

Network Working Group  
Request for Comments: 3202  
Category: Standards Track

R. Steinberger  
Paradyne Networks  
O. Nicklass  
RAD Data Communications Ltd.  
January 2002

## Definitions of Managed Objects for Frame Relay Service Level Definitions

### Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

### Copyright Notice

Copyright (C) The Internet Society (2002). All Rights Reserved.

### 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.

### Table of Contents

1. The SNMP Management Framework .....	2
2. Conventions .....	3
3. Overview .....	3
3.1. Frame Relay Service Level Definitions .....	4
3.2. Terminology .....	5
3.3. Network Model .....	5
3.4. Reference Points .....	6
3.5. Measurement Methodology .....	8
3.6. Theory of Operation .....	9
3.6.1. Capabilities Discovery .....	9
3.6.2. Determining Reference Points for Row Creation .....	10
3.6.2.1. Graphical Examples of Reference Points .....	11
3.6.2.1.1. Edge-to-Edge Interface Reference Point Example .....	12
3.6.2.1.2. Edge-to-Edge Egress Queue Reference Point Example ...	13
3.6.2.1.3. End-to-End Using Reference Point Example .....	14
3.6.3. Creation Process .....	15
3.6.4. Destruction Process .....	15

3.6.4.1. Manual Row Destruction .....	15
3.6.4.2. Automatic Row Destruction .....	16
3.6.5. Modification Process .....	16
3.6.6. Collection Process .....	16
3.6.6.1. Remote Polling .....	16
3.6.6.2. Sampling .....	17
3.6.6.3. User History .....	17
3.6.7. Use of MIB Module in Calculation of Service Level Definitions .....	17
3.6.8. Delay .....	20
3.6.9. Frame Delivery Ratio .....	20
3.6.10. Data Delivery Ratio .....	21
3.6.11. Service Availability .....	21
4. Relation to Other MIB Modules .....	22
5. Structure of the MIB Module .....	23
5.1. frsldPvcCtrlTable .....	23
5.2. frsldSmplCtrlTable .....	23
5.3. frsldPvcDataTable .....	23
5.4. frsldPvcSampleTable .....	24
5.5. frsldCapabilities .....	24
6. Persistence of Data .....	24
7. Object Definitions .....	24
8. Acknowledgments .....	61
9. References .....	61
10. Security Considerations .....	63
11. Authors' Addresses .....	63
12. Full Copyright Statement .....	64

## 1. The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- o An overall architecture, described in RFC 2571 [1].
- o 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].
- o 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.

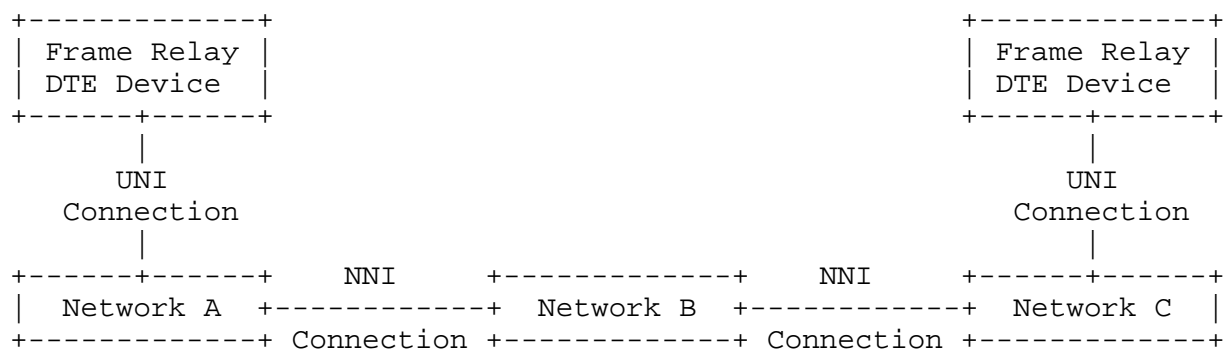


Figure 1  
Frame Relay Network Reference Model

### 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.

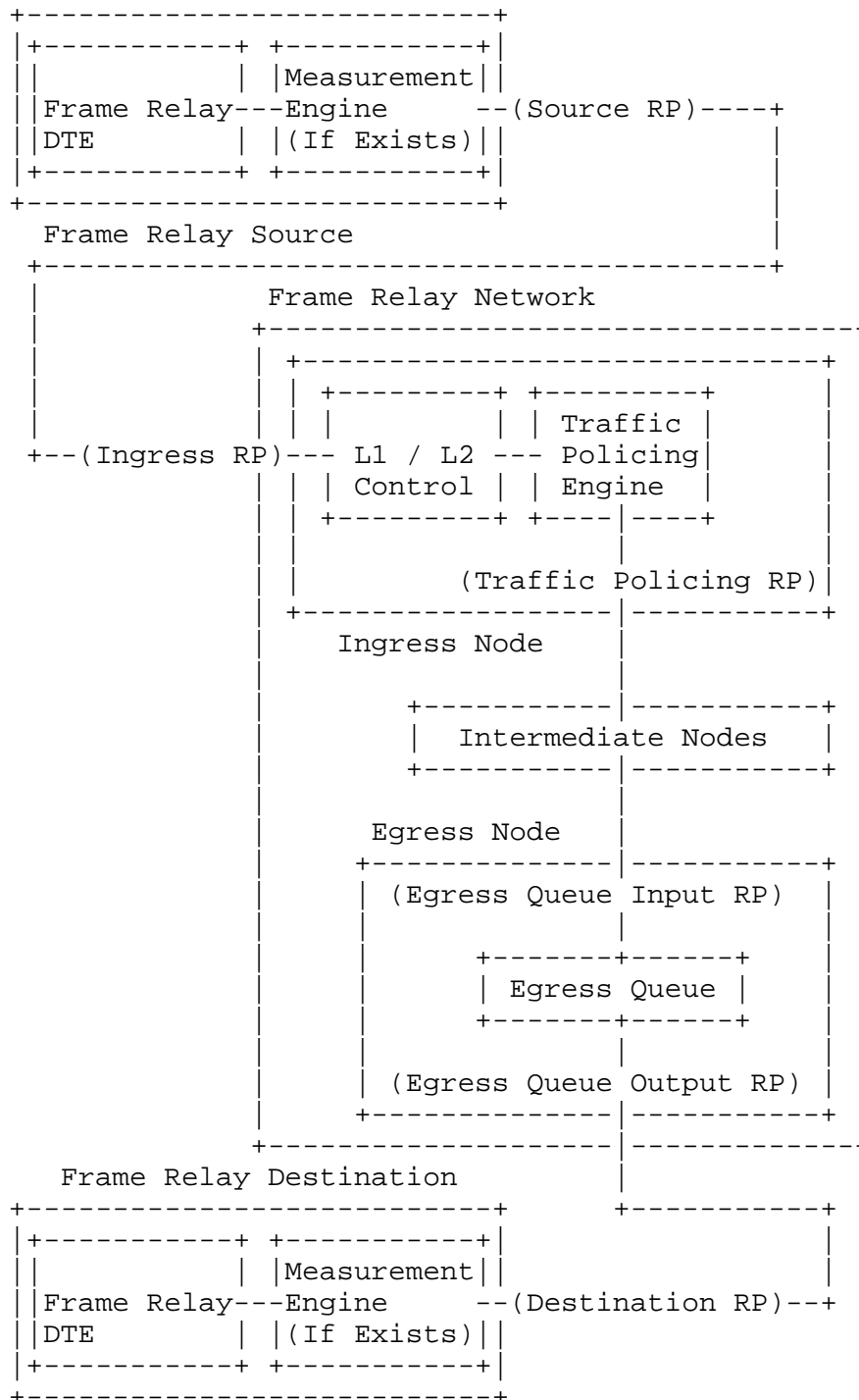


Figure 2  
Reference Points (FRF.13 [17])

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.

- o 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.
- o 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.
- o 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.

- o Local Information Only

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

- o Remote Information Only

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

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

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

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

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

- o Mixed One Device Model 1 (Directional Rows)

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

- o 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.

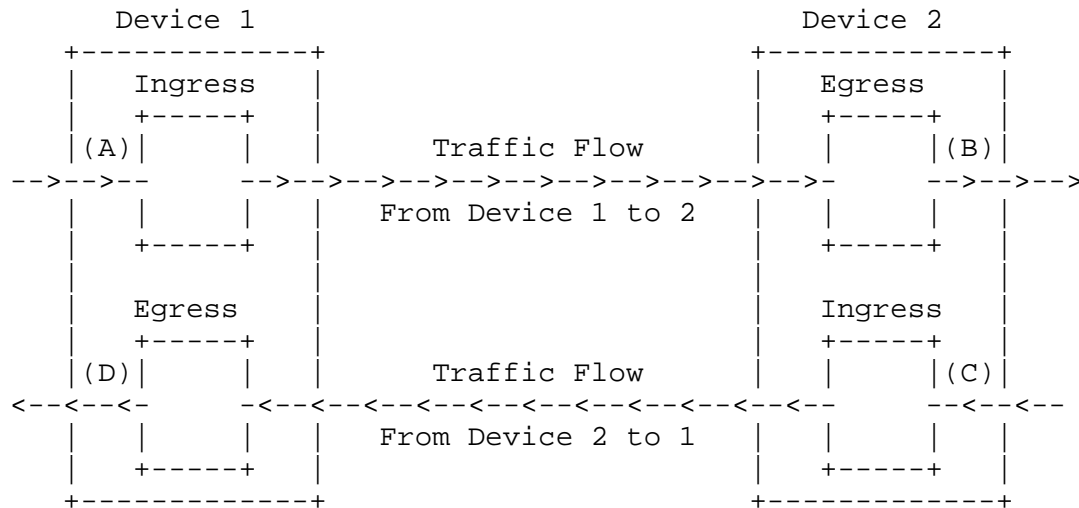
#### 3.6.2.1. Graphical Examples of Reference Points

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) frsldPvcCtrlReceiverRP for Device 2 = eqoRxLocalRP(5)

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

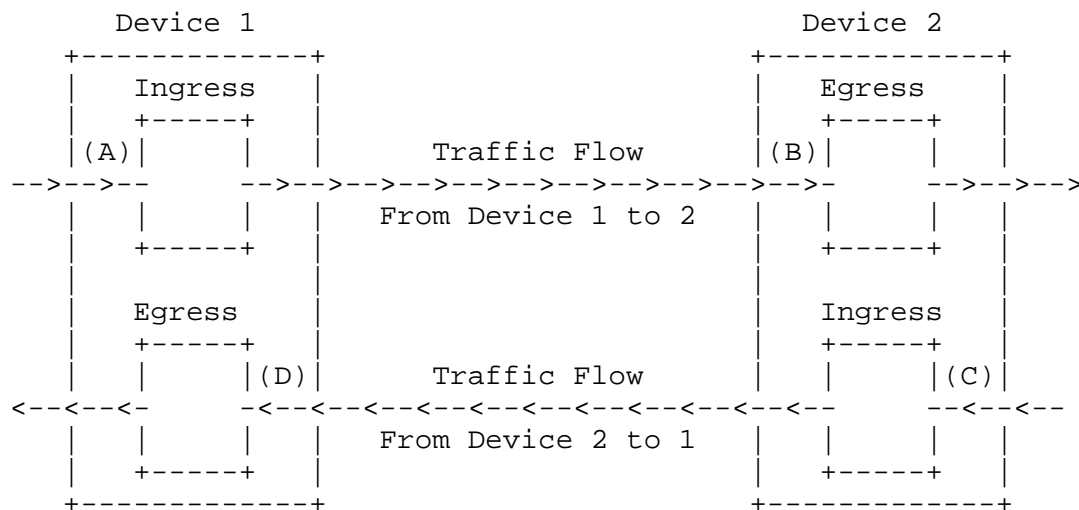
(D) frsldPvcCtrlReceiverRP for Device 1 = eqoRxLocalRP(5)

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) frsldPvcCtrlReceiverRP for Device 1 = eqoRxRemoteRP(11)
- (C) frsldPvcCtrlTransmitRP for Device 2 = ingTxLocalRP(2)
- (D) frsldPvcCtrlReceiverRP 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) frsldPvcCtrlReceiverRP for Device 2 = eqiRxLocalRP(4)
- (C) frsldPvcCtrlTransmitRP for Device 2 = ingTxLocalRP(2)
- (D) frsldPvcCtrlReceiverRP 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.

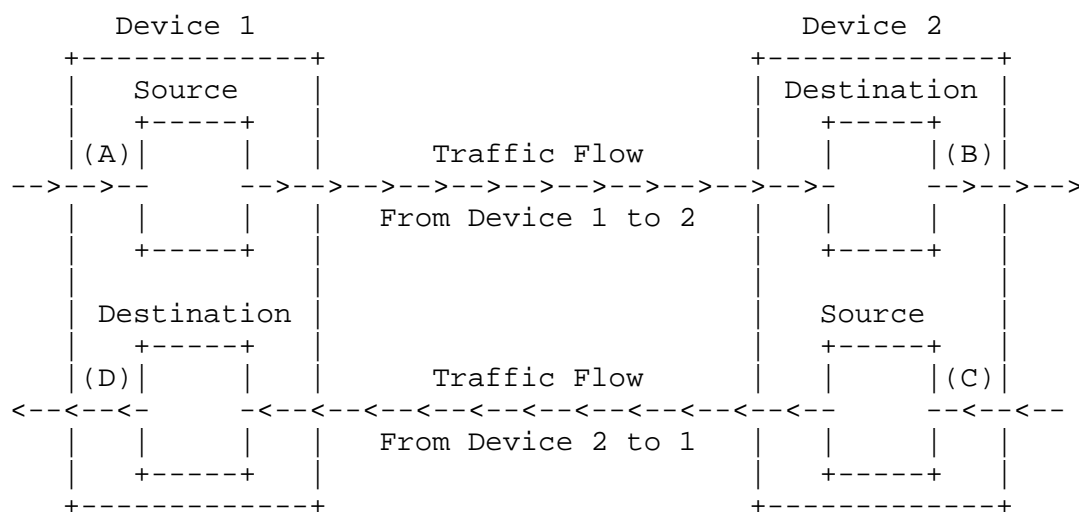
(A) frsldPvcCtrlTransmitRP for Device 1 = ingTxLocalRP(2)

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

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

(D) frsldPvcCtrlReceiverRP 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) frsldPvcCtrlReceiverRP for Device 2 = desLocalRP(1)

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

(D) frsldPvcCtrlReceiverRP 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) frsldPvcCtrlReceiverRP for Device 1 = desRemoteRP(7)

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

(D) frsldPvcCtrlReceiverRP 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 in 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:

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



- o frsldPvcDataDataOfferedC
- o frsldPvcDataDataOfferedE
- o frsldPvcDataHCFrDeliveredC
- o frsldPvcDataHCFrDeliveredE
- o frsldPvcDataHCFrOfferedC
- o frsldPvcDataHCFrOfferedE
- o frsldPvcDataHCDDataDeliveredC
- o frsldPvcDataHCDDataDeliveredE
- o frsldPvcDataHCDDataOfferedC
- o frsldPvcDataHCDDataOfferedE
- 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:

- o DelayAvg

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

- o 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`.

- o 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`.

- o 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`.

- o 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.

- o 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, frsldPvcDataHCDeliveredC, frsldPvcSmplDataDeliveredC, or frsldPvcSmplHCDeliveredC.

- o 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, frsldPvcDataHCDeliveredE, frsldPvcSmplDataDeliveredE, or frsldPvcSmplHCDeliveredE.

- o 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, frsldPvcDataHCDeliveredC, frsldPvcSmplDataOfferedC, or frsldPvcSmplHCDeliveredC.

- o 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, frsldPvcDataHCDeliveredE, frsldPvcSmplDataOfferedE, or frsldPvcSmplHCDeliveredE.

- o 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.

- o 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.

Otherwise, FRMTBSO = IntervalTime - ExcludedTime - UnavailableTime  
 -----  
 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 semantics 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](http://www.ietf.org/html.charters/frnetmib-charter.html)  
 WG-email: [frnetmib@sunroof.eng.sun.com](mailto:frnetmib@sunroof.eng.sun.com)  
 Subscribe: [frnetmib-request@sunroof.eng.sun.com](mailto: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),

```

        eqiTxFxLocalRP(4),
        eqoTxFxLocalRP(5),
        otherTxFxLocalRP(6),
        srcRemoteRP(7),
        ingTxFxRemoteRP(8),
        tpTxFxRemoteRP(9),
        eqiTxFxRemoteRP(10),
        eqoTxFxRemoteRP(11),
        otherTxFxRemoteRP(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, frsldPvcCtrlReceiverRP }
    ::= { frsldPvcCtrlTable 1 }
```

```
FrsldPvcCtrlEntry ::=
    SEQUENCE {
        --
        -- Index Control Variables
        --
        frsldPvcCtrlDlci          DLCI,
        frsldPvcCtrlTransmitRP    FrsldTxRP,
        frsldPvcCtrlReceiverRP    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 frsldPvcCtrlReceiverRP define the
         measurement domain."
    REFERENCE
        "FRF.13: Section 2.3"
    ::= { frsldPvcCtrlEntry 2 }

frsldPvcCtrlReceiverRP 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 frsldPvcCtrlReceiverRP 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),
                sampleControls(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 be 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 frsldSmplCtrlBucketsGranted 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, frsldPvcCtrlReceiverRP }
 ::= { 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,
    frsldPvcDataHCDDataDeliveredC Counter64,
    frsldPvcDataHCDDataDeliveredE Counter64,
    frsldPvcDataHCDDataOfferedC  Counter64,
    frsldPvcDataHCDDataOfferedE  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  
frsldPvcCtrlReceiverRP 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  
frsldPvcCtrlReceiverRP 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
     frsldPvcCtrlReceiverRP 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
     frsldPvcCtrlReceiverRP 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 (DataDelivered)"

::= { 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 frsldPvcCtrlReceiverRP 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 frsldPvcCtrlReceiverRP 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 frsldPvcCtrlReceiverRP 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 (DataDeliveredede)"

::= { 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, frsldPvcCtrlReceiverRP,  
 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  
frsldPvcCtrlReceiverRP 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  
frsldPvcCtrlReceiverRP 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 frsldPvcCtrlReceiverRP 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 frsldPvcSmplHCDataOfferedC."

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 frsldPvcCtrlReceiverRP 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 frsldPvcCtrlReceiverRP 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  
frsldPvcCtrlReceiverRP 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 }

frsldPvcSampleHCFRFrameGroup  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, frsldPvcHCFRFrameDataGroup
        MUST also be implemented."
    ::= { frsldMIBGroups 11 }

frsldPvcSampleHCDDataGroup  OBJECT-GROUP
    OBJECTS {
        frsldPvcSmplHCDDataDeliveredC,
        frsldPvcSmplHCDDataDeliveredE,
        frsldPvcSmplHCDDataOfferedC,
        frsldPvcSmplHCDDataOfferedE
    }
    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

This document was produced by the Frame Relay Service MIB Working Group. It is based on the Frame Relay Forum's implementation agreement on service level definitions, FRF.13 [17].

The editors would like to thank the following people for their helpful comments:

- o Ken Rehbehn, Visual Networks
- o Santa Dasu, Quick Eagle Networks

## 9. References

- [1] Harrington, D., Presuhn, R. and B. Wijnen, "An Architecture for Describing SNMP Management Frameworks", RFC 2571, April 1999.
- [2] Rose, M. and K. McCloghrie, "Structure and Identification of Management Information for TCP/IP-based Internets", STD 16, RFC 1155, May 1990.
- [3] Rose, M. and K. McCloghrie, "Concise MIB Definitions", STD 16, RFC 1212, March 1991.
- [4] Rose, M., "A Convention for Defining Traps for use with the SNMP", RFC 1215, March 1991.
- [5] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Structure of Management Information Version 2 (SMIv2)", STD 58, RFC 2578, April 1999.
- [6] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Textual Conventions for SMIv2", STD 58, RFC 2579, April 1999.
- [7] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Conformance Statements for SMIv2", STD 58, RFC 2580, April 1999.
- [8] Case, J., Fedor, M., Schoffstall, M. and J. Davin, "Simple Network Management Protocol", STD 15, RFC 1157, May 1990.

- [9] Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Introduction to Community-based SNMPv2", RFC 1901, January 1996.
- [10] Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Transport Mappings for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1906, January 1996.
- [11] Case, J., Harrington D., Presuhn R. and B. Wijnen, "Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)", RFC 2572, April 1999.
- [12] Blumenthal, U. and B. Wijnen, "User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)", RFC 2574, April 1999.
- [13] Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Protocol Operations for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1905, January 1996.
- [14] Levi, D., Meyer, P. and B. Stewart, "SNMPv3 Applications", RFC 2573, April 1999.
- [15] Wijnen, B., Presuhn, R. and K. McCloghrie, "View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)", RFC 2575, April 1999.
- [16] Case, J., Mundy, R., Partain, D. and B. Stewart, "Introduction to Version 3 of the Internet-standard Network Management Framework", RFC 2570, April 1999.
- [17] Frame Relay Forum Technical Committee, "Service Level Definitions Implementations Agreement", FRF.13, August 1998.
- [18] Rehbehn, K. and D. Fowler, "Definitions of Managed Objects for Frame Relay Service", RFC 2954, October 2000.
- [19] Waldbusser, S., "Remote Network Monitoring Management Information Base Version 2 using SMIV2", RFC 2021, January 1997.
- [20] Brown, C. and F. Baker, "Management Information Base for Frame Relay DTEs Using SMIV2", RFC 2115, September 1997.
- [21] McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB", RFC 2863, June 2000.
- [22] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

## 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.

## 11. Authors' Addresses

Robert Steinberger  
Fujitsu Network Communications  
2801 Telecom Parkway  
Richardson, TX 75082

Phone: 1-972-479-4739  
EMail: robert.steinberger@fnc.fujitsu.com

Orly Nicklass, Ph.D  
RAD Data Communications Ltd.  
12 Hanechoshet Street  
Tel Aviv, Israel 69710

Phone: 972 3 7659969  
EMail: Orly\_n@rad.co.il

## 12. Full Copyright Statement

Copyright (C) The Internet Society (2002). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assigns.

This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

## Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.



