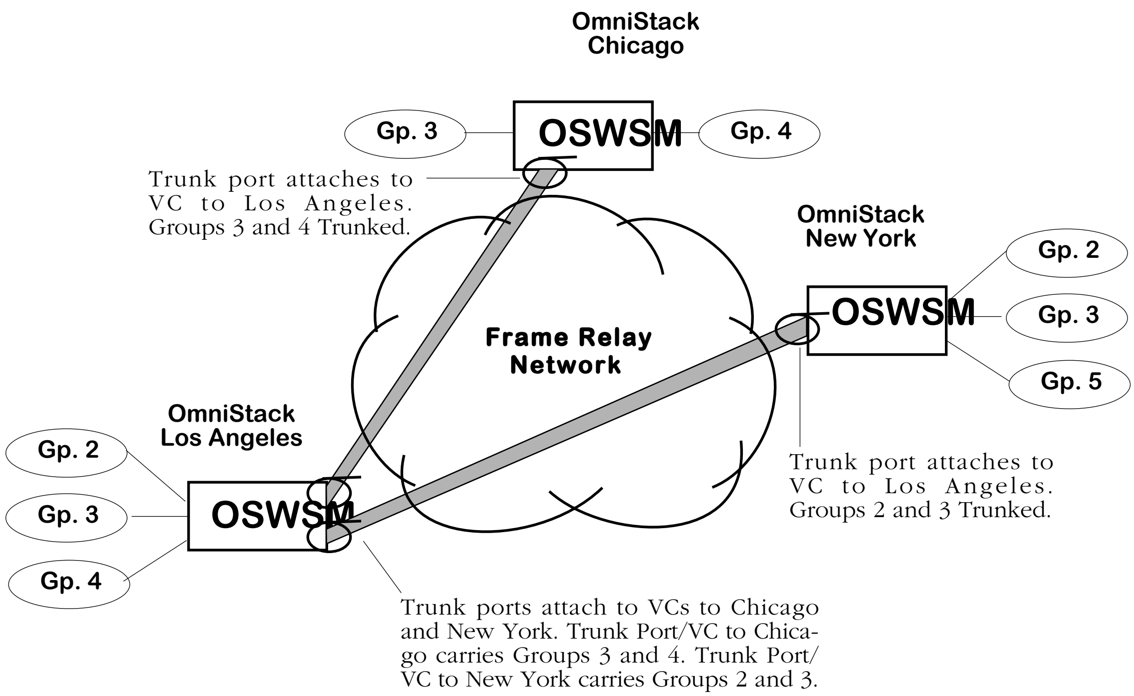
Not all Routers support IPX gleaning. If you need to interoperate with a Router that does not support gleaning, then you may need to statically map addresses on that Router.

The configuration of OSWSM routing services is described in *Configuring a WAN Routing Service* on page 31-51.

Trunking

A trunking service must be set up for each virtual circuit that will support trunking. When trunking is set up, you specify the slot, port, DLCI, and Groups that are going to be trunked over the virtual circuit.

The illustration below shows a sample trunking configuration. The OSWSM in Los Angeles has two trunk ports, one to Chicago and one to New York.



Trunk Ports and Virtual Circuits Over Frame Relay Network

Frame Relay virtual ports are mapped one-to-one to virtual circuits, so each of these trunk ports is connected to a virtual circuit. When setting up Trunking you need to be aware of your virtual circuit configurations, their DLCIs, and their termination points. Configuring a Trunking Service is described in *Configuring a Trunking Service* on page 31-54.

Note

No standard exists for trunking Groups or VLANs over Frame Relay. Therefore, you must configure Trunking using Xylan's method.

The Frame Relay Software Menu

User interface commands for Frame Relay are on a separate menu that you can access through the **fr** command. The Frame Relay menu is a sub-menu of the **Interface/WAN** menu. Typing **fr** at any system prompt displays the following menu:

```
Command         Frame-Relay Menu
-----------------------------------------------------------------------------------------------------------------------

frstatus        Status of entire chassis, slot, port, and DLCI (e.g., 4/1/32).
frview          View a given slot, port, or DLCI (e.g., 4/1/32).
frmodify        Modify a given slot, port, or DLCI (e.g., 4/1/32).
frdelete        Delete a given port or DLCI (e.g., 4/1/32).
fradd           Add a DLCI with slot, port, DLCI (e.g., 4/1/32)

Main       File       Summary   VLAN      Networking
Interface  Security   System    Services  Help
```

You can start any of the commands by typing just the first three (3) letters of the command name. For example, to use the **frview** command you could type only **frv**.

The following sections describe the use of commands on the Frame Relay menu.

Setting Configuration Parameters

When you plug in a OSWSM board it is automatically configured with default settings. The OSWSM board will default the WAN port protocol to frame relay for OSWSM serial ports, T1 and E1 ports. Commands generic to the OSWSM module can be found in Chapter 30.

By default the OSWSM frame relay software uses ANSI T1.617 Annex D for the Data Link Control Management Interface (DLCMI) and uses a Committed Information Rate (CIR) of 0. In addition, the access rate defaults to 64 Kbps for RS-232 cables and to 2 Mbps for all other cable types. You can change these settings as well as several other settings, such as clocking and compression, with the **frmodify** command.

You have a choice of modifying parameters at the port or DLCI (virtual circuit) level. You receive different configuration choices depending upon which level you choose. The two sections below describe both ways to use the **frmodify** command.

Modifying a Port

To modify a port, enter the following command

frmodify <slot>/<port>

where **<slot>** is the slot number where the OSWSM board is located, and **<port>** is the port number on the OSWSM board that you want to modify. For example, if you wanted to modify port number 1 on the OSWSM board in switch slot 3, you would enter

frmodify 3/1

or

frm 3/1

A screen similar to the following displays:

```
Modifying Frame Relay port for Slot 2, Port 1.

1)  Speed in BPS ................................................................ = 56000
            {9600, 19200, 56000, 64000, 128000, 256000, 512000, 768000}
           {1024000, 1536000, 2048000}
 2)  Clocking .................................................................. = External
         {(I)nternal, (E)xternal, (S)plit}
 3)  DLCMI Type  ............................................................... = Annex D
         {(L)MI Rev. 1.0, T1.617 Annex (D), Q.933 Annex (A)}
 4)  Polling Interval T391/nT1  ............................................. = 10
         {1 through 255 seconds}
 5)  Full Status Interval N391/nN1  ........................................ = 6
         {1 through 10}
 6)  Error Threshold N392/nN2  ............................................. = 3
         {1 through 10}
 7)  Monitored Events Counter N393/nN3  .................................. = 4
         {1 through 10}
 8)  Administrative Status  ................................................ = Up
         {(U)p, (D)own}
9)  Default Bridging Group................................................. = 1
         {1-65535}
10)  Default Bridging Mode................................................. = 1
         {1=Bridge All, 2=Ethernet only}
11)  Default Routing Group................................................. = 0
        {1-65535}
12)  Default Compression Admin Status.................................. = Enabled
         {1=Enable, 2=Disable}
13)  Default Compression PRetry Time.................................... = 3
         {1-10}
14)  Default Compression PRetry Count................................... = 10
         {3-255}
15)  Description.............................................................. =
         {Enter Up to 30 Characters}

To change a value, enter the corresponding number, an '=', and the new
  value. For example to set a new clocking, use
    : 2=i
 When complete enter "save" to save all changes, or cancel or Ctrl-C to
  cancel all changes. Enter ? to view the new configuration.
```

You make changes by entering the line number for the option you want to change, an equal sign (=), and then the value for the new parameter. When you are done entering all new values, type **save** at the colon prompt (:) and all new parameters will be saved. The following sections describe the options you can alter through this menu.

♦ Caution ♦

Several of the parameters in this menu (**Polling Interval, Full Status Interval, Error Threshold, and Monitored Events Counter**) are set to Frame Relay defaults and do not need to be changed except in rare cases. These options should only be modified by experienced Frame Relay network administrators. Changes to these options will probably also require coordination with the service provider.

In addition, the **DLCMI Type** option must be entered correctly or the OSWSM will not be able to communicate with the Frame Relay network. The OSWSM board is self-configuring in many ways, but it cannot compensate for an incorrect DLCMI Type.

Speed

This option specifies the access rate for the Frame Relay line to the service provider. This parameter is the speed of the entire connection, not an individual virtual circuit. For example, if you have a 56 Kbps line to your service provider, then this field should be set to 56000. A full T1 line would have an access rate of 1,536,000 bps, and a full E1 line would have an access rate of up to 1984 Kbps. For either T1 or E1, you can also have a fractional service with an access rate that is a multiple of 64 Kbps.

Enter a value that is the same as one of the values below this field. For T1 and E1 ports, this field is read-only; use the **wpm** command to configure T1 and E1 ports.

Note

If known, you should always enter a value for this field because it may be used in computing Congestion Control parameters, such as the Committed Information Rate (CIR). However, the value you enter only makes a difference in the actual speed if the OSWSM port is a physical DCE port (i.e., DCE cable plugged into the OSWSM port) that can control the access rate and clocking.

Clocking

This field sets the type of clocking used to clock transmit and receive data in and out of the serial port. When the clock is out-of-phase, you receive errors. If you set this value to External, then clocking is controlled by the external DCE (a DSU or other DCE device on the other end of the cable from the OSWSM port). External clocking is the default option when the OSWSM is a physical DTE device (i.e., controlled by an external DCE device).

Note

The Clocking value only makes a difference if the OSWSM port is a physical DCE port (i.e., DCE cable plugged into the OSWSM port). If the OSWSM port is a physical DTE port, then Clocking will default to External.

If you set this value to Internal, then clocking is controlled by the internal DCE (the OSWSM). Internal clocking should only be selected if the OSWSM is a physical DCE device and you are using an RS-232 cable. Internal clocking is the default when the OSWSM is a physical DCE device and an RS-232 DCE cable is connected to this port. For T1 and E1 ports, internal clocking is equivalent to local timing.

Split clocking, which is also known as “loop timing,” uses additional control signals (TXCE and RXCE) to keep the OSWSM and DSU clocking in sync. Split clocking takes the incoming clock signals (TX clock and RX clock) and loops them back out to the DSU. The OSWSM and DSU uses these additional signals to communicate the current status of their clocks. Split clocking should only be used if the OSWSM is a physical DCE device and you are using a non-RS-232 cable, such as V.35.

♦ Important Note ♦

Split clocking is required if the access rate of the Frame Relay line is greater than 256 Kbps. If Split clocking is not used at these data rates, then data out-of-phase errors, aborts, or CRC errors may occur.

Split clocking is the default when the OSWSM is a physical DCE device and a non-RS-232 DCE cable is connected to the port. For T1 and e1 ports, external or split clocking is the same as loop timing.

DLCMI

This field specifies the Data Link Control Management Interface (DLCMI) that you want to use for Frame Relay and virtual circuit management. You have three choices for this protocol, each of each corresponds to an existing widely used protocol. The letters used in the frmodify screen correspond to the following DLCMIs:

L LMI Rev. 1.0 (LMI)

D ANSI T1.617 Annex D

A CCITT-ITU-T Q.933 Annex A

Enter your choice by specifying the letter corresponding to your choice.

♦ Important Note ♦

The DLCMI protocol that you enter must match that used by your service provider. Entering an incorrect DLCMI protocol may cause the port to not operate. The OSWSM needs to know the protocol you are using to establish communication with the Frame Relay network.

Polling Interval

This interval is the time in seconds between OSWSM port polls of the Frame Relay network. The OSWSM port polls the network by sending STATUS ENQUIRY messages, which check the link integrity of the Frame Relay connection. By default this interval is set to 10 seconds, but you can increase or decrease it. The default is the standard Frame Relay value. Increasing the polling interval lightens the data load on the port, as it does not have to poll as often. The interval may range from 1 second to 4 minutes and 15 seconds (255 seconds).

♦ Important Note ♦

The **Polling Interval** that you enter must match that used by your service provider. This option should only be modified by experienced Frame Relay network administrators.

Full Status Interval

This interval is the time in seconds between FULL STATUS ENQUIRIES initiated by the OSWSM to the Frame Relay network. The Frame Relay network returns a list of all virtual circuits and whether they are active or inactive. You can set this interval from 1 to 10 seconds. By default, this interval is set to 6 seconds, which is the standard Frame Relay default value.

♦ Important Note ♦

The **Full Status Interval** that you enter must match that used by your service provider. This option should only be modified by experienced Frame Relay network administrators.

Error Threshold

The number of DLCMI protocol errors that will be tolerated before determining the Frame Relay line is down and all associated virtual circuits are inactive. These errors may include timeouts from STATUS ENQUIRY polls and invalid STATUS messages returned from the Frame Relay network. By default, this threshold is set to 3, which is the standard Frame Relay default value.

♦ Important Note ♦

The **Error Threshold** that you enter must match that used by your service provider. This option should only be modified by experienced Frame Relay network administrators.

Monitored Events Counter

The number of status polling intervals over which the **Error Threshold** is counted. This value should be greater than or equal to the **Error Threshold**. If the station received the number of errors specified in **Error Threshold** within the number of polling intervals specified for the **Monitored Events Counter**, then the Frame Relay line is considered down and all associated virtual circuits are considered inactive. By default, this counter is set to 4, which is the standard Frame Relay default value.

♦ Important Note ♦

The **Monitored Events Counter** that you enter must match that used by your service provider. This option should only be modified by experienced Frame Relay network administrators.

Administrative Status

This option enables or disables the port. If set to **UP**, then the port has been enabled and can transmit data as long as its Operational Status is also UP. If set to **DN**, then the port will not pass data even if its physical connection is good.

Default Bridging Group

The default Group for bridging any virtual circuits (user-configured or learned from the Frame Relay network) that are not specifically assigned to a Bridging service. If you set this value to 0, then virtual circuits will not perform bridging unless assigned to a bridging service. By default, the Default Bridging Group is set to 1. By entering a value here you can change the default for this port.

Default Bridging Mode

This field sets the default translation option for this port. When set to **All**, no translation is performed on frames before they are sent out to the Frame Relay network; frames are sent as is. When set to **Eth-only**, non-Ethernet frames are first translated to the default Ethernet frame format for this port before they are sent out to the Frame Relay network. Any MAC translations configured through the Switch menu are valid.

Default Routing Group

The default Group for bridging any virtual circuits (user-configured or learned from the Frame Relay network) that are not specifically assigned to a Routing service. If you set this value to 0 (the default value), then virtual circuits will not perform Routing unless specifically assigned to a Routing service.

This option is intended to simplify Routing configuration if you do not need to route many Groups over a Frame Relay physical port. The OSWSM learns about Data virtual circuits from the Frame Relay network. To enable routing on each of these learned virtual circuits, you would have to set up each circuit individually. However, if you already know the Routing Group for your VCs, then you can specify it here and all VCs will be placed in that Group with an extra configuration on your part. Note that you still need to set up a Frame Relay Routing Group through the **crgp** command. See *Configuring a WAN Routing Service* on page 31-51 for more information.

Default Compression Admin Status

This option indicates whether compression negotiation is enabled or disabled for virtual circuits that are learned from the Frame Relay network. Configured virtual circuits are enabled for compression through the **fradd** or **frmodify** (virtual circuit level) commands. The compression negotiation status that you set up for a specific virtual circuit overrides the status you enter here for the physical port.

Default Compression PRetry Time

This option sets the number of seconds between compression negotiation messages. If compression negotiation is enabled, the OSWSM will send compression negotiation messages as many times as you indicate in the Default Compression PRetry Count. The time between these tries is indicated in this field. The number of seconds between retries may range between 1 and 10 seconds. The default is 3 seconds. This default can be by using the **frmodify** command on an individual virtual circuit.

♦ Important Note ♦

The **Default Compression PRetry Time** should only be modified by experienced Frame Relay network administrators. In addition, it should match the setting for the remote OmniStack or Bridge/Router.

Default Compression PRetry Count

This option sets the total number of compression negotiation messages that will be sent before giving up and not running compression. You enter the time between these retries in the Default Compression PRetry Time field. The number of retries can range from 3 to 255. The default is 10. This default can be by using the **frmodify** command on an individual virtual circuit.

♦ Important Note ♦

The **Default Compression PRetry Time** should only be modified by experienced Frame Relay network administrators. In addition, it should match the setting for the remote OmniStack or Bridge/Router.

Description

Enter a description for this port. The description can be up to 30 characters long.

Modifying a Virtual Circuit

To modify a virtual circuit, enter the following command:

frmodify <slot>/<port>/<DLCI>

where **<slot>** is the slot number where the OSWSM board is located, **<port>** is the port number on the OSWSM board, and **<DLCI>** is the number used to identify the virtual circuit that you want to modify. For example, if you wanted to modify DLCI 17 on Port number 1 of the OSWSM board in slot 3, you would enter

frmodify 3/1/17

or

frm 3/1/17

A screen similar to the following displays:

```
Modifying Frame Relay DLCI for Slot 3, Port 1, DLCI 17.

1)  Administrative State  ............................................ = U
         {(U)p, (D)own}
2)  Committed Information Rate (CIR) in BPS  .................. = 0
         {0 through line speed in BPS}
3)  Committed Burst Rate(Bc)  ...................................... = 0
         {0 through positive number in bits}
4)  Excess Burst Rate(Be)  ............................................ = 0
         {0 through positive number in bits)
5)  Compression Administrative Status .............................. = Enabled
        {(E)nabled, (D)isabled}
6)  Compression PRetry Time ........................................... = 3
        {1..10}
7)  Compression PRetry Count .......................................... = 10
        {3..255}

 To change a value, enter the corresponding number, an '=', and the new
   value. For example to set a new DLCI Active/Inactive Traps, use
     : 5=d
 When complete enter "save" to save all changes, or cancel or Ctrl-C to
   cancel all changes. Enter ? to view the new configuration.
```

You make changes by entering the line number for the option you want to change, an equal sign (=), and then the value for the new parameter. When you are done entering all new values, type **save** at the colon prompt (:) and all new parameters will be saved. The following sections describe the options you can alter through this menu.

Administrative State

This option enables and disables the virtual circuit you are modifying. Setting this option to **Up** enables the circuit and allows data to be sent or received on it as long as the Operational Status is also Up. Setting this option to **Down** disables the circuit; no data can be sent on the circuit. This may be a good option to use when preconfiguring a virtual circuit in advance of live network operation.

Committed Information Rate (CIR)

This field sets the Committed Information Rate (CIR) for this virtual circuit. See *Congestion Control* on page 31-7 for further information on the CIR.

♦ **Important Note** ♦

The **CIR** that you enter must match that used by your service provider. This option should only be modified by experienced Frame Relay network administrators.

Committed Burst Size (Bc)

The Committed Burst Size (BC) is the amount of data that the network will guarantee to transfer under normal conditions. See *Congestion Control* on page 31-7 for further information.

♦ **Important Note** ♦

The **Committed Burst Rate** that you enter must match that used by your service provider. This option should only be modified by experienced Frame Relay network administrators.

Excess Burst Size (Be)

The Excess Burst Size (Be) is the amount of data over-and-above the Committed Burst Size (BC) that the network will transmit as long as excess bandwidth is available. See *Congestion Control* on page 31-7 for further information.

♦ **Important Note** ♦

The **Excess Burst Rate** that you enter must match that used by your service provider. This option should only be modified by experienced Frame Relay network administrators.

Compression Administrative State

This field enables and disables compression negotiation for this virtual circuit. If set to enable, then the OSWSM will query the Bridge/Router on the other end of the Frame Relay link as to whether it supports compression. Compressed data will be sent only when the other Bridge/Router also supports compression. If the Bridge/Router on the other end is an OmniStack, then data would be sent compressed as long as you set the Compression Administrative State to Enabled.

Disabling Compression Administrative State means that data will not be sent compressed even if the other Bridge/Router supports compression. Data compression is always negotiated before it is activated.

Compression PRetry Time

This option sets the number of seconds between compression negotiation messages on this virtual circuit. If compression negotiation is enabled, the OSWSM will send compression negotiation messages as many times as you indicate in the Compression PRetry Count. The time between these tries in indicated in this field. The number of seconds between retries may range between 1 and 10 seconds. The default is 3 seconds. The value you enter for this field overrides the **Default Compression PRetry Time** set up for the physical port with which this virtual circuit is associated.

♦ Important Note ♦

The **Compression PRetry Time** that should only be modified by experienced Frame Relay network administrators. In addition, it should match the setting for the remote OmniStack or Bridge/Router.

Compression PRetry Count

This option sets the total number of compression negotiation messages that will be sent before giving up and not running compression on this virtual circuit. You enter the time between these retries in the Compression PRetry Time field. The number of retries can range from 3 to 255. The default is 10. The value you enter for this field overrides the **Default Compression PRetry Count** set up for the physical port with which this virtual circuit is associated.

♦ Important Note ♦

The **Compression PRetry Count** that should only be modified by experienced Frame Relay network administrators. In addition, it should match the setting for the remote OmniStack or Bridge/Router.

Adding a Virtual Circuit

Data virtual circuits and their DLCIs are normally learned through status messages with the Frame Relay network. However, it may be convenient to pre-configure these virtual circuits before connecting to a live network. In such a case you will need to use the **fradd** command to set parameters for the virtual circuit. The information for the virtual circuit will be stored in the OSWSM database. This method of configuration is different than using the **frmodify** command, which changes virtual circuit parameters after the circuit has been learned from the network or configured through **fradd**.

To set up a data virtual circuit, enter the following command

fradd <slot>/<port>/<DLCI>

where **<slot>** is the slot number where the OSWSM board is located, **<port>** is the port number on the OSWSM board, and **<DLCI>** is the number used to identify the virtual circuit that you want to add. For example, if you wanted to add DLCI 32 on Port number 1 of the OSWSM board in slot 2, you would enter

fradd 2/1/32

or

fra 2/1/32

A screen similar to the following displays:

```
Adding Frame Relay port for Slot: 2, Port: 1 Dlci: 32.

1)  Administrative State .....................................................  = UP
      {(U)p, (D)own}
2)  Committed Information Rate (CIR) in BPS ....................  = 0
      {0 through line speed in BPS}
3)  Committed Burst Rate (Bc) in bits ...............................  = 0
      {0 through positive number in bits}
4)  Excess Burst Rate (Be) in bits ..................................... = 0
      {0 through positive number in bits}
5)  Compression Administrative Status.............................. = Enabled
      {(E)nabled, (D)isabled}
6)  Compression PRetry Time ............................................  = 3
      {1..10}
7)  Compression PRetry Count .......................................... = 10
      {3..255}
```

Enter the value for each parameter after the colon prompt (:). An additional field, **DLCI Number**, is displayed if you do not specify a DLCI number in the **fradd** command. The remaining parameters are the same ones used for the **frmodify** command. See *Modifying a Virtual Circuit* on page 31-25 for information on each of these parameters.

When you have entered values in all fields, the following prompt displays

Do you want to configure additional DLCIs? {(Y)es, (N)o}

Enter a **Y** to set up additional virtual circuits or enter **N** to exit the **fradd** command. If you enter **Y**, then you are prompted for all virtual circuit parameters again.

Viewing Configuration Parameters for the OSWSM

You can view all current parameters for a OSWSM port or an individual virtual circuit using the **frview** command. These parameters will be either the default parameters or parameters you modified using the **frmodify** command or network management software.

You have a choice of viewing parameters at the chassis, port or DLCI (virtual circuit) level. You receive different configuration choices depending upon which level you choose. The sections below describe both ways to use the **frview** command.

Viewing Parameters for all OSWSMs in the Chassis

To view port parameters for all OSWSM boards in a chassis, enter the following command

frview

or

frv

A screen similar to following displays:

Frame Relay Configuration for Chassis:

Slot/Port	Intf Type	Speed BPS	Clocking	Default Bridging Grp	Default Routing Grp
3/1	V35DTE	0	External	1	0
3/2	V35DCE	0	External	1	0
3/3	*NONE*	0	External	1	0
3/4	*NONE*	0	External	1	0

Only ports configured as frame relay will be displayed in this screen. This screen lists all the current values for the listed parameters. These parameters are the same ones set through the **frmodify** command. For detailed information on these values, see *Modifying a Port* on page 31-19. For detailed information on the **Intf Type** column, see *Intf Type* on page 31-35.

Viewing Port Parameters

To view port parameters, enter the following command

frview <slot>/<port>

where **<slot>** is the slot number where the OSWSM board is located, and **<port>** is the port number on the OSWSM board on which you want to view information. For example, if you wanted to view configuration parameters for Port number 1 on the OSWSM board in slot 3, you would enter

frview 3/1

or

frv 3/1

A screen similar to following displays:

```
Frame Relay port for Slot 2, Port 1.

 1)  Speed in BPS ............................................................ = 56000
 2)  Clocking .................................................................  = External
 3)  DLCMI Type ..............................................................  = ANSI T1.617 Annex D
 4)  Polling Interval T391/nT1 in seconds ..........................  = 10
 5)  Full Status Interval N391/nN1.......................................  = 6
 6)  Error Threshold N392/nN2 .......................................... = 3
 7)  Monitored Events Counter N393/nN3 ..........................  = 4
 8)  Administrative Status ................................................. = Up

9)  Default Bridging Group................................................  = 1
10)  Default Bridging Mode ............................................... = 1
11)  Default Routing Group ............................................... = 0
12)  Default Compression Admin Status............................ = Enabled
13)  Default Compression PRetry Time ............................. = 3
14) Default Compression PRetry Count ............................  = 10
15)  Description................................................................. = Port1
```

This screen lists all the current values for the listed parameters. These parameters are the same ones set through the **frmodify** command. For detailed information on these values, see *Modifying a Port* on page 31-19.

Viewing Virtual Circuit Parameters

To view virtual circuit parameters, enter the following command

frview <slot>/<port>/<DLCI>

where **<slot>** is the slot number where the OSWSM board is located, **<port>** is the port number on the OSWSM board, and **<DLCI>** is the number used to identify the virtual circuit that you want to view. For example, if you wanted to view configuration parameters for DLCI 17 on Port number 1 of the OSWSM board in switch slot 3, you would enter

frview 3/1/17

or

frv 3/1/17

A screen similar to the following displays:

```
Frame Relay DLCI for Slot 3, Port 1, DLCI 17.

1)  Administrative State .....................................................  = UP
2)  Committed Information Rate (CIR) in BPS ..................... = 16000
3)  Committed Burst Rate(Bc) in bits .................................  = 16000
4)  Excess Burst Rate(Be) in bits........................................ = 40000
5)  Compression Administrative Status.............................. = Enabled
6)  Compression PRetry Time ............................................ = 3
7)  Compression PRetry Count ........................................... = 10
```

This screen lists all the current values for the listed parameters. These parameters are the same ones set through the **frmodify** command. For detailed information on these values, see *Modifying a Virtual Circuit* on page 31-25.

Deleting Ports and Virtual Circuits

You can delete a OSWSM port or virtual circuit. When you delete a port or virtual circuit all configuration parameters revert back to default settings. You can use the **frdelete** command to delete:

- a single virtual circuit, or
- a port and all of its associated virtual circuits

The **frdelete** command always requires you to indicate at least a slot and port number. You cannot, for example, enter **frdelete** along with no slot and port parameters.

Deleting a Virtual Circuit

You can delete a single virtual circuit as long as you know its DLCI number and the OSWSM port where it exists. Deleting a virtual circuit resets the configuration parameters on that circuit to configuration and bridging defaults. By default, a virtual circuit is assigned to Group 1.

Virtual circuits are also not actually “deleted” when you use **frdelete**. The Frame Relay network stills sees them as active or inactive. If the virtual circuit was configured (management circuit or a circuit configured through **frmodify**), then the database record for the circuit is deleted; the VC is still present as long as it was present before you deleted it. If the virtual circuit is learned (through status updates from the Frame Relay network), then the database record for the circuit is deleted, but the circuit is still present.

To delete a virtual circuit, enter the following command

frdelete <slot>/<port>/<DLCI>

where **<slot>** is the OmniStack slot number for the OSWSM board, **<port>** is the port to which the virtual circuit maps, and **<DLCI>** is the identification number for the virtual circuit. For example, if you wanted to delete virtual circuit 32 on Port 1 of the OSWSM board in slot 2, then would enter:

frdelete 2/1/32

or

frd 2/1/32

This system returns the following prompt to confirm the deletion:

This will delete Slot 2, Port 1, DLCI 32. Continue? {(Y)es, (N)o} (N)

Enter a **Y** to confirm the deletion or press **<Enter>** to cancel the deletion.

Deleting a Port and Its Virtual Circuits

You can delete a port as well as all of its associated virtual circuits. Deleting a port means that all configuration parameters on the port and all learned virtual circuits will revert back to default settings. The port is not logically deleted, and can still be reconfigured after the delete. To truly “delete” a port you must disconnect its cable or set its Administrative Status to Disable.

To delete a virtual circuit, enter the following command:

frdelete <slot>/<port>

where **<slot>** is the OmniStack slot number for the OSWSM board, **<port>** is the port number on the OSWSM board that you want to delete. For example, if you wanted to delete Port 1 of the OSWSM board in slot 2, then would enter:

frdelete 2/1

or

frd 2/1

This system returns the following prompt to confirm the deletion:

This will delete Slot 2, Port 1 and its DLCIs. Continue? {(Y)es, (N)o} (N)

Enter a **Y** to confirm the deletion or press **<Enter>** to cancel the deletion.

Obtaining Status and Statistical Information

You can obtain general and detailed Frame Relay statistical information on all OSWSM boards in the switch, a single OSWSM board, individual ports, and individual virtual circuits. The **frstatus** command is used to provide this information. This information includes types of physical interface, access rate of the Frame Relay line, and errors. In addition, the **frstatus** command can display the number of frames received and transmitted categorized by frame type (i.e., compressed/uncompressed, Ethernet, IP, IPX, BPDU).

Information on All Boards in a Switch

To obtain status information on all OSWSM boards in a switch, you enter the **frstatus** command without any parameters as follows:

frstatus

or

frs

This command displays a screen similar to the following:

Frame Relay Status for the Chassis:

Slot/Port	Admin/ Oper Status	Intf Type	Speed BPS	Clocking	VCs Active/ Inactive
4/1	UP/UP	V35DCE	2048000	Split	2/0
4/2	DN/DN	*NONE*	EXT CLK	External	0/0
4/3	UP/DN	*NONE*	EXT CLK	External	0/0
4/4	UP/UP	232DCE	56000	Internal	19/1

Only ports configured as frame relay will be displayed in this screen. Each row in the table corresponds to a physical port on a OSWSM board in the switch. The following sections describe the columns shown in this table:

Slot/Port

The first number in this column is the slot in the switch where this OSWSM is installed. The second number is the port number on the OSWSM.

Admin/Oper Status

This column shows the Administrative and Operational Status of this OSWSM port. The status indicator before the slash refers to the Administrative Status. If **UP**, then the port has been enabled and can transmit data as long as its Operational Status is also **UP**. If the Administrative Status is **DN**, then the port will not pass data even if its physical connection is good.

The status indicator after the slash refers to the Operational Status. If **UP**, then the port is capable of passing data as long as it has been logically enabled at the Administrative level. If **DN**, then the port cannot pass data because of a problem in the physical connection (e.g., cable disconnected, OSWSM could not detect cable type) or because the port is Administratively Down.

Intf Type

This column indicates the physical cable type connected to this port. This cable type is automatically sensed by the OSWSM hardware. This column indicates the cable type and whether it is DCE or DTE. The following values may display in this column

- **V35DTE** (V.35 DTE cable)
- **V35DCE** (V.35 DCE cable)
- **232DTE** (RS-232 DTE cable)
- **232DCE** (RS-232 DCE cable)
- **X21DTE** (X.21 DTE cable)
- **X21DCE** (X.21 DCE cable)
- **530DTE** (RS-530 or RS-449 EIA DTE cable)
- **530DCE** (RS-530 or RS-449 EIA DCE cable)
- **T1** (T1 port)
- **E1** (E1 port)

The OSWSM sees RS-530 and RS-449 cables the same because they are electrically identical. However, this does not affect the operation of either cable type. Both RS-530 and RS-449 cables are supported. If no cable is connected to a port, then this column will display

NONE

If an error has been detected on the port (e.g., cable type could not be detected), then the following value displays:

ERROR!

Speed BPS

This column indicates the speed, or access rate, between the OSWSM serial port and DSU or other “physical” DTE device. The speed is expressed in bits per second (bps). This speed is the total available bandwidth on the line connected to this port. Virtual circuits on this port share this bandwidth.

Usually, the OSWSM port will be a physical DTE device and the speed will be determined by the DSU. In this case, this value will read **EXT CLK**, which means the OSWSM port gets its clocking from an externally attached DCE device (i.e., DTE cable plugged into OSWSM port) or no cable is attached. If the OSWSM port is a physical DCE device (i.e., DCE cable plugged into OSWSM port), then this value will be the actual clock rate used by the port. The speed on a T1 port will always be 1544000; the speed for an E1 port will always be 2048000.

Clocking

Indicates the type of clocking used on this port. The three different types of clocking are described in *Clocking* on page 31-21.

VCs Active/Inactive

Each port will have one or more associated virtual circuits. This column tells you the current status of *Data* virtual circuits. These counts do not apply to management virtual circuits. The first number is the number of active VCs and the second is the number of inactive VCs. An **Active** virtual circuit is one that is operationally Up and capable of transmitting data; it may not necessarily be transmitting at this time. An **Inactive** virtual circuit is present, but for some reason is operationally Down. It is not capable of passing data because either its administrative status was set to Down or the Frame Relay network indicated it was present but Down.

Information on the Ports for One OSWSM Board

To obtain status information on a single OSWSM board, you enter the **frstatus** command along with the slot number for the OSWSM board, as follows:

frstatus <slot>

where **<slot>** is the slot number where the OSWSM board is installed. For example, if you wanted to obtain status information for the board in slot 4, you would enter:

frstatus 4

or

frs 4

This command displays a screen similar to the following:

Frame Relay Status for slot: 4

PT	Admin/ Oper Status	Intf Type	Speed BPS	VCs Active/ Inactive	Frames In	Frames Out	Octets In	Octets Out
==	======	====	=======	========	======	=======	========	=======
1	UP/UP	V35DTE	2048000	2/0	364	128	8962	2650
2	DN/DN	*NONE*	9600	0/0	0	0	0	0
3	UP/DN	232DTE	56000	0/0	89	90	890	895
4	UP/UP	V35DTE	256000	19/1	9	21	124	245

Each row in the table corresponds to a port on the OSWSM you requested information on.

PT

The Port number on the OSWSM board for which statistics are displayed.

Admin/Oper Status, Int Type, Speed Bps, DLCI Active/Inactive

These columns are described in the section, *Information on All Boards in a Switch* on page 31-34. Please refer to this section for detailed information.

Frames In

The total number of frames received on this port since the last time the switch was initialized.

Frames Out

The total number of frames sent on this port since the last time the switch was initialized.

Octets In

The total number of Octets, or bytes, received on this port since the last time the switch was initialized. This statistic includes the data and Frame Relay header fields, but does not include CRC or flag characters.

Octets Out

The total number of Octets, or bytes, sent on this port since the last time the switch was initialized. This statistic includes the data and Frame Relay header fields, but does not include CRC or flag characters.

Information on One Port

To obtain status information on a single OSWSM port, you enter the **frstatus** command along with the slot number for the OSWSM board and the port number for which you want to receive information, as follows:

frstatus <slot>/<port>

where **<slot>** is the slot number where the OSWSM board is installed and **<port>** is the port number on the OSWSM board. For example, if you wanted to obtain status information for Port 1 on the OSWSM module in Slot 4, you would enter:

frstatus 4/1

This command displays a screen similar to the following:

Physical Level Information

```
Frame Relay Status for slot 4, port 1:

Administrative/Operational Status ........................................... Up/Up

 Speed    Intf.     Receive     Receive      Receive      Transmit    Signal
BPS      Type      CRC Errors  Aborts       Overruns     Overruns    Errors
 =======  ======= ========== ==========  ========== ========== ========
 2048000  V35DTE            18           12             0            0          2

Control       DTR   RTS          DSR    CTS    DCD
Signal        ON    ON           ON     ON     OFF
```

Logical (Frame Relay) Information

```
 Frame Relay Information:
                         UniCast      Discarded    Error
            Octets       Frames       Frames       Count
            ==========   ==========   ==========   ==========
 IN               8962          120            2            0
 Out              2650           24            5            0
 IN+OUT          11612          144            7            0

Administrative/Operational Phase ........................................... Up/Up

 Last Error Type               ................................................No Error Since Reset
 Last Error Time               ................................................. 0 Seconds
 Interface failures            .................................................. 0
 Last interface failure time      ............................................ 0 Seconds
```

Virtual Circuit Level Information

```
 DLCI Information:
        Admin/
 DLCI Oper     DLCI          Frames        Frames        Octets        Octets
 Num  Status   Type          In            Out           In            Out
 ==== ======   ==========    ==========    ==========    ==========    =========
 0    UP/UP    Configured            10            10           160           140
 31   UP/UP    Learned               31            20          4196          1250
 32   UP/DN    Learned              145           110          4813          1450
```

This command displays three (3) layers of information. The top section provides information on the physical interface. The middle section provides information on the logical, or Frame Relay, interface. The bottom section provides information on the virtual circuits associated with this physical port.

Physical Layer Information

The statistics shown in this section are taken at the physical, or serial, interface level.

Administrative/Operational Status

This field shows the Administrative and Operational Status of this OSWSM port. The status indicator before the slash refers to the Administrative Status. If **UP**, then the port has been enabled and can transmit data as long as its Operational Status is also UP. If the Administrative Status is **DN**, then the port will not pass data even if its physical connection is good.

The status indicator after the slash refers to the Operational Status. If UP, then the port is capable of passing data as long as it has been logically enabled at the Administrative level. If **DN**, then the port cannot pass data because of a problem in the physical connection (e.g., cable disconnected, OSWSM could not detect cable type) or because the port is Administratively Down.

Speed BPS

The configured speed of the port. For a physical DTE port, the actual rate is determined by the DCE device to which the OSWSM is attached (i.e., a modem or DSU). For a physical DCE port, the actual rate is the rate configured through the **frmodify** command.

Intf Type

The type of cable that is plugged into the OSWSM port. The cable may be DCE or DTE and one of 5 different serial types. See *Intf Type* on page 31-35 for further information.

Receive CRC Errors

The total number of frames with an invalid frame check sequence received on the port since the last time the switch was initialized.

Receive Aborts

The total number of frames received that were terminated with an HDLC abort sequence since the last time the switch was initialized. An abort sequence consists of 7 contiguous bits of ones (1111111).

Receive Overruns

The total number of frames that were not received on the port because the system could not keep up with the data flow. Receive overrun errors include buffer errors and errors reported by the RISC processor.

Transmit Overruns

The total number of frames that were not transmitted on the port because the system could not keep up with the data flow. Transmit overrun errors include buffer errors and errors reported by the RISC processor.

Signal Errors

The total number of frames that failed to be received or transmitted due to a loss of modem signals since the last time the switch was initialized. If the OSWSM port is a physical DTE, then this count is the number of frames dropped due to a loss of the Data Set Ready (DSR) signal. If the OSWSM port is a physical DCE, then this count is the number of frames dropped due to a loss of the Data Terminal Ready (DTR) signal.

Control Signal

This table (which displays only for serial ports, not T1 or E1 ports) lists two or more control signals along with their current state. If a V.35, RS-232, RS-530, or RS-449 cable is attached then this table lists the following signals:

- **DTR** (Data Terminal Ready.)
- **RTS** (Request To Send.)
- **DSR** (Data Set Ready.)
- **CTS** (Clear To Send.)
- **DCD** (Data Carrier Detect.)

The ON/OFF indicator below the signal name tells you the current status of the signal. Under normal operating conditions (physical connection is good and VC is administratively enabled), all signals should be On.

Whether the signal is an input or an output depends on whether the OSWSM is a physical DTE or DCE. The following table shows the Input/Output status of each signal type.

	Signal Direction When Port Is...	
Signal	**DCE**	**DTE**
DTR	In	Out
RTS	In	Out
DSR	Out	In
CTS	Out	In
DCD	Out	In

If using an X.21 cable, then the table shown in the sample display is replaced by the following table:

Control Signal	C(Control) ON	I(Indicator) ON

This X.21 table shows 2 rather than 5 signal statuses. The **C** signal is similar to the RTS (Request To Send) signal. The **I** signal is similar to the DCD (Data Carrier Detect) signal. Under normal operating conditions, both the **C** and **I** signals should be On.

Whether the signal is an input or an output depends on whether the OSWSM is a physical DTE or DCE. The following table shows the Input/Output status of each signal type.

	Signal Direction When Port Is...	
Signal	**DCE**	**DTE**
C	In	Out
I	Out	In

Frame Relay Information

The statistics shown in the section are gathered at the Frame Relay protocol level.

Octets

The total octets, or bytes, received (first row) and sent (second row) on this port. The third row shows the cumulative number of octets that have passed through the port (sent and received). This statistic includes the data and Frame Relay header fields, but does not include CRC or flag characters.

UniCast Frames

The total number of Unicast frames received (first row) and sent (second row) on this port. The third row shows the cumulative number of Unicast frames that have passed through this port (sent and received).

Unicast frames are destined for a specific virtual circuit, and are normally sent from one local DLCI to the corresponding DLCI on the other side of the Frame Relay link. In Frame Relay terms, these unicast frames are sent from a logical DTE, such as s OSWSM port, to a Remote logical DTE, such as a OSWSM port on the other side of the Frame Relay link.

Discarded Frames

The number of frames discarded due to an error.

Error Count

Frames that contained Frame Relay type errors, such as DLCMI protocol errors and invalid frame format. This count does not include standard physical errors, such as CRC and abort errors.

Administrative/Operational Status

This field shows the Administrative and Operational Status of this OSWSM port. The status indicator before the slash refers to the Administrative Status. If **UP**, then the port has been enabled and can transmit data as long as its Operational Status is also UP. If the Administrative Status is **DN**, then the port will not pass data even if its physical connection is good.

The status indicator after the slash refers to the Operational Status. If **UP**, then the port is capable of passing data as long as it has been logically enabled at the Administrative level. If **DN**, then the port cannot pass data due to a problem in the physical connection (e.g., cable disconnected, OSWSM could not detect cable type) or because the port is Administratively Down.

Last Error Type

The last type of Frame Relay DLCMI protocol error received on this port. The following list describes the error types displayed:

Unknown Error	An error occurred but it can not be classified into one of the standard Frame Relay error types.
Receive Short	The receive frame was not long enough to allow demultiplexing. The address field was incomplete, or the protocol identifier was missing or incomplete.
Receive Long	The receive frame exceeded the maximum length for this port.
Illegal Dlci	The DLCI address field in a frame did not match the configured format.
Unknown Dlci	A frame was received on a virtual circuit that was not active or was administratively disabled.
Dlcmi Protocol Error	An Unspecified error occurred while trying to interpret the Link Maintenance frame.
Dlcmi Unknown IE	DLCMI Unknown Information Element. The Link Maintenance frame contained an Information Element type that is not valid for the configured DLCMI protocol.
Dlcmi Sequence Error	The Link Maintenance frame contained a sequence flag that was different than the expected flag.
Dlcmi Unknown RPT	DLCMI Unknown Report Type. The Link Maintenance frame contained a Report Type Information Element with a value that is not valid for the configured DLCMI protocol.
No Error Since Reset	No error has occurred since the last time this port was initialized.

Last Error Time

The time since the last Frame Relay protocol error was received. A value of zero (0) indicates no Frame Relay protocol errors have been received. The type of error that was last received is indicated in the **Last Error Type** field.

Interface Failures

The number of times this Frame Relay port has gone down since it was initialized.

Last Interface Failure Time

The time since the interface was taken down due to excessive errors. Excessive errors are defined as the time when a DLCMI error exceeds the **Error Threshold** or the errors within the **Monitored Events Counter**. A value of zero (0) indicates the interface has not been taken down due to excessive errors. These error parameters are configured through **frmodify** and in most cases should be set to defaults. See *Setting Configuration Parameters* on page 31-19 for more information.

DLCI Layer Information

The information in this section of the display provides statistics on virtual circuits. Each row in this table corresponds to one virtual circuit.

DLCI Num

The DLCI number assigned to this virtual circuit. This value is only valid locally; the same virtual circuit on the other end of the Frame Relay line may or may not use the same DLCI for this VC.

Admin/Oper Status

This field shows the Administrative and Operational Status of this virtual circuit. The status indicator before the slash refers to the Administrative Status. If **UP**, then the virtual circuit has been enabled and can transmit data as long as its Operational Status is also UP. If the Administrative Status is **DN**, then the VC will not pass data even if its physical connection is good.

The status indicator after the slash refers to the Operational Status. If UP, then the virtual circuit is capable of passing data. If **DN**, then the VC cannot pass data because the network has declared the virtual circuit inactive, the network does not respond to STATUS ENQUIRY messages, or the VC is Administratively Down.

DLCI Type

The type of virtual circuit will be either **Configured** or **Learned**. Configured means this VC is a management, or control, circuit that is used by Frame Relay protocols, such as the DLCMI protocols, to pass various status messages. The Frame Relay network does not self-configure management virtual circuits. Data VCs can become “configured” if you use **frmodify** to change any of the default settings for the Data VC. Learned means this is a Data VC that the Frame Relay network informed the OSWSM module about through status messages (using a Control VC).

Note

The **VC Type** of the management DLCI (0 or 1023) is always **configured** since the Frame Relay network does not dynamically configure management virtual circuits.

Frames In

The number of frames received on this VC since it was created.

Frames Out

The number of frames transmitted on this VC since it was created.

Octets In

The number of octets, or bytes, received on this VC since it was created.

Octets Out

The number of octets, or bytes, transmitted on this VC since it was created.

Information on One Virtual Circuit

To obtain status information on a single virtual circuit, you enter the **frstatus** command along with the slot number for the OSWSM board, the port number, and DLCI number for the virtual circuit on which you want information, as follows:

frstatus <slot>/<port>/<DLCI>

where **<slot>** is the slot number where the OSWSM board is installed, **<port>** is the port number on the OSWSM board, and **<DLCI>** is the virtual circuit identifier. For example, if you wanted to obtain status information for the board in slot 4, port 1, DLCI 32, you would enter:

frstatus 4/1/32

or

frs 4/1/32

This command displays a screen similar to the following:

Frame Relay Status for slot 4, port 1, DLCI 32
Admin/Oper Status: UP:UP for 0 days, 00:34:40.59
Compression Administrative Status/Operational Phase: Enabled/Operation

	Frames In	Frames Out	Frames In+Out	Octets In	Octets Out	%In	%Out
Total	200	250	450	20000	17000		
Ethernet	100	150	250	10000	11000	50	65
802.5	0	0	0	0	0	0	0
FDDI	0	0	0	0	0	0	0
IP	0	4	4	0	2000	0	12
IPX	90	99	185	9560	3960	48	23
BPDU	10	1	11	440	40	2	<1
DE Bit	10	0	10				
FECN Bit	5						
BECN Bit	7						
Discarded	0						

FRF.9 Compression:	Compressed Frames	Compressed Octets	Uncompressed Octets	Compression Ratio
In	200	10000	20000	2.0:1
Out	250	15000	17000	1.2:1
In+Out	450	25000	37000	1.5:1

The top of the display provides information on the status of this virtual circuit. The **Admin/Oper Status** field indicates the current Administrative and Operation Status for this virtual circuit. The next informational field, **Compression Administrative Status/Operation Phase**, indicates the current Administrative and Operational status for Compression Negotiation on this VC. The Administrative Status will be either **Enabled** or **Disabled**. The Operational Phase will be **Disabled** (compression negotiation not enabled), **Initialization** (compression negotiation in progress), or **Operation** (negotiation successful, data being compressed).

The table below the status information breaks down traffic on the virtual circuit by protocol type. Each row corresponds to a frame type, such as Ethernet or IPX. For each frame type, the number of frames received, frames transmitted, octets received, and octets transmitted is given. The final two columns of the table (**%In** and **%Out**) represent the total percentage of traffic (octets, not frames) for that protocol type.

The final table provides information on compressed data on this virtual circuit. The following sections describe information in the table.

Total (Protocol)

Statistics in this row indicate traffic for all protocol (Ethernet, IP, IPX, and BPDU) frames and octets on this VC. Statistics for octets, or bytes, include the data and Frame Relay header fields, but they do not include CRC or flag characters.

Ethernet

Statistics in this row indicate traffic for Ethernet (bridged 802.3 or trunked format) frames and octets on this virtual circuit. Statistics for octets, or bytes, include the data and Frame Relay header fields, but they do not include CRC or flag characters.

802.5

Statistics in this row indicate traffic for Token Ring (802.5 format) frames and octets on this virtual circuit. Statistics for octets, or bytes, include the data and Frame Relay header fields, but they do not include CRC or flag characters.

FDDI

Statistics in this row indicate traffic for FDDI frames and octets on this virtual circuit. Statistics for octets, or bytes, include the data and Frame Relay header fields, but they do not include CRC or flag characters.

IP

Statistics in this row indicate traffic for routed IP, ARP, and Inverse ARP format frames and octets on this virtual circuit. Statistics for octets, or bytes, include the data and Frame Relay header fields, but they do not include CRC or flag characters.

IPX

Statistics in this row indicate traffic for routed IPX format frames and octets on this virtual circuit. Statistics for octets, or bytes, include the data and Frame Relay header fields, but they do not include CRC or flag characters.

BPDU

Statistics in this row indicate traffic for BPDU frames and octets on this virtual circuit. Statistics for octets, or bytes, include the data and Frame Relay header fields, but they do not include CRC or flag characters.

DE Bit

Statistics in this row indicate the number of frames sent and received that have been marked for Discard Eligibility (the DE bit in the frame is set to 1). No statistics are given for Octets in this row. See *Discard Eligibility (DE) Flag* on page 31-8 for more information on the DE bit.

FECN Bit

This value indicates the total number of frames received from the network indicating forward congestion. This occurs when the Frame Relay network sets the frame’s Forward Discard Eligibility (FECN) flag. These frames experienced congestion coming over the virtual circuit. Statistics are given only for Frames In for FECN Bit since the Frame Relay network sets it. See *Notification By FECN* on page 31-10 for more information on the FECN bit.

BECN Bit

This value indicates the number of frames received from the network indicating backward congestion. This occurs when the Frame Relay network sets a frame's Backward Discard Eligibility (BECN) flag. These frames observed congestion occurring in the opposite direction during their path over the virtual circuit. Statistics are given only for Frames In since the Frame Relay network sets the BECN bit. See *Notification By BECN* on page 31-9 for more information on the BECN bit.

Discarded

The number of inbound frames that were dropped due to format errors or because the VC was inactive.

Compressed Frames

Statistics in this column indicate traffic for compressed frames on this virtual circuit. Compressed frames are only sent if both sides of a Frame Relay link successfully negotiate for compression (i.e., both must support compression).

Compressed Octets

Statistics in this column indicate traffic for compressed octets on this virtual circuit. Compressed frames are only sent and received if both sides of a Frame Relay link successfully negotiate for compression (i.e., both must support compression). Statistics for octets include the data, Frame Relay header, and Data Compression header fields, but they do not include CRC or flag characters.

Uncompressed Octets

Statistics in this column indicate traffic for uncompressed octets on this virtual circuit. These values apply to the compressed data before compression or just after decompression. Statistics for octets include the uncompressed data and Frame Relay header fields, but they do not include CRC or flag characters.

Compression Ratio

Statistics in this column indicate the compression that was achieved for this type of traffic. For example, in the sample table Outgoing traffic had compression ration of

```
1.2:1
```

meaning that each compressed octet is 1.2 uncompressed octets.

Resetting Statistics Counters

You can reset the statistics counters for a single OSWSM board, a OSWSM port, or a specific DLCI. The statistics that are cleared on those that are displayed through the **frstatus** commands. The **frclear** command is used to reset statistics.

Resetting Statistics for a OSWSM Board

To reset statistics on a single OSWSM board, enter the **frclear** command along with the slot number for the OSWSM board, as follows:

frclear <slot>

where **<slot>** is the slot number where the OSWSM board is installed. For example, if you wanted to clear statistics for the board in slot 4, you would enter:

frclear 4

or

frc 4

Resetting Statistics for a OSWSM Port

To reset statistics on a single OSWSM port, enter the **frclear** command along with the slot number for the OSWSM board and the port number as follows:

frclear <slot>/<port>

where **<slot>** is the slot number where the OSWSM board is installed and **<port>** is the port number on the OSWSM board. For example, if you wanted to reset statistics for Port 1 on the OSWSM module in Slot 4, you would enter:

frclear4/1

or

frc 4/1

Resetting Statistics for a Virtual Circuit (DLCI)

To reset statistics on a single virtual circuit, you enter the **frclear** command along with the slot number for the OSWSM board, the port number, and DLCI number for the virtual circuit on which you want to reset statistics, as follows:

frclear <slot>/<port>/<DLCI>

where **<slot>** is the slot number where the OSWSM board is installed, **<port>** is the port number on the OSWSM board, and **<DLCI>** is the virtual circuit identifier. For example, if you wanted to reset statistics for the board in slot 4, port 1, DLCI 32, you would enter:

frclear 4/1/32

or

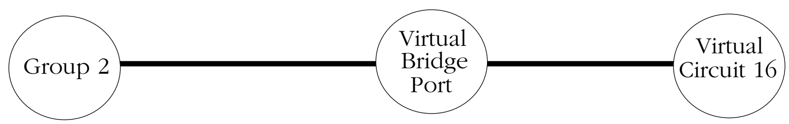
frc 4/1/32

Managing Frame Relay Services

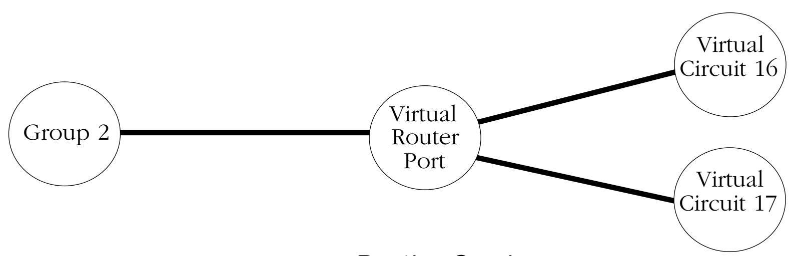
By default, all virtual circuits on a OSWSM port have a Bridging service and are assigned to Group 1. The **frmodify** command allows you to change this default bridging service to another Group and to set up a default routing service for the port. See *Setting Configuration Parameters* on page 31-19 for information on the **frmodify** command.

To extend your control over a Frame Relay service, you can use Service menu commands. These command allow you to create and modify bridging, routing, and trunking services by assigning specific virtual circuits and Groups to the services.

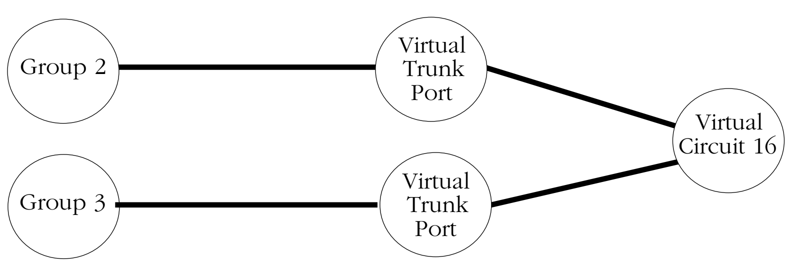
Setting up a bridging service requires you to map a virtual circuit to a Group. Setting up a routing service requires you to map one or more virtual circuits to a Group. And setting up a Trunking service requires you to map a single virtual circuit to one or more Groups. The diagrams below illustrate the relationship between Groups, virtual ports and virtual circuits for each Frame Relay service type:



Bridging Service



Routing Service



Trunking Service

An overview of each type of service and how each operates in a Frame Relay environment can be found earlier in this chapter in the following sections:

- Bridging — See *Bridging Services* on page 31-12.
- Routing — See *Frame Relay IP Routing* on page 31-13 and *Frame Relay IPX Routing* on page 31-16.
- Trunking — See *Trunking* on page 31-17.

The decision to set up one service over another is determined by your network configuration and amount of traffic. In general, you can follow these guidelines:

1. If all your Frame Relay connections are through OmniStackes, then Trunking is probably the best choice. Trunking is normally set up exclusively for a virtual circuit. No bridging or Routing service needs to be configured on the same virtual circuit where a Trunking service has already been set up.
2. If interoperability is important, then Bridging or Routing is a good choice. In an environment where broadcast traffic is low and high CIRs are deployed, Bridging is a simpler and better choice. In environments with higher broadcast traffic and lower CIRs, Routing is a good solution. However, if you choose to set up a Routing service in an environment with different types of routers, all must support RFC 1490 encapsulation.
3. Bridging and routing services may share a virtual circuit.

The following sections describe how to configure each service type and then how to modify, view, and delete your Frame Relay services.

Configuring a Bridging Service

Frame Relay traffic is automatically bridged for Group 1 in a switch. You can alter this default through two different commands: **frmodify** and **cas**.

The **frmodify** command allows you to change the default Bridging Group from Group 1 to another Group or to turn off bridging completely. This command configures bridging on a port-by-port basis, but does not configure bridging on a virtual circuit basis—all virtual circuits may also be assigned to the Group specified in **frmodify**. See *Modifying a Port* on page 31-19 for more information on the **frmodify** command.

The **cas** command provides more control over bridging service configuration. In addition to naming, enabling and disabling bridging services through **cas**, you can assign specific virtual circuits to a bridging service. Follow the steps below to set up a bridging service through the **cas** command.

1. Enter the **cas** command followed the slot number, a slash (/), the port number, and then the service number for the bridging service:

   cas 2/3 3

   A screen similar to the following displays:

```
Slot 1 Port 2 Service 3 Configuration
1) Description .................................................................. = Frame-Relay
     {Enter up to 30 characters}
2) Service Type ................................................................ = Bridging
     {(T)runking, (R)outing, (B)ridging}
3) Administrative Status .................................................... = Enabled
     {(E)nable, (D)isable}
4) VC(s).............................................................................. = 0
5) VLAN Group(s) ............................................................. = 0
6) Frame-Relay Bridging Mode (Applies to Bridging Only).. = Bridge All
     {Bridge (a)ll, (E)thernet only}


(save/quit/cancel)
  :
```

   You make changes to the options in this screen at the colon prompt (:). You make changes by entering the line number for the option you want to change, an equal sign (=), and then the value for the new parameter.

2. Enter a description of this bridging service by entering 1, an equal sign (=), and then a description for this service. Your description can be up to 30 characters long.

   1=<bridge service name>

   When you are done entering a description, press **<Enter>**.

3. Specify that this is a bridging service by entering a 2, an equal sign, and a **B** as follows:

   2=B

   This specifies that you want to set up a bridging service, as opposed to a Trunking or Routing service. Press **<Enter>**.

4. By default, the bridging service is Enabled. This means that as soon as you are done configuring the service, it will begin bridging Frame Relay traffic. If you would like to disable this bridging service now and enable it later, enter **3=D** and press **<Enter>**.

5. You need to specify the DLCI for the virtual circuit to include in this bridging service. Only one virtual circuit may be specified for each bridging service. There is a one-to-one mapping between the Group and the virtual circuit. Enter a 4, an equal sign (=), and the DLCI number for the virtual circuit. The example below includes the virtual circuit with DLCI 16 in the bridging service:

   4=16

   Press **<Enter>**.

6. Specify the Group number that you want to be part of this bridging service. Enter a 5, an equal sign (=), and the Group number. Remember, by default a virtual circuit already bridges on Group 1. The example below includes Group 3 in the bridging service:

   5=3

   Press **<Enter>**.

7. Indicate whether or not you want frames to be translated on this virtual bridge port. When the **Frame-Relay Bridging Mode** field is set to **Bridge all**, no translation is performed on frames before they are sent out to the Frame Relay network; enter an **A** at this field to select this option.

   When the **Frame-Relay Bridging Mode** field is set to **Ethernet only**, non-Ethernet frames are first translated to the default Ethernet frame format for this port before they are sent out to the Frame Relay network. Any MAC translations configured through the Switch menu are valid. Enter an **E** at this field to select this option.

8. Type **save** at the colon prompt (:) and press **<Enter>**. All parameters for this bridging service are saved.

Configuring a WAN Routing Service

There are two main steps to configuring WAN routing for frame relay:

1. Enable and configure routing for a specific WAN Routing group with the **crgp** command. (Frame Relay Groups are different from other Groups as far as router configurations are concerned.)

2. Set up a WAN routing service through the **cas** command.

Both of these steps are described in the next two sections.

Step 1. Set Up a Frame Relay Routing Group

You enable WAN routing for a Group when you create the Group through the **crgp** command. The steps for setting up a Group are described in Chapter 17, "Managing Groups and Ports." Please see that chapter for the generic steps used to create a Group. Also, understand the following points where WAN Groups differ from other Groups.

- During the process of configuring the Group, the **crgp** command will prompt you with the following prompt:

  Enable WAN Routing? (n):

  If you want to configure WAN routing on this Group, then you must answer Yes to this prompt. Otherwise, the Group will not be tagged correctly and will not be able to route Frame Relay traffic.

- When configuring IP and IPX Routing, you do not specify a a default framing type since Frame Relay routing always uses 1490 encapsulation.

- You do not set up physical interfaces (virtual ports) through the **crgp** command. All physical mappings for Frame Relay are done through services, as described in Step 2 of this section.

You can configure all virtual circuits to automatically be assigned to the WAN Routing Group you set up in this step. The **frmodify** command contains a parameter, **Default Routing Group**, that you can set to a WAN routing Group. All dynamically learned virtual circuits will automatically be assigned to this Group without any configuration required. See *Modifying a Port* on page 31-19 for more information on the **frmodify** command.

You can also configure a Frame Relay service using the **cas** command as described in *Step 2. Set Up a Frame Relay Routing Service* on page 31-52.

Step 2. Set Up a Frame Relay Routing Service

You create a Frame Relay routing service using the **cas** command. Follow the steps below to set up a routing service.

1. Enter the **cas** command followed the slot number, a slash (/), the port number, and then the service number for the routing service:

   cas 2/3 1

   A screen similar to the following displays:

   ```
   Slot 1 Port 2 Service 3 Configuration
   1) Description ..................................................................  = Frame-Relay
        {Enter up to 30 characters}
   2) Service Type ...............................................................  = Bridging
        {(T)runking, (R)outing, (B)ridging}
   3) Administrative Status ....................................................  = Enabled
        {(E)nable, (D)isable}
   4) VC(s)............................................................................. = 0
   5) VLAN Group(s) ............................................................. = 0
   6) Frame-Relay Bridging Mode (Applies to Bridging Only).. = Bridge All
        {Bridge (a)ll, (E)thernet only}


   (save/quit/cancel)
     :
   ```

   You make changes to the options in this screen at the colon prompt (:). You make changes by entering the line number for the option you want to change, an equal sign (=), and then the value for the new parameter.

2. Enter a description of this routing service by entering 1, an equal sign (=), and then a description for this service. Your description can be up to 30 characters long.

   1=<router service name>

   When you are done entering a description, press **<Enter>**.

3. Specify that this is a routing service by entering a 2, an equal sign, and an **R** as follows:

   2=5

   This specifies that you want to set up a routing service, as opposed to a Trunking or Bridging service. Press **<Enter>**.

4. By default, the routing service is Enabled. This means that as soon as you are done configuring the service, it will begin routing Frame Relay traffic. If you would like to disable this routing service now and enable it later, enter **3=D** and press **<Enter>**.

5. You need to specify the DLCIs of the virtual circuits to include in this routing service. Multiple VCs may be configured for a single routing service and all configured VCs will map to a single virtual router port. Enter a 4, an equal sign (=), and then the DLCI numbers for each virtual circuit. Separate DLCIs with spaces, as shown in the example below.

   4=16 17

   Press **<Enter>** after you entered all virtual circuits DLCIs.

6. Specify the Group number to which this router port belongs. Enter a 5, an equal sign (=), and the Group number. The example below includes Group 4 in the routing service:

5=4

Press **<Enter>**.

You must have previously configured this Group as a Frame Relay Routing Group through the **crgp** command. If you have not configured the Group for Frame Relay routing, then the following message displays:

Given Vlan Group is not a Frame-Relay Router Group

See the section, *Step 1. Set Up a Frame Relay Routing Group* on page 31-51 for further information on setting up a Frame Relay Group.

7. Disregard the **Frame-Relay Bridging Mode** field. It does not apply to virtual router ports.

8. Type **save** at the colon prompt (:) and press **<Enter>**. All parameters for this bridging service are saved.

Configuring a Trunking Service

To configure a Frame Relay Trunking service, you must use the **cas** command. Perform the following steps:

1. Enter the **cas** command followed the slot number, a slash (/), the port number, and then the service number for the Trunking service:

   cas 2/3 1

   A screen similar to the following displays:

```
Slot 1 Port 2 Service 3 Configuration
1) Description .................................................................. = Frame-Relay
     {Enter up to 30 characters}
2) Service Type ................................................................ = Bridging
     {(T)runking, (R)outing, (B)ridging}
3) Administrative Status ..................................................... = Enabled
     {(E)nable, (D)isable}
4) VC(s)............................................................................... = 0
5) VLAN Group(s) ............................................................... = 0
6) Frame-Relay Bridging Mode (Applies to Bridging Only).. = Bridge All
     {Bridge (a)ll, (E)thernet only}


(save/quit/cancel)
  :
```

   You make changes to the options in this screen at the colon prompt (:). You make changes by entering the line number for the option you want to change, an equal sign (=), and then the value for the new parameter.

2. Enter a description of this Trunking service by entering 1, an equal sign (=), and then a description for this service. Your description can be up to 30 characters long.

   1=<trunk service name>

   When you are done entering a description, press **<Enter>**.

3. Specify that this is a Trunking service by entering a 2, an equal sign, and a **T** as follows:

   2=T

   This specifies that you want to set up a Trunking service, as opposed to a bridging or Routing service. Press **<Enter>**.

4. By default, the Trunking service is Enabled. This means that as soon as you are done configuring the service, it will begin Trunking Frame Relay traffic as you configure it through this menu. If you would like to disable this Trunking service now and enable it later, enter **3=D** and press **<Enter>**.

5. You need to specify the DLCI for virtual circuit that will be used to trunk traffic over the Frame Relay network. Only one virtual circuit may be specified for each Trunking service. Enter a 4, an equal sign (=), and the DLCI number for the virtual circuit similar to the example below:

    4=16

    Press **<Enter>**.

6. Specify the Group number or numbers that you want to be Trunked over the specified virtual circuit. A separate virtual Trunk port is created for each Group you specify here. Each Group and Trunk port maps down to a single virtual circuit. Enter a 5, an equal sign (=), and the Group number(s). The example below includes Groups 5 and 6 in the trunking service:

    5=5 6

    Press **<Enter>**.

7. Disregard the **Frame-Relay Bridging Mode** field. It does not apply to virtual trunk ports.

8. Type **save** at the colon prompt (:) and press **<Enter>**. All parameters for this bridging service are saved.

Viewing Frame Relay Services

You can view all Frame Relay services for an entire switch, a single OSWSM board, or a single OSWSM port. Use the **vas** command with the following parameters:

vas <slot>/<port> <service number>

The <slot>, <port> and <service number> parameters are not required but may be specified to narrow the range of the information displayed. For example, if you specify the **vas** command alone, without specifying information on a specific Frame Relay board, then you will obtain information on any FDDI and ATM services in the switch as well.

The **vas** command displays all services configured in the switch (ATM, FDDI, and Frame Relay). The following is an example of the Frame Relay portion of the **vas** command display:

```
                     Frame-Relay Services
                             Service                                Service
Slot  Port  VCs  Groups  Number   Vport  Description            Type
==== ==== ==== ====== ======= ===== =============== =========
   3     2   16        1          1     10  Virtual port (#10)   Bridging
   3     3   16        1          1     11  Virtual port (#11)   Bridging
   3     3   17        1          2     13  Virtual port (#13)   Bridging
   3     2   17        1          2     14  Virtual port (#14)   Bridging
   3     3   17        3          3     17  Virtual port (#17)   Routing
   3     4   18        2          1     18  Virtual port (#18)   Trunking
```

The following sections describe the columns in this table.

Slot

The slot number where this OSWSM module is installed.

Port

The port number to which this service maps. A port may be listed more than once if multiple virtual circuits or multiple services are configured for it. The port is listed for each virtual circuit and for each service. For example, in the sample screen above Port 3 is listed three times—twice as a bridging service for virtual circuits 16 and 17 and again as a routing service for virtual circuit 17.

VCs

The DLCI of the virtual circuit supported by this service. A virtual circuit can be attached to more than one port and be supported by more than one service type.

Groups

The Group or Groups associated with this service. Only one Group is supported by a bridging or routing service. Trunking services may support multiple Groups.

Service Number

Each service for a port is assigned a number. This column lists the number for this service on this particular port. Note that in the sample screen, Port 2 has two services associated with it (Bridging for VC 16 and 17) and Port 3 has three services associated with it (Bridging for VC 16 and 17 and Routing for VC 17).

Vport

The virtual port associated with this service. For bridging services, there is a one-to-one mapping between a virtual port and a virtual circuit. For routing services, multiple virtual circuits may map to a single virtual port. For trunking services, multiple virtual ports can map to a single virtual circuit.

Description

The textual description given to this service when you set it up through the **cas** or **mas** command.

Service Type

A Frame Relay service may be **Bridging**, **Routing** or **Trunking**. All three service types are set up through the **cas** command. Bridging and Routing services may coexist on the same virtual circuit. Trunking cannot coexist with either Bridging or Routing on the same virtual circuit.

Modifying a Frame Relay Service

You can modify previously created Frame Relay services using the **mas** command. The **mas** command uses the same screen as the **cas** command. Simply enter **mas**, the slot, slash (/), port and service number. For example:

mas 2/3 1

would modify the first service on Port 3 for the OSWSM board in Slot 2. This command displays the same screen as the **cas** command. See the appropriate section for modifying the service type:

- Bridging — See *Configuring a Bridging Service* on page 31-49.
- Routing — See *Configuring a WAN Routing Service* on page 31-51.
- Trunking — See *Configuring a Trunking Service* on page 31-54.

Deleting a Frame Relay Service

You can delete a Frame Relay service using the **das** command as follows:

1. Enter **das** followed by the slot, port and service number for the Frame Relay service that you want to delete. You can obtain the service number by using the **vas** command. See *Viewing Frame Relay Services* on page 31-56. For example, if you wanted to delete service number 2 for Port 2 on the OSWSM board in Slot 3, you would enter

    das 3/2 2

    and the following screen would display:

```
                         Frame-Relay Services
                             Service                           Service
Slot  Port  VCs  Groups  Number   Vport  Description           Type
====  ====  ==== ======  =======  =====  ===============       =========
   3     2   16       1        1     10  Virtual port (#10)    Bridging
   3     2   17       1        2     14  Virtual port (#14)    Bridging

Remove Frame Relay Slot 3 Port 2 Service 2 (n)? :
```

2. Enter **1** and press **<Enter>** to confirm the deletion of this service. The following messages display confirming the deletion of the service:

```
Removing Frame Relay Slot 3 Port 2 Service 2, please wait...


Frame Relay Slot 3 Port 2 Service 2 removed
```