

ISDN Management Information Base using SMIV2

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.

Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it defines a minimal set of managed objects for SNMP-based management of ISDN terminal interfaces. ISDN interfaces are supported on a variety of equipment (for data and voice) including terminal adapters, bridges, hosts, and routers.

This document specifies a MIB module in a manner that is compliant to the SNMPv2 SMI. The set of objects is consistent with the SNMP framework and existing SNMP standards.

This document is a product of the ISDN MIB working group within the Internet Engineering Task Force. Comments are solicited and should be addressed to the working group's mailing list at isdn-mib@cisco.com and/or the author.

The current version of this document reflects changes made during the last call period and the IESG review.

Table of Contents

1 The SNMPv2 Network Management Framework	2
2 Object Definitions	2
3 Overview	3
3.1 Structure of the MIB	3
3.1.1 General Description	3
3.2 Relationship to the Interfaces MIB	4
3.2.1 Layering Model	4
3.2.2 ifTestTable	8
3.2.3 ifRcvAddressTable	8
3.2.4 ifEntry	8

3.2.4.1 ifEntry for a Basic Rate hardware interface	8
3.2.4.2 ifEntry for a B channel	9
3.2.4.3 ifEntry for LAPD (D channel Data Link Layer)	10
3.2.4.4 ifEntry for a signaling channel	12
3.3 Relationship to other MIBs	14
3.3.1 Relationship to the DS1/E1 MIB	14
3.3.2 Relationship to the DS0 and DS0Bundle MIBs	14
3.3.3 Relationship to the Dial Control MIB	14
3.4 ISDN interface specific information and implementation hints	14
3.4.1 ISDN leased lines	14
3.4.2 Hyperchannels	15
3.4.3 D channel backup and NFAS trunks	16
3.4.4 X.25 based packet-mode service in B and D channels	16
3.4.5 SPID handling	17
3.4.6 Closed User Groups	17
3.4.7 Provision of point-to-point line topology	18
3.4.8 Speech and audio bearer capability information elements ..	18
3.4.9 Attaching incoming calls to router ports	19
3.4.10 Usage of isdnMibDirectoryGroup and isdnDirectoryTable ...	20
4 Definitions	21
5 Acknowledgments	47
6 References	47
7 Security Considerations	49
8 Author's Address	49

1. The SNMPv2 Network Management Framework

The SNMPv2 Network Management Framework presently consists of three major components. They are:

- o the SMI, described in RFC 1902 [1] - the mechanisms used for describing and naming objects for the purpose of management.
- o the MIB-II, STD 17, RFC 1213 [2] - the core set of managed objects for the Internet suite of protocols.
- o the protocol, STD 15, RFC 1157 [3] and/or RFC 1905 [4], - the protocol for accessing managed objects.

The Framework permits new objects to be defined for the purpose of experimentation and evaluation.

2. Object Definitions

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the subset of Abstract Syntax Notation One (ASN.1)

defined in the SMI. In particular, each object type is named by an OBJECT IDENTIFIER, an administratively assigned name. The object type together with an object instance serves to uniquely identify a specific instantiation of the object. For human convenience, we often use a textual string, termed the descriptor, to refer to the object type.

3. Overview

3.1. Structure of the MIB

For managing ISDN interfaces, the following information is necessary:

- o Information for managing physical interfaces. In case of ISDN primary rate, this are usually T1 or E1 lines, being managed in the DS1/E1 MIB [12]. For Basic Rate lines, physical interfaces are managed by this MIB.
- o Information for managing B channels.
- o Information for managing signaling channels.
- o Optionally, information for managing Terminal Endpoints (TE). A Terminal Endpoint is a link layer connection to a switch.
- o Optionally, information for managing a list of directory numbers.

In order to manage connections over ISDN lines, the management of peer information and call history information is required as well. This information is defined in the Dial Control MIB [15].

The purpose for splitting the required information in two MIBs is to be able to use parts of this information for non-ISDN interfaces as well. In particular, the Dial Control MIB might also be used for other types of interfaces, e.g. modems or X.25 virtual connections.

Within this document, information has been structured into five groups, which are described in the following chapters.

3.1.1. General Description

This MIB controls all aspects of ISDN interfaces. It consists of five groups.

- o The `isdnMibBasicRateGroup` is used to provide information regarding physical Basic Rate interfaces.
- o The `isdnMibBearerGroup` is used to control B (bearer) channels.

It supports configuration parameters as well as statistical information related to B channels.

- o The `isdnMibSignalingGroup` is used to control D (delta) channels. There are three tables in this group. The `isdnSignalingTable` and `isdnSignalingStatsTable` support ISDN Network Layer configuration and statistics. The `isdnLapdTable` supports ISDN Data Link Layer (LAPD) configuration and statistics.
- o The optional `isdnMibEndpointGroup` can be used to specify Terminal Endpoints. It is required only if there are non-ISDN endpoints defined for a given D channel, or if additional information like Terminal Endpoint Identifier (TEI) values or Service Profile Identifiers (SPID) is required to identify a given ISDN user.
- o The optional `isdnMibDirectoryGroup` can be used to specify a list of directory numbers for each signaling channel. It is required only if the directory numbers to be accepted differ from the `isdnSignalingCallingAddress` as specified in the `isdnSignalingTable`.

3.2. Relationship to the Interfaces MIB

This section clarifies the relationship of this MIB to the Interfaces MIB [11]. Several areas of correlation are addressed in the following subsections. The implementor is referred to the Interfaces MIB document in order to understand the general intent of these areas.

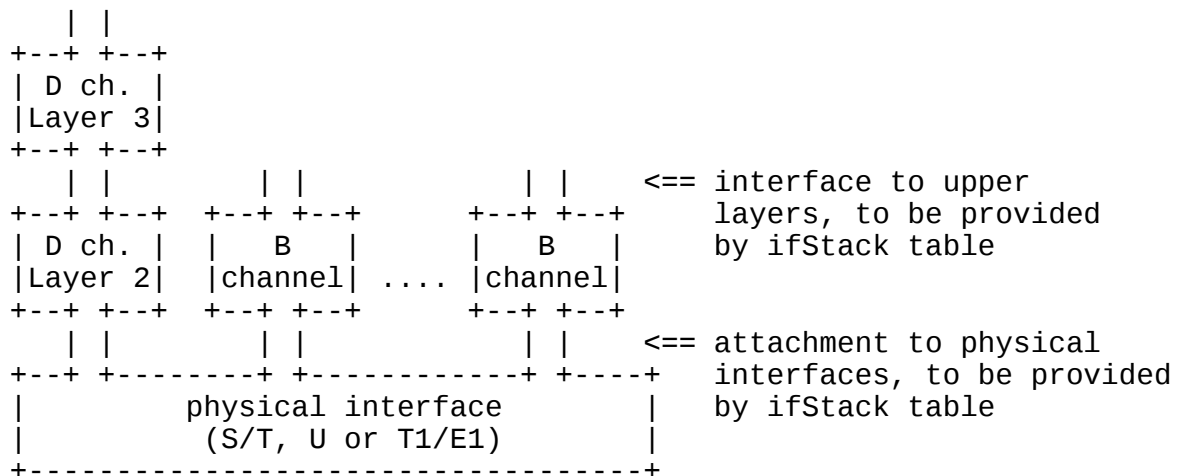
3.2.1. Layering Model

An ISDN interface usually consists of a D channel and a number of B channels, all of which are layered on top of a physical interface.

Furthermore, there are multiple interface layers for each D channel. There are Data Link Layer (LAPD) as well as Network Layer entities.

This is accomplished in this MIB by creating a logical interface (`ifEntry`) for each of the D channel entities and a logical interface (`ifEntry`) for each of the B channels. These are then correlated to each other and to the physical interface using the `ifStack` table of the Interfaces MIB [11].

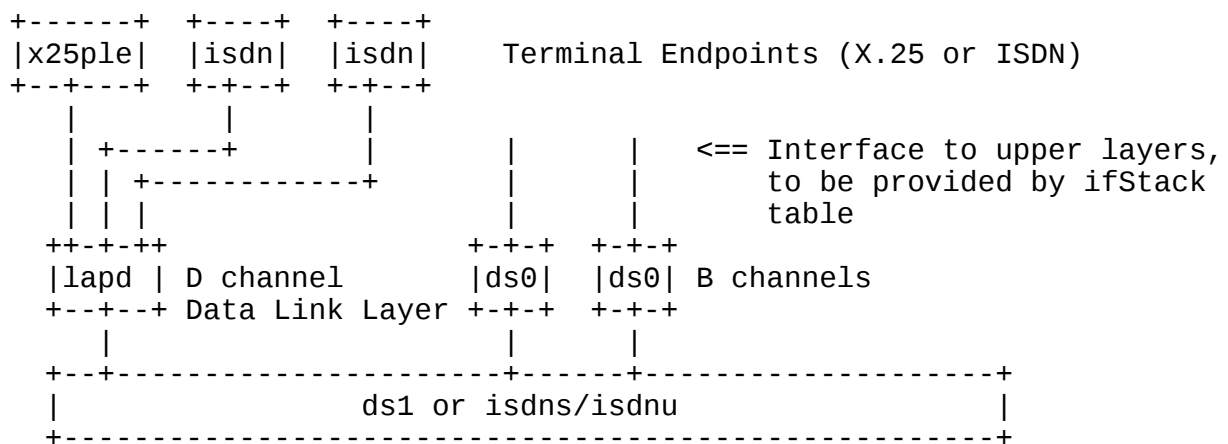
The basic model, therefore, looks something like this:



Mapping of B/D channels to physical interfaces

Each D channel can support multiple Terminal Endpoints. Terminal Endpoints can either be one or multiple ISDN signaling channels, or channels supporting X.25 based packet mode services.

To accomplish this, there can be multiple Network Layer entities on top of each ISDN Data Link Layer (LAPD) interface. The detailed model therefore looks something like this, including interface types as examples:



Detailed interface mapping

IfEntries are maintained for each D channel Network Layer entity (Terminal Endpoint), for LAPD and for each B channel.

The ifType for a Terminal Endpoint can be isdn(63) for ISDN signaling channels or x25ple(40) for X.25 based packet mode services. The ifType for D channel Data Link Layer (LAPD) interfaces is lapd(77). The ifType for B channels is ds0(81). The ifType for physical interfaces is the matching IANA ifType, usually ds1(18) for Primary Rate interfaces or isdns(75)/isdnu(76) for Basic Rate interfaces.

The ifStackTable is used to map B channels and LAPD interfaces to physical interfaces and to map D channel Network Layer interfaces (Terminal Endpoints) to LAPD.

In the example given above, the assignment of index values could for example be as follows:

ifIndex	ifType	ISDN MIB tables indexed by ifIndex	Description
1	isdns(75)	isdnBasicRateTable	Basic Rate physical interface
2	lapd(77)	isdnLapdTable	LAPD interface
3	x25ple(40)	isdnEndpointTable	X.25 Packet Layer
4	isdn(63)	isdnSignalingTable isdnEndpointTable	ISDN signaling channel #1
5	isdn(63)	isdnSignalingTable isdnEndpointTable	ISDN signaling channel #2
6	ds0(81)	isdnBearerTable	B channel #1
7	ds0(81)	isdnBearerTable	B channel #2
8	ppp(23)		peer entry #1 (see below)
9	ppp(23)		peer entry #2 (see below)

The corresponding ifStack table entries would then be:

ifStackTable Entries

HigherLayer	LowerLayer
0	3
0	4
0	5
0	8
0	9
1	0
2	1
3	2
4	2
5	2
6	1
7	1
8	6
9	7

Mapping of B channels to upper interface layers is usually done using the Dial Control MIB. For example, mapping on top of B channels might look as follows:

+-----+ Network Layer Protocol +-----+										
+--+ +--+		+--+ +--+		+--+ +--+		+--+ +--+		+--+ +--+		<== appears active ifEntry with shadow PeerEntry
PPP	PPP	F/R	PPP	F/R						
for	for	for	for	for						
Peer1	Peer2	switch	Peer3	switch						
		A		B						
+--+ +--+		+--+ +--+		+--+ +--+		+--+ +--+		+--+ +--+		<== some actually are
+--+ +--+		+--+ +--+		+--+ +--+		+--+ +--+		+--+ +--+		
B	B	B	B	B						
channel	channel	channel	channel	channel						
+--+ +--+		+--+ +--+		+--+ +--+		+--+ +--+		+--+ +--+		
+--+ +--+		+--+ +--+		+--+ +--+		+--+ +--+		+--+ +--+		
+-----+ Basic/Primary Rate Interface +-----+										

Mapping of IP interfaces to Called Peers to B Channels

In this model, ifEntries are maintained for each peer. Each peer is required to have an associated ifEntry. This interface can be of any kind, e.g. PPP or LAPB.

The Dial Control MIB can be used for all types of demand-access interfaces, e.g., ISDN, modems or X.25 virtual connections.

3.2.2. ifTestTable

The ifTestTable is not supported by this MIB.

3.2.3. ifRcvAddressTable

The ifRcvAddressTable is not supported by this MIB.

3.2.4. ifEntry

3.2.4.1. ifEntry for a Basic Rate hardware interface

The ifGeneralGroup is supported for Basic Rate hardware interfaces.

ifTable	Comments
=====	=====
ifIndex	Each ISDN Basic Rate hardware interface is represented by an ifEntry.
ifDescr	Textual port description.
ifType	The IANA value of isdns(75) or isdnu(76), whichever is appropriate.
ifSpeed	The overall bandwidth of this interface.
ifPhysAddress	Return an empty string.
ifAdminStatus	The administrative status of the ISDN interface.
ifOperStatus	The current operational status of this interface. The operational status is dormant(5) if the interface is in standby mode, i.e. connected to the network, but without call activity. The operational status is down(2) if the hardware has detected that there is no layer 1 connection to the switch. For other values, refer to the Interfaces MIB.
ifLastChange	Refer to the Interfaces MIB.

ifLinkUpDownTrapEnable
Refer to the Interfaces MIB.

ifConnectorPresent
Refer to the Interfaces MIB.

ifHighSpeed
Return zero.

ifName
Refer to the Interfaces MIB.

3.2.4.2. ifEntry for a B channel

The ifEntry for a B channel supports the ifGeneralGroup of the Interfaces MIB.

ifTable	Comments
=====	=====
ifIndex	Each ISDN B channel is represented by an ifEntry.
ifDescr	Textual port description.
ifType	The IANA value of ds0(81).
ifSpeed	The bandwidth of this B channel. Usually, this is the value of 56000 or 64000.
ifPhysAddress	Return an empty string.
ifAdminStatus	The administrative status of this interface.
ifOperStatus	The current operational status of this interface. Note that dormant(5) is explicitly being used as defined in the Interfaces MIB. For other values, refer to the Interfaces MIB.
ifLastChange	Refer to the Interfaces MIB.
ifLinkUpDownTrapEnable	Refer to the Interfaces MIB.
ifConnectorPresent	Refer to the Interfaces MIB.
ifHighSpeed	Return zero.
ifName	Refer to the Interfaces MIB.

3.2.4.3. ifEntry for LAPD (D channel Data Link Layer)

The ifEntry for LAPD (D channel Data Link Layer) supports the ifGeneralGroup and the ifPacketGroup of the Interfaces MIB.

ifTable =====	Comments =====
ifIndex	Each ISDN D channel Data Link layer is represented by an ifEntry.
ifDescr	Textual port description.
ifType	The IANA value of lapd(77).
ifSpeed	The bandwidth of this interface. Usually, this is the value of 16000 for basic rate interfaces or 64000 for primary rate interfaces.
ifPhysAddress	Return an empty string.
ifAdminStatus	The administrative status of this interface.
ifOperStatus	The current operational status of the ISDN LAPD interface. The operational status is dormant(5) if the interface is in standby mode (see Q.931 [8], Annex F, D channel backup procedures). For other values, refer to the Interfaces MIB.
ifLastChange	Refer to the Interfaces MIB.
ifLinkUpDownTrapEnable	Refer to the Interfaces MIB.
ifConnectorPresent	Refer to the Interfaces MIB.
ifHighSpeed	Return zero.
ifName	Refer to the Interfaces MIB.
ifMtu	The size of the largest frame which can be sent/received on this interface, specified in octets. Usually, this is the default value of 260 as specified in Q.921 [6], chapter 5.9.3.

ifInOctets	The total number of octets received on this interface.
ifInUcastPkts	The number of frames received on this interface whose address is not TEI=127.
ifInNUcastPkts	Deprecated. Return the number of frames received on this interface with TEI=127.
ifInMulticastPkts	Return zero.
ifInBroadcastPkts	Return the number of frames received on this interface with TEI=127.
ifInDiscards	The total number of received frames which have been discarded. The possible reasons are: buffer shortage.
ifInErrors	The number of inbound frames that contained errors preventing them from being deliverable to LAPD.
ifInUnknownProtos	The number of frames with known TEI, but unknown SAPI (Service Access Point Identifier, see Q.921 [6], chapter 3.3.3).
ifOutOctets	The total number of octets transmitted on this interface.
ifOutUcastPkts	The number of frames transmitted on this interface whose address is not TEI=127.
ifOutNUcastPkts	Deprecated. Return the number of frames transmitted on this interface with TEI=127.
ifOutMulticastPkts	Return zero.
ifOutBroadcastPkts	Return the number of frames transmitted on this interface with TEI=127.
ifOutDiscards	The total number of outbound frames which were discarded. Possible reasons are: buffer shortage.
ifOutErrors	The number of frames which could not be transmitted due to errors.

ifOutQlen Deprecated. Return zero.

ifSpecific Deprecated. Return {0 0}.

3.2.4.4. ifEntry for a signaling channel

The ifEntry for a signaling channel supports the ifGeneralGroup and the ifPacketGroup of the Interfaces MIB.

ifTable	Comments
=====	=====
ifIndex	Each ISDN signaling channel is represented by an ifEntry.
ifDescr	Textual port description.
ifType	The IANA value of isdn(63).
ifSpeed	The bandwidth of this signaling channel. Usually, this is the same value as for LAPD, i.e. 16000 for basic rate interfaces or 64000 for primary rate interfaces.
ifPhysAddress	The ISDN address assigned to this signaling channel. This is a copy of isdnSignalingCallingAddress.
ifAdminStatus	The administrative status of the signaling channel.
ifOperStatus	The current operational status of this signaling channel. The operational status is dormant(5) if the signaling channel is currently not activated. For other values, refer to the Interfaces MIB.
ifLastChange	Refer to the Interfaces MIB.
ifLinkUpDownTrapEnable	Refer to the Interfaces MIB.
ifConnectorPresent	Refer to the Interfaces MIB.
ifHighSpeed	Return zero.
ifName	Refer to the Interfaces MIB.

ifMtu	The size of the largest frame which can be sent/received on this signaling channel, specified in octets. Usually, this is the default value of 260 as specified in Q.921 [6], chapter 5.9.3.
ifInOctets	The total number of octets received on this signaling channel.
ifInUcastPkts	The number of frames received which are targeted to this channel.
ifInNUcastPkts	Deprecated. Return the number of frames received on this signaling channel with TEI=127.
ifInMulticastPkts	Return zero.
ifInBroadcastPkts	Return the number of frames received on this signaling channel with TEI=127.
ifInDiscards	The total number of received frames which have been discarded. The possible reasons are: buffer shortage.
ifInErrors	The number of inbound frames that contained errors preventing them from being deliverable to the signaling channel.
ifInUnknownProtos	Return zero.
ifOutOctets	The total number of octets transmitted on this signaling channel.
ifOutUcastPkts	The number of frames transmitted on this signaling channel whose address is not TEI=127.
ifOutNUcastPkts	Deprecated. Return the number of frames transmitted on this signaling channel with TEI=127.
ifOutMulticastPkts	Return zero.
ifOutBroadcastPkts	Return the number of frames transmitted on this signaling channel with TEI=127.

ifOutDiscards	The total number of outbound frames which were discarded. Possible reasons are: buffer shortage.
ifOutErrors	The number of frames which could not be transmitted due to errors.
ifOutQlen	Deprecated. Return zero.
ifSpecific	Deprecated. Return {0 0}.

3.3. Relationship to other MIBs

3.3.1. Relationship to the DS1/E1 MIB

Implementation of the DS1/E1 MIB [12] is not required for supporting this MIB. It is however recommended to implement the DS1/E1 MIB on entities supporting Primary Rate interfaces.

3.3.2. Relationship to the DS0 and DS0Bundle MIBs

Implementation of the DS0 MIB [13] is optional.

Implementation of the DS0Bundle MIB [13] may be required only if hyperchannels are to be supported, depending on the multiplexing scheme used in a given implementation. See chapter 3.4.2 for details on how to implement hyperchannels.

3.3.3. Relationship to the Dial Control MIB

Implementation of the Dial Control MIB [15] is required.

3.4. ISDN interface specific information and implementation hints

3.4.1. ISDN leased lines

ISDN leased lines can be specified on a per-B-channel basis. To do so, the value of `isdnBearerChannelType` has to be set to `leased(2)`. There is no signaling protocol support for leased line B channels, since there is no signaling protocol action for these kinds of interfaces.

If there is no signaling support available for an ISDN interface, this must be specified in the appropriate interface specific table. For Basic Rate interfaces, `isdnBasicRateSignalMode` of `isdnBasicRateTable` must be set to `inactive(2)`. For Primary Rate interfaces, `dsx1SignalMode` of `dsx1ConfigTable` in DS1/E1 MIB [12] must be set to `none(1)`. There are no `isdnLapdTable` or `isdnSignalingTable` entries for such interfaces.

Depending on the leased line type and the service provider, the D channel can be used for data transfer. If this is the case the D channel interface type is `ds0(81)` instead of `lapd(77)` and its usage is identical to B channel usage if there is no signaling channel available.

For a Primary Rate interface which is entirely used as a leased line, there is no ISDN specific information available or required. Such leased lines can entirely be handled by the DS1/E1 MIB.

3.4.2. Hyperchannels

The active switch protocol defines if hyperchannels are supported, and the actual support is implementation dependent. Hyperchannel connections will be requested by the interface user at call setup time, e.g. by the peer connection handling procedures.

In the ISDN MIB, the `isdnBearerMultirate` object of `isdnBearerTable` can be used to check if hyperchannels are being used for an active call.

If hyperchannels are being used, multiplexing between the encapsulation layer and the B channels is required, since there is one encapsulation layer interface connected to several B channel interfaces. This can be accomplished in two ways.

- o The `DS0Bundle` MIB [13] can be used to provide the multiplexing. See the `DS0Bundle` MIB document for details.
- o The `ifStackTable` can be used to provide the multiplexing. In this case, there are several `ifStackTable` entries with the same value of `HigherLayer`, and different values of `LowerLayer`.

It is up to the implementor to decide which multiplexing scheme to use.

Each hyperchannel call is treated as one call in the `isdnSignalingStatsTable`, independent of the number of B channels involved.

For a hyperchannel call, all objects in the `isdnBearerTable` entries related to this call (i.e., all `isdnBearerTable` entries associated to B channels used by the hyperchannel) have identical values. The related objects in the `isdnBearerTable` are:

```
isdnBearerPeerAddress  
isdnBearerPeerSubAddress  
isdnBearerCallOrigin  
isdnBearerInfoType  
isdnBearerMultirate  
isdnBearerCallSetupTime  
isdnBearerCallConnectTime  
isdnBearerChargedUnits
```

3.4.3. D channel backup and NFAS trunks

D channel backup is defined in Q.931 [8], Annex F. It describes Non-Associated signaling and its use and functionality is basically identical to Non Facility Associated Signaling (NFAS) trunks.

Non Facility Associated Signaling (NFAS) basically means that a D channel on a PRI interface is used to manage calls on other PRI trunks. This is required in North America for H11 channels, since all 24 time slots are being used for B channels.

According to Q.931, Annex F, the D channel backup feature can be provided on a subscription basis and is network dependent. The D channel backup procedure is described in detail in Q.931.

For D channel backup, the controlling `isdnSignalingTable` entry is layered on top of all attached LAPD interfaces. This layering is done using the `ifStack` table. There is only one active LAPD interface, however. Inactive LAPD interfaces have an `ifOperStatus` of `dormant(5)`.

NFAS trunks are also handled using the `ifStack` table. In this case, a signaling channel is layered on top of a LAPD interface as well as on top of all physical interfaces which are controlled by the signaling channel, but do not supply a D channel.

3.4.4. X.25 based packet-mode service in B and D channels

X.25 based packet mode service over B channels can be handled using the Dial Control MIB by creating an appropriate peer entry. The peer entry `ifType` can then be `x25(5)`, thus providing access to X.25 service.

X.25 based packet mode service over D channels can be handled by creating an ifEndpointTable entry with an isdnEndpointIfType of x25ple(40). The upper protocol layers can then be attached to this interface using the ifStack table.

3.4.5. SPID handling

Service Profile IDentifiers (SPIDs) are defined for BRI interfaces only, and being used in North America. SPIDs are required for DMS-100, NI-1 and NI-2, and are optional for 5ESS. A switch can define up to 8 SPIDs per BRI.

Each Terminal Endpoint has a SPID assigned. It is normally built from the party number (calling address for outgoing calls) with a number of digits prepended and appended. Since each network appears to be different, both the calling address and the SPID have to be stored.

The SPID identifies the particular services that have been provisioned for a terminal. If there are two B channels on a BRI, there can be two SPIDs, one for each of the two B channels. There can also be a single SPID, providing access to both B channels.

The SPID gets registered with the switch after link establishment. There is one data link for each SPID. As part of terminal registration, an EID (Endpoint IDentifier) is defined by the switch. On incoming calls, the switch may provide the EID, a called party number, or both, depending on the ISDN code implemented in the switch.

The EID has two bytes: USID (User Service IDentifier) and TID (Terminal IDentifier). These are later used by some of the software versions running on the switch side (e.g. compliant with NI-1, 5ESS custom) to broadcast SETUP messages with these included, so the correct endpoint would accept the call. Other switch software versions identify the endpoint with the Called Party Number.

In the ISDN MIB, the SPID can be entered using the isdnEndpointSpid object of isdnEndpointTable. The isdnSignalingCallingAddress, already being used to specify the calling number, cannot be used to record the SPID since the values of the SPID and the Calling Address may differ and both may be required to be present.

3.4.6. Closed User Groups

Closed User Groups (CUG), as defined in I.255.1 [14], are supported for circuit mode calls by ETSI (ETS 300 138) and 1TR6. In these networks, an ISDN address can have one or more Closed User Groups

assigned. If there is more than one Closed User Group assigned to a given address, one of those is the preferred Closed User Group. For such addresses, only calls from assigned Closed User Groups are accepted by the network.

Thus, Closed User Groups are a parameter for peer entries and are defined in the Dial Control MIB. A peer entry attached to a Closed User Group has to point to an ISDN interface which is attached to the Closed User Group in question.

3.4.7. Provision of point-to-point line topology

In the ISDN standards, there are two different meanings for the term "point-to-point".

In ISDN standards, the term point-to-point are usually used for data link connections, i.e. layer 2 connections, where each layer 2 connection from the TE to the network is a single point-to-point connection. Multiple connections of this kind may exist on one physical (layer 1) connection, however, and in case of Basic Rate interfaces there may be several TE's connected to one physical line to the network.

The second meaning of "point-to-point" refers to the line topology, i.e. to layer 1 connections. For Primary Rate interfaces, the line topology is always point-to-point. For Basic Rate interfaces, layer 1 point-to-point connections do exist in several countries, usually being used for connecting PBX systems to the network.

The second meaning (layer 1 connections) is what will be referred to as "point-to-point" connection throughout this document.

For Basic Rate interfaces, the `isdnBasicRateTable` object `isdnBasicRateLineTopology` can be used to select the line topology.

3.4.8. Speech and audio bearer capability information elements

The objects `speech(2)`, `audio31(6)` and `audio7(7)`, as being used in `isdnBearerInfoType`, refer to the Speech, 3.1 kHz Audio and old 7 kHz Audio (now Multi-use) bearer capabilities for ISDN, as defined in Q.931 [8], chapter 4.5.5, octet 3 of bearer capability information element.

These capabilities are signaling artifices that allow networks to do certain things with the call. It is up to the network to decide what to do.

The Speech Bearer Capability means that speech is being carried over the channel, as in two people talking. This would be POTS-type speech. The network may compress this, encrypt it or whatever it wants with it as long as it delivers POTS quality speech to the other end. In other words, a modem is not guaranteed to work over this connection.

The 3.1 kHz Audio capability indicates that the network carries the 3.1 kHz bandwidth across the network. This would (theoretically) allow modem signals to be carried across the network. In the US, the network automatically enters a capability of 3.1 kHz Audio on calls coming into the ISDN from a POTS network. This capability restricts the network from interfering with the data channel in a way that would corrupt the 3.1 kHz VoiceBand data.

7 kHz Audio was meant to signal the use of a higher quality audio connection (e.g., music from radio). It was changed to Multi-Use capability to allow it to be used for video-conferencing with fall back to audio.

In some cases, the Speech or 3.1 kHz Bearer Capability provides a 56 kbit/s data path through the network. Therefore, some people are setting up calls with the Speech or 3.1 kHz BC and transmitting 56 kbit/s data over the connection. This is usually to take advantage of favorable tariffs for Speech as opposed to Data.

On the incoming side, the equipment is usually configured to ignore the Bearer Capability and either answer all Speech calls as 56 kbit/s data or to use one Directory Number for real speech and another for data.

3.4.9. Attaching incoming calls to router ports

In ISDN, there are several ways to identify an incoming call and to attach a router port to this call.

- o The call can be identified and attached to a router port using the ISDN Calling Address, that is, the peer ISDN address. Since the peer address is defined in a Dial Control MIB configuration entry for this peer, this would be the most natural way to attach an incoming call to a router port.

In this configuration, only a single isdnSignalingTable entry is required for each physical ISDN interface. Unfortunately, the ISDN Calling Address is not available in all countries and/or switch protocols. Therefore, other means for attaching incoming calls to router ports must be provided.

- o The call can also be identified and attached to a router port using the ISDN Called Address. In this case, a distinct ISDN address or subaddress must be specified for each of the router ports. This can be accomplished in the ISDN MIB by creating a `isdnSignalingTable` entry for each of the router ports, and by connecting Dial Control MIB peer entries to the thereby created interface using the `dialCtlPeerCfgLowerIf` object of `dialCtlPeerCfgTable`.

If this type of router port identification is used in an implementation, it is up to the implementor to decide if there should be distinct TEI values assigned for each of the `isdnSignalingTable` entries. For this reason, the `isdnEndpointTable` permits specifying the same TEI value in multiple entries. It is recommended to use dynamic TEI assignment whenever possible.

The implementor should be aware that this type of configuration requires a lot of configuration work for the customer, since an entry in `isdnSignalingTable` must be created for each of the router ports.

- o Incoming calls can also be identified and attached to router ports using a higher layer functionality, such as PPP authentication. Defining this functionality is outside the scope of this document.

3.4.10. Usage of `isdnMibDirectoryGroup` and `isdnDirectoryTable`

In some switch protocol or PBX implementations, the Called Number Information Element on incoming calls can differ from the Calling Number on outgoing calls. Sometimes, the Called Number can be different for incoming Local Calls, Long Distance Calls and International Calls. For Hunt Groups, the Called Number can be any of the numbers in the Hunt Group.

The `isdnDirectoryTable` can be used to specify all these numbers.

Entries in the `isdnDirectoryTable` are always connected to specific `isdnSignalingTable` entries. No `ifEntry` is created for `isdnDirectoryTable` entries. Therefore, the `isdnDirectoryTable` can not be used to attach incoming calls to router ports. For router port identification, `isdnSignalingTable` entries should be created instead.

4. Definitions

```
ISDN-MIB DEFINITIONS ::= BEGIN
```

IMPORTS

```

    MODULE-IDENTITY,
    NOTIFICATION-TYPE,
    OBJECT-TYPE,
    Counter32,
    Gauge32,
    Integer32
        FROM SNMPv2-SMI
    DisplayString,
    TruthValue,
    TimeStamp,
    RowStatus,
    TestAndIncr,
    TEXTUAL-CONVENTION
        FROM SNMPv2-TC
    MODULE-COMPLIANCE,
    OBJECT-GROUP,
    NOTIFICATION-GROUP
        FROM SNMPv2-CONF
    ifIndex,
    InterfaceIndex
        FROM IF-MIB
    IANAifType
        FROM IANAifType-MIB
    transmission
        FROM RFC1213-MIB;
```

```
isdnMib MODULE-IDENTITY
```

```

    LAST-UPDATED "9609231642Z" -- Sep 23, 1996
    ORGANIZATION "IETF ISDN MIB Working Group"
    CONTACT-INFO
```

```

    "
        Guenter Roeck
        Postal: cisco Systems
                170 West Tasman Drive
                San Jose, CA 95134
                U.S.A.
        Phone:  +1 408 527 3143
        E-mail:  groeck@cisco.com"
```

DESCRIPTION

```

    "The MIB module to describe the
    management of ISDN interfaces."
```

```
::= { transmission 20 }
```

```
-- The ISDN hardware interface (BRI or PRI) is represented
```

```
-- by a media specific ifEntry.
--
-- For basic rate lines, the media specifics for the physical interface
-- is defined in the physical interface group of the ISDN MIB.
-- The ifType for physical basic rate interfaces is isdns(75)
-- or isdnu(76), whichever is appropriate.
--
-- For primary rate, the media specifics are defined in the Trunk
-- MIB and the ifType has a value of ds1(18).

-- Each signaling channel is represented by an entry
-- in the isdnSignalingTable.
-- The signaling channel has an ifType value of isdn(63).
-- Each B channel is also represented as an entry
-- in the ifTable. The B channels have an ifType value
-- of ds0(81).
-- This model is used while defining objects and tables
-- for management.
-- The ISDN MIB allows sub-layers. For example, the data transfer
-- over a B channel may take place with PPP encapsulation. While the
-- ISDN MIB describes the D and B channels, a media specific MIB
-- for PPP can be used on a layered basis. This is as per
-- the interfaces MIB.

-- Textual conventions
```

```
IsdnSignalingProtocol ::= TEXTUAL-CONVENTION
```

```
    STATUS      current
```

```
    DESCRIPTION
```

```
        "This data type is used as the syntax of the
         isdnSignalingProtocol object in the
         definition of ISDN-MIB's isdnSignalingTable.
```

```

         The definition of this textual convention with the
         addition of newly assigned values is published
         periodically by the IANA, in either the Assigned
         Numbers RFC, or some derivative of it specific to
         Internet Network Management number assignments. (The
         latest arrangements can be obtained by contacting the
         IANA.)
```

```

         Requests for new values should be made to IANA via
         email (iana@iana.org)."
```

```
    SYNTAX      INTEGER {
        other(1),          -- none of the following
        dss1(2),           -- ITU DSS1 (formerly CCITT) Q.931
        etsi(3),           -- Europe / ETSI ETS300-102
                           -- plus supplementary services
```

```

-- (ETSI 300-xxx)
-- note that NET3, NET5 define
-- test procedures for ETS300-102
-- and have been replaced by
-- I-CTR 3 and I-CTR 4.
dass2(4),      -- U.K. / DASS2 (PRI)
ess4(5),      -- U.S.A. / AT&T 4ESS
ess5(6),      -- U.S.A. / AT&T 5ESS
dms100(7),    -- U.S.A. / Northern Telecom DMS100
dms250(8),    -- U.S.A. / Northern Telecom DMS250
ni1(9),       -- U.S.A. / National ISDN 1 (BRI)
ni2(10),      -- U.S.A. / National ISDN 2 (BRI, PRI)
ni3(11),      -- U.S.A. / next one
vn2(12),      -- France / VN2
vn3(13),      -- France / VN3
vn4(14),      -- France / VN4 (ETSI with changes)
vn6(15),      -- France / VN6 (ETSI with changes)
-- delta document CSE P 10-21 A
-- test document CSE P 10-20 A
kdd(16),      -- Japan / KDD
ins64(17),    -- Japan / NTT INS64
ins1500(18),  -- Japan / NTT INS1500
itr6(19),     -- Germany/ 1TR6 (BRI, PRI)
cornet(20),   -- Germany/ Siemens HiCom CORNET
ts013(21),    -- Australia / TS013
-- (formerly TPH 1962, BRI)
ts014(22),    -- Australia / TS014
-- (formerly TPH 1856, PRI)
qsig(23),     -- Q.SIG
swissnet2(24), -- SwissNet-2
swissnet3(25), -- SwissNet-3
}

```

-- Isdn Mib objects definitions

```
isdnMibObjects OBJECT IDENTIFIER ::= { isdnMib 1 }
```

-- ISDN physical interface group

-- This group describes physical basic rate interfaces.

```
isdnBasicRateGroup      OBJECT IDENTIFIER ::= { isdnMibObjects 1 }
```

```
isdnBasicRateTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF IsdnBasicRateEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
```

"Table containing configuration and operational parameters for all physical Basic Rate interfaces on this managed device."
 ::= { isdnBasicRateGroup 1 }

isdnBasicRateEntry OBJECT-TYPE
 SYNTAX IsdnBasicRateEntry
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION
 "An entry in the ISDN Basic Rate Table."
 INDEX { ifIndex }
 ::= { isdnBasicRateTable 1 }

IsdnBasicRateEntry ::= SEQUENCE {
 isdnBasicRateIfType INTEGER,
 isdnBasicRateLineTopology INTEGER,
 isdnBasicRateIfMode INTEGER,
 isdnBasicRateSignalMode INTEGER
 }

isdnBasicRateIfType OBJECT-TYPE
 SYNTAX INTEGER {
 isdns(75),
 isdnu(76)
 }
 MAX-ACCESS read-write
 STATUS current
 DESCRIPTION
 "The physical interface type. For 'S/T' interfaces, also called 'Four-wire Basic Access Interface', the value of this object is isdns(75). For 'U' interfaces, also called 'Two-wire Basic Access Interface', the value of this object is isdnu(76)."
 ::= { isdnBasicRateEntry 1 }

isdnBasicRateLineTopology OBJECT-TYPE
 SYNTAX INTEGER {
 pointToPoint(1),
 pointToMultipoint(2)
 }
 MAX-ACCESS read-write
 STATUS current
 DESCRIPTION
 "The line topology to be used for this interface. Note that setting isdnBasicRateIfType to isdns(75) does not necessarily mean a line topology of

```

        point-to-multipoint."
 ::= { isdnBasicRateEntry 2 }

isdnBasicRateIfMode OBJECT-TYPE
    SYNTAX      INTEGER {
        te(1),
        nt(2)
    }
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "The physical interface mode. For TE mode, the value
         of this object is te(1). For NT mode, the value
         of this object is nt(2)."
```

```

 ::= { isdnBasicRateEntry 3 }

isdnBasicRateSignalMode OBJECT-TYPE
    SYNTAX      INTEGER {
        active(1),
        inactive(2)
    }
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "The signaling channel operational mode for this interface.
         If active(1) there is a signaling channel on this
         interface. If inactive(2) a signaling channel is
         not available."
```

```

 ::= { isdnBasicRateEntry 4 }

-- The B channel (bearer channel) group

-- Note that disconnects can explicitly be handled using the
-- ifStack table. If a connection is to be disconnected,
-- the according ifStack entry has to be removed.
-- More specifically, the ifStackTable entry which binds the high-layer
-- ifTable entry (and related dialCtlNbrCfgTable entry) to the
-- B channel ifTable entry (and related isdnBearerTable entry)
-- during an active call has to be removed.

isdnBearerGroup OBJECT IDENTIFIER ::= { isdnMibObjects 2 }

isdnBearerTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF IsdnBearerEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "This table defines port specific operational, statistics
```

and active call data for ISDN B channels. Each entry in this table describes one B (bearer) channel."
 ::= { isdnBearerGroup 1 }

isdnBearerEntry OBJECT-TYPE

SYNTAX IsdnBearerEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Operational and statistics information relating to one port. A port is a single B channel."

INDEX { ifIndex }

::= { isdnBearerTable 1 }

IsdnBearerEntry ::=

SEQUENCE {

isdnBearerChannelType	INTEGER,
isdnBearerOperStatus	INTEGER,
isdnBearerChannelNumber	INTEGER,
isdnBearerPeerAddress	DisplayString,
isdnBearerPeerSubAddress	DisplayString,
isdnBearerCallOrigin	INTEGER,
isdnBearerInfoType	INTEGER,
isdnBearerMultirate	TruthValue,
isdnBearerCallSetupTime	TimeStamp,
isdnBearerCallConnectTime	TimeStamp,
isdnBearerChargedUnits	Gauge32

}

isdnBearerChannelType OBJECT-TYPE

SYNTAX INTEGER {

dialup(1),

leased(2)

}

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"The B channel type. If the B channel is connected to a dialup line, this object has a value of dialup(1). In this case, it is controlled by an associated signaling channel. If the B channel is connected to a leased line, this object has a value of leased(2). For leased line B channels, there is no signaling channel control available."

::= { isdnBearerEntry 1 }

isdnBearerOperStatus OBJECT-TYPE

SYNTAX INTEGER {

```

        idle(1),
        connecting(2),
        connected(3),
        active(4)
    }
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "The current call control state for this port.
        idle(1):      The B channel is idle.
                     No call or call attempt is going on.
        connecting(2): A connection attempt (outgoing call)
                     is being made on this interface.
        connected(3):  An incoming call is in the process
                     of validation.
        active(4):     A call is active on this interface."
    ::= { isdnBearerEntry 2 }

```

```

isdnBearerChannelNumber      OBJECT-TYPE
    SYNTAX INTEGER (1..30)
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "The identifier being used by a signaling protocol
        to identify this B channel, also referred to as
        B channel number. If the Agent also supports the DS0 MIB,
        the values of isdnBearerChannelNumber and dsx0Ds0Number
        must be identical for a given B channel."
    ::= { isdnBearerEntry 3 }

```

```

isdnBearerPeerAddress        OBJECT-TYPE
    SYNTAX    DisplayString
    MAX-ACCESS    read-only
    STATUS      current
    DESCRIPTION
        "The ISDN address the current or last call is or was
        connected to.

        In some cases, the format of this information can not
        be predicted, since it largely depends on the type
        of switch or PBX the device is connected to. Therefore,
        the detailed format of this information is not
        specified and is implementation dependent.

        If possible, the agent should supply this information
        using the E.164 format. In this case, the number must
        start with '+'. Otherwise, IA5 number digits must be used.

```

If the peer ISDN address is not available,
this object has a length of zero."

REFERENCE

"ITU-T E.164, Q.931 chapter 4.5.10"

::= { isdnBearerEntry 4 }

isdnBearerPeerSubAddress OBJECT-TYPE

SYNTAX DisplayString

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The ISDN subaddress the current or last call is or was
connected to.

The subaddress is an user supplied string of up to 20
IA5 characters and is transmitted transparently through
the network.

If the peer subaddress is not available, this object
has a length of zero."

REFERENCE

"ITU-T I.330, Q.931 chapter 4.5.11"

::= { isdnBearerEntry 5 }

isdnBearerCallOrigin OBJECT-TYPE

SYNTAX INTEGER {

unknown(1),

originate(2),

answer(3),

callback(4)

}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The call origin for the current or last call. If since
system startup there was no call on this interface,
this object has a value of unknown(1)."

::= { isdnBearerEntry 6 }

isdnBearerInfoType OBJECT-TYPE

SYNTAX INTEGER {

unknown(1),

speech(2),

unrestrictedDigital(3), -- as defined in Q.931

unrestrictedDigital56(4), -- with 56k rate adaption

restrictedDigital(5),

audio31(6), -- 3.1 kHz audio

audio7(7), -- 7 kHz audio

```

        video(8),
        packetSwitched(9)
    }
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "The Information Transfer Capability for the current
        or last call.

        speech(2) refers to a non-data connection, whereas
        audio31(6) and audio7(7) refer to data mode connections.

        Note that Q.931, chapter 4.5.5, originally defined
        audio7(7) as '7 kHz audio' and now defines it as
        'Unrestricted digital information with tones/
        announcements'.

        If since system startup there has been no call on this
        interface, this object has a value of unknown(1)."
```

REFERENCE

"Q.931 [8], chapter 4.5.5, octet 3 of bearer capability information element, combined with the User Rate (as defined in octets 5 and 5a to 5d), if rate adaption is being used."

::= { isdnBearerEntry 7 }

```

isdnBearerMultirate          OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This flag indicates if the current or last call used
        multirate. The actual information transfer rate,
        in detail specified in octet 4.1 (rate multiplier),
        is the sum of all B channel ifSpeed values for
        the hyperchannel.

        If since system startup there was no call on this
        interface, this object has a value of false(2)."
```

REFERENCE

"Q.931 [8], chapter 4.5.5."

::= { isdnBearerEntry 8 }

```

isdnBearerCallSetupTime      OBJECT-TYPE
    SYNTAX      TimeStamp
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
```

"The value of sysUpTime when the ISDN setup message for the current or last call was sent or received. If since system startup there has been no call on this interface, this object has a value of zero."
 ::= { isdnBearerEntry 9 }

isdnBearerCallConnectTime OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime when the ISDN connect message for the current or last call was sent or received. If since system startup there has been no call on this interface, this object has a value of zero."

::= { isdnBearerEntry 10 }

isdnBearerChargedUnits OBJECT-TYPE

SYNTAX Gauge32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of charged units for the current or last connection. For incoming calls or if charging information is not supplied by the switch, the value of this object is zero."

::= { isdnBearerEntry 11 }

-- ISDN signaling group

isdnSignalingGroup OBJECT IDENTIFIER ::= { isdnMibObjects 3 }

-- signaling channel configuration table
 -- There is one entry in this table for each Terminal Endpoint
 -- (link layer connection to the switch).
 -- Usually, there is one endpoint per D channel. In some
 -- cases, however, there can be multiple endpoints.
 -- Thus, entries in this table can be created and deleted.
 -- This also means the creation of an associated ifEntry.
 --
 -- D channel backup and NFAS trunks are handled using the
 -- ifStack table.
 -- In case of D channel backup, there are multiple
 -- Data Link Layer (LAPD) interfaces. Only one interface is
 -- active; all others are dormant(5).
 -- In case of NFAS trunks, one lower interface is the
 -- LAPD interface, while the other lower interfaces are physical
 -- interfaces.

```
-- If directory number and calling address differ from each other
-- or multiple directory numbers are being used,
-- the isdnDirectoryTable has to be used to enter such
-- directory numbers.
```

isdnSignalingGetIndex OBJECT-TYPE

SYNTAX TestAndIncr

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"The recommended procedure for selecting a new index for isdnSignalingTable row creation is to GET the value of this object, and then to SET the object with the same value. If the SET operation succeeds, the manager can use this value as an index to create a new row in this table."

REFERENCE

"RFC1903, TestAndIncr textual convention."

::= { isdnSignalingGroup 1 }

isdnSignalingTable OBJECT-TYPE

SYNTAX SEQUENCE OF IsdnSignalingEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"ISDN signaling table containing configuration and operational parameters for all ISDN signaling channels on this managed device."

::= { isdnSignalingGroup 2 }

isdnSignalingEntry OBJECT-TYPE

SYNTAX IsdnSignalingEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in the ISDN Signaling Table. To create a new entry, only isdnSignalingProtocol needs to be specified before isdnSignalingStatus can become active(1)."

INDEX { isdnSignalingIndex }

::= { isdnSignalingTable 1 }

IsdnSignalingEntry ::= SEQUENCE {

isdnSignalingIndex	INTEGER,
isdnSignalingIfIndex	InterfaceIndex,
isdnSignalingProtocol	IsdnSignalingProtocol,
isdnSignalingCallingAddress	DisplayString,
isdnSignalingSubAddress	DisplayString,
isdnSignalingBchannelCount	Integer32,
isdnSignalingInfoTrapEnable	INTEGER,

```
        isdnSignalingStatus      RowStatus
    }
```

```
isdnSignalingIndex OBJECT-TYPE
    SYNTAX      INTEGER (1..2147483647)
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "The index value which uniquely identifies an entry
         in the isdnSignalingTable."
    ::= { isdnSignalingEntry 1 }
```

```
isdnSignalingIfIndex OBJECT-TYPE
    SYNTAX      InterfaceIndex
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The ifIndex value of the interface associated with this
         signaling channel."
    ::= { isdnSignalingEntry 2 }
```

```
isdnSignalingProtocol OBJECT-TYPE
    SYNTAX      IsdnSignalingProtocol
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The particular protocol type supported by the
         switch providing access to the ISDN network
         to which this signaling channel is connected."
    ::= { isdnSignalingEntry 3 }
```

```
isdnSignalingCallingAddress OBJECT-TYPE
    SYNTAX      DisplayString
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The ISDN Address to be assigned to this signaling
         channel. More specifically, this is the 'Calling Address
         information element' as being passed to the switch
         in outgoing call setup messages.

        It can be an EAZ (1TR6), a calling number (DSS1, ETSI)
        or any other number necessary to identify a signaling
        interface. If there is no such number defined or required,
        this is a zero length string. It is represented in
        DisplayString form.

        Incoming calls can also be identified by this number.
```

If the Directory Number, i.e. the Called Number in incoming calls, is different to this number, the `isdnDirectoryTable` has to be used to specify all possible Directory Numbers.

The format of this information largely depends on the type of switch or PBX the device is connected to. Therefore, the detailed format of this information is not specified and is implementation dependent.

If possible, the agent should implement this information using the E.164 number format. In this case, the number must start with '+'. Otherwise, IA5 number digits must be used."

REFERENCE

"ITU-T E.164, Q.931 chapter 4.5.10"

DEFVAL { "" }

::= { isdnSignalingEntry 4 }

`isdnSignalingSubAddress` OBJECT-TYPE

SYNTAX DisplayString

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Supplementary information to the ISDN address assigned to this signaling channel. Usually, this is the subaddress as defined in Q.931.

If there is no such number defined or required, this is a zero length string.

The subaddress is used for incoming calls as well as for outgoing calls.

The subaddress is an user supplied string of up to 20 IA5 characters and is transmitted transparently through the network."

REFERENCE

"ITU-T I.330, Q.931 chapter 4.5.11"

DEFVAL { "" }

::= { isdnSignalingEntry 5 }

`isdnSignalingBchannelCount` OBJECT-TYPE

SYNTAX Integer32 (1..65535)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The total number of B channels (bearer channels) managed by this signaling channel. The default value of this object depends on the physical interface type and is either 2 for Basic Rate interfaces or

```

        24 (30) for Primary Rate interfaces."
 ::= { isdnSignalingEntry 6 }

isdnSignalingInfoTrapEnable OBJECT-TYPE
    SYNTAX      INTEGER {
        enabled(1),
        disabled(2)
    }
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "Indicates whether isdnMibCallInformation traps
         should be generated for calls on this signaling
         channel."
    DEFVAL       { disabled }
    ::= { isdnSignalingEntry 7 }

isdnSignalingStatus OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "This object is used to create and delete rows in the
         isdnSignalingTable."
    ::= { isdnSignalingEntry 8 }

-- Signaling channel statistics table
-- There is one entry for each signaling connection
-- in this table.
-- Note that the ifEntry also has some statistics information.

isdnSignalingStatsTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF IsdnSignalingStatsEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "ISDN signaling table containing statistics
         information for all ISDN signaling channels
         on this managed device.
         Only statistical information which is not already being
         counted in the ifTable is being defined in this table."
    ::= { isdnSignalingGroup 3 }

isdnSignalingStatsEntry OBJECT-TYPE
    SYNTAX      IsdnSignalingStatsEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION

```

"An entry in the ISDN Signaling statistics Table."
AUGMENTS { isdnSignalingEntry }
::= { isdnSignalingStatsTable 1 }

IsdnSignalingStatsEntry ::= SEQUENCE {
 isdnSigStatsInCalls Counter32,
 isdnSigStatsInConnected Counter32,
 isdnSigStatsOutCalls Counter32,
 isdnSigStatsOutConnected Counter32,
 isdnSigStatsChargedUnits Counter32
}

isdnSigStatsInCalls OBJECT-TYPE
 SYNTAX Counter32
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "The number of incoming calls on this interface."
 ::= { isdnSignalingStatsEntry 1 }

isdnSigStatsInConnected OBJECT-TYPE
 SYNTAX Counter32
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "The number of incoming calls on this interface
 which were actually connected."
 ::= { isdnSignalingStatsEntry 2 }

isdnSigStatsOutCalls OBJECT-TYPE
 SYNTAX Counter32
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "The number of outgoing calls on this interface."
 ::= { isdnSignalingStatsEntry 3 }

isdnSigStatsOutConnected OBJECT-TYPE
 SYNTAX Counter32
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "The number of outgoing calls on this interface
 which were actually connected."
 ::= { isdnSignalingStatsEntry 4 }

isdnSigStatsChargedUnits OBJECT-TYPE
 SYNTAX Counter32

```

MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
    "The number of charging units on this interface since
    system startup.
    Only the charging units applying to the local interface,
    i.e. for originated calls or for calls with 'Reverse
    charging' being active, are counted here."
 ::= { isdnSignalingStatsEntry 5 }

```

```
--
```

```
-- The LAPD table
```

```

isdnlapdTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF IsdnLapdEntry
    MAX-ACCESS   not-accessible
    STATUS      current
    DESCRIPTION
        "Table containing configuration and statistics
        information for all LAPD (D channel Data Link)
        interfaces on this managed device.
        Only statistical information which is not already being
        counted in the ifTable is being defined in this table."
    ::= { isdnSignalingGroup 4 }

```

```

isdnlapdEntry OBJECT-TYPE
    SYNTAX      IsdnLapdEntry
    MAX-ACCESS   not-accessible
    STATUS      current
    DESCRIPTION
        "An entry in the LAPD Table."
    INDEX { ifIndex }
    ::= { isdnLapdTable 1 }

```

```

IsdnLapdEntry ::= SEQUENCE {
    isdnLapdPrimaryChannel  TruthValue,
    isdnLapdOperStatus      INTEGER,
    isdnLapdPeerSabme        Counter32,
    isdnLapdRecvdFrmr        Counter32
}

```

```

isdnlapdPrimaryChannel OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS   read-write
    STATUS      current
    DESCRIPTION
        "If set to true(1), this D channel is the designated
        primary D channel if D channel backup is active.

```

There must be exactly one primary D channel configured. If D channel backup is not used, this object has a value of true(1)."

REFERENCE

"Q.931 [8], Annex F, D channel backup procedures."

::= { isdnLapdEntry 1 }

isdnLapdOperStatus OBJECT-TYPE

SYNTAX INTEGER {
 inactive(1),
 l1Active(2),
 l2Active(3)
}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The operational status of this interface:

inactive all layers are inactive
l1Active layer 1 is activated,
 layer 2 datalink not established
l2Active layer 1 is activated,
 layer 2 datalink established."

::= { isdnLapdEntry 2 }

isdnLapdPeerSabme OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of peer SABME frames received on this interface. This is the number of peer-initiated new connections on this interface."

::= { isdnLapdEntry 3 }

isdnLapdRecvdFrMr OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of LAPD FRMR response frames received. This is the number of framing errors on this interface."

::= { isdnLapdEntry 4 }

--

-- Optional groups follow here.

```
-- The Terminal Endpoint group and table

-- This table is required only if TEI values or SPID numbers
-- have to be entered.
-- The ifIndex values for this table are identical to those of
-- the isdnSignalingChannel table.
```

```
isdnEndpointGroup OBJECT IDENTIFIER ::= { isdnMibObjects 4 }
```

```
isdnEndpointGetIndex OBJECT-TYPE
```

```
    SYNTAX          TestAndIncr
```

```
    MAX-ACCESS      read-write
```

```
    STATUS          current
```

```
    DESCRIPTION
```

```
        "The recommended procedure for selecting a new index for
        isdnEndpointTable row creation is to GET the value of
        this object, and then to SET the object with the same
        value. If the SET operation succeeds, the manager can use
        this value as an index to create a new row in this table."
```

```
    REFERENCE
```

```
        "RFC1903, TestAndIncr textual convention."
```

```
    ::= { isdnEndpointGroup 1 }
```

```
isdnEndpointTable OBJECT-TYPE
```

```
    SYNTAX          SEQUENCE OF IsdnEndpointEntry
```

```
    MAX-ACCESS      not-accessible
```

```
    STATUS          current
```

```
    DESCRIPTION
```

```
        "Table containing configuration for Terminal
        Endpoints."
```

```
    ::= { isdnEndpointGroup 2 }
```

```
isdnEndpointEntry OBJECT-TYPE
```

```
    SYNTAX          IsdnEndpointEntry
```

```
    MAX-ACCESS      not-accessible
```

```
    STATUS          current
```

```
    DESCRIPTION
```

```
        "An entry in the Terminal Endpoint Table. The value
        of isdnEndpointIfType must be supplied for a row
        in this table to become active."
```

```
    INDEX { isdnEndpointIndex }
```

```
    ::= { isdnEndpointTable 1 }
```

```
IsdnEndpointEntry ::= SEQUENCE {
```

```
    isdnEndpointIndex      INTEGER,
    isdnEndpointIfIndex    InterfaceIndex,
    isdnEndpointIfType     IANAIfType,
    isdnEndpointTeiType    INTEGER,
```

```
        isdnEndpointTeiValue    INTEGER,
        isdnEndpointSpid       DisplayString,
        isdnEndpointStatus     RowStatus
    }
```

isdnEndpointIndex OBJECT-TYPE

SYNTAX INTEGER (1..2147483647)

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The index value which uniquely identifies an entry
in the isdnEndpointTable."

::= { isdnEndpointEntry 1 }

isdnEndpointIfIndex OBJECT-TYPE

SYNTAX InterfaceIndex

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The ifIndex value of the interface associated with this
Terminal Endpoint."

::= { isdnEndpointEntry 2 }

isdnEndpointIfType OBJECT-TYPE

SYNTAX IANAifType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The interface type for this Terminal Endpoint.
Interface types of x25ple(40) and isdn(63) are allowed.
The interface type is identical to the value of
ifType in the associated ifEntry."

::= { isdnEndpointEntry 3 }

isdnEndpointTeiType OBJECT-TYPE

SYNTAX INTEGER {

dynamic(1),

static(2)

}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The type of TEI (Terminal Endpoint Identifier)
used for this Terminal Endpoint. In case of dynamic(1),
the TEI value is selected by the switch. In
case of static(2), a valid TEI value has to be
entered in the isdnEndpointTeiValue object.
The default value for this object depends on the

interface type as well as the Terminal Endpoint type.
 On Primary Rate interfaces the default value is
 static(2). On Basic Rate interfaces the default value
 is dynamic(1) for isdn(63) Terminal Endpoints and
 static(2) for x25ple(40) Terminal Endpoints."
 ::= { isdnEndpointEntry 4 }

isdnEndpointTeiValue OBJECT-TYPE

SYNTAX INTEGER (0..255)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The TEI (Terminal Endpoint Identifier) value
 for this Terminal Endpoint. If isdnEndpointTeiType
 is set to static(2), valid numbers are 0..63,
 while otherwise the value is set internally.
 The default value of this object is 0 for static
 TEI assignment.
 The default value for dynamic TEI assignment is also
 0 as long as no TEI has been assigned. After TEI
 assignment, the assigned TEI value is returned."

::= { isdnEndpointEntry 5 }

isdnEndpointSpid OBJECT-TYPE

SYNTAX DisplayString

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The Service profile Identifier (SPID) information
 for this Terminal Endpoint.

The SPID is composed of 9-20 numeric characters.

This information has to be defined in addition to
 the local number for some switch protocol types,
 e.g. Bellcore NI-1 and NI-2.

If this object is not required, it is a
 zero length string."

REFERENCE

"Bellcore SR-NWT-001953, Generic Guidelines for ISDN
 Terminal Equipment on Basic Access Interfaces,
 Chapter 8.5.1."

DEFVAL { "" }

::= { isdnEndpointEntry 6 }

isdnEndpointStatus OBJECT-TYPE

SYNTAX RowStatus

```
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
    "This object is used to create and delete rows in the
     isdnEndpointTable."
 ::= { isdnEndpointEntry 7 }

--
-- The Directory Number group
--

isdnDirectoryGroup OBJECT IDENTIFIER ::= { isdnMibObjects 5 }

isdnDirectoryTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF IsdnDirectoryEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Table containing Directory Numbers."
    ::= { isdnDirectoryGroup 1 }

isdnDirectoryEntry OBJECT-TYPE
    SYNTAX      IsdnDirectoryEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "An entry in the Directory Number Table. All objects
         in an entry must be set for a new row to become active."
    INDEX { isdnDirectoryIndex }
    ::= { isdnDirectoryTable 1 }

IsdnDirectoryEntry ::= SEQUENCE {
    isdnDirectoryIndex      INTEGER,
    isdnDirectoryNumber     DisplayString,
    isdnDirectorySigIndex   INTEGER,
    isdnDirectoryStatus     RowStatus
}

isdnDirectoryIndex OBJECT-TYPE
    SYNTAX      INTEGER ( 1..'7fffffff'h )
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "The index value which uniquely identifies an entry
         in the isdnDirectoryTable."
    ::= { isdnDirectoryEntry 1 }

isdnDirectoryNumber OBJECT-TYPE
```

SYNTAX DisplayString
 MAX-ACCESS read-create
 STATUS current

DESCRIPTION

"A Directory Number. Directory Numbers are used to identify incoming calls on the signaling channel given in isdnDirectorySigIndex.

The format of this information largely depends on the type of switch or PBX the device is connected to. Therefore, the detailed format of this information is not specified and is implementation dependent.

If possible, the agent should implement this information using the E.164 number format. In this case, the number must start with '+'. Otherwise, IA5 number digits must be used."

REFERENCE

"ITU-T E.164, Q.931 chapter 4.5.10"

::= { isdnDirectoryEntry 2 }

isdnDirectorySigIndex OBJECT-TYPE

SYNTAX INTEGER (1..2147483647)
 MAX-ACCESS read-create
 STATUS current

DESCRIPTION

"An index pointing to an ISDN signaling channel. Incoming calls are accepted on this signaling channel if the isdnDirectoryNumber is presented as Called Number in the SETUP message."

::= { isdnDirectoryEntry 3 }

isdnDirectoryStatus OBJECT-TYPE

SYNTAX RowStatus
 MAX-ACCESS read-create
 STATUS current

DESCRIPTION

"This object is used to create and delete rows in the isdnDirectoryTable."

::= { isdnDirectoryEntry 4 }

-- Traps

isdnMibTrapPrefix OBJECT IDENTIFIER ::= { isdnMib 2 }

isdnMibTraps OBJECT IDENTIFIER ::= { isdnMibTrapPrefix 0 }

isdnMibCallInformation NOTIFICATION-TYPE

OBJECTS {

```

        ifIndex,                                -- isdnBearerTable ifIndex
        isdnBearerOperStatus,
        isdnBearerPeerAddress,
        isdnBearerPeerSubAddress,
        isdnBearerCallSetupTime,
        isdnBearerInfoType,
        isdnBearerCallOrigin
    }
    STATUS          current
    DESCRIPTION
        "This trap/inform is sent to the manager under the
        following conditions:
        - on incoming calls for each call which is rejected for
          policy reasons (e.g. unknown neighbor or access
          violation)
        - on outgoing calls whenever a call attempt is determined
          to have ultimately failed. In the event that call retry
          is active, then this will be after all retry attempts
          have failed.
        - whenever a call connects. In this case, the object
          isdnBearerCallConnectTime should be included in the
          trap.

        Only one such trap is sent in between successful or
        unsuccessful call attempts from or to a single neighbor;
        subsequent call attempts result in no trap.

        If the Dial Control MIB objects dialCtlNbrCfgId and
        dialCtlNbrCfgIndex are known by the entity generating
        this trap, both objects should be included in the trap
        as well. The receipt of this trap with no dial neighbor
        information indicates that the manager must poll the
        callHistoryTable of the Dial Control MIB to see what
        changed."
    ::= { isdnMibTraps 1 }

--
-- conformance information
--

isdnMibConformance OBJECT IDENTIFIER ::= { isdnMib 2 }
isdnMibCompliances OBJECT IDENTIFIER ::= { isdnMibConformance 1 }
isdnMibGroups      OBJECT IDENTIFIER ::= { isdnMibConformance 2 }

-- compliance statements

isdnMibCompliance MODULE-COMPLIANCE
    STATUS          current

```

```
DESCRIPTION
    "The compliance statement for entities which implement
      the ISDN MIB."
MODULE      -- this module

-- unconditionally mandatory groups
MANDATORY-GROUPS {
    isdnMibSignalingGroup,
    isdnMibBearerGroup,
    isdnMibNotificationsGroup
}

-- conditionally mandatory group
GROUP      isdnMibBasicRateGroup
DESCRIPTION
    "The isdnMibBasicRateGroup is mandatory for entities
      supporting ISDN Basic Rate interfaces."

-- optional groups
GROUP      isdnMibEndpointGroup
DESCRIPTION
    "Implementation of this group is optional for all systems
      that attach to ISDN interfaces."

GROUP      isdnMibDirectoryGroup
DESCRIPTION
    "Implementation of this group is optional for all systems
      that attach to ISDN interfaces."

OBJECT      isdnBasicRateIfType
MIN-ACCESS  read-only
DESCRIPTION
    "It is conformant to implement this object as read-only."

OBJECT      isdnBasicRateLineTopology
MIN-ACCESS  read-only
DESCRIPTION
    "It is conformant to implement this object as read-only."

OBJECT      isdnBasicRateIfMode
MIN-ACCESS  read-only
DESCRIPTION
    "It is conformant to implement this object as read-only."

OBJECT      isdnBasicRateSignalMode
MIN-ACCESS  read-only
DESCRIPTION
    "It is conformant to implement this object as read-only."
```

```
 ::= { isdnMibCompliances 1 }

-- units of conformance

isdnMibBasicRateGroup OBJECT-GROUP
    OBJECTS {
        isdnBasicRateIfType,
        isdnBasicRateLineTopology,
        isdnBasicRateIfMode,
        isdnBasicRateSignalMode
    }
    STATUS      current
    DESCRIPTION
        "A collection of objects required for ISDN Basic Rate
        physical interface configuration and statistics."
    ::= { isdnMibGroups 1 }

isdnMibBearerGroup OBJECT-GROUP
    OBJECTS {
        isdnBearerChannelType,
        isdnBearerOperStatus,
        isdnBearerChannelNumber,
        isdnBearerPeerAddress,
        isdnBearerPeerSubAddress,
        isdnBearerCallOrigin,
        isdnBearerInfoType,
        isdnBearerMultirate,
        isdnBearerCallSetupTime,
        isdnBearerCallConnectTime,
        isdnBearerChargedUnits
    }
    STATUS      current
    DESCRIPTION
        "A collection of objects required for ISDN Bearer channel
        control and statistics."
    ::= { isdnMibGroups 2 }

isdnMibSignalingGroup OBJECT-GROUP
    OBJECTS {
        isdnSignalingGetIndex,
        isdnSignalingIfIndex,
        isdnSignalingProtocol,
        isdnSignalingCallingAddress,
        isdnSignalingSubAddress,
        isdnSignalingBchannelCount,
        isdnSignalingInfoTrapEnable,
        isdnSignalingStatus,
        isdnSigStatsInCalls,
```

```
        isdnSigStatsInConnected,
        isdnSigStatsOutCalls,
        isdnSigStatsOutConnected,
        isdnSigStatsChargedUnits,
        isdnLapdPrimaryChannel,
        isdnLapdOperStatus,
        isdnLapdPeerSabme,
        isdnLapdRecvdFrmr
    }
    STATUS          current
    DESCRIPTION
        "A collection of objects required for ISDN D channel
        configuration and statistics."
    ::= { isdnMibGroups 3 }

isdnMibEndpointGroup OBJECT-GROUP
    OBJECTS {
        isdnEndpointGetIndex,
        isdnEndpointIfIndex,
        isdnEndpointIfType,
        isdnEndpointTeiType,
        isdnEndpointTeiValue,
        isdnEndpointSpid,
        isdnEndpointStatus
    }
    STATUS          current
    DESCRIPTION
        "A collection of objects describing Terminal Endpoints."
    ::= { isdnMibGroups 4 }

isdnMibDirectoryGroup OBJECT-GROUP
    OBJECTS {
        isdnDirectoryNumber,
        isdnDirectorySigIndex,
        isdnDirectoryStatus
    }
    STATUS          current
    DESCRIPTION
        "A collection of objects describing directory numbers."
    ::= { isdnMibGroups 5 }

isdnMibNotificationsGroup NOTIFICATION-GROUP
    NOTIFICATIONS { isdnMibCallInformation }
    STATUS          current
    DESCRIPTION
        "The notifications which a ISDN MIB entity is
        required to implement."
    ::= { isdnMibGroups 6 }
```

END

5. Acknowledgments

This document was produced by the ISDN MIB Working Group. Special thanks is due to the following persons:

Ed Alcock
Fred Baker
Scott Bradner
Bibek A. Das
Maria Greene
Ken Grigg
Stefan Hochuli
Jeffrey T. Johnson
Glenn Kime
Oliver Korfmacher
Kedar Madineni
Bill Miskovetz
Mike O'Dowd
David M. Piscitello
Lisa A. Phifer
Randy Roberts
Hascall H. Sharp
John Shriver
Robert Snyder
Bob Stewart
Ron Stoughton
James Watt

6. References

- [1] SNMPv2 Working Group, Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Structure of Management Information for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1902, January 1996.
- [2] McCloghrie, K., and M. Rose, Editors, "Management Information Base for Network Management of TCP/IP-based internets: MIB-II", STD 17, RFC 1213, Hughes LAN Systems, Performance Systems International, March 1991.
- [3] Case, J., Fedor, M., Schoffstall, M., and J. Davin, "A Simple Network Management Protocol (SNMP)", STD 15, RFC 1157, SNMP Research, Performance Systems International, MIT Lab for Computer Science, May 1990.

- [4] SNMPv2 Working Group, 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.
- [5] ITU-T Recommendation "Digital subscriber Signaling System No. 1 (DSS 1) - ISDN User-Network Interface Data Link Layer - General Aspects Rec. Q.920.
- [6] ITU-T Recommendation "Digital subscriber Signaling System No. 1 (DSS 1) - ISDN User-Network Interface - Data Link Layer Specification Rec. Q.921.
- [7] ITU-T Recommendation "Digital subscriber Signaling System No. 1 (DSS 1) - ISDN Data Link Layer Specification for Frame Mode Bearer Services (LAPF) Rec. Q.922.
- [8] ITU-T Recommendation "Digital subscriber Signaling System No. 1 (DSS 1) - ISDN user-network interface layer 3 specification for basic call control", Rec. Q.931(I.451), March 1993.
- [9] ITU-T Recommendation "Generic procedures for the control of ISDN supplementary services ISDN user-network interface layer 3 specification", Rec. Q.932(I.452).
- [10] ITU-T Recommendation "Digital subscriber Signaling System No. 1 (DSS 1) - Signaling specification for frame-mode basic call control", Rec. Q.933.
- [11] McCloghrie, K. and F. Kastenholz, "Evolution of the Interfaces Group of MIB-II", RFC 1573, Hughes LAN Systems, FTP Software, January 1994.
- [12] Fowler, D., "Definitions of Managed Objects for the DS1/E1/DS2/E2 Interface Types", Work in Progress.
- [13] Fowler, D., "Definitions of Managed Objects for the DS0 and DS0Bundle Interface Types", Work in Progress.
- [14] ITU-T Recommendation "Integrated Services Digital Network (ISDN) General Structure and Service Capabilities - Closed User Group", Rec. I.255.1.
- [15] Roeck, G., "Dial Control Management Information Base", RFC 2128, March 1997.

7. Security Considerations

Security issues are not discussed in this memo.

8. Author's Address

Guenter Roeck
cisco Systems
170 West Tasman Drive
San Jose, CA 95134
U.S.A.

Phone: +1 408 527 3143
EMail: groeck@cisco.com

