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Technical Report

Access and Terminals (AT);
IPCablecom Access Network;
End to end Provisioning for the IPAT Architecture
(Between the eMTA to the V5.2 interface)

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ETSI

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Contents

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Access and Terminals (AT).

Introduction

The cable industry in Europe and across other Global regions has already deployed broadband cable television Hybrid Fibre Coaxial (HFC) data networks running the DOCSIS or EuroDOCSIS Cable Modem Protocol. The Cable Industry is in the rapid stages of deploying IP Voice and other time critical multimedia services over these broadband cable television networks.

The cable Industry has recognized the urgent need to develop ETSI Technical Specifications aimed at developing interoperable interface specifications and mechanisms for the delivery of end to end advanced real time IP multimedia time critical services over bi-directional broadband cable networks.

IPCablecom is a set of protocols and associated element functional requirements developed to deliver Quality of Service (QoS) enhanced secure IP multimedia time critical communications services using packetized data transmission technology to a consumer's home over the broadband cable television Hybrid Fibre/Coaxial (HFC) data network running the Cable Modem protocol. IPCablecom utilizes a network superstructure that overlays the two-way data-ready cable television network. While the initial service offerings in the IPCablecom product line are anticipated to be Packet Voice, the long-term project vision encompasses packet video and a large family of other packet-based services.

The Cable Industry is a global market and therefore the ETSI standards are developed to align with standards either already developed or under development in other regions. The ETSI Specifications are consistent with the CableLabs/PacketCable set of specifications as published by the SCTE. An agreement has been established between ETSI and SCTE in the US to ensure, where appropriate, that the release of PacketCable and IPCablecom set of specifications are aligned and to avoid unnecessary duplication. The set of IPCablecom ETSI specifications also refers to ITU-SG9 draft and published recommendations relating to IP Cable Communication.

The whole set of multi-part ETSI deliverables to which the present document refers specify a Cable Communication Service for the delivery of IP Multimedia Time Critical Services over a HFC Broadband Cable Network to the consumer's home cable telecom terminal. "IPCablecom" also refers to the ETSI working group program that must define and develop these ETSI deliverables.

1 Scope

The present document is: "End to End provisioning of the LCS Architecture" and it refers to the IPCablecom TS 101 909 series of documents. IPCablecom has defined a set of protocols and associated element functional requirements in the TS 101 909 series of documents. These have been developed to deliver Quality of Service (QoS), enhanced secure IP multimedia time critical communication services, using packetized data transmission technology to a consumer's home over a cable television Hybrid Fibre/Coaxial (HFC) data network.

To facilitate maintenance and future enhancements to support other real-time multimedia services the TS 101 909 document series consist of multi-parts as detailed in TS 101 909-1 [1].

The present document introduces a high-level management framework for IPCablecom managed objects not covered in the existing NCS architecture. The present document describes at a very high level the key processes involved in an end-to-end Operations Support System/Back office Support System (OSS/BSS) management system for an IPCablecom network using the V5.2 protocol and a Local exchange. It is a "delta" document, in that is covers the changes from the existing NCS architecture, including any extensions to the MTA, the new elements of the IPAT, and changes that may affect other IPCablecom architecture elements. It assumes detailed familiarity with the NCS architecture. It focuses on provisioning, and not the total set of Operation Support System (OSS) capabilities.

Note that the focus of the document it to identify those elements for the provisioning of an LCS architecture to provide basic telephony services to a subscriber. Higher level issues such as business management, customer care, and billing are not part of the scope of the present document. Other services (such as data, video) are not part of the scope of the present document. Local Exchange provisioning is not part of the scope of the present document. It is not intended to define Managed Information Blocks (MIBs) for LCS components in the present document.

The following notes are considerations that define the background to several provisioning issues:

NOTE 1: The present document presents a view of provisioning based on MIB frameworks and definitions as of 2001. Since that time a great deal of work has been done on globalization of MIBS in the IETF, SCTE, ITU and other standard bodies that is not incorporated into ETSI MIB documentation. Future work will be required to redefine the ETSI MIBs to align with global MIB definitions as defined by the IETF.

NOTE 2: Although this is a document describing the additions and changes for LCS against a baseline NCS architecture. In many cases the baseline ETSI IPCablecom NCS documents are incomplete on provisioning at the time of the release of the present document. This is particularly true for provisioning of components outside the customer premise. Thus, as with NCS, many LCS provisioning areas remain undefined and their implementation are left up to vendors of IPCablecom equipment.

A number of issues arose during the creation of the present document that can not be solved at the time of writing it, and are noted for future work. This includes:

- The MIBs as defined in existing ETSI documents (TS 101 909 parts 6 [6], 7 [34], 8 [7] and 9 [8]) are two years out of date from the state in the industry; the MIB defined in the present document are state of the art. When the IETF publishes the RFC, the LCS and NCS MIBs should be revisited and compared against the published RFC. Refer to annex A for the specific RFC draft used as a basis for the present document.

- There is a new RFC from the IETF (RFC 3495 [35]). This document defines a Dynamic Host Configuration Protocol (DHCP) option used to configure various devices deployed within cable network architectures. Specifically, the document describes DHCP option to configure one class of a Multimedia Terminal Adapter (MTA). Currently this only addresses the PacketCable version from Cablelabs, and work is required to ensure that there is an IPCablecom version from ETSI as well.

- There is no end to end provisioning specification for components in the NCS architecture other than the MTA.

- There is no provisioning specification for the S-MTA.

- The IPCablecom OSS should evolve to support a generic (perhaps XML like) dynamic object management model. With such an approach, new objects definitions would be downloaded when new features are installed. Eventually, even the SNMP MIBS could also be replaced by a dynamically defined XML.

2 References

For the purposes of this Technical Report (TR) the following references apply:

[1] ETSI TS 101 909-1: "Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 1: General".

[2] ITU-T Recommendation J.112: "Transmission systems for interactive cable television services".

[3] ETSI TS 101 909-2: "Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 2: Architectural framework for the delivery of time critical services over cable Television networks using cable modems".

[4] ETSI TS 101 909-3: "Access and Terminals (AT); Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 3: Audio Codec Requirements for the Provision of Bi-Directional Audio Service over Cable Television Networks using Cable Modems".

[5] ETSI TS 101 909-4: "Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 4: Network Call Signalling Protocol".

[6] ETSI TS 101 909-6: "Access and Terminals (AT); Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 6: Media Terminal Adapter (MTA) device provisioning".

[7] ETSI TS 101 909-8: "Access and Terminals (AT); Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 8: Media Terminal Adapter (MTA) Management Information Base (MIB)".

[8] ETSI TS 101 909-9: "Access and Terminals (AT); Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 9: Network Call Signalling (NCS) MIB Requirements".

[9] ETSI TS 101 909-22: "Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 22: Management Event Messages".

[10] Miniature 6-position plug as described in FCC 47, CFR 68.500 (10-1-98 Edition): "Code of federal regulations (USA); Title 47 Telecommunication; Chapter 1 - Federal Communications Commission, Part 68 - Connection of Terminal Equipment to the Telephone Network; Subpart F Connectors; Section 68.500 Specifications".

[11] ETSI TR 101 182: "Analogue Terminals and Access (ATA); Definitions, abbreviations and symbols".

[12] ITU-T Recommendation J.161: "Audio codec requirements for the provision of bidirectional audio service over cable television networks using cable modems".

[13] ETSI TS 101 909-5: "Access and Terminals (AT); Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 5: Dynamic Quality of Service for the Provision of Real Time Services over Cable Television Networks using Cable Modems".

[14] ETSI TS 101 909-17: "Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 17: Inter-domain Quality of Service".

[15] IETF RFC 3181: "Signaled Preemption Priority Policy Element".

[16] IETF RFC 2212: "Specification of Guaranteed Quality of Service".

[17] IETF RFC 2474: "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers".

[18] IETF RFC 2998: "A Framework for Integrated Services Operation over Diffserv Networks".

[19] IETF RFC 3084: "COPS Usage for Policy Provisioning (COPS-PR)".

[20] IETF RFC 2475: "An Architecture for Differentiated Service".

[21] IETF RFC 2702: "Requirements for Traffic Engineering Over MPLS".

[22] IETF RFC 2638: "A Two-bit Differentiated Services Architecture for the Internet".

[23] IETF RFC 2597: "Assured Forwarding PHB Group".

[24] IETF RFC 3246: "An Expedited Forwarding PHB (Per-Hop Behavior)".

[25] ETSI ES 201 488: "Data-Over-Cable Service Interface Specifications Radio Frequency Interface Specification".

[26] ETSI ES 200 800: "Digital Video Broadcasting (DVB); DVB interaction channel for Cable TV distribution systems (CATV)".

[27] ETSI EN 300 324-1: "V interfaces at the digital Local Exchange (LE); V5.1 interface for the support of Access Network (AN); Part 1: V5.1 interface specification".

[28] ETSI EN 300 347 (all parts): "V interfaces at the digital Local Exchange (LE); V5.2 interface for the support of Access Network (AN)".

[29] IETF RFC 1899: "Request for Comments Summary RFC Numbers 1800-1899".

[30] IETF RFC 3551: "RTP Profile for Audio and Video Conferences with Minimal Control".

[31] ETSI ES 201 235 (all parts): "Access and Terminals (AT); Specification of Dual-Tone Multi-Frequency (DTMF) Transmitters and Receivers".

[32] ETSI EG 201 188: "Public Switched Telephone Network (PSTN); Network Termination Point (NTP) analogue interface; Specification of physical and electrical characteristics at a 2-wire analogue presented NTP for short to medium length loop applications".

[33] ETSI EN 300 659 (all parts): "Access and Terminals (AT);Analogue access to the Public Switched Telephone Network (PSTN);Subscriber line protocol over the local loop for display (and related) services".

[34] ETSI TS 101 909-7: "Access and Terminals (AT); Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 7: Management Information Base (MIB) Framework".

[35] IETF RFC 3495: "Dynamic Host Configuration Protocol (DHCP) Option for CableLabs Client Configuration".

[36] ETSI TS 101 909-23: "Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 23: Internet Protocol Access Terminal - Line Control Signalling (IPAT - LCS)".

[37] IETF RFC 2327: "SDP: Session Description Protocol".

[38] ETSI 101 909-11: "Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 11: Security".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Access Node (AN): layer two termination device that terminates the network end of the ITU-T Recommendation J.112 [2] connection

NOTE: It is technology specific. In ITU-T Recommendation J.112 [2] annex A, it is called the INA while in annex B it is the CMTS.

cable modem: layer two termination device that terminates the customer end of the J.112 connection

Cable Modem Termination System (CMTS): cable modem termination system, located at the cable television system headend or distribution hub, which provides complementary functionality to the cable modems to enable data connectivity to a wide-area network. With reference to ES 201 488 [25] this is the AN device in the IPCablecom Architecture when using the DOCSIS RF Interface Protocol.

endpoint: Terminal, Gateway or MCU

Flow (IP Flow): unidirectional sequence of packets identified by ISO Layer 3 and Layer 4 header information

NOTE: This information includes source/destination IP addresses, source/destination port numbers, protocol ID. Multiple multimedia streams may be carried in a single IP Flow.

Flow (J.112 Flow): unidirectional sequence of packets associated with a SID and a QoS. Multiple multimedia streams may be carried in a single J.112 Flow

Gateway: devices bridging between the IPCablecom IP Voice Communication world and the PSTN

NOTE: Examples are the Media Gateway which provides the bearer circuit interfaces to the PSTN and transcodes the media stream, and the Signalling Gateway which sends and receives circuit switched network signalling tot he edge of the IPCablecom network.

IPCablecom: architecture and a series of Specifications that enable the delivery of real time services (such as telephony) over the cable television networks using cable modems

latency: time, expressed in quantity of symbols, taken for a signal element to pass through a device

proxy: facility that indirectly provides some service or acts as a representative in delivering information there by eliminating a host from having to support the services themselves

trunk: analogue or digital connection from a circuit switch which carries user media content and may carry voice signalling (MF, R2, etc.)

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AALN Analogue Access Line Number
AN Access Node
BSS Back office Support System
BTI Broadband Telephony Interface
CM Cable Modem
CMS Call Management Server
CMTS Cable Modem Termination System
COPS Common Open Policy Service protocol
DHCP Dynamic Host Configuration Protocol
DOCSIS Data Over Cable System Interface Specification
NOTE: A 6MHz channel width with 5 MHz to 42 MHz upstream frequency plan. DOCSIS is a trade mark of CableLabs.

DQoS	Dynamic Quality of Service
DSCP	DiffServ Code Point
E-MTA	Embedded-Multimedia Terminal Adapter
EuroDOCSIS	European DOCSIS

NOTE: Provides a 8 MHz channel width with 5 MHz to 65 MHz upstream frequency plan.

FQDN	Fully Qualified Domain Name
GC	Gate Coordination
HFC	Hybrid Fibre/Coaxial
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPAT	Internet Protocol Access Terminal
LE	Local Exchange
MG	Media Gateway
MGC	Media Gateway Controller
MIB	Managed Information Block
MP	Media Player
MPC	Media Player Controller
MPLS	MultiProtocol Label Switching
MTA	Multimedia Terminal Adapter
OSS	Operations Support System
PHB	Per Hop Behaviour
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RKS	Record Keeping Service
RSVP	Resource reSerVation Protocol
SG	Signalling Gateway
UDP	User Datagram Protocol
VoIP	Voice-over-IP

4 Provisioning delta

The intent of the present document is to describe how the provisioning of an LCS based IPCablecom system differs from an NCS. Thus the NCS system is assumed as a baseline, and the document focuses on describing those areas that are new or changed from NCS; where there is no change, this is usually just noted rather then reproducing existing NCS documentation. Each component of the LCS system as described below has some provisioning. Most equipment runs off standard computers with provisioning requirements (memory, disk, video, printer, etc.), and all have IP based communications: these are not addressed here, as the document focuses on IPCablecom specific provisioning.

There are three categories of equipment as well: network components, customer premise components, and Operations Support System (OSS) "back office" components:

- Network components are typically owned and managed by the operator and provide real time subscriber services; they are often provisioned by proprietary vendor specific interfaces. The approach in the present document is to briefly describe the data that is required for provisioning, but not to attempt a detailed definition. Note that in IPCablecom, such components may be distributed, or "bundled" into one, two, or any number of components by operator choice.

- The OSSs are typically used as part of the network's "back office" to manage, administer, and provision the IPCablecom systems. They provide fault management, performance management, security management, accounting management, and configuration management for all devices and equipment in the IPCablecom system; the provisioning of the OSS components is not addressed in the present document.

- Customer premise equipment represents the largest volume of components, the hardest provisioning task, and the greatest problem for migration, upgrade, and replacement of services. Such equipment may be owned by the operator or by the subscriber or by an enterprise, Thus a strong and continuing effort has been made to precisely describe the definition and operations of such equipment using standard protocols.

Since there is a migration plan to take existing LCS equipment- the MTA, CMTS, and IPAT hardware, and upgrade it to a full NCS architecture, the provisioning of the LE is considered completely separated from the provisioning of the LCS architecture components. This does not mean that the coordination of the two are unrelated, but that such coordination is out of the scope of the present document.

4.1 Architecture overview

The LCS System Architecture consists of a DOCSIS 1.1 Hybrid Fibre Coaxial (HFC) access network interworking with PSTN Local Exchanges (LEs) through an Internet Protocol Access Terminal (IPAT).

This system is illustrated by physical, data link, and transport layers between components in figure 1. The HFC access network includes all of the system components required to support IPCablecom Voice-over-IP (VoIP) telephony; in the LCS application, and for future full VoIP system operations. The IP Access Terminal (IPAT) together with the LE provide all the functions of a Media Gateway Controller (MGC), Signalling Gateway (SG), Media Gateway (MG), Announcement Servers (The Media Player Controller (MPC)/Media Player (MP))and a partial replacement of the Call Management Server (CMS) and Record Keeping Service (RKS).

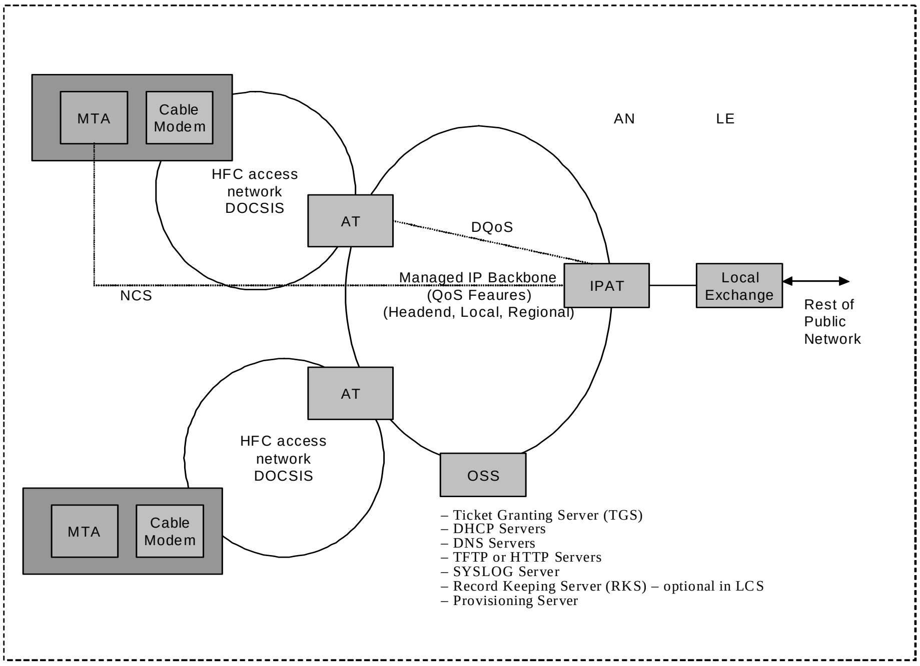

Figure 1: LCS architecture

The present document focuses on the delta requirement of the LCS architecture using the NCS architecture as a baseline. Thus the major changes in provisioning are:

- IPAT provisioning of V5.2 ports, IP side ports, security, mapping and other managed objects.
- CMTS (AT) provisioning has some changes, in that it must be provisioned to handle gate coordination in a special way for the LCS architecture
- OSS provisioning is obviously descoped, since many components in the NCS architecture (CMS, MGC, MG, etc.) are not used in the LCS architecture. Other functions, required by the remaining components (MTA, CMTS) remains as defined in the relevant specifications, with possibly some configuration options to set the gate control management properly.

Note that the specification of provisioning for IPCablecom components has been limited to the component at the customer's premises - the E-MTA. The E-MTA equipment provisioning specifications rely on:

- SNMP protocols and their associated MIBs (see annex A for details).
- DHCP and DNS protocols for Internet related functions.

- TFTP download of configuration data.

A MIB is defined for the CMTS, but no new data-objects are introduced into this MIB to support the LCS architecture.

While it also necessary to provide provisioning data for other components (ex: CMS, MG, SG, MGC, etc.), the methods of provisioning these components have not been specified using SNMP, XML, DHCP, DNS or other standards. In the present document, the customer premise equipment MIBs were evaluated for continuing applicability to the LCS architecture, but no attempt was made to provide standardization where non existed in the NCS architecture.

Also note that is has been proposed to reorganize the IPCablecom MIB definition so that the same MIB can be used to define a stand alone or an embedded MTA. However, the current MIB definitions in TS 101 909 parts 6 [6], 7 [34] and 8 [7] do not yet reflect this change, and only work for embedded MTAs.

4.2 Migration

The LCS architecture is designed to be an *interim* and *transitional* architecture. This architecture has been developed to enable early deployment of IP telephony capability in the HFC access network by using mature local exchange equipment to handle some telephony functions defined in the full NCS architecture. It allows cable system operators a path of entry into the evolving IP telephony marketplace, and an opportunity to gain market share and start generating revenue. Thus cable system operators can offer telephone service to their subscribers without having to wait for availability of complete IPCablecom systems, by reusing existing switched network local exchanges.

The LCS architecture has been developed to take advantage of the IPCablecom operator's investment in equipment. The LCS system components migrate naturally from the switched LCS architecture to IPCablecom's full VoIP NCS architecture by transforming the IPAT into a Media Gateway. Thus where possible, the LCS architecture will provision components that will be reused in the NCS architecture, without requiring changes in the components capability. The MTA, CMTS, and possibly the IPAT hardware ideally should be reused for the NCS architecture with only provisioning and software upgrades required.

The migration from LCS to NCS will have to be carefully done to prevent interruptions in service, billing problems, or service issues. The operator may wish to take the opportunity to also replace the E-package with the L-package in the MTA, thus eliminating legacy cadencing, timeout, etc. singling information that is no longer necessary and can be deleted from the NCS OSS database.

A suggested migration plan will:

1) install, provision, and test CMS, MGC, SG, and OSS components from the NCS architecture;

2) piecewise replace the IPAT component with MG components provisioned to supply identical services, and validate the services work identically to the LCS architecture;

3) piecewise replace the E-package with the L-package and upgrade MIB related information in customer premise MTAs to match NCS architecture.

The main issue will likely be the potential loss of stable calls during step 2 above. If the IPAT can be reused as a MG by software replacement, it may be possible to preserve stable calls during the reloading of the software on the IPAT equipment; service for new call may be interrupted. This however depends on the equipment design, and each vendor must address this issue based on the design of their equipment. If the IPAT is not reused, and new MGs are installed, it may be possible to "wait for traffic to clear", by inhibiting new calls on the old IPAT equipment, then cutting over IPAT subscribers to the new MG. Even if the IPAT can be converted to a MG by software reload, it might be best to use such a waiting strategy by cutting over one IPAT to a MG at a time using a spare MG. The DNS server can be effectively used to manage the switchover of one set of IPAT URLs associated with a particular IPAT IP address to the cutover MG IP address.

4.3 Gate coordination and Quality of Service options

IPCablecom Dynamic QoS (DQoS) uses the call signalling information at the time that the call is made to dynamically authorize resources for the call. Dynamic QoS prevents various thefts of service attack types by integrating QoS messaging with other protocols and network elements. The LCS System is defined over ES 201 488 [25] only, based on, Dynamic QoS control Specification, TS 101 909-5 [13].

In the LCS architecture, there are two options for DQoS, one called "with Gate Coordination", and one called "without Gate Coordination". The difference is primarily in the choice of whether to use the full Gate Coordination function of the CMS inside the IPAT, or to use a reduced version.

Gate Coordination (GC) is the process by which gates in the CMTS are managed by the CMS; gates are the mechanism used to dynamically authorize Quality of Service resources while providing security to prevent theft and loss of service attacks on the network. The GC function is essentially a policy decision maker. DOCSIS QoS is based upon the objects which describe traffic and flow specifications, similar to the TSpec and RSpec objects as defined in the IETF Resource reSerVation Protocol (RSVP). This allows QoS resource reservations to be defined on a per flow basis.

The two options require different provisioning choices in the IPAT and the CMTS gate object, differences in RADIUS support, differences in the use of the either "get close" or the "get info" messages to validate gate closure, and differences in the monitoring of the RTP stream.

1) In the CMTS, the remote gate info object can be provisioned in one of three ways: with a local CMS IP address, with a remote proxy CMS address for interdomain cases, or a null address. In the "with coordination" case, the IPAT's IP address should be provisioned into the info object; this will cause the CMTS to operate as if there were a full CMS involved for gate functions. In the "without coordination" case, the field should be null; the CMTS will then take no proactive action.

2) In the CMTS both options require provisioning using the Gate Set command to enforce the omission of the "Event-Generation-Info" object; this will indicate that no event generation should be done for this Gate and the CMTS should not communicate with the RKS.

3) In the CMTS the "without Gate coordination" case requires that a flag be set in the Gate Set command and the "Remote Gate Info" object is omitted; this will stop the CMTS from sending or receiving the Radius "Gate close" or "Gate Open" commands from the IPAT. Thus in the IPAT, the "without Gate coordination" option does not use the Gate coordination message, but the info message which is sent as message after every call release from the IPAT.

4) In the "with Gate Coordination" option, the IPAT requires RADIUS protocol support.

5 LE provisioning

The Local Exchange (LE) is an component external to the LCS architecture that provides line side call features and interfaces to the PSTN. It is a digital switch equipped with an interface supporting remote subscriber lines over digital trunks. These digital trunks, or "digital loop carriers", normally terminate in a Access Network that concentrates the analogue line traffic, converts analogue line signalling into digital signals, and performs remote line maintenance. This integrated digital line system has been long deployed to reduce operating, installation, and capital equipment costs while delivering an equivalent range of telecommunications services to a direct analogue line interface; it is capable of supporting ISDN CPE terminals as well. A large percentage of subscriber lines in Europe today are connected to the Local Exchange over these remote concentrated digital interfaces instead of direct analogue lines.

The LE OSS has certain provisioning expectations and will manage some line and subscriber features although not the full scope of line related calling features. The LCS OSS also has its requirements on provisioning, many of which are subscriber related and call feature related. These two provisioning systems will have to by synchronized, if not integrated. There will also be some additional requirements on LCS provisioning to handle the requirements of the IPAT gateway and digital loop trunk provisioning.

However, LE provisioning details are out of the scope of the present document, since it is considered an external component to the LCS architecture. Nevertheless the following clause illustrates some of the work required to integrate a LE into an LCS architecture.

5.1 V5.2 provisioning

The V5.2 interfaces are defined by two documents: EN 300 324-1 [27] and EN 300 347 [28].

The LE and IPAT use these interfaces to support digital lines, and the provisioning requirements follows those documents. TS 101 909-23 [36], annex A provides a framework for mapping the V5.2 Interface to the NCS protocol. The provisioning of the V5.2 interface of the IPAT does not use a MIB framework, but will follow the above referenced documents taking into account the subset defined in TS 101 909-23 [36].

The provisioning of the E-MTA must conform to the provisioning of the LE. There is a large subset of MIB data objects that are applicable to the LCS-based architecture. These can be found listed in annex A of the present document. The values that are assigned to the elements of the MIB must correspond to those assigned in the LE/SCN. For example, the method used by the LE to implement the delivery of Caller ID must be one of the MTA's MIB object types.

V5.2 provisioning in the LE, while out of the scope of the present document, is expected to support the easy and incremental addition of new digital subscriber lines to the IPCablecom network. It -should be coordinated with the provisioning of V5.2 lines in the IPAT.

When the system migrates from LCS to NCS, this V5.2 provisioning information will be removed from the LE after a successful cutover.

5.2 Line/Subscriber provisioning

The subscriber line features are determined by the LE feature set, and not necessarily by IPCablecom requirements. At this time, most LEs support all the IPCablecom call features needed in the initial release, and include many features not specified in IPCablecom; however LEs do not typically support internet, web, or IP-based multi-media features, which must be considered beyond the scope of LCS, and do not support the MTA and CMTS provisioning required to implement these features. Since the LCS architecture is considered to be a transient step in an evolution to NCS, it may be important for the cable operating company to restrict the subscriber line call features allowed in the LE to those defined by IPCablecom to avoid backward compatibility issues in the future, since many existing LE features may prove difficult or impracticable to implement in the IPCablecom Architecture.

When the system migrates from LCS to NCS, this provisioning will be discarded, and the lines and interface hardware, will be taken out of service and presumably made available for other purposes. Note that some care must be taken in the NCS OSS to be compatible with the LE OSS so that billing information is smoothly migrated, and there is no service disruption.

5.3 Customer care

The LE customer care system exists independently of the IPCablecom system, but must be synchronized with the IPCablecom OSS. While most customer care is done in the LE, all provisioning functions in the network or customer premise support customer care processes. It is expected that the OSS back office for IPCablecom will be connected, at least by IP access, to the LE Customer care systems. However, issues beyond provisioning, such as maintenance, net services, and reconciliation are not covered as customer care is beyond the scope of the present document.

Migration is a complex and large issue for customer care. When a customer is switched from an LCS to an NCS based architecture, back office functions must ensure that the services are identical, and billing is accurate. This will require that the customer care handle both LE and NCS OSS component interfaces during the cutover phase. In addition, audits should be performed to ensure no information was lost in the process of migration to NCS.

5.4 Billing

The LE billing system exists independently of the IPCablecom system, but must be synchronized with the IPCablecom OSS. Billing design, protocols, and description is beyond the scope of the present document.

Note that on a migration from LCS to NCS the billing system must be able to interface with both LE and NCS OSS components, and smoothly handle the data retrieved from both in order to transparently produce a billing statement for the customer, and to handle customer care issues.

5.5 Lawful intercept

The LE implements all lawful intercept functions.

Note that on migration from LCS to NCS the Operator will be responsible for the Lawful intercept functions. As these are new, there should be no impact on existing components, but a provisioning system will have to be created to manage this mandated function.

6 E-MTA device provisioning

An embedded MTA (E-MTA) is a hardware device that integrates a DOCSIS 1.1 Cable Modem (CM) and a IPCablecom multi-media terminal adapter (MTA). Thus the E-MTA has two logical parts, which are physically combined into one component. Every home using IPCablecom services has at least one E-MTA. On the subscriber side, it supports one or more phone lines, and optionally includes one or more ports for high-speed data access such as a local 10BaseT or 100BaseT interface. On the network side it supports the IPCablecom/DOCSIS 1.1/HFC network requirements. MIBs have been defined for the support and provisioning of the E-MTA. Annex A provides a list of these MIBs.

The E-MTA definition is unchanged from the NCS version, and thus the existing NCS provisioning descriptions apply to it. However, Compared to the IPCablecom NCS architecture, the LCS E-MTA has the following changes:

1) The E-MTA is still required to support only a subset of the NCS signalling; however since LCS E-MTAs are expected to migrate to a full NCS architectures, this should not be construed as a guideline for MTA development. This includes the provisioning aspects as well.

2) Only G.711 codec translation and compression is supported for the LCS architectures. Minimum requirements to support G.711 are given in the Codec Specification TS 101 909-3 [4]. Provisioning of this is identical to the NCS provisioning.

3) The E-MTA interfaces at the DOCSIS physical and logical level with the CMTS, but the LCS Architecture suggests two architecture changes (which are transparent to the E-MTA):

   - the telephone signalling interface is with IPAT instead of the MGC/CMS;

   - the voice to packet translations are handled by the IPAT instead of the MG.

Thus the provisioning of the LCS MTA is identical to the provisioning of the NCS MTA, and the NCS provisioning descriptions apply. A description of MTA device provisioning can be found in the IPCablecom MTA Device Provisioning Specification, TS 101 909-6 [6].

During MTA provisioning, the MTA gets its configuration with the help of the DHCP and TFTP servers, as well as the OSS. Provisioning interfaces must be secured and the MTAs must be configured with the appropriate security parameters (e.g. customer X.509 certificate signed by the Service Provider). IPCablecom TS 101 909-11 [38] specifies the steps in MTA provisioning, but provides detailed specifications only for the security parameters.
Refer to TS 101 909-6 [6] for a full specification on MTA provisioning and customer enrolment.

For the LCS application, the MTA uses single stage QoS bandwidth allocation - when an originating or terminating call is processed the QoS resources are reserved and committed in a single step.

6.1 MTA Migration

When the deployed system migrates from an LCS architecture to an NCS architecture, each MTA must be reprovisioned, and the signalling package in the MTA updated. Annex A defines the MIB delta in detail.

Provisioning values depend on the deployment options chosen by the service provider, but the following is a brief overview of values that may be changed when migrating from LCS to NCS:

- Codec type supported by the MTA.
- Connection nodes that the MTA device can support.
- Type of signalling used.
- Service Class Name used to create an Upstream Service Flow for NCS.
- String indicating the Service Class Name used to create a Downstream Service Flow for NCS.
- Value for the Call Signalling Network Mask.

The following types of values will likely be different in the NCS from the LCS:

- Dial time out values.
- Busy tone timeout values.
- Dial tone timeout values.
- Message waiting tone timeout values.
- Off-hook warning tone timeout values.
- Ringing timeout values.
- Ring back timeout values.
- Re-order tone timeout values.
- Stutter dial tone timeout values.
- Pulse dial interdigit timeout (if used).
- Pulse dial make pulse width (if used).
- Pulse dial break pulse width (if used).
- Value of jitter the Broadband Telephony Interface (BTI) can compensate.
- on-hook and off-hook debounce length.

The various electrical values defined in the E-package for the LCS Architecture may need to be re-evaluated and possibly changed on a migration to NCS. This evaluation has to take into consideration the types of terminal equipment and legacy issues. They include such items as:

- User-defined ring cadences; note that NCS may retain "special" ring cadence values or download melodies or other audible substitutes for ringing (example: pop-tunes).
- Frequency at which the sinusoidal voltage must travel down the twisted pair to make terminal equipment ring.
- Pulse signal operation and associated values.
- Meter pulsing and associated values.
- Caller id and associated values.
- Polarity reversal.

For details on the above provisioning migration issues, see annex A.

7 CMTS device provisioning

The Cable Modem Termination System (CMTS) is the component that terminates one or more DOCSIS 1.1 based Hybrid Fiber/Coax (HFC) access links and provides connectivity to one or more wide area networks (typically IP). It is located at the cable television system head-end or distribution hub. On the HFC network side, it supports several layers of interface protocols to manage the population of MTAs as defined by DOCSIS. On the IPCablecom managed IP network side, it supports the transport of RTP voice packets with appropriate priority and Quality of Service constraints.

The CMTS itself is unchanged from the NCS, and the provisioning capabilities are identical: however, there are some provisioning requirements on the gate objects. As noted in clause 4.3, there are two options for DQoS, one called "with Gate Coordination", and one called "without Gate Coordination". The two options require different provisioning choices in the CMTS gate object. In the CMTS, the remote gate info object can be provisioned in one of three ways: with a local CMS IP address, with a remote proxy CMS address for interdomain cases, or a null address. In the "with coordination" case, the IPAT's IP address should be provisioned into the info object; this will cause the CMTS to operate as if there were a full CMS involved for gate functions. In the "without coordination" case, the field should be null; the CMTS will then take no proactive action. In the CMTS both options require provisioning using the Gate Set command to enforce the omission of the "Event-Generation-Info" object; this will indicate that no event generation should be done for this Gate and the CMTS should not communicate with the RKS. In the CMTS the "without Gate coordination" case requires that a flag be set in the Gate Set command and the "Remote Gate Info" object is omitted; this will stop the CMTS from sending or receiving the Radius "Gate close" or "Gate Open" commands from the IPAT. Thus in the IPAT, the "without Gate coordination" option does not use the Gate coordination message, but the info message which is sent as message after every call release from the IPAT.

Upon migration to an NCS architecture, the gate provisioning may or may not have to be changed. If the new NCS equipment uses gate coordination, the CMTS must match it, and may have to be re provisioned accordingly. In any case the IPAT's IP address will be replaced with the CMS IP address in the appropriate provisioning objects. See annex A for details.

8 IPAT provisioning

The IP Access Terminal (IPAT) provides the inter-working between the LE and the IPCablecom network. It interfaces to the LE over digital trunks which carry signalling and voice traffic. It interfaces to other components (CMTS, OSS, and, indirectly, the MTA) of the IPCablecom architecture over an IP network, which carries signalling and voice traffic. From the LE side, it simulates a remote digital loop carrier CMTS interface. From the IPCablecom IP network side, it replaces the subscriber line call related functions and voice to packet translation functions. Thus it must support provisioning for:

1) The V5.2 digital lines between the IPAT and the LE.

2) The IP ports which convert outgoing IPCablecom voice packets into digital circuit voice traffic and pass it to the LE over digital trunks: this is similar to the provisioning of MG IP side ports.

3) Conversion of NCS protocol call control signalling into digital line interface signalling (V5.2) required by the LE. This requires provisioning of the mapping of the V5.2 line addressing (layer 3 address as per V5.2 specification) into IPCablecom addressing (Fully Qualified Domain Name (FQDN) and Analogue Access Line port number).

4) IPCablecom security procedures, both for the media streams and the signalling layers, including gate controller functions.

When migrating from an LCS to an NCS based architecture, much of this information must be provisioned in the CMS, MG, and MGC. Additional provisioning data will also be needed in the new CMS, MGC, MGC, SG, and OSS components that are not in the IPAT.

8.1 Assumptions

The following assumptions are implicit in the provisioning of the IPAT:

- No standard provisioning framework or protocol is specified for provisioning the IPAT; as with NCS, the LCS provisioning interface is undefined, and will be vendor specific.

- The back office OSS is responsible for coordinating endpoint updates with affected network entities (MTAs, CMTSs, etc.) and the IPAT.

- IPAT will not play a manager role, nor does it specify SNMP communications to an MTA during IPAT provisioning.

- The IPAT and OSS reside in the same secure provisioning domain.

8.2 Provisioning data requirements

The IPAT IP side endpoint must be provisioned with information required by the NCS, RTP, UDP and IP protocols. In general this is similar to the existing IP and NCS Signalling MIB provisioning, except where identified otherwise in the present document. It includes:

1) data used for codecs;

2) data used for general signalling related definitions;

3) data used for endpoint-specific signalling information.

Note that a major issue is that various MTAs may support multi-media, broadband, and other phone features capabilities beyond those supported by a LE, and the IPAT should be provisioned for a "least common denominator" implementation of telecom services. In the case of a mismatch of services, the IPAT should generate an event to the operator to notify them of the problem.

Specifically:

- IPAT provisioning must enable the support of signal mapping:
  - For cadence ringing requests, LCS defines an expanded range of ring cadences using a similar syntax as the NCS ringing cadence signals (clause A.4.2.7).
  - For pulsed and steady state signals, LCS defines how the IPAT translates a V5.2 protocol message received from the LE to a corresponding signal from the IPAT to the E-MTA. Line treatment; pulse duration, pulse period and the number of repetitions are among the parameters that must be mapped.
- Time-out values for command signals must be provisioned with a default time-out value, as per NCS. However, the values must be carefully considered, and possibly are different from the NCS case, since the LE introduces some extra latency in the signalling process, and timers expected by the switch might timeout before some procedures in the MTA/CMTS/IPAT are completed.
- For migration purposes the naming of entities (CA, CMS, MG, MGC, SG, etc.) required in the NCS architecture should be retained and mapped by DNS entities to a common IP address for the IPAT.
- The IPAT CA name must be specified as the default "notified entity" controlling the endpoints.
- Selection of codecs must be supported. It must match the MTA codec selection.
- Session Description Protocol related data must be provisioned This includes connection parameters such as IP addresses, UDP port, and RTP profiles. SDP descriptions follow the conventions in the session description protocol (SDP), as per RFC 2327 [37]. SDP allows for description of multimedia conferences, but only "audio" connections are required for LCS.
- IPAT component OA&M must be supported. Other values may be needed for OA&M of IPAT elements. This is likely to include the IPAT platform itself, including memory, printers, IP communications, etc.
- The IPAT must be provisioned with V5 pulse type and duration coding mapping to NCS pulse type and pulse duration timing in ms. as defined in the annex B of the NCS specification. This provisioning must be consistent with the LE provisioning and the local administration guidance on values.
- Where pulse metering is employed, the IPAT must be provisioned to support this.

For detailed information on provisioning of MTA, see annex A.

When migrating from an LCS to an NCS based architecture, much of this information must be provisioned in the CMS, MG, and MGC. Additional data will also be needed in the new CMS, MGC, MGC, SG, and OSS components. Some provisioning, such as time out rules and IP address, may differ between the LCS and NCS components.

8.3 V5.2 digital line provisioning

The V 5.2 Signalling between IPAT CA and LE and voice communications between IPAT MG and LE are fully defined in EN 300 324-1 [27] and EN 300 347-1 [28]. Security methods are not specified on this interface; in the LCS architecture this is considered a trusted part of the network. TS 101 909-23 [36], annex A provides a framework for mapping the V5.2 signalling interface to the NCS protocol. The provisioning of the V5.2 interface is not defined in the LCS architecture and will be vendor specific; however, it must follow the above referenced documents taking into account the subset defined in TS 101 909-23 [36].When communications from an MTA to a PSTN phone are made, bearer channel traffic is passed directly between an MTA and the IPAT. The protocols used in this case are RTP and RTCP, as in the MTA-to-MTA case. Both security requirements and specifications are fully defined in TS 101 909-11 [38]. After a voice communication enters the PSTN, the security requirements as well as specifications are the responsibility of the PSTN. Thus no further provision work is needed in the LCS to support V5.2 digital lines.

After migrating from LCS to NCS based components, this provisioning information is no longer needed.

8.4 IP ports provisioning

The media stream between MTA and the IPAT Media Gateways uses the RTP protocol. Although ITU J.112/BPI+ provides for privacy over the HFC network, the potential threats within the rest of the voice communications network (over the IP Network) require that the RTP packets must be encrypted.

In addition to RTP, there is an accompanying RTCP protocol, primarily used for reporting of RTCP statistics. In addition, RTCP packets may carry CNAME - a unique identifier of the sender of RTP packets. RTCP also defines a BYE message that can be used to terminate an RTP session. These two additional RTCP functions raise privacy and denial-of-service threats. Due to these threats, RTCP security requirements are the same as the requirements for all other signalling and are addressed in the same manner. For more information on Codec functionality, see TS 101 909-3 [4].

Only G.711 codec translation and compression is supported for the LCS architectures. Minimum requirements to support G.711 are given in the Codec Specification TS 101 909-3 [4]. Provisioning of this is identical to the NCS provisioning.

8.5 Mapping

The mapping between the V5.2 address on the LE/SCN side and the MTA port on the IP side is dynamic and requires no provisioning.

However, a static mapping is required to associate a E.164 telephone number to the corresponding MTA's Fully Qualified Domain Name (FQDN) and port identifier (Analogue Access Line Number- AALN). This data will be used to setup translation tables enabling the IPAT to route calls to the appropriate device/port given a specific telephone number.

8.6 QoS/Gates

IPCablecom LCS provides guaranteed Quality of Service (QoS) for each voice communication within a single zone with Dynamic QoS, TS 101 909-5 [13].

As noted in clause 4.3, there are two options for DQoS, one called "with Gate Coordination", and one called "without Gate Coordination". The two options require different provisioning choices in the CMTS gate object and the IPAT should support this. In the "with coordination" case, the IPAT's IP address should be provisioned into the info object; this will cause the CMTS to operate as if there were a full CMS involved for gate functions. In the "without coordination" case, the field should be null; the CMTS will then take no proactive action.

The IPAT Gate Controller must use the COPS protocol to download QoS policy into the CMTS. Should Gate Coordination be used, the IPAT Gate Controller must use the Radius protocol to coordinate the QoS reservation. The MTA must the J.112 QoS or/and the RSVP protocol to establish the QoS to the CMTS. QoS reservations are also forwarded to the IP Backbone between the CMTSs and the IPAT. DiffServ allows IP traffic to be marked with different DiffServ Code Points (DSCP) to obtain different queuing treatment on routers. Different queuing treatments in each router are called Per-Hop Behaviour (PHB), which is a mechanism for enforcing QoS for different flows in the IP Backbone. These must be provision in the IPAT in a manner similar to the MG.

The IPAT must provision the Activity-Count object to place a protective limit on the number of simultaneously active Gates an MTA can have.

The LCS supports two Quality of Service options: "With Gate Control" and "Without Gate Control". When a subscriber migrates from an LCS to an NCS based architecture, these options may change, and the provisioning will have to be managed so match the CMTS with CMS gate options. The COPS, RSVP, DSCP, PHB, RADIUS, and other provisioning data in the LCS IPAT, are also supported by the CMS and OSS components in the NCS architecture. Note that the NCS architecture may also have additional provisioning data to support its operations beyond that supported by the LCS architecture.

The provisioning differences implied by the choice of QoS option are indicated in table 1.

Table 1

Functional element and attributes	with gate control	without gate control
CMTS		
Value of RemoteGate InfoObject	IP Address of IPAT	Null
EventGenerationInfoObject	Use GateSet	UseGateSet
EventGenerationInfoObject	-	Set a flag in the GateSet command to inhibit the sending of gate open and close messages
IPAT		
Radius Support	Yes	No
GateCoordination message	Yes	Uses Info message instead; gate open and close messages are not sent

9 IPCablecom OSS

The Operational Support System components are typically used as part of the network's "back office" to manage, administer, and provision the IPCablecom systems. They provide fault management, performance management, security management, accounting management, and configuration management for all devices and equipment in the IPCablecom system. The OSS components for LCS are mostly unchanged from the NCS IPCablecom architecture. The main impact of LCS on the OSS components is:

1) Additional management is required for the IPAT, including:

   - V5.2 trunk (digital line) provisioning and management.

   - V5.2 trunk (digital line) numbering mapping to NCS trunk numbering mapping.

2) Less management is required for features in the CMS, MGC, SG, MG, RKS, and AS components that have been replaced by the LE.

3) The Record Keeping Server (RKS) will not be used to keep billing (CDR) related data, as the LE will keep its own records.

NOTE: Ideally the IPCablecom OSS should evolve to support a generic (perhaps XML like) dynamic object management model. With such an approach, new objects definitions would be downloaded when new features are installed. Eventually, even the SNMP MIBS could also be replaced by a dynamically defined XML. However, such an effort, attractive as it is, is beyond the scope of the present document, and must be considered future work.

There are three independently provisioned areas: the traditional phone domain in the LE, the LCS domain and the IP domain. The provisioning operator should note that the following items are linked in any provisioning of subscriber equipment:

- MTA device MIBs.

- MTA signalling MIBs.

- IPAT E.164 to FQDN mapping.
- LE subscriber provisioning.

9.1 OSS/Provisioning Server

The provisioning server is not specified in IPCablecom, and will likely be a vendor specific implementation. The OSS supports all provisioning of the LCS, except where noted as not required in the present document.

9.1.1 Equipment setup and configuration

This may include physical installation and/or connection of equipment as well as any software and/or database updates necessary to actually deliver the service to the customer. Equipment setup affects three major components in an IPCablecom environment.

- E-MTA: As noted above the E-MTA consists of two functional components - the Cable Modem (CM) and the Media Terminal Adapter (MTA). The provisioning of the CM is documented elsewhere. Its provisioning is the same for the LCS and NCS architectures and will not be discussed in the present document. The provisioning of the MTA device does vary between the LCS and NCS architecture. The provisioning of the MTA Signalling MIB can differ between NCS and LCS architectures. For a list of the Signalling MIB object types and their variance see annex A of the present document.
- CMTS: Its provisioning is the same for the LCS and NCS architecture with the exception of the options on gate control. Its provisioning interface is not defined by IPCablecom, and will be vendor specific.
- IPAT: This network component is specific to the LCS architecture. Its provisioning interface is not defined by IPCablecom, and will be vendor specific. It performs some of the functions of the Call Agent and the Media Gateway components of the NCS architecture.

9.1.2 IPAT mapping

Mapping data consists of a E.164 telephone number mapped to its associated MTA's FQDN (Fully Qualified Domain Name) and port identifier (Analogue Access Line Number- AALN). This data will be used to setup translation tables enabling the IPAT to route calls to the appropriate device/port given a specific telephone number. The mapping is required before that customer can receive any calls in an IPCablecom network. Other subscriber related provisioning is handled in the LE. Note that when the operator expands to an NCS architecture, subscriber feature provisioning will have to be expanded to handle the large set of feature related data.

9.1.3 LCS provisioning requirements

The following are requirements on an LCS provisioning system:

1) The LCS provisioning shall make no assumptions regarding OSS/PS and IPAT implementation technologies.
2) The LCS provisioning shall only be concerned with static/semi-permanent data.
3) The interface shall support transport of static (typically billable) provisioning state.
4) The LCS provisioning shall be extensible to support features needed to enhance the LCS in the future; in particular it must support the migration of a system into the NCS architectures.
5) LCS provisioning shall not impact any MTA operations in progress, except for a software replacement of the MTA. Endpoint specific data may be added, deleted, or modified on the MTA without affecting other MTA endpoints or sessions in progress. LCS endpoint provisioning scenarios that would result in an endpoint/MTA to be taken out of service must be carefully documented.

9.1.4 Provisioning transport requirements

The transport sub layer for provisioning has a number of requirements that may differ from signalling or media stream layer transport. In general, real time constraints are relaxed.

1) The transport shall make no assumptions regarding the physical networking infrastructure between a PS and a CMS.

   It is possible that multiple service providers will be interoperating over a single access network. Thus, multiple enterprises will be communicating, potentially using IPAT and PS implementations from various vendors, over various network infrastructures (firewalls, proxies, etc.). The CMS/PS transport protocol should facilitate the ability to communicate with various network infrastructures.

2) The transport shall handle conditions such as IPAT busy, errors, etc.

3) The transport shall provide positive/negative acknowledgement of operation received.

4) The transport shall provide positive/negative acknowledgement of operation handled.

5) The transport shall be secure.

9.2 DNS

This is unchanged from the NCS architecture. Note that for migration purposes, domain names should be allocated for functions subsumed by the IPAT (CMS, MGC, etc.) but should point to the IP address of the IPAT. When the operator moves to an NCS architecture, the migration can be most easily accomplished by changing the DNS addresses to the new component's IP addresses.

9.3 DHCP Server

This is unchanged from the NCS architecture.

9.4 TFTP/HTTP server

This is unchanged from the NCS architecture.

9.5 SYSLOG

This is expected to be unchanged from the NCS architecture.

9.6 Ticket Granting Server

This is expected to be unchanged from the NCS architecture, except that IPAT must also support secure interfaces using encryption keys/tickets.

9.7 TOD Server

The time of day server is unchanged from the NCS architecture.

9.8 RKS

The Record Keeping Server (RKS) is not needed for the LCS architecture, since these functions are provided by the LE.

Annex A: delta MIB specification

This annex covers a delta between the NCS MIB specification of the baseline architecture and the changes needed to implement and deploy an LCS based system. The MTA uses SNMP standard based MIBs for provisioning. The MIBS used by IPCablecom are based on IETF RFCs. Where possible, IPCablecom uses IETF MIBs: in particular, the IP based MIBs are used. IPCablecom also uses MIB defined by DOCSIS to manage the lower layers of the MTA. Some new MIBs were created in NCS to handle technology specific to the IPCablecom system. For LCS, the NCS signalling MIB had to be extended to include additional functions. All other MIB definitions remain unchanged.

A.1 IETF MIBS

IETF MIBs used in IPCablecom are unchanged, and include:

- ETHERNET MIB - RFC 1643.
- BRIDGE MIB - RFC 1493.
- EVENT MIB - RFC 2981.

A.2 DOCSIS ETSI MIBS

DOCSIS MIBs used in IPCablecom as per ES 201 488 [25] are unchanged, and include:

- CM Device MIB.
- CM RF MIB.
- CM QOS MIB.
- CM BPI+ MIB.
- IF MIB.
- MIB II.

A.3 IPCablecom MIBS

There are three Management Information Bases (MIBs) defined for the application layer parameters of an MTA in an IPCablecom network. The three MTA MIBS are:

- MTA MIB.
- EVENT MIB (not yet specified in ETSI).
- NCS Signalling MIB.

Only the NCS signalling MIB is changed for the LCS architecture.

A.4 NCS Signalling MIB delta

The object-types defined in the MTA MIB and the Event MIB need to be implemented in both the IPAT-based (LCS) and the CMS-based (NCS) architecture. However, there are some differences that should be noted. The tables below list the object-types present in the NCS signalling MIB and classify them into three categories. The categories and their descriptions are as follows:

- S - same for both LCS IPAT-based and NCS CMS-based architecture.
- S* - the object must be supported but the values which it assumes may differ between the two architectures.
- D - different for LCS IPAT-based than for NCS CMS-based architecture.
- E - supports an E-Package signal or event.

A summary statement of the differences is provided before each table. In some cases LCS requires fewer types or parameters than NCS. For example, one such case is "pktcSigDevCodecEntry 2" which provides a description of the codecs supported by the MTA. LCS only requires that the MTA support g711a, type 9.

In other instances, however, the LCS architecture requires more MIB elements than a full NCS implementation might need. This is because the elements of the LCS architecture replace analogue and digital facilities and equipment in the AN of the SCN. The SCN uses a variety of specialized methods for sending signals across the AN.

These methods are based on the assumption that the terminal equipment does not contain intelligence and that signals are sent in-band by means of electrical pulses and frequencies, and out-of-band by means of bit encoded messages on time division multiplexed facilities. These signals need to be translated into NCS signals by the IPAT and then translated by the MTA back to signals that the analogue terminal equipment can respond to. The E Package defined in Part 4 of the IPCablecom suite defines a set of signals and events designed to make this a one-to-one translation.

In the tables below, object types in category "e" relate to call-processing timers and to call features such as the method by which caller ID will be delivered, the implementation of ring splash, and the description of distinctive ringing patterns, etc. Current SCN -based telephone service with a V5.2 interface employs signals that may be replicated by the use of the parameters provided by the MIB types in category e.

There is no general rule that can be stated for which of the E-package elements should be adopted and which rejected as a telephone system migrates from LCS-based to NCS-based architecture. That decision will be based on considerations outside the scope of the present document, including the preferences of the customer base and the marketing strategies of the service provider. The tables below may help deployers of IPCablecom service make the choice.

NOTE: The information in the tables below is in conformance with an IETF Internet Draft, draft-ietf-ipcdn-pktc-signaling.00. The text of that draft is provided as an informative reference in annex B of the present document. When the draft is adopted as an RFC, annex B will be removed and the reference to the RFC will be inserted. At that time it may be necessary to align this annex A with any changes between the draft and the RFC.

A.4.1 Description of the Signalling MIB

PacketCable Signalling MIB elements are defined in pktcSigMib 1. This object contains four sub-objects identified as pktcSigMibObjects 1, 2, 3 and 4. Two of these four sub-objects are place holders and are outside the scope of the present document. The elements contained in "pctcSigDevConfigObjects" (object ID -"pktcSigMibObjects 1") are applicable to the whole MTA. The elements contained in "pktcNcsEndPntConfigObjects" (object ID - "pktcSigMibObjects 2"), are applicable to specific NCS endpoints associated with the MTA. PktcSigMibObjects 1 contains a total of 36 objects including several tables. PktcSigMibObjects 2 contains a single object, a table with 43 entries.

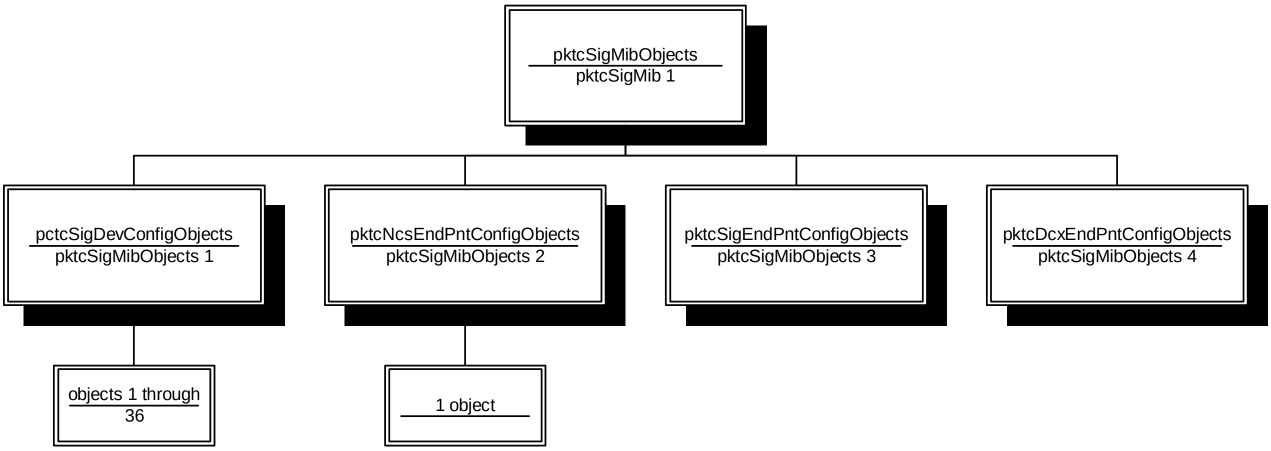

Figure A.1

To clarify the elements of the Signalling MIB and to indicate which elements may very between an LCS and an NCS application the contents of the MIBS is set out in a series of tables below. The tables are identified by the functions supported or described by the MIB elements.

A.4.2 Signalling device configuration objects

This clause of the signalling MIB describes signalling variables that apply to all endpoints on the MTA. The first of these is the codec table whose parameters are identified below.

A.4.2.1 Codec Table

The Codec Table is the first object in this part of the signalling MIB. It describes the codecs supported by the MTA. There is one entry for each codec supported. Each entry consists of a sequence of three parameters: an index into the table; the identity of the codec (using a textual convention that is also defined in the MIB), and a Maximum number of simultaneous sessions of the specific codec that the MTA can support. The LCS architecture requires the presence of this table. The S* next to entry number 2 indicates that while the entry must be present in the LCS architecture there is only one codec type that is required for the LCS architecture. In the migration from an IPAT-based to CMS-based architecture additional values may need to be supported.

Table A.1

Object Name		Description	Object ID		S/D/E
pktcSigDevCodecTable	s	Describes the codecs supported by the MTA. There is one entry for each codec supported.	pktcSigDevConfigObjects	1	S
pktcSigDevCodecEntry	s; id	Each entry consists of an index and a type. In the ipcdn version there is a third value in each entry - the Max number (see definition below).	pktcSigDevCodecTable	1	S
pktcSigDevCodecIndex	s	Index uniquely identifies a table entry	pktcSigDevCodecEntry	1	S
pktcSigDevCodecType	s	Codec type supported by this MTA.	pktcSigDevCodecEntry	2	S*
pktcSig DevCodecMax	id	Maximum number of simultaneous sessions of the specific codec that the MTA can support.	pktcSigDevCodecEntry	3	S

A.4.2.1.1 Textual conventions used to identify codec types

Table A.2 defines the textual convention used to identify the codec types. The g711a codec, identified by the textual convention as 9, is the only one mandated in the LCS architecture. The last column in the table uses an N to indicate that the type is required in NCS and an L to indicate that the type is required in LCS.

Table A.2

Types of Codecs	convention	N/L
other	1	N
unknown	2	N
g729	3	N
g729a (4)	4	N
g729e (5)	5	N
g711mu (6)	6	N
g726 (7)	7	N
g728 (8)	8	N
g711a (9)	9	L
g726k16	10	N
g726k24	11	N
g726k40	12	N

A.4.2.2 Continued list of device configuration objects

Table A.3 continues the list of signalling MIB elements that apply to endpoints of the MTA. These parameters describe echo cancellation, silence suppression, a set of user-defined cadence rings standardized in the default L Package of the NCS protocol, Quality of Service parameters to be used in IP packets for media and for signalling in the upstream and downstream direction, and a table that describes the signalling types valid for the MTA.

In this set of ten parameters there is one that may vary between the CMS based (NCS) and the IPAT based (LCS) architecture. For an LCS architecture, the required connection mode is "voice".

Table A.3

Object Name	Description	Object ID		Option	ID and/or default	S/D/E
pktcSigDevEchoCancellation	Specifies if the device is capable of echo cancellation	pktcSigDevConfigObjects	2			S
pktcSigDevSilenceSuppression	Specifies if the device is capable of silence suppression (Voice Activity Detection).	pktcSigDevConfigObjects	3			S
pktcSigDevConnectionMode	Specifies the connection nodes that the MTA device can support.	pktcSigDevConfigObjects	4			S*
				voice	0	S*
				fax	1	S
				modem	2	S
Custom ring cadences						
pktcSigDevR0Cadence	Ring cadence 0 - a user defined field where each bit represents a duration of 100 ms for a total of 6 seconds.	pktcSigDevConfigObjects	5			S
pktcSigDevR6Cadence	Ring cadence 6 - a user defined field where each bit represents a duration of 100 ms for a total of 6 seconds.	pktcSigDevConfigObjects	6			S
pktcSigDevR7Cadence	Ring cadence 7 - a user defined field where each bit represents a duration of 100 ms for a total of 6 seconds.	pktcSigDevConfigObjects	7			S

Object Name	Description	Object ID		Option	ID and/or default	S/D/E
Type of service						
pktcSigDefCallSigTos	Default value used in the IP header for setting the TOS for call signalling packets.	pktcSigDevConfigObjects	8		0 by default	S
pktcSigDefMediaStreamTos	Default value used in the IP header for setting the TOS for media stream packets.	pktcSigDevConfigObjects	9		0 by default	S
pktcSigTosFormatSelector	Format of the default signalling and media TOS value.	pktcSigDevConfigObjects	10			S
				ipv4TOS octet	1	S
				dscpCodepoint	2	S

A.4.2.3 Continued list of device configuration objects - Packet Signalling Capability Table

The capability table is a single element in the pktcSigDevConfig Objects section of the MTA's signalling MIB. The table must be present in both NCS and LCS architectures. The content of entry number 2, the signalling type, is restricted in the LCS architecture to NCS signalling, identified according the textual convention as type "3". The textual conventions used to identify signalling types are listed in table A.5. The S* at Entry 2 indicates that the Entry itself must be present for both architectures, but the only required value for LCS is "NCS".

Table A.4

Object Name	Description	Object ID		S/D/E
pktcSigCapabilityTable	Defines the valid signalling types supported by this MTA.	pktcSigDevConfigObjects	11	S
pktcSigCapabilityEntry	Index, Type, Version and Vendor Extensions.	pktSigCapabilityTable	1	S
pktcSignalingIndex	Index value that uniquely identifies an entry in the pktcSigCapabilityTable.	pktSigCapabilityEntry	1	S
pktcSignalingType	Identifies the type of signalling used.	pktSigCapabilityEntry	2	S*
pktcSignalingVersion	Provides the version of the signalling type.	pktSigCapabilityEntry	3	S
pktcSignalingVendorExtension	Allows vendors to provide a list of additional capabilities.	pktSigCapabilityEntry	4	S

A.4.2.3.1 PacketCable Signalling Types

The PacketCable Signalling Types referred to in entry 2 above are listed as a textual convention in the Signalling MIB according to table A.5. LCS only uses signalling type "NCS" designated by convention as "3". The last column in the table uses an N to indicate that the type is required in NCS and an L to indicate that the type is required in LCS.

Table A.5

Signalling Types	convention	N/L/E
other	1	N
unknown	2	N
ncs	3	L
dcs	4	N

A.4.2.4 Continued list of device configuration objects

Table A.6 continues the list of signalling objects applicable to the whole MTA with object number 12. In the LCS architecture there are two methods indicated for implementing Quality of Service - with gate coordination and without gate coordination. The elements in table A.6 that are categorized with the S* will be affected by the choice of this implementation. The significance of the S* notation is that the object itself needs to be present in both architectures. See clause 4.2 in the present document for an explanation of the two options.

Table A.6

Object Name	Description	Object ID		Values	Values	S/D/E
pktcSigDefNcsReceiveUdpPort	MTA UDP receives port used for NCS call signalling. NOTE: This object should only be changed by the configuration file.	pktcSigDevConfigObjects	12		2427 default	S
pktcSigServiceClassNameUS	String indicating the Service Class Name to create an Upstream Service Flow for NCS. If the object has an empty string value then the NCS SF is not created and the best effort primary SF is used for NCS data. Setting this object to a different value does not cause the US SF to be re-created.	pktcSigDevConfigObjects	13			S*
pktcSig ServiceClassNameDS	String indicating the Service Class Name to create a Downstream Service Flow for NCS. If the object has an empty string value then the NCS SF is not created and the best effort primary SF is used for NCS data. Setting this object to a different value does not cause the DS SF to be re-created.	pktcSigDevConfigObjects	14			S*
pktcSigServiceClassNameMask	Value for the Call Signalling Network Mask. Used as the NCS Call Signalling classifier mask. Deletes the NCS SF when set to zero. When set to a non-zero value by the SNMP manager, the NCS SF are to be created.	pktcSigDevConfigObjects	15			S*
pktcSigNcsServiceFlowState	Status value of the Call Signalling Service Flow.	pktcSigDevConfigObjects	16			S
		pktcSigDevConfigObjects		notactive	1	S
		pktcSigDevConfigObjects		active	2	S
		pktcSigDevConfigObjects		error	3	S
pktcSigDevR1Cadence	Ring cadence 1 - a user defined field - where each bit represents a duration of 100 milliseconds (6 seconds total).	pktcSigDevConfigObjects	17			S

Object Name	Description	Object ID		Values	Values	S/D/E
pktcSigDevR2Cadence	Ring cadence 2 - a user defined field - where each bit represents a duration of 100 milliseconds (6 seconds total).	pktcSigDevConfigObjects	18			S
pktcSigDevR3Cadence	Ring cadence 3 - a user defined field - where each bit represents a duration of 100 milliseconds (6 seconds total).	pktcSigDevConfigObjects	19			S
pktcSigDevR4Cadence	Ring cadence 4 - a user defined field - where each bit represents a duration of 100 milliseconds (6 seconds total).	pktcSigDevConfigObjects	20			S
pktcSigDevR5Cadence	Ring cadence 5 - a user defined field - where each bit represents a duration of 100 milliseconds (6 seconds total).	pktcSigDevConfigObjects	21			S
pktcSigDevRgCadence	Ring cadence rg - which stands for "ring" - a user defined field - where each bit represents a duration of 100 milliseconds (6 seconds total).	pktcSigDevConfigObjects	22			S
pktcSigDevRsCadence	Ring cadence rs - which stands for "ring splash"- a user defined field - where each bit represents a duration of 100 milliseconds (6 seconds total).	pktcSigDevConfigObjects	23			S
pktcSigDevRsCadence	Ring cadence rt - a user defined field - where each bit represents a duration of 100 milliseconds (6 seconds total).	pktcSigDevConfigObjects	24			S
pktcSigPowerRingFrequency	Frequency at which the sinusoidal voltage must travel down the twisted pair to make terminal equipment ring. See ETS 300 001 (1998) for lists of the frequencies that are defined for each country.	pktcSigDevConfigObjects	25			E
				twenty	1	E
				twentyfive	2	E
				thirtyThree PointThree Three	3	E
				fifty	4	E
pktcSigPCMCoding	PCM format used by the EMTA when coding and decoding analogue telephone signals.	pktcSigDevConfigObjects	26		aLaw = default	N
				aLaw	1	N
				muLaw	2	N

A.4.2.5 Continued list of device configuration objects - Pulse signalling elements

Table A.7 lists elements of a pulse signal table in the device configuration objects section of the signalling MIB. The elements of this table are used to implement services that operate by generating and responding to analogue electrical pulses at the telephone side of the MTA. All the elements in this table are associated with the E-Package defined in TS 101 909-4 [5].

Table A.7

Object Name	Description	Object ID		Value	Value	S/D/E
pktcSigPulseSignalTable	Defines the pulse signal operation. There are four types of international pulse signals: Initial ring; Meter pulse; Reverse polarity; No battery. The pulse duration type is specific and it is specified with a 1 to 32 value.	pktcSigDevConfigObjects	27			E
pktcSigPulseSignalEntry	An entry consists of a sequence of the following: Index; Duration; Type; DbLevel; Frequency; RepeatCount; PauseDuration.	pktcSigPulseSignalTable 1	1			E
pktcSigPulseSignalIndex	Table index is equivalent to the operator - specific pulse type and duration.	pktSigPulseSignalEntry	1			E
pktcSigPulseSignalDuration	Varies according to operator and country.	pktSigPulseSignalEntry	2	1000 is default		E
pktcSigPulseSignalType	There are four types of international pulse signals.	pktSigPulseSignalEntry	3	initialRing is default		E
				initialRing	1	E
				meterPulse	2	E
				Reverse Polarity	3	E
				noBattery	4	E
pktcSigPulseSignalDbLevel	dB level at which the meter pulse should be generated.	pktSigPulseSignalEntry	4			E
pktcSigPulseSignalFrequency	Frequency at which the meter pulse should be generated.	pktSigPulseSignalEntry	5			E
				fifty	1	E
				twelve thousand	2	E
				sixteen thousand	3	E
pktcSigPulseSignalRepeat Count	The number of times to repeat the pulse.	pktSigPulseSignalEntry	6			E
pktcSigPulseSignalPause Duration	Pause duration between pulses varies with operator and country.	pktSigPulseSignalEntry	7			E

A.4.2.6 Continued list of device configuration objects - Caller ID elements

The following elements support caller id as it is implemented in the European and North American telephone networks. All the elements in table A.8 are defined in the E-Package defined in TS 101 909-4 [5].

Table A.8

Object Name	Description	Object ID		Value	Value	S/D/E
pktcSigDevCIDMode	Selects between North American modulation (BellCore 202) and ETS modulation (v.23). For on-hook CID, selects between 4 different methods: Send FSK between first and second ring pattern, which is both North American and duringRingingETS; Dual Tone alert signal (DtAsETS); After a Ring Pulse (rsAsETS); After a Line Reversal followed by a Dual Tone Alert Signal (lrAsETS).	pktcSigDevConfigObjects	28	northAmerican = default		E
				northAmerican	1	E
				duringRingingETS	2	E
				dtAsETS	3	E
				rpAsETS	4	E
				lrAsETS	5	E
pktcSigDevCIDFskAfterRing	Delay between the end of first ringing pattern and the transmission of the FSK containing the CallerID information. Only used when pktcSigDevCIDMode is northAmerican or during RingingETS.	pktcSigDevConfigObjects	29	550 by default		E
pktcSigDevCIDAfterDTAS	Delay between the Dual Tone Alert Signal (DT-AS) and the transmission of the FSK containing the Caller ID Information. Only used when pktcSigDevCIDMode is dtAsETS or lrAsETS.	pktcSigDevConfigObjects	30			E
pktcSigDevCIDAfterFSK	Delay between the complete transmission of the FSK containing the Caller ID information and the first ring pattern. Only used when pktcSigDevCIDMode is dtAsETS, rpAsETS or lrAsETS.	pktcSigDevConfigObjects	31			E
pktcSigDevCIDDTASAfterLR	Delay between the end of the Line Reversal and Dual Tone Alert Signal (DT-AS). Only used when pktcSigDevCIDMode is lrAsETS.	pktcSigDevConfigObjects	32			E

A.4.2.7 Continued list of device configuration objects - Ringing cadence

Table A.9 contains elements that support the various ringing cadences that are used in European telephone networks. All the elements in this table are described in the E-Package defined in TS 101 909-4 [5].

Table A.9

Object name	Description	Object ID		S/D/E
pktcSigDevRingCadenceTable	In V5.2 Cadence rings are defined by the telco governing body for each country. The MTA must be able to support various ranges of cadence patterns and cadence periods. The MTA will be able to support country specific provisioning of the cadence and idle period. There will be at most 3 on/off transitions per cadence period. Each cadence pattern will be assigned a unique value ranging 1 to 128 corresponding to the value sent by the LE SIGNAL message plus one. MTA will derive the cadence periods from the ring Cadence table entry as provisioned by the customer.	pktcSigDevConfigObjects	33	E
pktcSigDevRingCadenceEntry		pktcSigDevRingCadenceTable	1	E
pktcSigDevRingCadenceIndex	Country specific index ranging from 1 to 128.	pktcSigDevRingCadenceEntry	1	E
pktcSigDevRingCadence	Ring Cadence octet string. The first octet represents the length in bits of the duration of the cadence. Each bit after the first octet represents 50 ms. 1 represents ring and 0 represents silence. The first bit of the second octet is the first bit of the ring cadence. Only 216 bits can be set total to represent 10 800 ms of total cadence cycle.	pktcSigDevRingCadenceEntry	2	E
pktcSigDevStandardRingCadence	Ring cadence octet string for the standard ring. The first octet represents the length in bits of the duration of the cadence. Each bit after the first octet represents 50 ms. 1 represents ring and 0 represents silence. The first bit of the second octet is the first bit of the ring cadence. Only 216 bits can be set total to represent 10 800 ms of total cadence cycle.	pktcSigDevConfigObjects	34	E
pktcSigDevRingSplashCadence	Ring cadence octet string for splash ring. The first octet represents the length in bits of the duration of the cadence. Each bit after the first octet represents 50 ms. 1 represents ring and 0 represents silence. The first bit of the second octet is the first bit of the ring cadence. Only 216 bits can be set total to represent 10 800 ms of total cadence cycle.	pktcSigDevConfigObjects	35	E

A.4.2.8 Continued list of device configuration objects - Tone Generation

The elements in table A.10 describe signals to replicate the tone operations used in the AN of the telephone network. All these elements are described in the E-Package.

Table A.10

Object Name	Description	Object ID		Values	Values	N/L/E
pktcSigDevToneTable	Defines tone operations.	pktcSigDevConfigObjects	36			E
pktcSigDevToneEntry	Sequence of the following variables: Type; DbLevel; FreqType; NumFrequencies; FirstFrequency; SecondFrequency; ThirdFrequency; FourthFrequency; NumOnOffTimes; FirstToneOn; FirstToneOff; SecondToneOn; SecondToneOff; ThirdToneOn; ThirdToneOff; FourthToneOn; FourthToneOff; WholeToneRepeat Count; Steady (a boolean value);	pktcSigDevToneTable	1			E
pktcSigDevToneType	Type of tone being accessed.	pktcSigDevToneEntry	1			E
				dtmf0	2	E
				dtmf1	3	E
				dtmf2	4	E
				dtmf3	5	E
				dtmf4	6	E
				dtmf5	7	E
				dtmf6	8	E
				dtmf7	9	E
				dtmf8	10	E
				dtmf9	11	E
				dtmfToneStar	12	E
				dtmfTonePound	13	E
				dtmfA	14	E
				dtmfB	15	E
				dtmfC	16	E
				dtmfD	17	E
				busy	18	E
				confirmation	19	E
				dial	20	E
				messageWaiting	21	E
				offHookWarning	22	E
				ringBack	31	E
				reOrder	33	E
				stutterdial	34	E
				loopback	38	E
				callWaiting1	39	E
				callWaiting2	40	E
				callWaiting3	41	E
				callWaiting4	42	E
				alertingSignal	43	E

Object Name	Description	Object ID		Values	Values	N/L/E
				testTone	44	E
				specialDial	45	E
				specialInfo	46	E
				release	47	E
				congestion	48	E
				userDefinedOne	49	E
pktcSigDevToneDbLevel	dB level at which to generate the tone	pktcSigDevToneEntry	2			E
pktcSigDevToneFreqType	Describes how the frequencies are applied.	pktcSigDevToneEntry	3	allFrequencies = default.		E
				allFrequencies	1	E
				singleFrequency Sequence	2	E
				dualFrequency Sequence	3	E
				allFrequencies Modulated	4	E
pktcSigDevToneNumFrequencies	Number of frequencies specified in the table entry.	pktcSigDevToneEntry	4			E
pktcSigDevToneFirstFrequency	First frequency at which the tones should be generated in a multiple frequency tone.	pktcSigDevToneEntry	5			E
pktcSigDevToneSecondFrequency	Second frequency at which the tones should be generated in a multiple frequency tone.	pktcSigDevToneEntry	6			E
pktcSigDevToneThirdFrequency	Third frequency at which the tones should be generated in a multiple frequency tone.	pktcSigDevToneEntry	7			E
pktcSigDevToneFourthFrequency	Fourth frequency at which the tones should be generated in a multiple frequency tone.	pktcSigDevToneEntry	8			E
pktcSigDevToneNumOnOffTimes	Number of on/off times specified in the table entry.	pktcSigDevToneEntry	9			E
pktcSigDevToneFirstToneOn	Duration of the first tone interval.	pktcSigDevToneEntry	10			E
pktcSigDevToneFirstToneOff	Duration of the first idle interval.	pktcSigDevToneEntry	11			E
pktcSigDevToneSecondToneOn	Duration of the second tone interval.	pktcSigDevToneEntry	12			E
pktcSigDevToneSecondToneOff	Duration of the second idle interval.	pktcSigDevToneEntry	13			E
pktcSigDevToneThirdToneOn	Duration of the third tone interval.	pktcSigDevToneEntry	14			E
pktcSigDevToneThirdToneOff	Duration of the third idle interval.	pktcSigDevToneEntry	15			E
pktcSigDevToneFourthToneOn	Duration of the fourth tone interval.	pktcSigDevToneEntry	16			E
pktcSigDevToneFourthToneOff	Duration of the fourth idle interval.	pktcSigDevToneEntry	17			E

Object Name	Description	Object ID		Values	Values	N/L/E
pktcSigDevToneWholeToneRepeat Count	Tells how many times to repeat the entire on-off sequence.	pktcSigDevToneEntry	18			E
pktcSigDevToneSteady	Indicates whether or not to apply steady tone. When this is set to true, the last tone continues to play after the on-off sequence.	pktcSigDevToneEntry	19			E
NOTE: In the LCS architecture, a number of the above parameters can be defaulted to a common value as determined by the LE; however, to preserve migration data structure communality, and to support legacy MTA equipment, these values are retained for each MTA.						

A.4.3 Elements specific to a particular endpoint

The NCS endpoint configuration objects section of the MTA's signalling MIB provides information about the signalling parameters of the MTA's individual NCS signalling endpoints. Each table "row" or "entry" is a sequence of values that can be associated with an individual endpoint. The number of "rows" or entries in the table is the number of NCS endpoints that are provisioned on the MTA.

Tables A.11 and A.12 highlight the elements of that MIB table. In the LCS architecture the switch controls some of the functions for which the table provides values. The "D" entry in the final column of this table indicates that the switch is responsible for this policy covering this parameter in an LCS architecture. When the system migrates from LCS to NCS, this parameter will need to be supplied by the CMS. In the LCS architecture this parameter is not used since the switch is responsible for the function.

Table A.11

Object name	Description	Object Identifier		Values	S/D/E
pktcNcsEndPntConfigTable	Describes the IPCablecom NCS EndPoint configuration. The number of entries in this table represents the number of provisioned NCS end points.	pktcNcsEndPntConfigObjects	1		S
pktcNcsEndPntConfigEntry	List of attributes for a single NCS endpoint interface. There are 39 attributes identified for each entry. They are listed below.	pktcNcsEndPntConfigTable	1		S
pktcNcsEndPntConfigCallAgentId	A string indicating the call agent name. This can be either an FQDN or an IP address.	pktcNcsEndPntConfigEntry	1		S
pktcNcsEndPntConfigCallAgentUdpPort	Call agent UDP port that is being used for this instanced of call signalling.	pktcNcsEndPntConfigEntry	2	2427 by default	S
pktcNcsEndPntConfigPartialDialTO	Maximum value of partial dial time out. Per TS 101 909-4 [5].	pktcNcsEndPntConfigEntry	3		D
pktcNcsEndPntConfigCriticalDialTO	Maximum value of critical dial time out. Per TS 101 909-4 [5].	pktcNcsEndPntConfigEntry	4		D
pktcNcsEndPntConfigBusyToneTO	Timeout value for busy tone. Per TS 101 909-4 [5].	pktcNcsEndPntConfigEntry	5		D
pktcNcsEndPntConfigDialToneTO	Timeout value for dial tone. Per TS 101 909-4 [5].	pktcNcsEndPntConfigEntry	6		D
pktcNcsEndPntConfigMessageWaitingTO	Timeout value for the message waiting tone. Per TS 101 909-4 [5].	pktcNcsEndPntConfigEntry	7		D

Object name	Description	Object Identifier		Values	S/D/E
pktcNcsEndPntConfigOffHookWarnToneTO	Timeout value for the off-hook warning tone. Per TS 101 909-4 [5].	pktcNcsEndPntConfigEntry	8		D
pktcNcsEndPntConfigRingingTO	Timeout value for ringing. Per TS 101 909-4 [5].	pktcNcsEndPntConfigEntry	9		D
pktcNcsEndPntConfigRingBackTO	Timeout value for ring back. Per TS 101 909-4 [5].	pktcNcsEndPntConfigEntry	10		D
pktcNcsEndPntConfigReorderToneTO	Timeout value for re-order tone. Per TS 101 909-4 [5].	pktcNcsEndPntConfigEntry	11		D
pktcNcsEndPntConfigStutterDialToneTO	Timeout value for stutter dial tone. Per TS 101 909-4 [5].	pktcNcsEndPntConfigEntry	12		D
pktcNcsEndPntConfigTSMAx	Max time in seconds since the sending of the initial datagram.	pktcNcsEndPntConfigEntry	13	20 by default	S
pktcNcsEndPntConfigMax1	Suspicious error threshold for signalling messages.	pktcNcsEndPntConfigEntry	14	5 by default	S
pktcNcsEndPntConfigMax2	Disconnect error threshold for signalling messages.	pktcNcsEndPntConfigEntry	15	7 by default	S
pktcNcsEndPntConfigMax1QEnable	Enables or disables the Max1 Domain NameServer (DNS) query operation when Mzx1 expires.	pktcNcsEndPntConfigEntry	16	true by default	S
pktcNcsEndPntConfigMax2QEnable	Enables or disables the Max2 Domain NameServer (DNS) query operation when Mzx1 expires.	pktcNcsEndPntConfigEntry	17	true by default	S
pktcNcsEndPntConfigMWD	Maximum number of seconds an MTA waits after a restart.	pktcNcsEndPntConfigEntry	18	600 seconds by default	S
pktcNcsEndPntConfigTdInit	Initial number of seconds an MTA waits after a disconnect.	pktcNcsEndPntConfigEntry	19	15 by default	S
pktcNcsEndPntConfigTdMin	Minimum number of seconds an MTA waits after a disconnect.	pktcNcsEndPntConfigEntry	20	15 by default	S
pktcNcsEndPntConfigTdMax	Maximum number of seconds an MTA waits after a disconnect.	pktcNcsEndPntConfigEntry	21	600 by default	S
pktcNcsEndPntConfigRtoMax	Maximum number of seconds for the retransmission timer.	pktcNcsEndPntConfigEntry	22	4 by default	S
pktcNcsEndPntConfigRtoInit	Initial number of milliseconds for the retransmission timer.	pktcNcsEndPntConfigEntry	23	200 by default	S
pktcNcsEndPntConfigLongDurationKeepAlive	Timeout value in minutes for sending long duration call notification message.	pktcNcsEndPntConfigEntry	24	60 by default	S
pktcNcsEndPntConfigThist	Timeout period in seconds before no response is declared.	pktcNcsEndPntConfigEntry	25	30 by default	S
pktcNcsEndPntConfigStatus	The row status associated with the pktcNcsEndPntTable.	pktcNcsEndPntConfigEntry	26		S
pktcNcsEndPntConfigCallWaitingMaxRep	Maximum number of repetitions of the call waiting tone that the MTA will play from a single CMS request. A value of zero (0) can be used if the CMS is to control the repetitions of the call waiting tone.	pktcNcsEndPntConfigEntry	27	1 = default	S
pktcNcsEndPntConfigCallWaitingReply	Delay between repetitions of the call waiting tone that the MTA will play from a single CMS request.	pktcNcsEndPntConfigEntry	28		S

Object name	Description	Object Identifier		Values	S/D/E
pktcNcsEndPntStatusCallIpAddressType	Type of Internet address of the CMS currently being used for this endpoint	pktcNcsEndPntConfigEntry	44		S
pktcNcsEndPntStatusCallIpAddress	Internet address of the CMS currently being used for this endpoint. This internet address is used to create the appropriate security association.	pktcNcsEndPntConfigEntry	29		S
pktcNcsEndPntStatusError	Error status of the interface. "Operational state" indicates that all operations necessary to put the line in service have occurred. "NoSecurityAssociation" status indicates that no security association yet exists for this endpoint. "Disconnected" status indicates that the Security Association has been established and the NCS signalling software is in process of establishing the NCS signalling link via an RSIP exchange.	pktcNcsEndPntConfigEntry	30		S

A.4.3.1 Electrical signals associated with a single NCS endpoint

Table A.12 contains the electrical signals that can be associated with an individual NCS endpoint of an MTA. These elements are shown in a separate table in this annex in order to focus on their separate function whereas in the NCS signalling MIB, they are in the same table with the elements shown in table A.11. The "D" entries next to the pulse dial parameters result from the fact that pulse dial is not required for the LCS architecture. Whether it will be required in the full NCS architecture is a question outside the scope of the present document.

Table A.12

Object name	Description	Object ID		Values	S/D/E
pktcNcsEndPntConfigMinHookFlash	Minimum time a line needs to be on hook for a valid hook flash.	pktcNcsEndPntConfigEntry	31	300 ms by default.	S
pktcNcsEndPntConfigMaxHookFlash	Maximum time a line needs to be on hook for a valid hook flash.	pktcNcsEndPntConfigEntry	32	1 000 ms by default	S
pktcNcsEndPntConfigPulseDialInterdigitTime	Pulse dial interdigit timeout.	pktcNcsEndPntConfigEntry	33	100 ms by default	D
pktcNcsEndPntConfigPulseDialMinMakeTime	Pulse dial minimum make pulse width for the dial pulse.	pktcNcsEndPntConfigEntry	34	25 ms by default	D
pktcNcsEndPntConfigPulseDialMaxMakeTime	Pulse dial maximum make pulse width for the dial pulse.	pktcNcsEndPntConfigEntry	35	55 ms by default	D
pktcNcsEndPntConfigPulseDialMinBreakTime	Pulse dial minimum break pulse width.	pktcNcsEndPntConfigEntry	36	45 ms by default	D
pktcNcsEndPntConfigPulseDialMaxBreakTime	Pulse dial maximum break pulse width.	pktcNcsEndPntConfigEntry	37	75 ms by default	D
pktcNcsEndPntConfigNomJitterBufferSize	Current setting for the nominal amount of jitter the bti can compensate.	pktcNcsEndPntConfigEntry	38		D

Object name	Description	Object ID		Values	S/D/E
pktcNcsEndPntConfigMaxJitterBufferSize	Current setting for the maximum amount of jitter the bti can compensate.	pktcNcsEndPntConfigEntry	39		D
pktcNcsEndPntConfigOnHookDebounce	The length of the on-hook debounce.	pktcNcsEndPntConfigEntry	40	200 ms = default	D
pktcNcsEndPntConfigOffHookDebounce	The length of the off-hook debounce.	pktcNcsEndPntConfigEntry	41	100 ms = default	D
pktcNcsEndPntConfigTxGain	Per line transmitter gain.	pktcNcsEndPntConfigEntry	42	0 = default	S
pktcNcsEndPntConfigRxGain	Per line receiver gain.	pktcNcsEndPntConfigEntry	43	0 = default	S

History

Document history		
V1.1.1	March 2004	Publication