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Definitions of Managed Objects for Frame Relay Service Level Definitions

Status of this Memo

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Abstract

This memo defines an extension of the Management Information Base (MIB) for use with network management protocols in TCP/IP-based internets. In particular, it defines objects for managing the Frame Relay Service Level Definitions.

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1. The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- An overall architecture, described in RFC 2571 [1].
- Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIv1 and described in STD 16, RFC 1155 [2], STD 16, RFC 1212 [3] and RFC 1215 [4]. The second version, called SMIv2, is described in STD 58, RFC 2578 [5], RFC 2579 [6] and RFC 2580 [7].
- Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in STD 15, RFC 1157 [8]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [9] and RFC

1906 [10]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [10], RFC 2572 [11] and RFC 2574 [12].

- o Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, RFC 1157 [8]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [13].

- o A set of fundamental applications described in RFC 2573 [14] and the view-based access control mechanism described in RFC 2575 [15].

A more detailed introduction to the current SNMP Management Framework can be found in RFC 2570 [16].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined in the SMI.

This memo specifies a MIB module that is compliant to the SMIv2. A MIB conforming to the SMIv1 can be produced through the appropriate translations. The resulting translated MIB must be semantically equivalent, except where objects or events are omitted because no translation is possible (use of Counter64). Some machine readable information in SMIv2 will be converted into textual descriptions in SMIv1 during the translation process. However, this loss of machine readable information is not considered to change the semantics of the MIB.

2. Conventions

The keywords MUST, MUST NOT, REQUIRED, SHALL, SHALL NOT, SHOULD, SHOULD NOT, RECOMMENDED, NOT RECOMMENDED, MAY, and OPTIONAL, when they appear in this document, are to be interpreted as described in RFC 2119 [22].

3. Overview

This MIB module addresses the items required to manage the Frame Relay Forum's Implementation Agreement for Service Level Definitions (FRF.13 [17]). At present, this applies to these values of the ifType variable in the Internet-standard MIB:

- o frameRelay (32)

- o frameRelayService (44)

This section provides an overview and background of how to use this MIB module.

3.1. Frame Relay Service Level Definitions

The frame relay service level definitions address specific characteristics of a frame relay service that can be used to facilitate the following tasks:

- o Evaluation of frame relay service providers, offerings or products.
- o Measurement of Quality of Service.
- o Enforcement of Service Level Agreements.
- o Planning or describing a frame relay network.

The following parameters are defined in FRF.13 [17] as a sufficient set of values to accomplish the tasks previously stated.

- o Delay - The amount of time elapsed, in microseconds, from the time a frame exits the source to the time it reaches the destination. NOTE: FRF.13 [17] defines this value in terms of milliseconds.
- o Frame Delivery Ratio - The ratio of the number of frames delivered to the destination versus the number of frames sent by the source. This ratio can be further divided by inspecting either only the frames within the CIR or only the frames in excess of the CIR.
- o Data Delivery Ratio - The ratio of the amount of data delivered to the destination versus the amount of data sent by the source. This ratio can be further divided by inspecting either only the data within the CIR or only the data in excess of the CIR.
- o Service Availability - The amount of time the frame relay service was not available. There are three types of availability statistics defined in FRF.13 [17]: Mean Time to Repair, Virtual Connection Availability, and Mean Time Between Service Outages. The later two require information about the scheduled outage time. It is assumed that scheduled outage time information will be maintained by the network management software, so it is not included in the MIB module.

Consult FRF.13 [17] for more details.

3.2. Terminology

- o CIR - The Committed Information Rate (CIR) is the subscriber data rate (expressed in bits/second) that the network commits to deliver under normal network conditions [18].

- o DLCI - Data Link Connection Identifier [18].

- o Logical Port - This term is used to model the Frame Relay "interface" on a device [18].

- o NNI - Network to Network Interface [18].

- o Permanent Virtual Connection (PVC) - A virtual connection that has its end-points and bearer capabilities defined at subscription time [18].

- o Reference Point (RP) - The point of reference within the network model at which the calculations or data collection takes place.

- o UNI - User to Network Interface [18].

3.3. Network Model

The basic model, as illustrated in figure 1 below, contains two frame relay DTE endpoints connected to a network cloud via a frame relay UNI interface. The network cloud can contain zero or more internal frame relay NNI connections that interconnect multiple networks. The calculations and data collection can be performed at any reference point within the network.

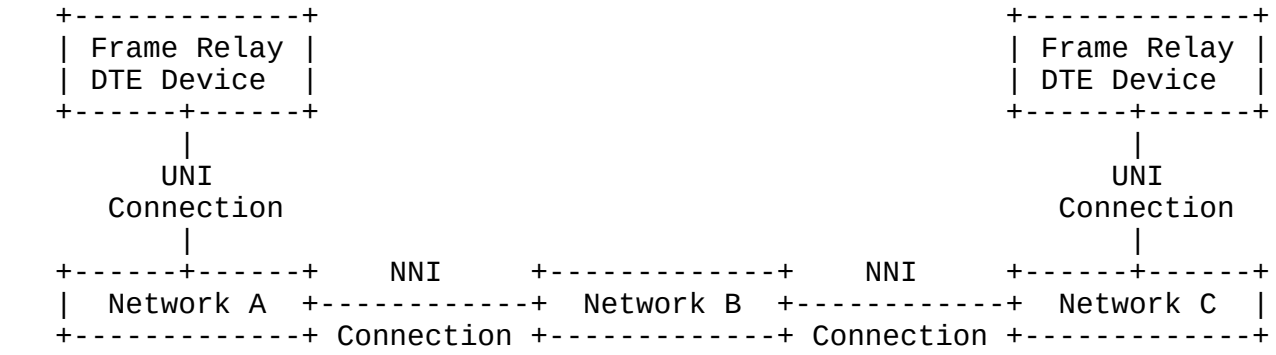


Figure 1
Frame Relay Network Reference Model

3.4. Reference Points

The collection and calculations of the service level definitions apply to two reference points within the network. These two points are the locations where the frames are referenced in the collection of the service level specific information. The reference points used in the MIB module are shown in figure 2 below. For completeness, the module also allows for proprietary reference points which MAY exist anywhere in the network that is not a previously defined reference point. The meaning of the proprietary reference points is insignificant unless defined by the device manufacturer.

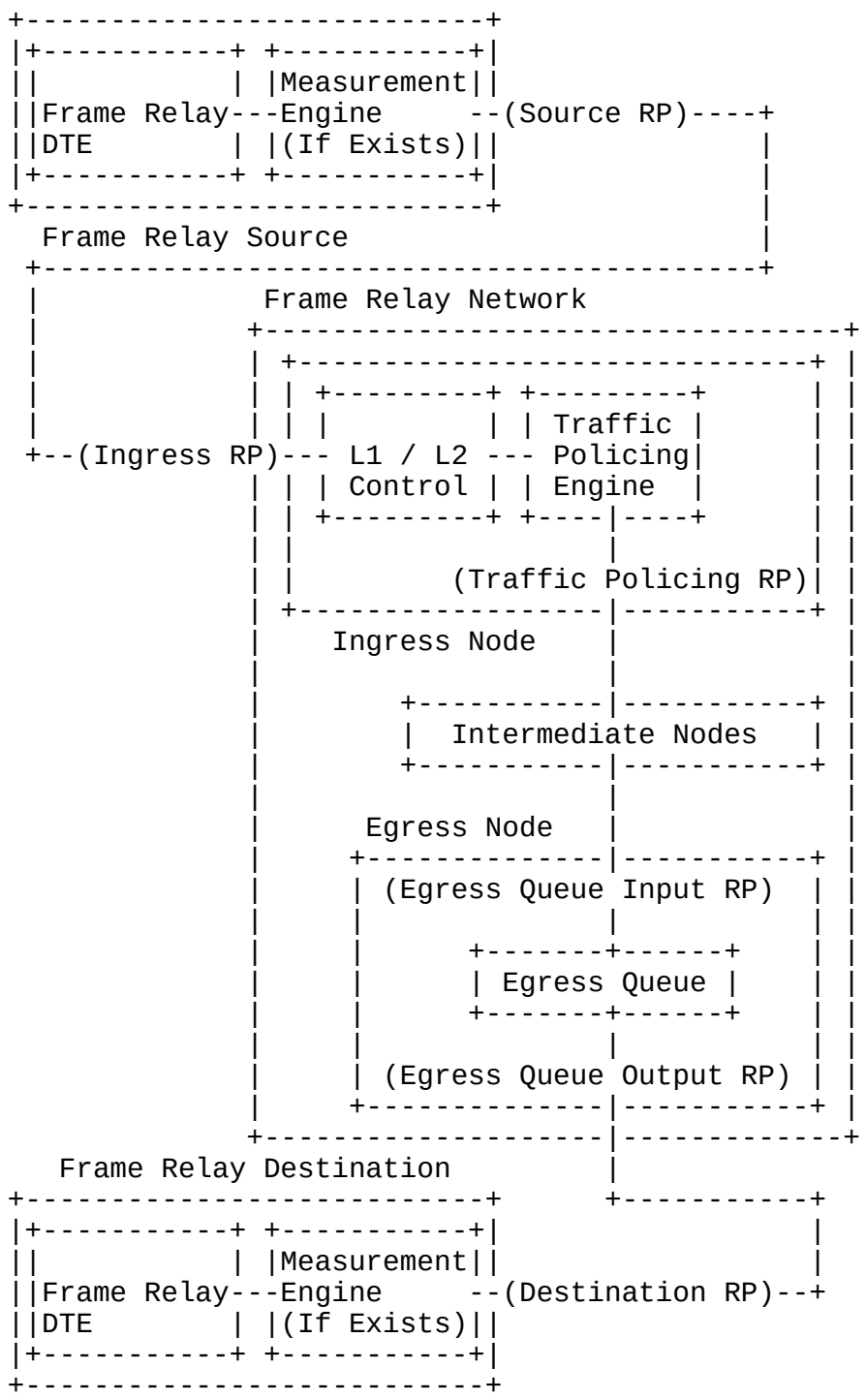


Figure 2
Reference Points (FRF.13 [17])

The MIB variables frsldPvcCtrlTransmitRP and frsldPvcCtrlReceiveRP allow the user to view and configure the reference points at which the calculations occur. These variables are specific to the device on which they are located. Frame relay devices act as both frame sources and frame destinations. The definitions in this MIB module apply to the interaction of a pair of devices on the network path. The same device can potentially use different reference points for calculation and collection of the statistics based on whether the referenced frame is sent or received by the device. When the device is acting as a frame source, the value of frsldPvcCtrlTransmitRP reflects the reference point used for all source calculations pertaining to the specified PVC. When the device is acting as a frame destination, the value of frsldPvcCtrlReceiveRP reflects the reference point used for all destination calculations pertaining to the specified PVC.

For example, FRF.13 [17] defines an Edge-to-Edge Egress Queue measurement domain as a domain in which measurement is performed between an Ingress Reference Point and an Egress Queue Input Reference Point. For this domain between a source device and a destination device, the value of frsldPvcCtrlTransmitRP for the source device would be set to ingTxLocalRP(2) and the value of frsldPvcCtrlReceiveRP for the destination device would be set to eqiRxLocalRP(4). While it is usually the case that the reference points would be equivalent on the remote device when monitoring frames going in the opposite direction, there is no requirement for them to be so.

It can be seen from the above example that a total of four reference points are required in order to collect information for both directions of traffic flow. The reference points represent the transmit and receive directions at both ends of a PVC. If a device has knowledge of the information from the remote device, it is possible to collect the statistics from a single device. This is not always the case. In most instances, two devices will need to be monitored to capture a complete description of the service level on a PVC. The reference points a single device is capable of monitoring are contained in the frsldRPCaps object.

3.5. Measurement Methodology

This document neither recommends nor suggests a method of implementation. This is left to the device manufacturer and should be independent of the data that is actually collected.

Periodic collection of this data can be performed through either polling of the data table, use of the sample tables or use of the user history group of RFC 2021 [19].

3.6. Theory of Operation

The following sections describe how to use this MIB module. They include row handling, data collection and data calculation. The recommendations here in are suggestions as to implementation and do not infer that they are the only method that can be used to perform such operations.

3.6.1. Capabilities Discovery

Three objects are provided specifically to aid the network manager in discovering the capabilities of the device with respect to this MIB module.

- frsldPvcCtrlWriteCaps This object reports the write capabilities of the PVC Control Table. Use this object to determine which objects can be modified. This need only be referenced if row creation or modification is to be performed.

- frsldSmplCtrlWriteCaps This object reports the write capabilities of the Sample Control Table. Use this object to determine which objects can be modified. The group need only be referenced if the sample tables will be used to collect historical information.

- frsldRPCaps This object reports the reference points at which the device is capable of collecting information. This object needs to be referenced if row creation is to be performed in the PVC Control Table. Devices can only create rows containing supported reference points.

These objects do not imply that there is no need for an Agent Capabilities macro for devices that do not fully support every object in this MIB module. They are provided specifically to aid in the ensured network management operations of this MIB module with respect to row creation and modification.

An additional four objects are provided to report and control memory the utilization of this MIB module. These objects are frsldMaxPvcCtrls, frsldNumPvcCtrls, frsldMaxSmplCtrls are frsldNumSmplCtrls. Together, they allow a manager to control the

amount of memory allocated for specific utilization by this MIB module. This is done by setting the maximum allowed allocation of controls.

3.6.2. Determining Reference Points for Row Creation

The performance of a PVC is monitored by evaluating the uni-directional flow of frames from an ingress point to an egress point. Reference points describe where each of the two measurements are made. Monitoring both of the uni-directional flows that make-up the PVC frame traffic requires a total of four reference points as shown in Figures 3 through 5. A monitoring point that evaluates traffic is restricted to counting frames that pass the reference points hosted locally on the monitoring point. Thus, if the monitoring point is near the ingress point of the flow, it will count the frames entering into the frame relay network. The complete picture of frame loss for the uni-directional flow requires information from the downstream reference point located at another (remote) monitoring point.

The local monitoring point MAY be implemented in such way that the information from the downstream monitoring point is moved to the local monitoring point using implementation-specific mechanisms. In this case all information required to calculate frame loss becomes available from the local measurement point. The local measurement point agent is capable of reporting all the objects in the FrsldPvcDataEntry row - the counts for offered frames entering the network and delivered frames exiting the network.

Alternatively, the local monitoring point MAY be restricted to counts of frames observed on the local device only. In this case, the objects of the FrsldPvcDataEntry row reporting what happened on the remote device are not available.

The following list shows the possible valid reference points for an FRF.13 SLA from the source reference point to the destination reference point in both directions.

- Local Information Only

  Local Device: srcLocalRP, desLocalRP
  Remote Device: srcLocalRP, desLocalRP

- Remote Information Only

  Local Device: srcRemoteRP, desRemoteRP
  Remote Device: srcRemoteRP, desRemoteRP

- Mixed Two Device Model 1 (Local Device Always Transmitter)

  Local Device: srcLocalRP, desRemoteRP
  Remote Device: srcLocalRP, desRemoteRP

- Mixed Two Device Model 2 (Local Device Always Receiver)

  Local Device: srcRemoteRP, desLocalRP
  Remote Device: srcRemoteRP, desLocalRP

- Mixed One Device Model 1 (Directional Rows)

  First Row: srcRemoteRP, desLocalRP (Receiver Row)
  Second Row: srcLocalRP, desRemoteRP (Sender Row)

- Mixed One Device Model 2 (Device Based Rows)

  First Row: srcLocalRP, desLocalRP (Local Row)
  Second Row: srcRemoteRP, desRemoteRP (Remote Row)

Each of the above combinations is valid and provides the same information.

The following steps are recommended to find which reference points need to be configured:

1) Locate both of the devices at either end of the PVC to be monitored.

2) Determine the capabilities by referencing the frsldRPCaps object of each device.

3) Locate the best combination of the two devices such that the necessary reference points are all represented.

4) If any one of the necessary reference points does not exist in the combination of the two devices, it is not possible to monitor the FRF.13 defined SLA between the two reference point on the PVC.

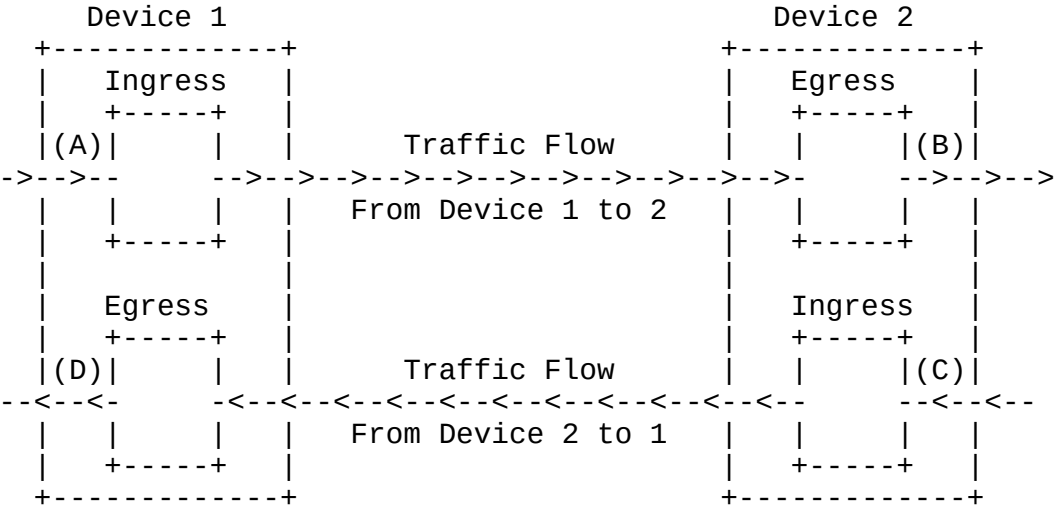
3.6.2.1. Graphical Examples of Reference Points

FRF.13 [17] defines three specific combinations of reference points: Edge-to-Edge Interface, Edge-to-Edge Egress Queue and End-to-End.

Examples of valid reference points that may be used for each of these are discussed in the sections below.

It is often the case that a device knows as a minimum either only local information or both local and remote information. Because these are two common examples, each will be illustrated below.

3.6.2.1.1. Edge-to-Edge Interface Reference Point Example



where (A), (B), (C) and (D) are reference points

Figure 3

For devices with only local knowledge, one row is required on each device as follows:

(A) frsldPvcCtrlTransmitRP for Device 1 = ingTxLocalRP(2)

(B) frsldPvcCtlrReceiveRP for Device 2 = eqoRxLocalRP(5)

(C) frsldPvcCtrlTransmitRP for Device 2 = ingTxLocalRP(2)

(D) frsldPvcCtlrReceiveRP for Device 1 = eqoRxLocalRP(5)

In which a single row is created on Device 1 containing reference points (A) and (D), and a single row is created on Device 2 containing reference points (C) and (B).

For devices with both local and remote knowledge, the two rows can exist in any combination on either device. For this example, the transmitting devices will be responsible for information regarding the flow for which they are the origin. Only one row is required per device for this example.

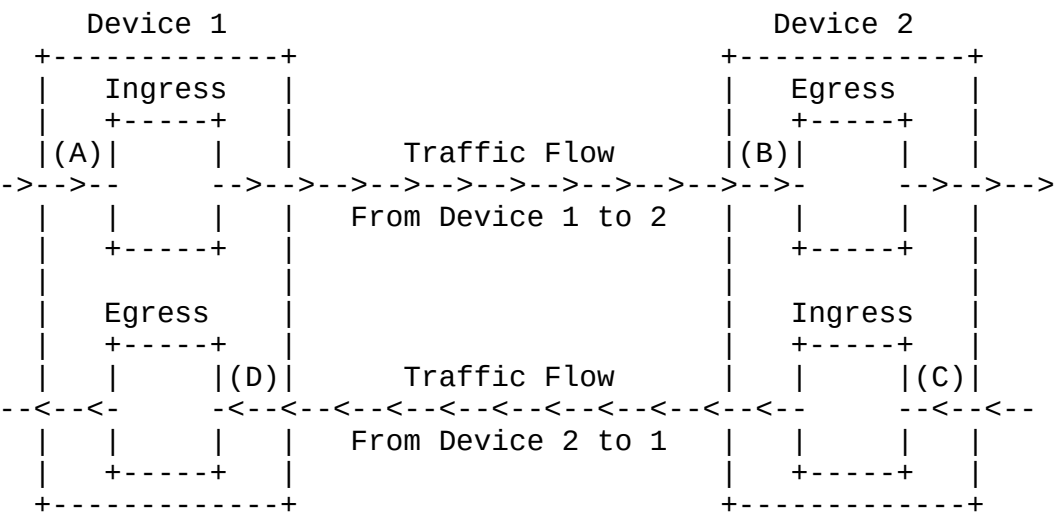
(A) frsldPvcCtrlTransmitRP for Device 1 = ingTxLocalRP(2)

(B) frsldPvcCtlrReceiveRP for Device 1 = eqoRxRemoteRP(11)

(C) frsldPvcCtrlTransmitRP for Device 2 = ingTxLocalRP(2)

(D) frsldPvcCtlrReceiveRP for Device 2 = eqoRxRemoteRP(11)

3.6.2.1.2. Edge-to-Edge Egress Queue Reference Point Example



where (A), (B), (C) and (D) are reference points

Figure 4

For devices with only local knowledge, one row is required on each device as follows:

(A) frsldPvcCtrlTransmitRP for Device 1 = ingTxLocalRP(2)

(B) frsldPvcCtlrReceiveRP for Device 2 = eqiRxLocalRP(4)

(C) frsldPvcCtrlTransmitRP for Device 2 = ingTxLocalRP(2)

(D) frsldPvcCtlrReceiveRP for Device 1 = eqiRxLocalRP(4)

In which a single row is created on Device 1 containing reference points (A) and (D), and a single row is created on Device 2 containing reference points (C) and (B).

For devices with both local and remote knowledge, the two rows can exist in any combination on either device. For this example, the transmitting devices will be responsible for information regarding the flow for which they are the origin. Only one row is required per device for this example.

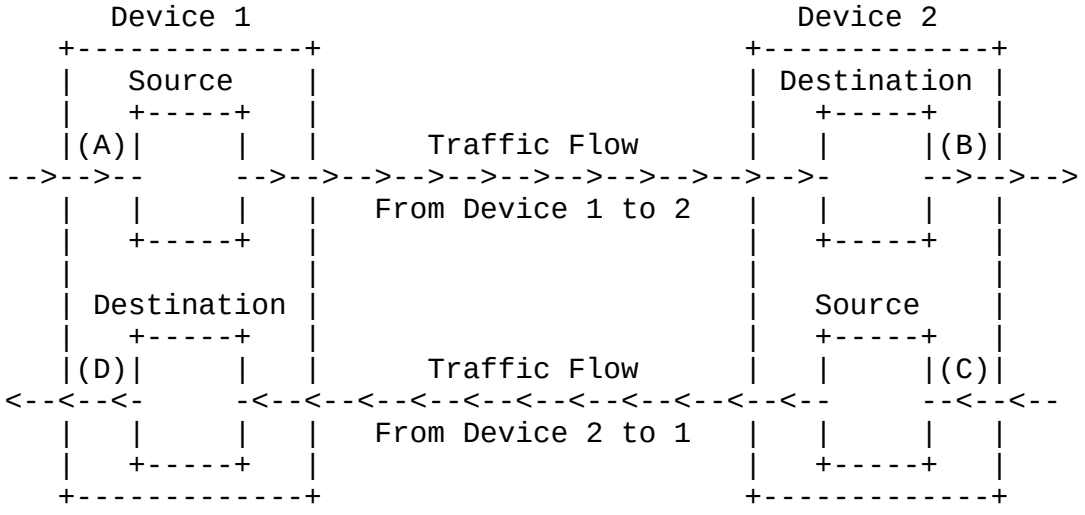
(A) frsldPvcCtrlTransmitRP for Device 1 = ingTxLocalRP(2)

(B) frsldPvcCtlrReceiveRP for Device 1 = eqiRxRemoteRP(10)

(C) frsldPvcCtrlTransmitRP for Device 2 = ingTxLocalRP(2)

(D) frsldPvcCtlrReceiveRP for Device 2 = eqiRxRemoteRP(10)

3.6.2.1.3. End-to-End Using Reference Point Example



where (A), (B), (C) and (D) are reference points

Figure 5

For devices with only local knowledge, one row is required on each device as follows:

(A) frsldPvcCtrlTransmitRP for Device 1 = srcLocalRP(1)

(B) frsldPvcCtlrReceiveRP for Device 2 = desLocalRP(1)

(C) frsldPvcCtrlTransmitRP for Device 2 = srcLocalRP(1)

(D) frsldPvcCtlrReceiveRP for Device 1 = desLocalRP(1)

In which a single row is created on Device 1 containing reference points (A) and (D), and a single row is created on Device 2 containing reference points (C) and (B).

For devices with both local and remote knowledge, the two rows can exist in any combination on either device. For this example, the transmitting devices will be responsible for information regarding the flow for which they are the origin. Only one row is required per device for this example.

(A) frsldPvcCtrlTransmitRP for Device 1 = srcLocalRP(1)

(B) frsldPvcCtlrReceiveRP for Device 1 = desRemoteRP(7)

(C) frsldPvcCtrlTransmitRP for Device 2 = srcLocalRP(1)

(D) frsldPvcCtlrReceiveRP for Device 2 = desRemoteRP(7)

3.6.3. Creation Process

In some cases, devices will automatically populate the rows of PVC Control Table and potentially the Sample Control Table. However, in many cases, it may be necessary for a network manager to manually create rows.

Manual creation of rows requires the following steps:

1) Ensure the PVC exists between the two devices.

2) Determine the necessary reference points for row creation.

3) Create the row(s) in each device as needed.

4) Create the row(s) in the sample control tables if desired.

3.6.4. Destruction Process

3.6.4.1. Manual Row Destruction

Manual row destruction is straight forward. Any row can be destroyed and the resources allocated to it are freed by setting the value of its status object (either frsldPvcCtrlStatus or frsldSmplCtrlStatus) to destroy(6). It should be noted that when frsldPvcCtrlStatus is set to destroy(6) all associated sample control, sample and data table rows will also be destroyed. Similarly, when frsldSmplCtrlStatus is set to destroy(6) all sample rows will also be

destroyed. The frsldPvcCtrlPurge objects do not apply to manual row destruction. If the row is set to destroy(6) manually, the rows are destroyed as part of the set.

3.6.4.2. Automatic Row Destruction

Rows is the tables may be destroyed automatically based on the existence of the DLCI on which they rely. This behavior is controlled by the frsldPvcCtrlPurge and frsldPvcCtrlDeleteOnPurge objects. When a DLCI no longer exists in the device, the data in the tables has no relation to anything known on the network. However, there may be some need to keep the historic information active for a short period after the destruction or removal of a DLCI. If the basis for the row no longer exists, the row will be destroyed at the end of the purge interval that is controlled by frsldPvcCtrlPurge.

The effects of automatic row destruction are the same as manual row destruction.

3.6.5. Modification Process

All read-create items in this MIB module can be modified at any time if they are fully supported. Write access is not required. To simplify the use of the MIB frsldPvcCtrlWriteCaps and frsldSmplCtrlWriteCaps state which of the read-create variables can actually be written on a particular device.

3.6.6. Collection Process

3.6.6.1. Remote Polling

This MIB module supports data collection through remote polling of the free running counters in the PVC Data Table. Remote polling is a common method used to capture real-time statistics. A remote management station polls the device to collect the desired information. It is recommended all statistics for a single PVC be collected in a single PDU.

The following objects are designed around the concept of real-time polling:

- frsldPvcDataMissedPolls
- frsldPvcDataFrDeliveredC
- frsldPvcDataFrDeliveredE
- frsldPvcDataFrOfferedC
- frsldPvcDataFrOfferedE
- frsldPvcDataDataDeliveredC
- frsldPvcDataDataDeliveredE

- o frsldPvcDataDataOfferedC
- o frsldPvcDataDataOfferedE
- o frsldPvcDataHCFrDeliveredC
- o frsldPvcDataHCFrDeliveredE
- o frsldPvcDataHCFrOfferedC
- o frsldPvcDataHCFrOfferedE
- o frsldPvcDataHCDataDeliveredC
- o frsldPvcDataHCDataDeliveredE
- o frsldPvcDataHCDataOfferedC
- o frsldPvcDataHCDataOfferedE
- o frsldPvcDataUnavailableTime
- o frsldPvcDataUnavailables

3.6.6.2. Sampling

The sample tables provide the ability to historically sample data without requiring the additional overhead of polling. At key periods, a network management station can collect the samples needed. This method allows the manager to perform the collection of data at times that will least affect the active network traffic.

The sample data can be collected using a series of SNMP getNext or getBulk operations. The value of frsldPvcSmplIdx increments with each new collection bucket. This allows the managers to skip information that has already been collected. However, care should be taken in that the value can roll over after a long period of time.

The start and end times of a collection period allow the manager to know what the actual period of collection was. It is possible for there to be discontinuities in the sample table, so both start and end should be referenced.

3.6.6.3. User History

User history, as defined in RFC 2021 [19], is an alternative mechanism that can be used to get the same benefits as the sample table by using the objects provided for real-time polling. Some devices MAY have the ability to use user history and opt not to support the sample tables. If this is the case, the information from the data table can be used to define a group of user history objects.

3.6.7. Use of MIB Module in Calculation of Service Level Definitions

The objects in this MIB module can be used to calculate the statistics defined in FRF.13 [17]. The description below describes the calculations for one direction of the data flow, i.e., data sent from local transmitter to a remote receiver. A complete set of bidirectional information would require calculations based on both

directions. For the purposes of this description, the reference points used SHOULD consistently represent data that is sent by one device and received by the other.

A complete evaluation requires the combination of two uni-directional flows. It is possible for a management station to combine all of the calculated information into one conceptual row. Doing this requires that each of the metrics are collected for both flow directions and grouped by direction If the information is split between two devices, the management station must know which two devices to communicate with for the collection of all information. The grouping of information SHOULD be from ingress to egress in each flow direction.

The calculations below use the following terminology:

- DelayAvg

  The average delay on the PVC. This is represented within the MIB module by frsldPvcSmplDelayAvg.

- FrDeliveredC

  The number of frames received by the receiving device through the receive reference point that were delivered within CIR. This is represented within the MIB module by one of frsldPvcDataFrDeliveredC, frsldPvcDataHCFrDeliveredC, frsldPvcSmplFrDeliveredC, or frsldPvcSmplHCFrDeliveredC.

- FrDeliveredE

  The number of frames received by the receiving device through the receive reference point that were delivered in excess of CIR. This is represented within the MIB module by one of frsldPvcDataFrDeliveredE, frsldPvcDataHCFrDeliveredE, frsldPvcSmplFrDeliveredE, or frsldPvcSmplHCFrDeliveredE.

- FrOfferedC

  The number of frames offered by the transmitting device through the transmit reference point that were sent within CIR. This is represented within the MIB module by one of frsldPvcDataFrOfferedC, frsldPvcDataHCFrOfferedC, frsldPvcSmplFrOfferedC, or frsldPvcSmplHCFrOfferedC.

- FrOfferedE

  The number of frames offered by the transmitting device through the transmit reference point that were sent in excess of CIR. This is represented within the MIB module by one of frsldPvcDataFrOfferedE, frsldPvcDataHCFrOfferedE, frsldPvcSmplFrOfferedE, or frsldPvcSmplHCFrOfferedE.

- DataDeliveredC

  The number of octets received by the receiving device through the receive reference point that were delivered within CIR. This is represented within the MIB module by one of frsldPvcDataDataDeliveredC, frsldPvcDataHCDataDeliveredC, frsldPvcSmplDataDeliveredC, or frsldPvcSmplHCDataDeliveredC.

- DataDeliveredE

  The number of octets received by the receiving device through the receive reference point that were delivered in excess of CIR. This is represented within the MIB module by one of frsldPvcDataDataDeliveredE, frsldPvcDataHCDataDeliveredE, frsldPvcSmplDataDeliveredE, or frsldPvcSmplHCDataDeliveredE.

- DataOfferedC

  The number of octets offered by the transmitting device through the transmit reference point that were sent within CIR. This is represented within the MIB module by one of frsldPvcDataDataOfferedC, frsldPvcDataHCDataOfferedC, frsldPvcSmplDataOfferedC, or frsldPvcSmplHCDataOfferedC.

- DataOfferedE

  The number of octets offered by the transmitting device through the transmit reference point that were sent in excess of CIR. This is represented within the MIB module by one of frsldPvcDataDataOfferedE, frsldPvcDataHCDataOfferedE, frsldPvcSmplDataOfferedE, or frsldPvcSmplHCDataOfferedE.

- UnavailableTime

  The amount of time the PVC was not available during the interval of interest. This is represented within the MIB module by either frsldPvcDataUnavailableTime or frsldPvcSmplUnavailableTime.

- Unavailables

  The number of times the PVC was declared to be unavailable during the interval of interest. This is represented within the MIB module by either frsldPvcDataUnavailables or frsldPvcSmplUnavailables.

3.6.8. Delay

The frame transfer delay is defined as the amount of time elapsed, in microseconds, from the time a frame exits the source to the time it reaches the destination. The average delay can be found using the MIB variable described in DelayAvg above. The delay may be calculated as either round trip or one way, and this information is held in the frsldPvcCtrlDelayType MIB variable. If the delay be calculated as round trip, the value of DelayAvg represents the average of the total delays of the round trips. In this case, the manager SHOULD divide the value returned by the agent by two to obtain the frame transfer delay. In the case that frsldPvcCtrlDelayType is oneWay, the value of DelayAvg represents the average of the frame transfer delays and SHOULD be used as is.

3.6.9. Frame Delivery Ratio

The frame delivery ratio is defined as the total number of frames delivered to the destination divided by the frames offered by the source. The destination values can be obtained using FrDeliveredC and FrDeliveredE. The source values can be obtained using FrOfferedC and FrOfferedE.

$$\text{Frame Delivery Ratio} = \frac{\text{FrDeliveredC} + \text{FrDeliveredE}}{\text{FrOfferedC} + \text{FrOfferedE}}$$

$$\text{Committed Frame Delivery Ratio} = \frac{\text{FrDeliveredC}}{\text{FrOfferedC}}$$

$$\text{Excess Frame Delivery Ratio} = \frac{\text{FrDeliveredE}}{\text{FrOfferedE}}$$

3.6.10. Data Delivery Ratio

The data delivery ratio is defined as the total amount of data delivered to the destination divided by the data offered by the source. The destination values can be obtained using DataDeliveredC and DataDeliveredE. The source values can be obtained using DataOfferedC and DataOfferedE.

$$\text{Data Delivery Ratio} = \frac{\text{DataDeliveredC} + \text{DataDeliveredE}}{\text{DataOfferedC} + \text{DataOfferedE}}$$

$$\text{Committed Data Delivery Ratio} = \frac{\text{DataDeliveredC}}{\text{DataOfferedC}}$$

$$\text{Excess Data Delivery Ratio} = \frac{\text{DataDeliveredE}}{\text{DataOfferedE}}$$

3.6.11. Service Availability

Some forms of service availability measurement defined in FRF.13 [17] require knowledge of the amount of time the network is allowed to be unavailable during the period of measurement. This is called the excluded outage time and will be represented in the measurements below as ExcludedTime. It is assumed that the management software will maintain this information in that it often relates to specific times and dates that many devices are not capable of maintaining. Further, it may change based on a moving maintenance window that the device cannot track well.

Mean Time to Repair (FRMTTR) = 0 if Unavailables is 0.

$$\text{Otherwise, FRMTTR} = \frac{\text{UnavailableTime}}{\text{Unavailables}}$$

Virtual Connection Availability (FRVCA) = 0 if IntervalTime equals ExcludedTime.

$$\text{Otherwise, FRVCA} = \frac{\text{IntervalTime} - \text{ExcludedTime} - \text{UnavailableTime}}{\text{IntervalTime} - \text{ExcludedTime}} * 100$$

Mean Time Between Service Outages (FRMTBSO) = 0 if Unavailables is 0.

$$\text{Otherwise, FRMTBSO} = \frac{\text{IntervalTime} - \text{ExcludedTime} - \text{UnavailableTime}}{\text{Unavailables}}$$

4. Relation to Other MIB Modules

There is no explicit relation to any other frame relay MIB module nor are any required to implement this MIB module. However, there is a need for knowledge of ifIndexes and some understanding of DLCIs. The ifIndex information can be found in the IF-MIB [21] which is required. The DLCI information can be found in either the Frame Relay DTE MIB (RFC 2115) [20] or the Frame Relay Network Services MIB (RFC 2954) [18]; however, neither is required.

Upon setting of frsldPvcCtrlStatus in the frsldPvcCtrlTable to active(1) the system can be in one of the following three states:

(1) The respective DLCI is known and is active. This corresponds to a state in which frPVCEndptRowStatus is active(1) and frPVCEndptRcvdSigStatus is either active(2) or none(4) for the Frame Relay Network Services MIB (RFC 2954) [18]. For the Frame Relay DTE MIB, the same state is shown by frCircuitRowStatus of active(1) and frCircuitState of active(2).

(2) The respective DLCI has not been created. This corresponds to a state in which the row with either frPVCEndptDLCIIndex or frCircuitDlci equal to the respective DLCI does not exist in either the frPVCEndptTable or the frCircuitTable respectively.

(3) The respective DLCI has just been removed. This corresponds to a state in which either frPVCEndptRowStatus is no longer active(1) or frPVCEndptRcvdSigStatus is no longer active(2) or none(4) for the Frame Relay Network Services MIB (RFC 2954) [18]. For the Frame Relay DTE MIB, the same state is shown when either frCircuitRowStatus is no longer active(1) or frCircuitState is no longer active(2).

For the first case, the row in the frsldPvcDataTable will be filled. If frsldSmplCtrlStatus in the frsldSmplCtrlTable for the respective DLCI is also ‘active’ the frsldPvcSampleTable will be filled as well.

For the second case, the respective rows will not be added to any of the data or sample tables and frsldPvcCtrlStatus SHOULD report notReady(3).

For the third case, frsldPvcCtrlDeleteOnPurge should direct the behavior of the system. If all tables are purged, this case will be equivalent to the second case above. Otherwise, frsldPvcCtrlStatus SHOULD remain active(1).

5. Structure of the MIB Module

The FRSLD-MIB consists of the following components:

- o frsldPvcCtrlTable
- o frsldSmplCtrlTable
- o frsldPvcDataTable
- o frsldPvcSampleTable
- o frsldCapabilities

Refer to the compliance statement defined within for a definition of what objects MUST be implemented.

5.1. frsldPvcCtrlTable

The frsldPvcCtrlTable is the central control table for operations of the Frame Relay Service Level Definitions MIB. It provides variables to control the parameters required to calculate the objects in the other tables.

A row in this table MUST exist in order for a row to exist in any other table in this MIB module.

5.2. frsldSmplCtrlTable

This is an optional table to allow control of sampling of the data in the data table.

5.3. frsldPvcDataTable

This table contains the calculated data. It relies on configuration from the control table.

5.4. frsldPvcSampleTable

This table contains samples of the delivery and availability information from the data table as well as delay information calculated over the sample period. It relies on configuration from both the control table and the sample control table.

5.5. frsldCapabilities

This is a group of objects that define write capabilities of the read-create objects in the tables above.

6. Persistence of Data

The data in frsldPvcCtrlTable and frsldSmplCtrlTable SHOULD persist through power cycles. Note, however, that the symantics of readiness for the rows still applies. This means that it is possible for a row to be reprovisioned as notReady(3) if the underlying DLCI does not persist. The data collected in the other tables SHOULD NOT persist through power cycles in that the reference TimeStamp is no longer valid.

7. Object Definitions

```
FRSLD-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE,
    Counter32, Gauge32, Integer32,
    Counter64, TimeTicks, mib-2             FROM SNMPv2-SMI
    CounterBasedGauge64                     FROM HCNUM-TC
    TEXTUAL-CONVENTION, RowStatus,
    TimeStamp                               FROM SNMPv2-TC
    MODULE-COMPLIANCE, OBJECT-GROUP         FROM SNMPv2-CONF
    ifIndex                                 FROM IF-MIB
    DLCI                                    FROM FRAME-RELAY-DTE-MIB;

    frsldMIB MODULE-IDENTITY
        LAST-UPDATED "200201030000Z" -- January 3, 2002
        ORGANIZATION "IETF Frame Relay Service MIB Working Group"
        CONTACT-INFO
          "IETF Frame Relay Service MIB (frnetmib) Working Group

           WG Charter:    http://www.ietf.org/html.charters/
                                 frnetmib-charter.html
           WG-email:      frnetmib@sunroof.eng.sun.com
           Subscribe:     frnetmib-request@sunroof.eng.sun.com
           Email Archive: ftp://ftp.ietf.org/ietf-mail-archive/frnetmib
```

```
           Chair:      Andy Malis
                       Vivace Networks
           Email:      Andy.Malis@vivacenetworks.com

           WG editor:  Robert Steinberger
                       Paradyne Networks and
                       Fujitsu Network Communications
           Email:      robert.steinberger@fnc.fujitsu.com

           Co-author:  Orly Nicklass
                       RAD Data Communications Ltd.
           EMail:      Orly_n@rad.co.il"
        DESCRIPTION
            "The MIB module to describe generic objects for
             FRF.13 Frame Relay Service Level Definitions."
        REVISION "200201030000Z" -- January 3, 2002
        DESCRIPTION
            "Initial version, published as RFC 3202"
        ::= { mib-2 95 }

    --
    -- Textual Conventions
    --
    FrsldTxRP ::= TEXTUAL-CONVENTION
        STATUS  current
        DESCRIPTION
            "The reference point a PVC uses for calculation
             of transmitter related statistics.

             The valid values for this type of object are as follows:
               - srcLocalRP(1) for the local source
               - ingTxLocalRP(2) for the local ingress queue input
               - tpTxLocalRP(3) for the local traffic policing
               - eqiTxLocalRP(4) for the local egress queue input
               - eqoTxLocalRP(5) for the local egress queue output
               - otherTxLocalRP(6) for any other local transmit point
               - srcRemoteRP(7) for the remote source
               - ingTxLocalRP(8) for the remote ingress queue input
               - tpTxLocalRP(9) for the remote traffic policing
               - eqiTxRemoteRP(10) for the remote egress queue input
               - eqoTxRemoteRP(11) for the remote egress queue output
               - otherTxRemoteRP(12) for any other remote xmit point"
        REFERENCE
            "FRF.13: Section 2.3"
        SYNTAX      INTEGER {
                      srcLocalRP(1),
                      ingTxLocalRP(2),
                      tpTxLocalRP(3),
```

```
                      eqiTxLocalRP(4),
                      eqoTxLocalRP(5),
                      otherTxLocalRP(6),
                      srcRemoteRP(7),
                      ingTxRemoteRP(8),
                      tpTxRemoteRP(9),
                      eqiTxRemoteRP(10),
                      eqoTxRemoteRP(11),
                      otherTxRemoteRP(12)
                    }

    FrsldRxRP ::= TEXTUAL-CONVENTION
        STATUS      current
        DESCRIPTION
            "The reference point a PVC uses for calculation
             of receiver related statistics.

             The valid values for this object are as follows:
               - desLocalRP(1) for the local destination
               - ingRxLocalRP(2) for the local ingress queue input
               - tpRxLocalRP(3) for the local traffic policing
               - eqiRxLocalRP(4) for the local egress queue input
               - eqoRxLocalRP(5) for the local egress queue output
               - otherRxLocalRP(6) for any other local receive point
               - desRemoteRP(7) for the remote destination
               - ingRxRemoteRP(8) for the remote ingress input
               - tpRxRemoteRP(9) for the remote traffic policing
               - eqiRxRemoteRP(10) for the remote egress queue input
               - eqoRxRemoteRP(11) for the remote egress queue output
               - otherRxRemoteRP(12) for any other remote receive point"
        REFERENCE
            "FRF.13: Section 2.3"
        SYNTAX      INTEGER {
                      desLocalRP(1),
                      ingRxLocalRP(2),
                      tpRxLocalRP(3),
                      eqiRxLocalRP(4),
                      eqoRxLocalRP(5),
                      otherRxLocalRP(6),
                      desRemoteRP(7),
                      ingRxRemoteRP(8),
                      tpRxRemoteRP(9),
                      eqiRxRemoteRP(10),
                      eqoRxRemoteRP(11),
                      otherRxRemoteRP(12)
                    }

    --
```

```
    -- Base Objects
    ---

    frsldObjects      OBJECT IDENTIFIER ::= { frsldMIB 1 }
    frsldCapabilities OBJECT IDENTIFIER ::= { frsldMIB 2 }
    frsldConformance  OBJECT IDENTIFIER ::= { frsldMIB 3 }

    -- The Frame Relay Service Level Definitions PVC Control Table
    --
    -- This table is used to define and display the parameters of
    -- service level definitions on individual PVCs.

    frsldPvcCtrlTable  OBJECT-TYPE
        SYNTAX      SEQUENCE OF FrsldPvcCtrlEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The Frame Relay Service Level Definitions
             PVC control table."
        ::= { frsldObjects 1 }

    frsldPvcCtrlEntry OBJECT-TYPE
        SYNTAX      FrsldPvcCtrlEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "An entry in the Frame Relay Service Level
             Definitions PVC control table."
        INDEX    { ifIndex, frsldPvcCtrlDlci,
                   frsldPvcCtrlTransmitRP, frsldPvcCtrlReceiveRP}
        ::= { frsldPvcCtrlTable 1 }

    FrsldPvcCtrlEntry ::=
        SEQUENCE {
            --
            -- Index Control Variables
            --
            frsldPvcCtrlDlci                DLCI,
            frsldPvcCtrlTransmitRP          FrsldTxRP,
            frsldPvcCtrlReceiveRP           FrsldRxRP,
            frsldPvcCtrlStatus              RowStatus,
            --
            -- Service Level Definitions Setup Variables
            --
            frsldPvcCtrlPacketFreq          Integer32,
            --
            -- Delay Specific Setup Variables
            --
```

```
            frsldPvcCtrlDelayFrSize         Integer32,
            frsldPvcCtrlDelayType           INTEGER,
            frsldPvcCtrlDelayTimeOut        Integer32,
            --
            -- Data Persistence Control Variables
            --
            frsldPvcCtrlPurge               Integer32,
            frsldPvcCtrlDeleteOnPurge       INTEGER,
            frsldPvcCtrlLastPurgeTime       TimeStamp
        }

    frsldPvcCtrlDlci OBJECT-TYPE
        SYNTAX      DLCI
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The value of this object is equal to the DLCI
             value for this PVC."
        ::= { frsldPvcCtrlEntry 1 }

    frsldPvcCtrlTransmitRP OBJECT-TYPE
        SYNTAX      FrsldTxRP
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The reference point this PVC uses for calculation
             of transmitter related statistics.  This object
             together with frsldPvcCtrlReceiveRP define the
             measurement domain."
        REFERENCE
            "FRF.13: Section 2.3"
        ::= { frsldPvcCtrlEntry 2 }

    frsldPvcCtrlReceiveRP OBJECT-TYPE
        SYNTAX      FrsldRxRP
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The reference point this PVC uses for calculation
             of receiver related statistics.  This object
             together with frsldPvcCtrlTransmitRP define the
             measurement domain."
        ::= { frsldPvcCtrlEntry 3 }

    frsldPvcCtrlStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
```

```
        DESCRIPTION
            "The status of the current row.  This object is
             used to add, delete, and disable rows in this
             table.  When the status changes to active(1) for the
             first time, a row will also be added to the data
             table below.  This row SHOULD not be removed until
             the status is changed to deleted.

             When this object is set to destroy(6), all associated
             sample and data table rows will also be deleted.
             When this object is changed from active(1) to any
             other valid value, the defined purge behavior will
             affect the data and sample tables.

             The rows added to this table MUST have a valid
             ifIndex and an ifType related to frame relay.  Further,
             the reference points referred to by frsldPvcCtrlTransmitRP
             and frsldPvcCtrlReceiveRP MUST be supported (see the
             frsldRPCaps object).

             If at any point the row is not in the active(1) state
             and the DLCI no longer exists, the state SHOULD
             report notReady(3).

             The data in this table SHOULD persist through power
             cycles.  The symantics of readiness for the rows still
             applies.  This means that it is possible for a row to be
             reprovisioned as notReady(3) if the underlying DLCI does
             not persist."
        ::= { frsldPvcCtrlEntry 4 }

    frsldPvcCtrlPacketFreq OBJECT-TYPE
        SYNTAX      Integer32 (0..3600)
        UNITS       "seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The frequency in seconds between initiation of
             specialized packets used to collect delay and / or
             delivery information as supported by the device.
             A value of zero indicates that no packets will
             be sent."
        DEFVAL { 60 }
        ::= { frsldPvcCtrlEntry 5 }

    frsldPvcCtrlDelayFrSize OBJECT-TYPE
        SYNTAX      Integer32 (1..8188)
        UNITS       "octets"
```

```
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The size of the payload in the frame used for
             calculation of network delay."
        DEFVAL { 128 }
        ::= { frsldPvcCtrlEntry 6 }

    frsldPvcCtrlDelayType OBJECT-TYPE
        SYNTAX      INTEGER {
                      oneWay(1),
                      roundTrip(2)
                    }
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                "The type of delay measurement performed."
        REFERENCE
            "FRF.13: Section 3"
        ::= { frsldPvcCtrlEntry 7 }

    frsldPvcCtrlDelayTimeOut OBJECT-TYPE
        SYNTAX      Integer32 (1..3600)
        UNITS       "seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "A delay frame will count as a missed poll if
             it is not updated in the time specified by
             frsldPvcCtrlDelayTimeOut."
        DEFVAL { 60 }
        ::= { frsldPvcCtrlEntry 8 }

    frsldPvcCtrlPurge OBJECT-TYPE
        SYNTAX      Integer32 (0..172800) -- up to 48 hours
        UNITS       "seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "This object defines the amount of time the device
             will wait, after discovering that a DLCI does not exist,
             the DLCI was deleted or the value of frsldPvcCtrlStatus
             changes from active(1) to either notInService(2) or
             notReady(3), prior to automatically purging the history
             in the sample tables and resetting the data in the data
             tables to all zeroes.  If frsldPvcCtrlStatus is manually
             set to destroy(6), this object does not apply."
        DEFVAL { 0 }
```

```
        ::= { frsldPvcCtrlEntry 9 }

    frsldPvcCtrlDeleteOnPurge OBJECT-TYPE
        SYNTAX      INTEGER {
                      none(1),
                      sampleContols(2),
                      all(3)
                    }
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "This object defines whether rows will
             automatically be deleted from the tables
             when the information is purged.

             - A value of none(1) indicates that no rows
               will deleted.  The last known values will
               be preserved.
             - A value of sampleControls(2) indicates
               that all associated sample control rows
               will be deleted.
             - A value of all(3) indicates that all
               associated rows SHOULD be deleted."
        DEFVAL { all }
        ::= { frsldPvcCtrlEntry 10 }

    frsldPvcCtrlLastPurgeTime OBJECT-TYPE
        SYNTAX      TimeStamp
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This object returns the value of sysUpTime
             at the time the information was last purged.
             This value SHOULD be set to the sysUpTime
             upon setting frsldPvcCtrlStatus to active(1)
             for the first time.  Each time a
             discontinuity in the counters occurs, this
             value MUST be set to the sysUpTime.

             If frsldPvcCtrlStatus has never been active(1),
             this object SHOULD return 0.

             This object SHOULD be used as the discontinuity
             timer for the counters in frsldPvcDataTable."
        ::= { frsldPvcCtrlEntry 11 }

    -- The Frame Relay Service Level Definitions Sampling Control
    -- Table
```

```
    --
    -- This table is used to define the sample control parameters
    -- of service level definitions on individual PVCs.

    frsldSmplCtrlTable  OBJECT-TYPE
        SYNTAX      SEQUENCE OF FrsldSmplCtrlEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The Frame Relay Service Level Definitions
             sampling control table."
        ::= { frsldObjects 2 }

    frsldSmplCtrlEntry OBJECT-TYPE
        SYNTAX      FrsldSmplCtrlEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "An entry in the Frame Relay Service Level
             Definitions sample control table."
        INDEX    { ifIndex, frsldPvcCtrlDlci,
                   frsldPvcCtrlTransmitRP, frsldPvcCtrlReceiveRP,
                   frsldSmplCtrlIdx }
        ::= { frsldSmplCtrlTable 1 }

    FrsldSmplCtrlEntry ::=
        SEQUENCE {
            --
            -- Index Control Variables
            --
            frsldSmplCtrlIdx                Integer32,
            frsldSmplCtrlStatus             RowStatus,
            --
            -- Collection Control Variables
            --
            frsldSmplCtrlColPeriod          Integer32,
            frsldSmplCtrlBuckets            Integer32,
            frsldSmplCtrlBucketsGranted     Integer32
        }

    frsldSmplCtrlIdx OBJECT-TYPE
        SYNTAX  Integer32 (1..256)
        MAX-ACCESS not-accessible
        STATUS  current
        DESCRIPTION
            "The unique index for this row in the
             sample control table."
        ::= { frsldSmplCtrlEntry 1 }
```

```
    frsldSmplCtrlStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The status of the current row.  This object is
             used to add, delete, and disable rows in this
             table.  This row SHOULD NOT be removed until the
             status is changed to destroy(6).  When the status
             changes to active(1), the collection in the sample
             tables below will be activated.

             The rows added to this table MUST have a valid
             ifIndex, an ifType related to frame relay,
             frsldPvcCtrlDlci MUST exist for the specified
             ifIndex and frsldPvcCtrlStatus MUST have a
             value of active(1).

             The value of frsldPvcCtrlStatus MUST be active(1)
             to transition this object to active(1).  If
             the value of frsldPvcCtrlStatus becomes anything
             other than active(1) when the state of this object
             is not active(1), this object SHOULD be set to
             notReady(3).

             The data in this table SHOULD persist through power
             cycles.  The symantics of readiness for the rows still
             applies.  This means that it is possible for a row to be
             reprovisioned as notReady(3) if the underlying DLCI does
             not persist."
        ::= { frsldSmplCtrlEntry 2 }

    frsldSmplCtrlColPeriod OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        UNITS       "seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The amount of time in seconds that defines a
             period of collection for the statistics.
             At the end of each period, the statistics will be
             sampled and a row is added to the sample table."
        ::= { frsldSmplCtrlEntry 3 }

    frsldSmplCtrlBuckets OBJECT-TYPE
        SYNTAX      Integer32 (1..65535)
        MAX-ACCESS  read-create
        STATUS      current
```

```
        DESCRIPTION
            "The number of discrete buckets over which the
             data statistics are sampled.

             When this object is created or modified, the device
             SHOULD attempt to set the frsldSmplCtrlBuckets-
             Granted to a value as close as is possible
             depending upon the implementation and the available
             resources."
        DEFVAL { 60 }
        ::= { frsldSmplCtrlEntry 4 }

    frsldSmplCtrlBucketsGranted OBJECT-TYPE
        SYNTAX      Integer32 (0..65535)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of discrete buckets granted.  This
             object will return 0 until frsldSmplCtrlStatus is
             set to active(1).  At that time the buckets will be
             allocated depending upon implementation and
             available resources."
        ::= { frsldSmplCtrlEntry 5 }

    -- The Frame Relay Service Level Definitions PVC Data Table
    --
    -- This table contains the accumulated values of
    -- the collected data.  This table is the table that should
    -- be referenced by external polling mechanisms if time
    -- based polling be desired.

     frsldPvcDataTable  OBJECT-TYPE
        SYNTAX      SEQUENCE OF FrsldPvcDataEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The Frame Relay Service Level Definitions
             data table.

             This table contains accumulated values of the
             collected data.  It is the table that should be
             referenced by external polling mechanisms if
             time based polling be desired."
        ::= { frsldObjects 3 }

    frsldPvcDataEntry OBJECT-TYPE
        SYNTAX      FrsldPvcDataEntry
        MAX-ACCESS  not-accessible
```

```
        STATUS      current
        DESCRIPTION
            "An entry in the Frame Relay Service Level
             Definitions data table."
        INDEX    { ifIndex, frsldPvcCtrlDlci,
                   frsldPvcCtrlTransmitRP, frsldPvcCtrlReceiveRP}
        ::= { frsldPvcDataTable 1 }

    FrsldPvcDataEntry ::=
        SEQUENCE {
            frsldPvcDataMissedPolls       Counter32,
            frsldPvcDataFrDeliveredC      Counter32,
            frsldPvcDataFrDeliveredE      Counter32,
            frsldPvcDataFrOfferedC        Counter32,
            frsldPvcDataFrOfferedE        Counter32,
            frsldPvcDataDataDeliveredC    Counter32,
            frsldPvcDataDataDeliveredE    Counter32,
            frsldPvcDataDataOfferedC      Counter32,
            frsldPvcDataDataOfferedE      Counter32,
            frsldPvcDataHCFrDeliveredC    Counter64,
            frsldPvcDataHCFrDeliveredE    Counter64,
            frsldPvcDataHCFrOfferedC      Counter64,
            frsldPvcDataHCFrOfferedE      Counter64,
            frsldPvcDataHCDataDeliveredC  Counter64,
            frsldPvcDataHCDataDeliveredE  Counter64,
            frsldPvcDataHCDataOfferedC    Counter64,
            frsldPvcDataHCDataOfferedE    Counter64,
            frsldPvcDataUnavailableTime   TimeTicks,
            frsldPvcDataUnavailables      Counter32
        }

    frsldPvcDataMissedPolls OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The total number of polls that have been determined
             to be missed.  These polls are typically associated
             with the calculation of delay but may also be
             used for the calculation of other statistics.  If an
             anticipated poll is not received in a reasonable
             amount of time, it should be counted as missed.
             The value used to determine the reasonable amount
             of time is contained in frsldPvcCtrlDelayTimeOut.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
```

```
             frsldPvcCtrlLastPurgeTime."
        ::= { frsldPvcDataEntry 1 }

    frsldPvcDataFrDeliveredC OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of frames that were received at
             frsldPvcCtrlReceiveRP and determined to have been
             sent within CIR.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
             frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 4.1 (FramesDeliveredc)"
        ::= { frsldPvcDataEntry 2 }

    frsldPvcDataFrDeliveredE OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of frames that were received at
             frsldPvcCtrlReceiveRP and determined to have been
             sent in excess of the CIR.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
             frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 4.1 (FramesDeliverede)"
        ::= { frsldPvcDataEntry 3 }

    frsldPvcDataFrOfferedC OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of frames that were offered through
             frsldPvcCtrlTransmitRP within CIR.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
```

```
             frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 4.1 (FramesOfferedc)"
        ::= { frsldPvcDataEntry 4 }

    frsldPvcDataFrOfferedE OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of frames that were offered through
             frsldPvcCtrlTransmitRP in excess of the CIR.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
             frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 4.1 (FramesOfferede)"
        ::= { frsldPvcDataEntry 5 }

    frsldPvcDataDataDeliveredC OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were received at
             frsldPvcCtrlReceiveRP and determined to have been
             sent within CIR.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
             frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 5.1 (DataDeliveredc)"
        ::= { frsldPvcDataEntry 6 }

    frsldPvcDataDataDeliveredE OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were received at
             frsldPvcCtrlReceiveRP and determined to have been
             sent in excess of the CIR.

             Discontinuities in the value of this counter can
```

```
            occur at re-initialization of the management system
            and at other times as indicated by
            frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 5.1 (DataDeliverede)"
        ::= { frsldPvcDataEntry 7 }

    frsldPvcDataDataOfferedC OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were offered through
             frsldPvcCtrlTransmitRP within CIR.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
             frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 5.1 (DataOfferedc)"
        ::= { frsldPvcDataEntry 8 }

    frsldPvcDataDataOfferedE OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were offered through
             frsldPvcCtrlTransmitRP in excess of the CIR.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
             frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 5.1 (DataOfferede)"
        ::= { frsldPvcDataEntry 9 }

    frsldPvcDataHCFrDeliveredC OBJECT-TYPE
        SYNTAX      Counter64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of frames that were received at
             frsldPvcCtrlReceiveRP and determined to have been
             sent within CIR.  This object is a 64-bit version
             of frsldPvcDataFrDeliveredC.
```

```
            Discontinuities in the value of this counter can
            occur at re-initialization of the management system
            and at other times as indicated by
            frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 4.1 (FramesDeliveredc)"
        ::= { frsldPvcDataEntry 10 }

    frsldPvcDataHCFrDeliveredE OBJECT-TYPE
        SYNTAX      Counter64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of frames that were received at
             frsldPvcCtrlReceiveRP and determined to have been
             sent in excess of the CIR.  This object is a 64-bit
             version of frsldPvcDataFrDeliveredE.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
             frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 4.1 (FramesDeliverede)"
        ::= { frsldPvcDataEntry 11 }

    frsldPvcDataHCFrOfferedC OBJECT-TYPE
        SYNTAX      Counter64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of frames that were offered through
             frsldPvcCtrlTransmitRP within CIR.  This object is
             a 64-bit version of frsldPvcDataFrOfferedC.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
             frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 4.1 (FramesOfferedc)"
        ::= { frsldPvcDataEntry 12 }

    frsldPvcDataHCFrOfferedE OBJECT-TYPE
        SYNTAX      Counter64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
```

```
            "The number of frames that were offered through
             frsldPvcCtrlTransmitRP in excess of the CIR.  This
             object is a 64-bit version of frsldPvcDataFrOfferedE.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
             frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 4.1 (FramesOfferede)"
        ::= { frsldPvcDataEntry 13 }

    frsldPvcDataHCDataDeliveredC OBJECT-TYPE
        SYNTAX      Counter64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were received at
             frsldPvcCtrlReceiveRP and determined to have been
             sent within CIR.  This object is a 64-bit version of
             frsldPvcDataDataDeliveredC.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
             frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 5.1 (DataDeliveredc)"
        ::= { frsldPvcDataEntry 14 }

    frsldPvcDataHCDataDeliveredE OBJECT-TYPE
        SYNTAX      Counter64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were received at
             frsldPvcCtrlReceiveRP and determined to have been
             sent in excess of the CIR.  This object is a 64-bit
             version of frsldPvcDataDataDeliveredE.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
             frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 5.1 (DataDeliverede)"
        ::= { frsldPvcDataEntry 15 }
```

```
    frsldPvcDataHCDataOfferedC OBJECT-TYPE
        SYNTAX      Counter64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were offered through
             frsldPvcCtrlTransmitRP within CIR.  This object is
             a 64-bit version of frsldPvcDataDataOfferedC.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
             frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 5.1 (DataOfferedc)"
        ::= { frsldPvcDataEntry 16 }

    frsldPvcDataHCDataOfferedE OBJECT-TYPE
        SYNTAX      Counter64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were offered through
             frsldPvcCtrlTransmitRP in excess of the CIR.
             This object is a 64-bit version of
             frsldPvcDataDataOfferedE.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
             frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 5.1 (DataOfferede)"
        ::= { frsldPvcDataEntry 17 }

    frsldPvcDataUnavailableTime OBJECT-TYPE
        SYNTAX      TimeTicks
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The amount of time this PVC was declared unavailable
             for any reason since this row was created."
        REFERENCE
            "FRF.13: Section 6.1 (OutageTime)"
        ::= { frsldPvcDataEntry 18 }

    frsldPvcDataUnavailables OBJECT-TYPE
        SYNTAX      Counter32
```

```
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of times this PVC was declared unavailable
             for any reason since this row was created.

             Discontinuities in the value of this counter can
             occur at re-initialization of the management system
             and at other times as indicated by
             frsldPvcCtrlLastPurgeTime."
        REFERENCE
            "FRF.13: Section 6.1 (OutageCount)"
        ::= { frsldPvcDataEntry 19 }

    -- The Frame Relay Service Level Definitions PVC Sample Table
    --
    -- This table contains the sampled delay, delivery and
    -- availability information.

    frsldPvcSampleTable  OBJECT-TYPE
        SYNTAX      SEQUENCE OF FrsldPvcSampleEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The Frame Relay Service Level Definitions
             sample table."
        ::= { frsldObjects 4 }

    frsldPvcSampleEntry OBJECT-TYPE
        SYNTAX      FrsldPvcSampleEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "An entry in the Frame Relay Service Level
             Definitions data sample table."
        INDEX    { ifIndex, frsldPvcCtrlDlci,
                   frsldPvcCtrlTransmitRP, frsldPvcCtrlReceiveRP,
                   frsldSmplCtrlIdx, frsldPvcSmplIdx }
        ::= { frsldPvcSampleTable 1 }

    FrsldPvcSampleEntry ::=
        SEQUENCE {
            frsldPvcSmplIdx             Integer32,
            frsldPvcSmplDelayMin        Gauge32,
            frsldPvcSmplDelayMax        Gauge32,
            frsldPvcSmplDelayAvg        Gauge32,
            frsldPvcSmplMissedPolls     Gauge32,
            frsldPvcSmplFrDeliveredC    Gauge32,
```

```
            frsldPvcSmplFrDeliveredE     Gauge32,
            frsldPvcSmplFrOfferedC       Gauge32,
            frsldPvcSmplFrOfferedE       Gauge32,
            frsldPvcSmplDataDeliveredC   Gauge32,
            frsldPvcSmplDataDeliveredE   Gauge32,
            frsldPvcSmplDataOfferedC     Gauge32,
            frsldPvcSmplDataOfferedE     Gauge32,
            frsldPvcSmplHCFrDeliveredC   CounterBasedGauge64,
            frsldPvcSmplHCFrDeliveredE   CounterBasedGauge64,
            frsldPvcSmplHCFrOfferedC     CounterBasedGauge64,
            frsldPvcSmplHCFrOfferedE     CounterBasedGauge64,
            frsldPvcSmplHCDataDeliveredC CounterBasedGauge64,
            frsldPvcSmplHCDataDeliveredE CounterBasedGauge64,
            frsldPvcSmplHCDataOfferedC   CounterBasedGauge64,
            frsldPvcSmplHCDataOfferedE   CounterBasedGauge64,
            frsldPvcSmplUnavailableTime  TimeTicks,
            frsldPvcSmplUnavailables     Gauge32,
            frsldPvcSmplStartTime        TimeStamp,
            frsldPvcSmplEndTime          TimeStamp
        }

    frsldPvcSmplIdx OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The bucket index of the current sample.  This
             increments once for each new bucket in the
             table."
        ::= { frsldPvcSampleEntry 1 }

    frsldPvcSmplDelayMin OBJECT-TYPE
        SYNTAX      Gauge32
        UNITS       "microseconds"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The minimum delay reported in microseconds measured
             for any information packet that arrived during this
             interval.

             A value of zero means that no data is available."
        REFERENCE
            "FRF.13: Section 3.1 (FTD)"
        ::= { frsldPvcSampleEntry 2 }

    frsldPvcSmplDelayMax OBJECT-TYPE
        SYNTAX      Gauge32
```

```
        UNITS       "microseconds"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The largest delay reported in microseconds measured
             for any information packet that arrived during this
             interval.

             A value of zero means that no data is available."
        REFERENCE
            "FRF.13: Section 3.1 (FTD)"
        ::= { frsldPvcSampleEntry 3 }

    frsldPvcSmplDelayAvg OBJECT-TYPE
        SYNTAX      Gauge32
        UNITS       "microseconds"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The average delay reported in microseconds measured
             for all delay packets that arrived during this
             interval.

             A value of zero means that no data is available."
        REFERENCE
            "FRF.13: Section 3.1 (FTD)"
        ::= { frsldPvcSampleEntry 4 }

    frsldPvcSmplMissedPolls OBJECT-TYPE
        SYNTAX      Gauge32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The total number of polls that were missed during
             this interval."
        ::= { frsldPvcSampleEntry 5 }

    frsldPvcSmplFrDeliveredC OBJECT-TYPE
        SYNTAX      Gauge32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of frames that were received at
             frsldPvcCtrlReceiveRP and determined to have been
             sent within CIR during this interval.

             If it is the case that the high capacity counters
             are also used, this MUST report the value of the
```

```
            lower 32 bits of the CounterBasedGauge64 value of
            frsldPvcSmplHCFrDeliveredC."
        REFERENCE
            "FRF.13: Section 4.1 (FramesDeliveredc)"
        ::= { frsldPvcSampleEntry 6 }

    frsldPvcSmplFrDeliveredE OBJECT-TYPE
        SYNTAX      Gauge32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of frames that were received at
            frsldPvcCtrlReceiveRP and determined to have been
            sent in excess of the CIR during this interval.

            If it is the case that the high capacity counters
            are also used, this MUST report the value of the
            lower 32 bits of the CounterBasedGauge64 value of
            frsldPvcSmplHCFrDeliveredE."
        REFERENCE
            "FRF.13: Section 4.1 (FramesDeliverede))"
        ::= { frsldPvcSampleEntry 7 }

    frsldPvcSmplFrOfferedC OBJECT-TYPE
        SYNTAX      Gauge32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of frames that were offered through
            frsldPvcCtrlTransmitRP within CIR during this
            interval.

            If it is the case that the high capacity counters
            are also used, this MUST report the value of the
            lower 32 bits of the CounterBasedGauge64 value of
            frsldPvcSmplHCFrOfferedC."
        REFERENCE
            "FRF.13: Section 4.1 (FramesOfferedc)"
        ::= { frsldPvcSampleEntry 8 }

    frsldPvcSmplFrOfferedE OBJECT-TYPE
        SYNTAX      Gauge32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of frames that were offered through
            frsldPvcCtrlTransmitRP in excess of the CIR
            during this interval.
```

```
            If it is the case that the high capacity counters
            are also used, this MUST report the value of the
            lower 32 bits of the CounterBasedGauge64 value of
            frsldPvcSmplHCFrOfferedE."
        REFERENCE
            "FRF.13: Section 4.1 (FramesOfferede)"
        ::= { frsldPvcSampleEntry 9 }

    frsldPvcSmplDataDeliveredC OBJECT-TYPE
        SYNTAX      Gauge32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were received at
             frsldPvcCtrlReceiveRP and determined to have been
             sent within CIR during this interval.

             If it is the case that the high capacity counters
             are also used, this MUST report the value of the
             lower 32 bits of the CounterBasedGauge64 value of
             frsldPvcSmplHCDataDeliveredC."
        REFERENCE
            "FRF.13: Section 5.1 (DataDeliveredc)"
        ::= { frsldPvcSampleEntry 10 }

    frsldPvcSmplDataDeliveredE OBJECT-TYPE
        SYNTAX      Gauge32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were received at
             frsldPvcCtrlDeliveredRP and determined to have been
             sent in excess of the CIR during this interval.

             If it is the case that the high capacity counters
             are also used, this MUST report the value of the
             lower 32 bits of the CounterBasedGauge64 value of
             frsldPvcSmplHCDataDeliveredE."
        REFERENCE
            "FRF.13: Section 5.1 (DataDeliverede)"
        ::= { frsldPvcSampleEntry 11 }

    frsldPvcSmplDataOfferedC OBJECT-TYPE
        SYNTAX      Gauge32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were offered through
```

```
            frsldPvcCtrlTransmitRP within CIR during this
            interval.

            If it is the case that the high capacity counters
            are also used, this MUST report the value of the
            lower 32 bits of the CounterBasedGauge64 value of
            frsldPvcSmplHCDataOfferredC."
        REFERENCE
            "FRF.13: Section 5.1 (DataOfferedc)"
        ::= { frsldPvcSampleEntry 12 }

    frsldPvcSmplDataOfferedE OBJECT-TYPE
        SYNTAX      Gauge32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were offered through
             frsldPvcCtrlTransmitRP in excess of the CIR
             during this interval.

             If it is the case that the high capacity counters
             are also used, this MUST report the value of the
             lower 32 bits of the CounterBasedGauge64 value of
             frsldPvcSmplHCDataOfferedE."
        REFERENCE
            "FRF.13: Section 5.1 (DataOfferede)"
        ::= { frsldPvcSampleEntry 13 }

    frsldPvcSmplHCFrDeliveredC OBJECT-TYPE
        SYNTAX      CounterBasedGauge64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of frames that were received at
             frsldPvcCtrlReceiveRP and determined to have been
             sent within CIR during this interval.  This object
             is a 64-bit version of frsldPvcSmplFrDeliveredC."
        REFERENCE
            "FRF.13: Section 4.1 (FramesDeliveredc)"
        ::= { frsldPvcSampleEntry 14 }

    frsldPvcSmplHCFrDeliveredE OBJECT-TYPE
        SYNTAX      CounterBasedGauge64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of frames that were received at
             frsldPvcCtrlReceiveRP and determined to have been
```

```
            sent in excess of the CIR during this interval.
            This object is a 64-bit version of frsldPvcSmpl-
            FrDeliveredE."
        REFERENCE
            "FRF.13: Section 4.1 (FramesDeliverede)"
       ::= { frsldPvcSampleEntry 15 }

    frsldPvcSmplHCFrOfferedC OBJECT-TYPE
        SYNTAX      CounterBasedGauge64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of frames that were offered through
             frsldPvcCtrlTransmitRP within CIR during this
             interval.  This object is a 64-bit version of
             frsldPvcSmplFrOfferedC."
        REFERENCE
            "FRF.13: Section 4.1 (FramesOfferedc)"
        ::= { frsldPvcSampleEntry 16 }

    frsldPvcSmplHCFrOfferedE OBJECT-TYPE
        SYNTAX      CounterBasedGauge64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of frames that were offered through
             frsldPvcCtrlTransmitRP in excess of the CIR
             during this interval.  This object is a 64-bit
             version of frsldPvcSmplFrOfferedE."
        REFERENCE
            "FRF.13: Section 4.1 (FramesOfferede)"
        ::= { frsldPvcSampleEntry 17 }

    frsldPvcSmplHCDataDeliveredC OBJECT-TYPE
        SYNTAX      CounterBasedGauge64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were received at
             frsldPvcCtrlReceiveRP and determined to have been
             sent within CIR during this interval.  This value
             is a 64-bit version of frsldPvcSmplDataDeliveredC."
        REFERENCE
            "FRF.13: Section 5.1 (DataDeliveredc)"
        ::= { frsldPvcSampleEntry 18 }

    frsldPvcSmplHCDataDeliveredE OBJECT-TYPE
        SYNTAX      CounterBasedGauge64
```

```
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were received at
             frsldPvcCtrlReceiveRP and determined to have been
             sent in excess of the CIR during this interval.  This
             value is a 64-bit version of frsldPvcSmplData-
             DeliveredE."
        REFERENCE
            "FRF.13: Section 5.1 (DataDeliverede)"
        ::= { frsldPvcSampleEntry 19 }

    frsldPvcSmplHCDataOfferedC OBJECT-TYPE
        SYNTAX      CounterBasedGauge64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were offered through
             frsldPvcCtrlTransmitRP within CIR during this
             interval.  This value is a 64-bit version of
             frsldPvcSmplDataOfferedC."
        REFERENCE
            "FRF.13: Section 5.1 (DataOfferedc)"
        ::= { frsldPvcSampleEntry 20 }

    frsldPvcSmplHCDataOfferedE OBJECT-TYPE
        SYNTAX      CounterBasedGauge64
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of octets that were offered through
             frsldPvcCtrlTransmitRP in excess of the CIR
             during this interval.  This object is a 64-bit
             version of frsldPvcSmplDataOfferedE."
        REFERENCE
            "FRF.13: Section 5.1 (DataOfferede)"
        ::= { frsldPvcSampleEntry 21 }

    frsldPvcSmplUnavailableTime OBJECT-TYPE
        SYNTAX  TimeTicks
        MAX-ACCESS  read-only
        STATUS  current
        DESCRIPTION
            "The amount of time this PVC was declared
             unavailable for any reason during this interval."
        REFERENCE
            "FRF.13: Section 6.1 (OutageTime)"
        ::= { frsldPvcSampleEntry 22 }
```

```
    frsldPvcSmplUnavailables OBJECT-TYPE
        SYNTAX  Gauge32
        MAX-ACCESS  read-only
        STATUS  current
        DESCRIPTION
            "The number of times this PVC was declared
             unavailable for any reason during this interval."
        REFERENCE
            "FRF.13: Section 6.1 (OutageCount)"
        ::= { frsldPvcSampleEntry 23 }

    frsldPvcSmplStartTime OBJECT-TYPE
        SYNTAX      TimeStamp
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The value of sysUpTime when this sample interval
             started."
        ::= { frsldPvcSampleEntry 24 }

    frsldPvcSmplEndTime OBJECT-TYPE
        SYNTAX      TimeStamp
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The value of sysUpTime when this sample interval
             ended.  No data will be reported and the row will
             not appear in the table until the sample has
             been collected."
        ::= { frsldPvcSampleEntry 25 }

    -- Capabilities Group
    -- This group provides capabilities objects for the tables
    -- that control configuration.

    frsldPvcCtrlWriteCaps OBJECT-TYPE
        SYNTAX  BITS {
                frsldPvcCtrlStatus(0),
                frsldPvcCtrlPacketFreq(1),
                frsldPvcCtrlDelayFrSize(2),
                frsldPvcCtrlDelayType(3),
                frsldPvcCtrlDelayTimeOut(4),
                frsldPvcCtrlPurge(5),
                frsldPvcCtrlDeleteOnPurge(6)
        }
        MAX-ACCESS  read-only
        STATUS  current
        DESCRIPTION
```

```
            "This object specifies the write capabilities
             for the read-create objects of the PVC Control
             table.  If the corresponding bit is enabled (1),
             the agent supports writes to that object."
        ::= { frsldCapabilities 1 }

    frsldSmplCtrlWriteCaps OBJECT-TYPE
        SYNTAX  BITS {
                frsldSmplCtrlStatus(0),
                frsldSmplCtrlBuckets(1)
        }
        MAX-ACCESS  read-only
        STATUS  current
        DESCRIPTION
            "This object specifies the write capabilities
             for the read-create objects of the Sample Control
             table.  If the corresponding bit is enabled (1),
             the agent supports writes to that object."
        ::= { frsldCapabilities 2 }

    frsldRPCaps OBJECT-TYPE
        SYNTAX  BITS {
                srcLocalRP(0),
                ingTxLocalRP(1),
                tpTxLocalRP(2),
                eqiTxLocalRP(3),
                eqoTxLocalRP(4),
                otherTxLocalRP(5),
                srcRemoteRP(6),
                ingTxRemoteRP(7),
                tpTxRemoteRP(8),
                eqiTxRemoteRP(9),
                eqoTxRemoteRP(10),
                otherTxRemoteRP(11),
                desLocalRP(12),
                ingRxLocalRP(13),
                tpRxLocalRP(14),
                eqiRxLocalRP(15),
                eqoRxLocalRP(16),
                otherRxLocalRP(17),
                desRemoteRP(18),
                ingRxRemoteRP(19),
                tpRxRemoteRP(20),
                eqiRxRemoteRP(21),
                eqoRxRemoteRP(22),
                otherRxRemoteRP(23)
        }
        MAX-ACCESS  read-only
```

```
        STATUS  current
        DESCRIPTION
            "This object specifies the reference points that
             the agent supports.  This object allows the management
             application to discover which rows can be created on
             a specific device."
        ::= { frsldCapabilities 3 }

    frsldMaxPvcCtrls   OBJECT-TYPE
        SYNTAX      Integer32 (0..2147483647)
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The maximum number of control rows that can be created
             in frsldPvcCtrlTable.  Sets to this object lower than
             the current value of frsldNumPvcCtrls should result in
             inconsistentValue."
        ::= { frsldCapabilities 4 }

    frsldNumPvcCtrls   OBJECT-TYPE
        SYNTAX      Gauge32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The current number of rows in frsldPvcCtrlTable."
        ::= { frsldCapabilities 5 }


    frsldMaxSmplCtrls   OBJECT-TYPE
        SYNTAX      Integer32 (0..2147483647)
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The maximum number of control rows that can be created
             in frsldSmplCtrlTable.  Sets to this object lower than
             the current value of frsldNumSmplCtrls should result in
             inconsistentValue."
        ::= { frsldCapabilities 6 }

    frsldNumSmplCtrls   OBJECT-TYPE
        SYNTAX      Gauge32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The current number of rows in frsldSmplCtrlTable."
        ::= { frsldCapabilities 7 }

    -- Conformance Information
```

```
    frsldMIBGroups      OBJECT IDENTIFIER ::= { frsldConformance 1 }
    frsldMIBCompliances OBJECT IDENTIFIER ::= { frsldConformance 2 }

    --
    -- Compliance Statements
    --

    frsldCompliance MODULE-COMPLIANCE
        STATUS  current
        DESCRIPTION
            "The compliance statement for SNMP entities
             which support with Frame Relay Service Level
             Definitions.  This group defines the minimum
             level of support required for compliance."
        MODULE -- this module
            MANDATORY-GROUPS { frsldPvcReqCtrlGroup,
                               frsldPvcReqDataGroup,
                               frsldCapabilitiesGroup}

            GROUP       frsldPvcHCFrameDataGroup
            DESCRIPTION
               "This group is mandatory only for those network
                interfaces with corresponding instance of ifSpeed
                 greater than 650,000,000 bits/second."

            GROUP       frsldPvcHCOctetDataGroup
            DESCRIPTION
               "This group is mandatory only for those network
                interfaces with corresponding instance of ifSpeed
                greater than 650,000,000 bits/second."

            GROUP       frsldPvcPacketGroup
            DESCRIPTION
               "This group is optional.  Network interfaces that
                allow control of the packets used to collect
                information are encouraged to implement this
                group."

            GROUP       frsldPvcDelayCtrlGroup
            DESCRIPTION
               "This group is optional.  Network interfaces that
                offer control of the delay measurement are
                strongly encouraged to implement this group."


            GROUP       frsldPvcSampleCtrlGroup
            DESCRIPTION
               "This group is mandatory only for those network
```

```
            interfaces that allow data sampling."

        GROUP       frsldPvcDelayDataGroup
        DESCRIPTION
           "This group is only mandatory when
            frsldPvcDelayCtrlGroup is implemented.  It is
            strongly encouraged that any device capable
            of measuring delay implement this group."

        GROUP       frsldPvcSampleDelayGroup
        DESCRIPTION
           "This group is only mandatory when both
            frsldPvcSampleCtrlGroup and frsldPvcDelayDataGroup
            are supported."

        GROUP       frsldPvcSampleDataGroup
        DESCRIPTION
           "This group is mandatory whenever
            frsldPvcSampleCtrlGroup is supported."

        GROUP       frsldPvcSampleHCFrameGroup
        DESCRIPTION
           "This group is mandatory whenever both
            frsldPvcSampleCtrlGroup and frsldPvcHCFrameDataGroup
            are supported."

        GROUP       frsldPvcSampleHCDataGroup
        DESCRIPTION
           "This group is mandatory whenever both
            frsldPvcSampleCtrlGroup and frsldPvcHCOctetDataGroup
            are supported."

        GROUP       frsldPvcSampleAvailGroup
        DESCRIPTION
           "This group is mandatory whenever
            frsldPvcSampleCtrlGroup is supported."

        GROUP       frsldPvcSampleGeneralGroup
        DESCRIPTION
           "This group is mandatory whenever
            frsldPvcSampleCtrlGroup is supported."

        OBJECT      frsldPvcCtrlStatus
        SYNTAX      RowStatus { active(1) } -- subset of RowStatus
        MIN-ACCESS  read-only
        DESCRIPTION
           "Row creation can be done outside of the scope of
            the SNMP protocol.  If this object is implemented
```

```
                with max-access of read-only, then the only value
                that MUST be returned is active(1) and
                frsldPvcCtrlWriteCaps MUST return 0 for the
                frsldPvcCtrlStatus(0) bit."

            OBJECT      frsldPvcCtrlPurge
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  If this object is
                 implemented with a max-access of read-only, then
                 the frsldPvcCtrlPurge(5) bit must return 0."

            OBJECT      frsldPvcCtrlDeleteOnPurge
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  If this object is
                 implemented with a max-access of read-only, then
                 the frsldPvcCtrlDeleteOnPurge(6) bit must return
                 0."

            OBJECT      frsldMaxPvcCtrls
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required if the device either
                 dynamically allocates memory or statically allocates
                 a fixed number of entries.  In the case of static
                 allocation, the device should always report the
                 correct maximum number of controls.  In the case
                 of dynamic allocation, the device SHOULD always
                 report a number greater than frsldNumPvcCtrls
                 when allocation is possible and a number equal to
                 frsldNumPvcCtrls when allocation is not possible."
            OBJECT      frsldMaxSmplCtrls
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required if the device either
                 dynamically allocates memory or statically allocates
                 a fixed number of entries.  In the case of static
                 allocation, the device should always report the
                 correct maximum number of controls.  In the case
                 of dynamic allocation, the device SHOULD always
                 report a number greater than frsldNumSmplCtrls
                 when allocation is possible and a number equal to
                 frsldNumSmplCtrls when allocation is not possible."

    ::= { frsldMIBCompliances 1 }

    --
```

```
    -- Units of Conformance
    --
    frsldPvcReqCtrlGroup  OBJECT-GROUP
       OBJECTS {
            frsldPvcCtrlStatus,
            frsldPvcCtrlPurge,
            frsldPvcCtrlDeleteOnPurge,
            frsldPvcCtrlLastPurgeTime
       }
       STATUS  current
       DESCRIPTION
           "A collection of required objects providing
            control information applicable to a PVC which
            implements Service Level Definitions."
       ::= { frsldMIBGroups 1 }

    frsldPvcPacketGroup OBJECT-GROUP
       OBJECTS {
            frsldPvcCtrlPacketFreq
       }
       STATUS  current
       DESCRIPTION
           "A collection of optional objects providing packet
            level control information applicable to a PVC which
            implements Service Level Definitions."
       ::= { frsldMIBGroups 2 }

    frsldPvcDelayCtrlGroup  OBJECT-GROUP
       OBJECTS {
            frsldPvcCtrlDelayFrSize,
            frsldPvcCtrlDelayType,
            frsldPvcCtrlDelayTimeOut
       }
       STATUS  current
       DESCRIPTION
           "A collection of optional objects providing delay
            control information applicable to a PVC which
            implements Service Level Definitions.

            If this group is implemented, frsldPvcPacketGroup
            and frsldPvcDelayDataGroup MUST also be implemented."
       ::= { frsldMIBGroups 3 }

    frsldPvcSampleCtrlGroup  OBJECT-GROUP
       OBJECTS {
            frsldSmplCtrlStatus,
            frsldSmplCtrlColPeriod,
            frsldSmplCtrlBuckets,
```

```
            frsldSmplCtrlBucketsGranted
        }
        STATUS  current
        DESCRIPTION
            "A collection of optional objects providing sample
             control information applicable to a PVC which
             implements Service Level Definitions.

             If this group is implemented, frsldPvcReqDataGroup
             and frsldPvcSampleGeneralGroup MUST also be
             implemented."
        ::= { frsldMIBGroups 4 }

    frsldPvcReqDataGroup  OBJECT-GROUP
        OBJECTS {
            frsldPvcDataFrDeliveredC,
            frsldPvcDataFrDeliveredE,
            frsldPvcDataFrOfferedC,
            frsldPvcDataFrOfferedE,
            frsldPvcDataDataDeliveredC,
            frsldPvcDataDataDeliveredE,
            frsldPvcDataDataOfferedC,
            frsldPvcDataDataOfferedE,
            frsldPvcDataUnavailableTime,
            frsldPvcDataUnavailables
        }
        STATUS  current
        DESCRIPTION
            "A collection of required objects providing data
             collected on a PVC which implements Service
             Level Definitions."
        ::= { frsldMIBGroups 5 }

    frsldPvcDelayDataGroup  OBJECT-GROUP
        OBJECTS {
            frsldPvcDataMissedPolls
        }
        STATUS  current
        DESCRIPTION
            "A collection of optional objects providing delay
             data collected on a PVC which implements Service
             Level Definitions.

             If this group is implemented, frsldPvcDelayCtrlGroup
             MUST also be implemented."
        ::= { frsldMIBGroups 6 }

    frsldPvcHCFrameDataGroup  OBJECT-GROUP
```

```
       OBJECTS {
            frsldPvcDataHCFrDeliveredC,
            frsldPvcDataHCFrDeliveredE,
            frsldPvcDataHCFrOfferedC,
            frsldPvcDataHCFrOfferedE
       }
       STATUS  current
       DESCRIPTION
           "A collection of optional objects providing high
            capacity frame data collected on a PVC which
            implements Service Level Definitions."
       ::= { frsldMIBGroups 7 }

    frsldPvcHCOctetDataGroup  OBJECT-GROUP
       OBJECTS {
            frsldPvcDataHCDataDeliveredC,
            frsldPvcDataHCDataDeliveredE,
            frsldPvcDataHCDataOfferedC,
            frsldPvcDataHCDataOfferedE
       }
       STATUS  current
       DESCRIPTION
           "A collection of optional objects providing high
            capacity octet data collected on a PVC which
            implements Service Level Definitions."
       ::= { frsldMIBGroups 8 }

    frsldPvcSampleDelayGroup  OBJECT-GROUP
       OBJECTS {
            frsldPvcSmplDelayMin,
            frsldPvcSmplDelayMax,
            frsldPvcSmplDelayAvg,
            frsldPvcSmplMissedPolls
       }
       STATUS  current
       DESCRIPTION
           "A collection of optional objects providing delay
            sample data collected on a PVC which implements
            Service Level Definitions.

            If this group is implemented, frsldPvcDelayCtrlGroup
            MUST also be implemented."
       ::= { frsldMIBGroups 9 }

    frsldPvcSampleDataGroup  OBJECT-GROUP
       OBJECTS {
            frsldPvcSmplFrDeliveredC,
            frsldPvcSmplFrDeliveredE,
```

```
            frsldPvcSmplFrOfferedC,
            frsldPvcSmplFrOfferedE,
            frsldPvcSmplDataDeliveredC,
            frsldPvcSmplDataDeliveredE,
            frsldPvcSmplDataOfferedC,
            frsldPvcSmplDataOfferedE
        }
        STATUS  current
        DESCRIPTION
            "A collection of optional objects providing data
             and frame delivery sample data collected on a PVC
             which implements Service Level Definitions.

             If this group is implemented, frsldPvcReqDataGroup
             MUST also be implemented."
        ::= { frsldMIBGroups 10 }

    frsldPvcSampleHCFrameGroup  OBJECT-GROUP
        OBJECTS {
            frsldPvcSmplHCFrDeliveredC,
            frsldPvcSmplHCFrDeliveredE,
            frsldPvcSmplHCFrOfferedC,
            frsldPvcSmplHCFrOfferedE
        }
        STATUS  current
        DESCRIPTION
            "A collection of optional objects providing high
             capacity frame delivery sample data collected on a PVC
             which implements Service Level Definitions.

             If this group is implemented, frsldPvcHCFrameDataGroup
             MUST also be implemented."
        ::= { frsldMIBGroups 11 }

    frsldPvcSampleHCDataGroup  OBJECT-GROUP
        OBJECTS {
            frsldPvcSmplHCDataDeliveredC,
            frsldPvcSmplHCDataDeliveredE,
            frsldPvcSmplHCDataOfferedC,
            frsldPvcSmplHCDataOfferedE
        }
        STATUS  current
        DESCRIPTION
            "A collection of optional objects providing high
             capacity data delivery sample data collected on a PVC
             which implements Service Level Definitions.

             If this group is implemented, frsldPvcHCOctetDataGroup
```

```
            MUST also be implemented."
       ::= { frsldMIBGroups 12 }

    frsldPvcSampleAvailGroup  OBJECT-GROUP
       OBJECTS {
            frsldPvcSmplUnavailableTime,
            frsldPvcSmplUnavailables
       }
       STATUS  current
       DESCRIPTION
           "A collection of optional objects providing
            availability sample data collected on a PVC which
            implements Service Level Definitions.

            If this group is implemented, frsldPvcReqDataGroup
            MUST also be implemented."
       ::= { frsldMIBGroups 13 }

    frsldPvcSampleGeneralGroup  OBJECT-GROUP
       OBJECTS {
            frsldPvcSmplStartTime,
            frsldPvcSmplEndTime
       }
       STATUS  current
       DESCRIPTION
           "A collection of optional objects providing
            general sample data collected on a PVC which
            implements Service Level Definitions."
       ::= { frsldMIBGroups 14 }

    frsldCapabilitiesGroup  OBJECT-GROUP
       OBJECTS {
            frsldPvcCtrlWriteCaps,
            frsldSmplCtrlWriteCaps,
            frsldRPCaps,
            frsldMaxPvcCtrls,
            frsldNumPvcCtrls,
            frsldMaxSmplCtrls,
            frsldNumSmplCtrls
       }
       STATUS  current
       DESCRIPTION
           "A collection of required objects providing
            capability information and control for this
            MIB module."
       ::= { frsldMIBGroups 15 }
END
```

8. Acknowledgments

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10. Security Considerations

There are a number of management objects defined in this MIB that have a MAX-ACCESS clause of read-write and/or read-create. Such objects may be considered sensitive or vulnerable in some network environments. The support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations.

SNMPv1 by itself is not a secure environment. Even if the network itself is secure (for example by using IPSec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB.

It is recommended that the implementers consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model RFC 2574 [12] and the View-based Access Control Model RFC 2575 [15] is recommended.

It is then a customer/user responsibility to ensure that the SNMP entity giving access to an instance of this MIB, is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

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12. Full Copyright Statement

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