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SERIES J: CABLE NETWORKS AND TRANSMISSION OF TELEVISION, SOUND PROGRAMME AND OTHER MULTIMEDIA SIGNALS

IPCablecom

IPCablecom management information base (MIB) framework

ITU-T Recommendation J.166

(Formerly CCITT Recommendation)

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ITU-T Recommendation J.166

IPCablecom management information base (MIB) framework

Summary

Many cable television operators are upgrading their facilities to provide two-way capability and using this capability to provide a variety of IP time-critical services, including voice communications. This Recommendation describes the framework in which IPCablecom MIBs are defined.

Source

ITU-T Recommendation J.166 was prepared by ITU-T Study Group 9 (2001-2004) and approved under the WTSA Resolution 1 procedure on 9 March 2001.

FOREWORD

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The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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CONTENTS

ITU-T Recommendation J.166

IPCablecom management information base (MIB) framework

1 Scope

This Recommendation describes the framework in which IPCablecom MIBs (Management Information Base) are defined. It provides information on the management requirements of IPCablecom-specified devices and functions and how these requirements are supported in the MIB. It is intended to support and complement the actual MIB Recommendations, which are issued separately.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revisions; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

2.1 Normative references

- ITU-T J.83 (1997), *Digital multi-programme systems for television, sound, and data services for cable distribution*.
- ITU-T J.112 Annex A (2001), *Digital video broadcasting: DVB interaction channel for cable TV (CATV) distribution systems*.
- ITU-T J.112 Annex B (2001), *Data-over-cable service interface specifications: Radio-frequency interface specification*.
- ITU-T J.160 (Draft), *Architectural framework for the delivery of time-critical services over cable television networks using cable modems*.
- ITU-T J.162 (2001), *Network call signalling protocol for the delivery of time-critical services over cable television networks using cable modems*.
- ITU-T J.167 (2001), *Media terminal adapter (MTA) device provisioning requirements for the delivery of real-time services over cable television networks using cable modems*.
- ITU-T J.170 (Draft), *IPCablecom security specification*.
- IETF RFC 1907 (1996), *Management Information Base for Version 2 of the Simple Network Management Protocol (SNMPv2)*.
- IETF RFC 2011 (1996), *SNMPv2 Management Information Base for the Internet Protocol using SMIv2*.
- IETF RFC 2013 (1996), *SNMPv2 Management Information Base for the User Datagram Protocol Using SMIv2*.
- IETF RFC 2863 (2000), *The Interfaces Group MIB*.
- IETF RFC 2578 (1999), *Structure of Management Information Version 2 (SMIv2)*.
- IETF RFC 2579 (1999), *Textual Conventions for SMIv2*.

NOTE – The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

2.2 Informative references

– IETF RFC 1493 (1993), *Definitions of Managed Objects for Bridges*.

– IETF RFC 1643 (1994), *Definitions of Managed Objects for the Ethernet-like Interfaces Types*.

– IETF RFC 2571 (1999), *An Architecture for Describing SNMP Management Frameworks*.

– IETF RFC 2572 (1999), *Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)*.

– IETF RFC 2573 (1999), *SNMP Applications*.

– IETF RFC 2574 (1999), *User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)*.

– IETF RFC 2575 (1999), *View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)*.

3 Terms and definitions

This Recommendation defines the following terms:

3.1 cable modem: A cable modem is a layer-two termination device that terminates the customer end of the ITU-T J.112 connection.

3.2 IPCablecom: An ITU-T project that includes an architecture and a series of Recommendations that enable the delivery of real-time services over the cable television networks using cable modems.

3.3 management information base (MIB): The specification of information in a manner that allows standard access through a network management protocol.

3.4 MUST: The term "MUST" or "MUST NOT" is used as a convention in the present Recommendation to denote an absolutely mandatory aspect of the specification.

4 Abbreviations

This Recommendation uses the following abbreviations:

CM Cable Modem

MIB Management Information Base

MTA Media Terminal Adapter – contains the interface to a physical voice device, a network interface, CODECs, and all signalling and encapsulation functions required for VoIP transport, class features signalling, and QoS signalling.

NCS Network Call Signalling

QoS Quality of Service, guarantees network bandwidth and availability for applications.

5 Overview

IPCablecom MIBs are designed to provide necessary functionality defined in IPCablecom Recommendations. MIBs that are developed for IPCablecom support embedded Media Terminal Adapters (MTAs) and provide definitions for NCS call signalling and MTA device provisioning functions. Future IPCablecom development phases will include other functional areas as well as requirements for other IPCablecom components, which will be considered for MIB development. IPCablecom functional areas that are being studied for future IPCablecom MIB definition include ITU-T J.162, ITU-T J.167, ITU-T J.170, and ITU-T J.163.

5.1 IPCablecom reference architecture

The conceptual diagram for the IPCablecom architecture is shown in Figure 1. Please refer to ITU-T J.160 for more detailed information concerning the IPCablecom architecture.

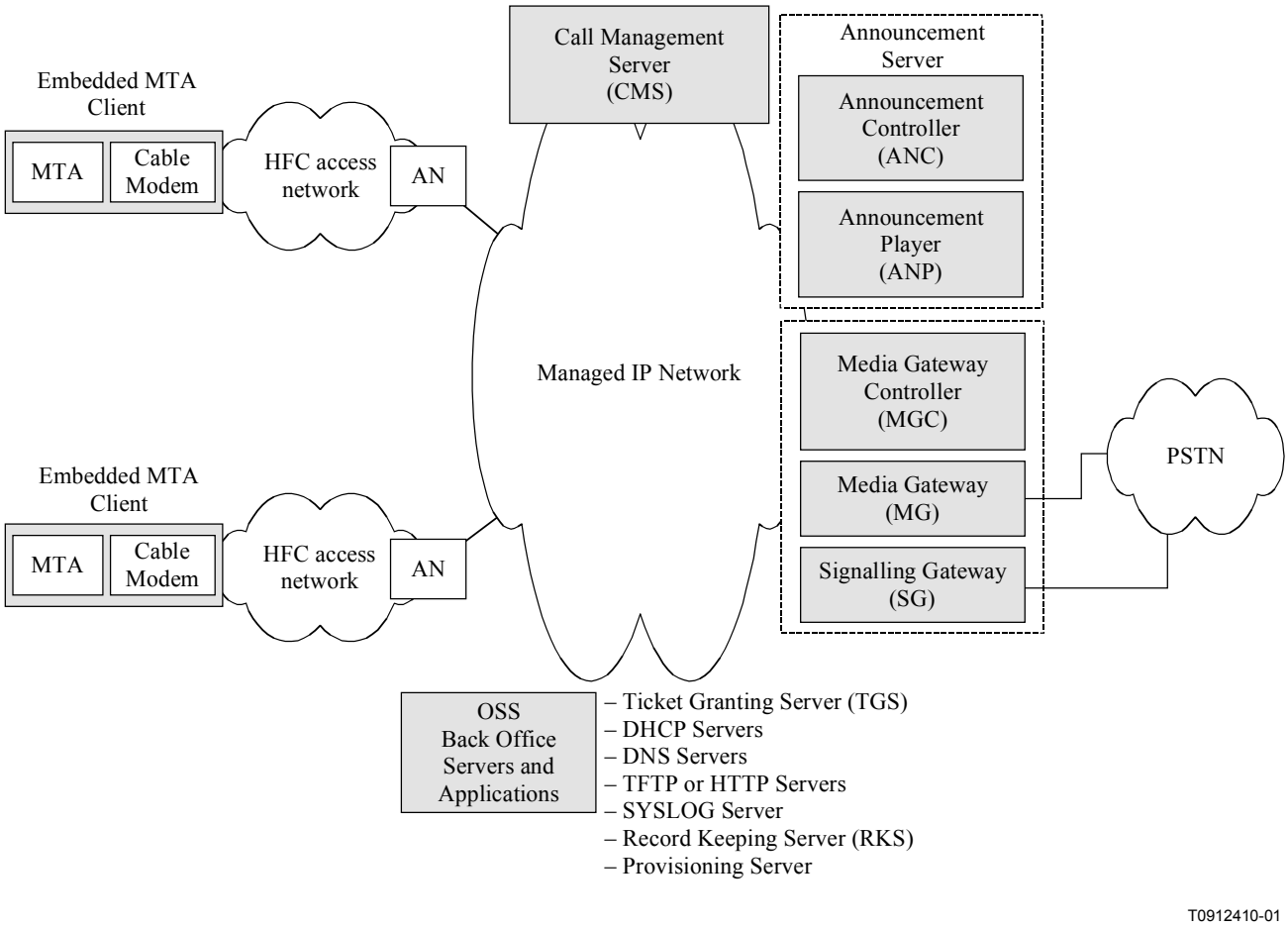

Figure 1/J.166 – IPCablecom network component reference model (partial)

5.2 General requirements

The following requirements have been considered in the design of IPCablecom MIBs:

- IPCablecom devices MUST be compliant with ITU-T J.83 and ITU-T J.112;
- Take a minimalist approach for design of the IPCablecom MIB, i.e. if other MIBs define the same functions, then rely on these MIBs rather than create new ones;
- Organize MIBs to support both embedded and stand-alone MTAs;
- Organize MIBs so as to allow functional partitioning of ITU-T J.112 (high-speed data) and voice features;
- IPCablecom MIBs MUST comply with SMIv2 and SNMPv2 as defined in RFC 2578.

5.2.1 Provisioning and network management service provider

A single physical device (e.g. embedded-MTA) will be completely provisioned and managed by a single business entity. In the case of multiple service providers offering different services on the same device (e.g. data by one provider, voice by another provider), a secondary service provider will

act as the "contractor" for the primary provider in the areas of device provisioning and management. See Figure 2.

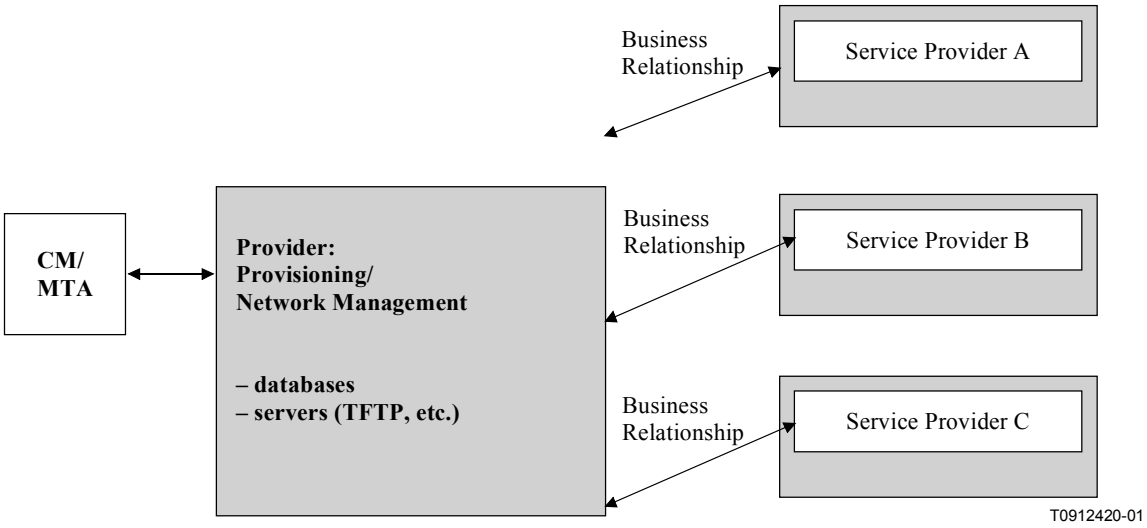

Figure 2/J.166 – Partitioning of Management Domains

5.2.2 Support for embedded and stand-alone MTAs

The IPCablecom MIBs will provide features for both embedded and stand-alone MTAs. Stand-alone MTAs are not required to include any CM related functions. The IPCablecom MIBs, therefore, should be independent of CM and able to provide management support for voice communications functionalities using a stand-alone MTA device that does not have a CM as a base. Although definitions and design of the stand-alone MTA is not part of the IPCablecom, the MIBs have been designed with the understanding that they will be used in Stand-alone MTA (S-MTA) implementations.

5.2.3 Simple network management protocol (SNMP) considerations

SNMPv3 provides an extended User Security Model which implies changes to the way SNMP packets are exchanged between agents and managers. Since MIBs are used to define the content of the packets, the changes for SNMPv3 do not affect MIB design.

The only requirements imposed are that IPCablecom MIBs MUST conform to SMIv2, which is described in RFCs 2578 and 2579.

The following RFCs provide more information on SNMPv3:

- RFC 2571: An Architecture for Describing SNMP Management Framework;
- RFC 2572: Message Processing and Dispatching for SNMP;
- RFC 2573: SNMPv3 Applications;
- RFC 2574: User-based Security Model for SNMPv3;
- RFC 2575: View-based Access Control Model (VACM) for SNMP.

5.3 Functional requirements

This clause describes management functions that are supported by the IPCablecom MIB.

5.3.1 IPCablecom device provisioning

The IPCablecom MIB should provide definitions for attributes that are required in the MTA device-provisioning flows. These attributes are specified in the ITU-T J.167 MTA device provisioning specification and include parameters such as CMS identifier, MTA domain name, MTA server addresses, and MTA capabilities. These attributes are defined as configuration file attributes and/or MIB objects as needed.

5.3.2 Security

The IPCablecom MIB provides definitions for attributes that are required for security handshake of the MTA and the provisioning server. These attributes are contained in ITU-T J.170 and include certificates and signatures.

5.3.3 QoS (FFS)

The IPCablecom MIB should provide attributes for support of Quality of Service (QoS) on the MTA, as well as interoperate with QoS definitions of ITU-T J.112. Given that CM MIBs are including QoS attribute definitions, the IPCablecom MIB will not be required to repeat these attributes. Examples of these attributes are:

- Type of QoS protocol supported, D-QoS;
- QoS authority;
- QoS assignments;
- Provisioned bandwidth;
- Admitted bandwidth;
- Active bandwidth;
- Service flow identifiers for each connection.

5.3.4 Primary line requirements (FFS)

The IPCablecom MIB should provide attributes that are needed to satisfy high availability requirements of the voice communications service as defined in the IPCablecom "primary line" specification. Examples of these attributes are power loss and network element failure.

5.3.5 Voice interfaces (FFS)

The IPCablecom MIB should provide attributes that can be used to manage voice ports on the MTA. Examples of voice port attributes that can be included in the MIB include:

- Physical port description;
- Analogue phone;
- Digital – Integrated Services Digital Network (ISDN);
- Signalling protocols used on this interface;
- Dial-tone delay;
- Minimum call setup latency time.

5.3.6 Packet voice call signalling

The IPCablecom MIB should provide attributes that are needed for management of the packet voice call signalling protocol. The only call signalling protocol that is now being specified by IPCablecom is NCS; however, work on DCS is in progress. Examples of attributes that have to be supported for packet voice call signalling include:

- Dial time-outs;
- Distinctive ring patterns;

- COder-DECoder (Codec) capabilities;
- Signalling configuration for voice communication end points;
- Call agent identifier.

5.3.7 Packet voice transport (FFS)

The IPCablecom MIB should provide attributes that can be used to monitor and manage packet voice transport. The Real-Time Protocol (RTP) protocol is used for packet voice transport, and therefore the RTP MIB (IETF draft-ietf-avt-rtp-mib-05.txt) can be used for management of the packet voice transport function of the MTA.

Given that the RTP MIB consists of attributes that relate to fault and performance data, it is not being considered for this release of the IPCablecom MIB.

5.3.8 Fault management (FFS)

The IPCablecom MIB should provide attributes that can be used in management of network faults and failures. Examples of attributes include:

- standard alerts;
- common fault messages (software upgrades, resets, link up/down);
- prioritized alerts (0-7) for throttling and limiting and class;
- possible "thin RMON" agent;
- fault isolation.

5.3.9 Performance management (FFS)

The IPCablecom MIB should provide attributes that can be used in monitoring of the performance of the network when used for voice communications. Examples of attributes that should be considered for performance monitoring are:

- packet counts;
- call signalling status.

6 MIBs available in a IPCablecom network

In designing the IPCablecom MIBs, it was necessary to consider other MIBs that are also present in the network and which can provide the required attributes and functions. This clause describes the MIBs that can be present in the IPCablecom MTA device, and which can be used for IPCablecom management functions as needed.

6.1 IF MIB

This is the interfaces section of the MIB II (RFC 2863), and is needed for definitions of multiple interfaces in the MTA.

6.2 MIB II

Request for Comments (RFC) 1907, RFC 2011, and RFC 2013 define the second version of the Management Information Base (MIB-II) for use with network management protocols in TCP/IP-based Internets. Not all objects in this MIB are deemed necessary for the IPCablecom MTA device. This MIB only requires the **system, interfaces, IP,** and **transmission** objects of MIB II to be present in the MTA.

The system object group contact, administrative, location, and service information regarding the managed node.

The interfaces table provides mechanism for identification and independent management of the interfaces in the device.

The IP object group provides information that is relevant to the IP protocol.

The transmission group provides a mechanism for other MIBs that are related to the underlying media for that interface to be hooked in to the MIB tree.

6.3 IPCablecom ITU-T J.169

ITU-T J.169 contains Network Call Signalling information for provisioning. The data is derived from the IPCablecom NCS Recommendation (J.162). No other functionality other than MTA NCS provisioning is defined at this time, although future releases of J.169 may enhance the capabilities.

6.3.1 ITU-T J.169 general configuration information

ITU-T J.169 contains general configuration information that applies to network call signalling on a device basis. This information is also contained in ITU-T J.162.

This data only provides the means to provision network call signalling on a device basis.

6.3.2 ITU-T J.169 per endpoint data

ITU-T J.169 contains a per endpoint table. This table contains general configuration information that applies to network call signalling on a per endpoint basis. This information is also found in the configuration file defined in ITU-T J.162. This data only provides the means to provision network call signalling per endpoint.

6.4 IPCablecom ITU-T J.168

ITU-T J.168 contains data for provisioning the MTA device and supporting the provisioned functions, specifically Syslog. The data is derived from the IPCablecom ITU-T J.167, and the CM Device MIB. No other functionality other than device provisioning and support of provisioned data is defined at this time, although future releases of the MTA Device MIB may enhance the capabilities.

6.4.1 ITU-T J.168 general configuration information

ITU-T J.168 contains general configuration information to provision the MTA on a device basis. These objects support provisioning required servers, security information, and non-type specific call signalling data.

6.4.2 ITU-T J.168 Syslog information

ITU-T J.168 contains Syslog control information such as Syslog server, local logging and traps to maintain the Syslog capability of the voice communication MTA.

6.5 IPCablecom MIB implementation

This clause describes a reference implementation of the MIBs in an IPCablecom device. Only E-MTA type implementations are considered here.

6.6 MTA components

Figure 3 shows the components of a typical MTA.

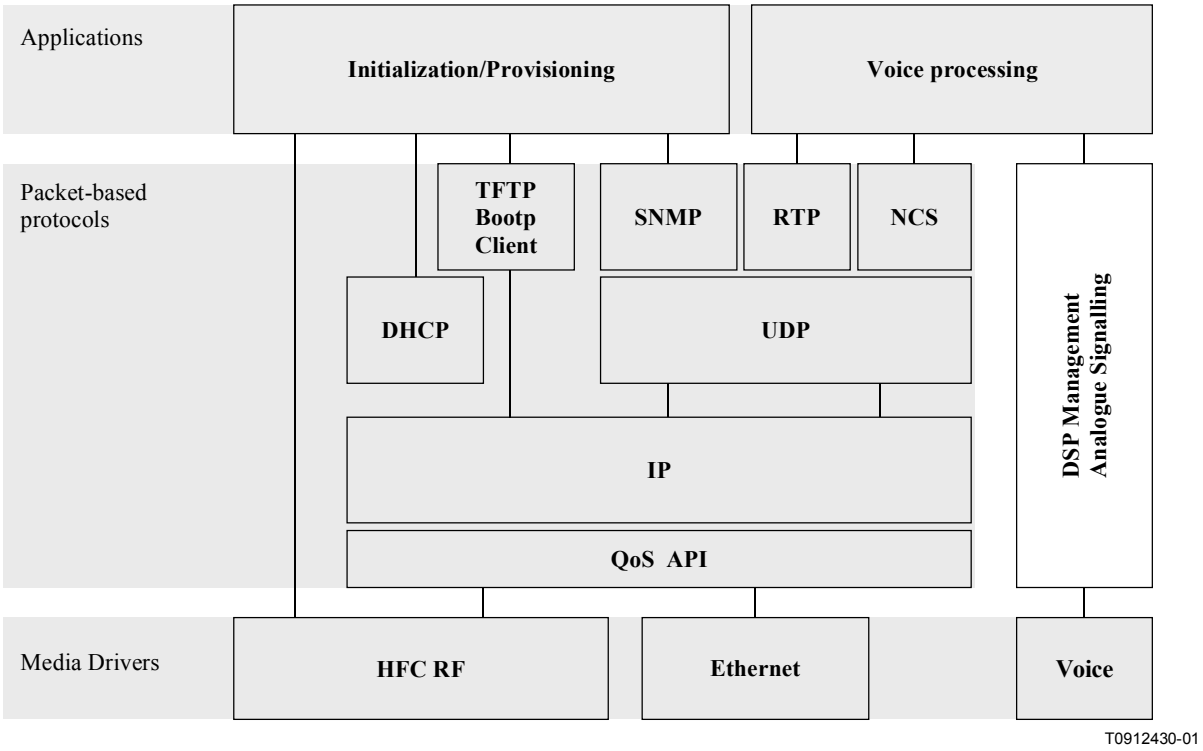

Figure 3/J.166 – MTA components

As shown here, the MTA components can be organized into separate areas, i.e. packet-based protocols, which run on top of IP and the voice subsystem which consists of DSP engines and their associated software. MIBs that are implemented in the MTA have to be organized so as to facilitate this separation. IPCablecom MIB specifies functions for the packet-based protocol section of the MTA. No analogue voice MIBs are specified for the MTA.

6.7 MIB layering

Figure 4 describes the MIB layering model. The two stacks represent the packet network and analogue voice sections of the MTA. On the packet network side MIB layering follows the same layering model as the protocol stacks.

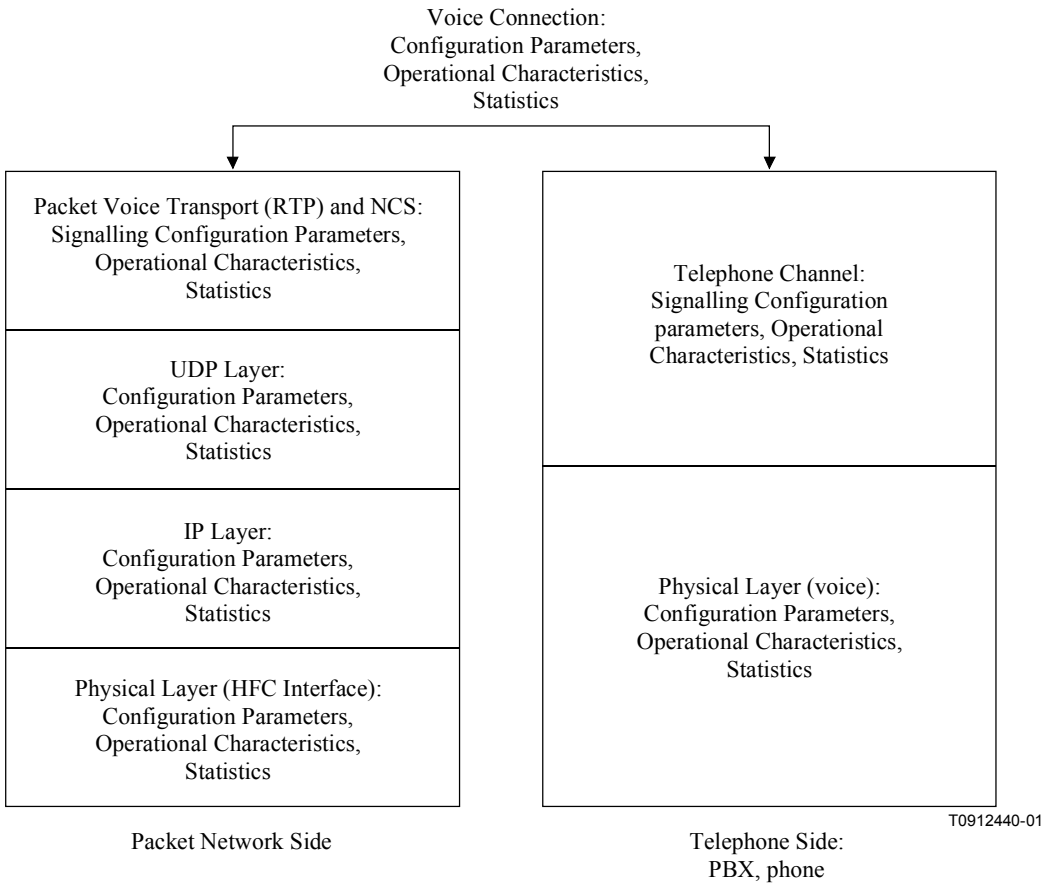

Figure 4/J.166 – MIB layering model

In the context of voice communications, MIBs can be layered into the physical layer attributes which deal with the voice interface and the telephone channel attributes which deal with voice signalling. MIBs for the telephone side of the MTA are for further study.

ANNEX A

MIB import data

The MIB containing import data required for import by IPCablecom NCS MIB and MTA MIB is shown below.

```
CLAB-DEF-MIB DEFINITIONS: := BEGIN
IMPORTS
  MODULE-IDENTITY,
    enterprises
  FROM SNMPv2-SMI;
    cableLabs MODULE-IDENTITY
  LAST-UPDATED  "9910280000Z" -- October 28, 1999
  ORGANIZATION  "ITU-T SG 9"
  CONTACT-INFO
"Roy Spitzer
      Postal: Telogy Networks, Inc.
      20250 Century Blvd.
      Germantown, MD 20855
      U.S.A.
```

```
      Phone: +1 301-515-6531
      Fax: +1 301-515-7954
      E-mail: rspitzer@telogy.com"
  DESCRIPTION
    "This MIB module supplies the basic management
     object categories for Cable Labs. "
 : := { enterprises 4491 }
clabFunction   OBJECT IDENTIFIER: := { cableLabs 1 }
clabFuncMib2   OBJECT IDENTIFIER: := { clabFunction 1 }
clabFuncProprietary OBJECT IDENTIFIER: := { clabFunction 2 }
clabProject   OBJECT IDENTIFIER: := { cableLabs 2 }
clabProjDocsis OBJECT IDENTIFIER: := { clabProject 1 }
clabProjPacketCable    OBJECT IDENTIFIER: := { clabProject 2 }
clabProjOpenCable  OBJECT IDENTIFIER: := { clabProject 3 }
END
```

APPENDIX I

Additional MIBs available in a J.112 Annex B and a J.112 Annex C implementation of an IPCablecom network

This appendix describes possible MIB implementations and additional MIBs that may be available in a J.112 Annex B and a J.112 Annex C implementation of the IPCablecom network.

This appendix describes possible MIB implementations for embedded and stand-alone MTAs based on J.112 Annex B and J.112 Annex C implementations. The S-MTA definitions are for further study.

In Figure I.1, the MIBs are divided into categories that can be placed into both Embedded MTA (E-MTA) and stand-alone MTA (S-MTA). The box that is labelled as "common MIB" represents a set of MIBs that has to be present on any device. An example of a common MIB is the interfaces group of MIB II.

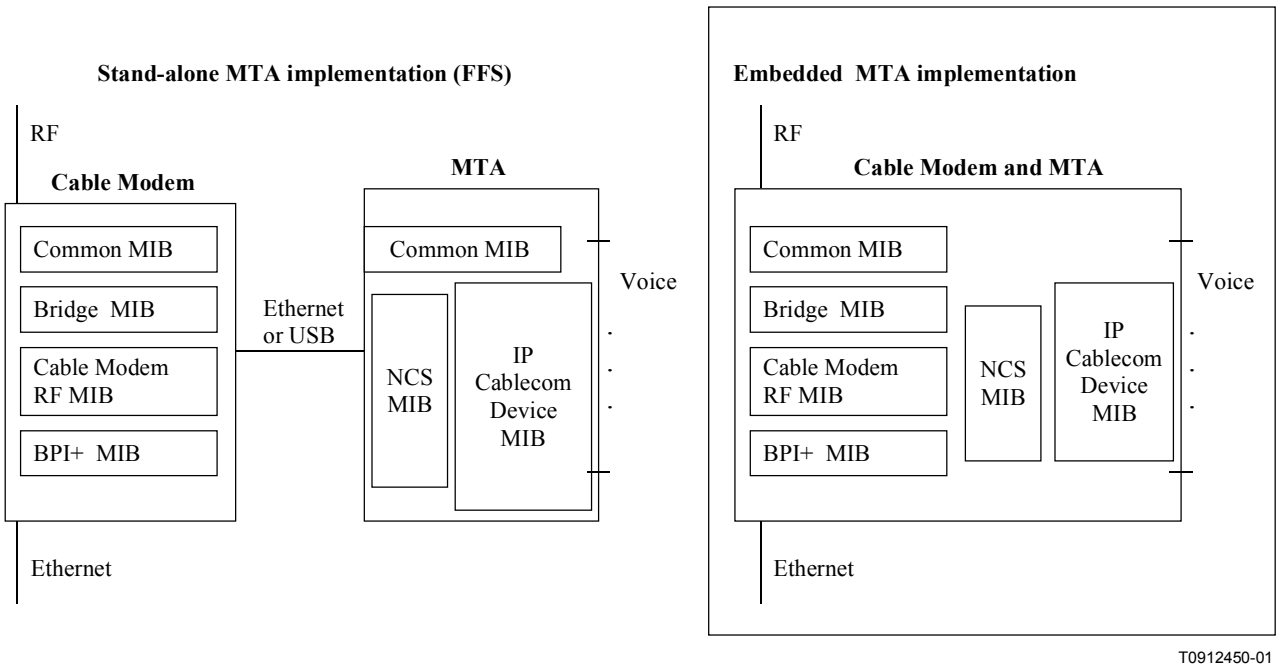

Figure I.1/J.166 – Embedded and stand-alone MTA implementations

Table I.1 lists MIBs that may be present in the J.112 Annex B and J.112 Annex C implementation of an IPCablecom device. Note that the device can be a CM or an E-MTA or an S-MTA.

Table I.1/J.166 – Additional MIBs

Possible MIBs present in IPCablecom device
CM Device MIB
CM RF MIB
CM QoS MIB
CM BPI+ MIB
IF MIB
MIB II
Ethernet MIB
Bridge MIB
IPCablecom Device MIB
NCS MIB

Partitioning of voice and data services and support of both S-MTA and E-MTA have been requirements for design of the MIB. This appendix describes possible organizations of the MIB in order to meet these requirements. In doing so, the common MIB category was introduced which is basically a collection of MIBs which can be present on both the CM as the MTA device.

I.1 CM MIBs

The embedded MTA may take advantage of the MIBs that are available in the CM as appropriate.

I.2 Ethernet MIB

Contains definitions of managed objects for the Ethernet-like interfaces. See RFC 1643.

I.3 Bridge MIB

Contains definitions of managed objects for bridges. See RFC 1493.

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