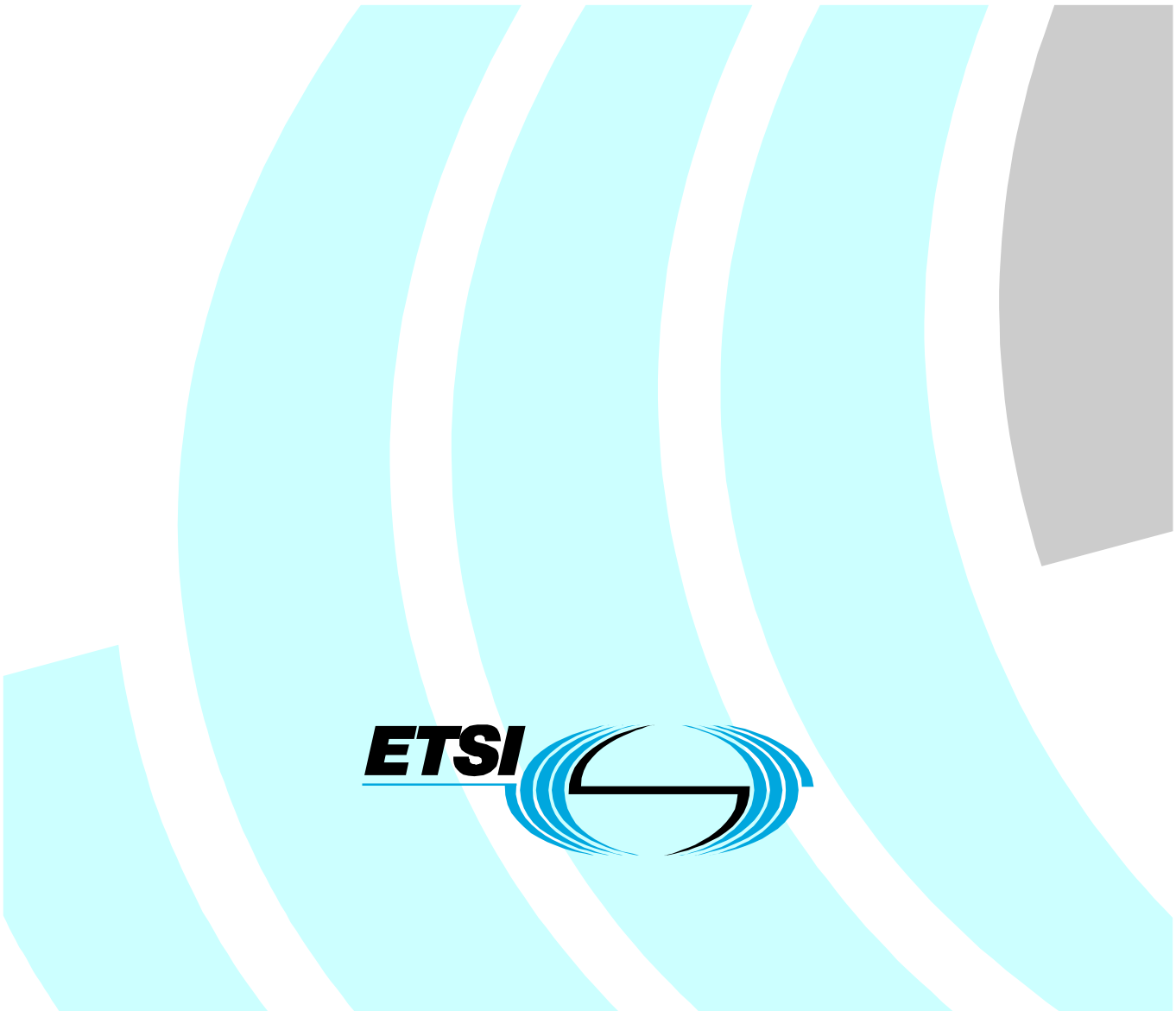
ETSI TR 101 963 V1.1.1 (2002-04)

Technical Report

Access and Terminals (AT);
Report on the Requirements of European Cable Industry for Implementation of IPCablecom Technologies;
Identification of high level requirements and establishment of priorities



Reference
DTR/AT-020021

Keywords
broadband, cable, multimedia, IPCable

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://webapp.etsi.org/IPR/home.asp).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

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

The present document is intended to be fully in line with initiative **"eEurope 2002 - An Information Society For All"**, under "The contribution of European standardization to the eEurope Initiative, A rolling Action Plan", especially under the key objectives:

1) Providing a cheaper, faster and more secure Internet:
   a) cheaper and faster Internet access;
   b) faster Internet for researchers and students;
   c) secure networks and smart cards.
2) Investing in people and skills:
   a) european youth into the digital age;
   b) working in the knowledge-based economy;
   c) participation for all in the knowledge-based economy.
3) Stimulating the use of the Internet:
   a) accelerating e-commerce;
   b) government online: electronic access to public services;
   c) health online;
   d) european digital content for global networks;
   e) intelligent transport systems.

Introduction

The present document reports on studies of the high level functionality for IPCablecom as defined by a number of European Cable Operators, equipment vendors and other interested parties, and makes an assessment of the relative priorities of these features, related to the expected roll-out needs of the various operators.

1 Scope

The present document aims to describe the high level service features of European Cable Communications Operators and the European cable industry for time critical multimedia IP Cable Communications, to analyse these, make an assessment of their relative priorities and to collate them into a Technical Report. The present work is intended to compliment the specifications issued by Cable Labs, ITU-T and ETSI, by the addition of the specific needs of European operators.

The present document defines the service features for the delivery of PSTN like telephone services. Future versions are expected to extend this set to include multimedia integrated services. While the initial service offerings in IPCablecom are anticipated to be Packet Voice and Packet Video, the long-term project vision encompasses a large family of packet-based services.

The present document is intended to form the basis of further ETSI work in developing a series of Specifications TS 101 909 by the addition of European specific content to existing material from PacketCable, SCTE and ITU-T. There will be an ongoing need to track subsequent developments with a range of interested parties including European cable operators, regulators and equipment vendors, for later inclusion in new or revised clauses of this ETSI Specification.

The European cable operators' needs are based on the IPCablecom Reference Architecture (see TS 101 909-2 [70], and PacketCable LCS Architecture. This report is mainly concerned with the exchange of the data and signalling information associated with voice telephony.

The present document lists these features by functional area and describes them in sufficient detail to define the service operation. Features are deliberately specified without analysing their impact on the underlying transport network. The end-to-end system defined by IPCablecom and forming the basis for the present document has been designed to run seamlessly across today's standardized, HFC-based, cable communication systems using either ES 200 800 [4] or ES 201 488 [5]. Therefore, it is assumed that the mechanisms necessary to implement the functionality listed in the present document will already be available at the transport layer.

The present document does not specify how any interfaces should be achieved; it is expected that these will mostly be served by existing specifications.

The present document does not specify which network interfaces should be published to satisfy the requirements of the of the EC Directive 1999/5/EC (RTTE Directive). Refer to ETSI TR 101 857 [71] for guidance on the publication of network interfaces.

2 References

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

[1] ITU-T Recommendation J.1: "Terms, definitions and acronyms applicable to the transmission of television and sound-programme signals and of related data signals".

[2] PacketCable PKT-TR-ARCH1.2-V01-001229: "PacketCable 1.2 Architecture Framework Technical Report".

NOTE: See http://www.packetcable.com/specs/PKT-TR-ARCH1.2-V01-001229.pdf

[3] "The Pulver Report" , J. Pulver, 2000.

NOTE: See http://pulver.com/reports/25sep00.html

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

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

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

[7] IETF RFC 2543: "SIP: Session Initiation Protocol".

[8] IETF RFC 2705: "Media Gateway Control Protocol (MGCP) Version 1.0".

[9] IETF RFC 2719: "Framework Architecture for Signalling Transport".

[10] IETF RFC 3015: "Megaco Protocol Version 1.0".

[11] IETF RFC 2960: "Stream Control Transmission Protocol".

[12] ETSI TS 101 909-13: "Access and Terminals (AT); Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 13: Trunking Gateway Control Protocol".

[13] ITU-T Recommendation G.965: "V-Interfaces at the digital local exchange (LE) - V5.2 interface (Based on 2048 kbit/s) for the support of access network (AN)".

[14] ITU-T Recommendation H.248: "Gateway control protocol".

[15] ITU-T Recommendation Q.767: "Application of the ISDN user part of CCITT signalling system No. 7 for international ISDN interconnections".

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

[17] ETSI EN 300 356: "Integrated Services Digital Network (ISDN); Signalling System No.7 (SS7); ISDN User Part (ISUP) version 4 for the international interface".

[18] ETSI EN 300 122: "Integrated Services Digital Network (ISDN); Generic keypad protocol for the support of supplementary services; Digital Subscriber Signalling System No. one (DSS1) protocol".

[19] ETSI EN 300 196: "Integrated Services Digital Network (ISDN); Generic functional protocol for the support of supplementary services; Digital Subscriber Signalling System No. one (DSS1) protocol".

[20] ETSI ETS 300 402: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Data link layer".

[21] ETSI EN 300 403: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Signalling network layer for circuit-mode basic call control".

[22] ETSI TR 102 088: "Public Switched Telephone Network (PSTN); Subscriber line protocol for Advice of Charge (AoC) display services".

[23] ETSI EN 300 052: "Integrated Services Digital Network (ISDN); Multiple Subscriber Number (MSN) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol".

[24] ETSI EN 300 058: "Integrated Services Digital Network (ISDN); Call Waiting (CW) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol".

[25] ETSI EN 300 064: "Integrated Services Digital Network (ISDN); Direct Dialling In (DDI) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol".

[26] ETSI EN 300 092: "Integrated Services Digital Network (ISDN); Calling Line Identification Presentation (CLIP) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol".

[27] ETSI EN 300 093: "Integrated Services Digital Network (ISDN); Calling Line Identification Restriction (CLIR) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol".

[28] ETSI ETS 300 128: "Integrated Services Digital Network (ISDN); Malicious Call Identification (MCID) supplementary service; Service description".

[29] ETSI EN 300 138: "Integrated Services Digital Network (ISDN); Closed User Group (CUG) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol".

[30] ETSI EN 300 141: "Integrated Services Digital Network (ISDN); Call Hold (HOLD) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol".

[31] ETSI EN 300 182: "Integrated Services Digital Network (ISDN); Advice of Charge (AOC) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol".

[32] ETSI EN 300 188: "Integrated Services Digital Network (ISDN); Three-Party (3PTY) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol".

[33] ETSI EN 300 199: "Integrated Services Digital Network (ISDN); Call Forwarding Busy (CFB) supplementary service; Service description".

[34] ETSI ETS 300 200: "Integrated Services Digital Network (ISDN); Call Forwarding Unconditional (CFU) supplementary service; Service description".

[35] ETSI EN 300 201: "Integrated Services Digital Network (ISDN); Call Forwarding No Reply (CFNR) supplementary service; Service description".

[36] ETSI EN 300 207: "Integrated Services Digital Network (ISDN); Diversion supplementary services; Digital Subscriber Signalling System No. One (DSS1)".

[37] ETSI EN 300 359: "Integrated Services Digital Network (ISDN); Completion of Calls to Busy Subscriber (CCBS) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol".

[38] ITU-T Recommendation G.711: "Pulse code modulation (PCM) of voice frequencies".

[39] ITU-T Recommendation T.38: "Procedures for real-time Group 3 facsimile communication over IP networks".

[40] ETSI TBR 021: "Terminal Equipment (TE); Attachment requirements for pan-European approval for connection to the analogue Public Switched Telephone Networks (PSTNs) of TE (excluding TE supporting the voice telephony service) in which network addressing, if provided, is by means of Dual Tone Multi Frequency (DTMF) signalling".

[41] ETSI ETS 300 437: "Broadband Integrated Services Digital Network (B-ISDN); Signalling ATM Adaptation Layer (SAAL); Service Specific Co-ordination Function (SSCF) for support of signalling at the User-Network Interface (UNI)".

[42] ETSI TBR 038: "Public Switched Telephone Network (PSTN); Attachment requirements for a terminal equipment incorporating an analogue handset function capable of supporting the justified case service when connected to the analogue interface of the PSTN in Europe".

[43] ETSI ES 201 187: "2-wire analogue voice band interfaces; Loop Disconnect (LD) dialling specific requirements".

[44] ETSI ES 201 729: "Public Switched Telephone Network (PSTN); 2-wire analogue voice band switched interfaces; Timed break recall (register recall); Specific requirements for terminals".

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

[46] ETSI ETR 206: "Public Switched Telephone Network (PSTN); Multifrequency signalling system to be used for push-button telephones [CEPT Recommendation T/CS 46-02 E (1985)]".

[47] 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".

[48] ETSI EN 300 001: "Attachments to the Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".

[49] ETSI EN 300 659-1: "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; Part 1: On-hook data transmission".

[50] ETSI EN 300 659-2: "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; Part 2: Off-hook data transmission".

[51] ETSI EN 300 659-3: "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; Part 3: Data link message and parameter codings".

[52] ETSI EN 300 778-1: "Access and Terminals (AT); Analogue access to the Public Switched Telephone Network (PSTN); Protocol over the local loop for display and related services; Terminal Equipment requirements; Part 1: On-hook data transmission".

[53] ETSI EN 300 778-2: "Access and Terminals (AT); Analogue access to the Public Switched Telephone Network (PSTN); Protocol over the local loop for display and related services; Terminal Equipment requirements; Part 2: Off-hook data transmission".

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

[55] ETSI ETR 133: "Radio Equipment and Systems (RES); HIgh PErformance Radio Local Area Networks (HIPERLAN); System definition".

[56] Commission Directive of 28 June 1990 on competition in the markets for telecommunications services.

[57] Directive 97/33/EC of the European Parliament and of the Council of 30 June 1997 on interconnection in Telecommunications with regard to ensuring universal service and interoperability through application of the principles of Open Network Provision (ONP).

[58] Directive 97/66/EC of the European Parliament and of the Council of 15 December 1997 concerning the processing of personal data and the protection of privacy in the telecommunications sector.

[59] Directive 98/10/EC of the European Parliament and of the Council of 26 February 1998 on the application of open network provision (ONP) to voice telephony and on universal service for telecommunications in a competitive environment.

[60] Directive 98/61/EC of the European Parliament and of the Council of 24 September 1998 amending Directive 97/33/EC with regard to operator number portability and carrier pre-selection.

[61] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

[62] Commission Directive 1999/64/EC of 23 June 1999 amending Directive 90/388/EEC in order to ensure that telecommunications networks and cable TV networks owned by a single operator are separate legal entities.

[63] Council Resolution of 17 January 1995 on the lawful interception of telecommunications; OJ C 1996/329, 04.11.1996, page 1.

[64] Status of voice communications on Internet under Community law and, in particular, pursuant to Directive 90/388/EEC (98/C 6/04) C 6/4 10. 1. 98 Official Journal of the European Communities, page 4.

[65] 12.7.2000 EN C 197/1 Official Journal of the European Communities (Acts adopted pursuant to Title VI of the Treaty on European Union) council act of 29 May 2000 establishing in accordance with Article 34 of the Treaty on European Union the Convention on Mutual Assistance in Criminal Matters between the Member States of the European Union (2000/C 197/01), page 1.

[66] Communication from the commission: Status of voice on the Internet under Community law, and in particular, under Directive 90/388/EEC Supplement to the Communication by the Commission to the European Parliament and the Council on the status and implementation of Directive 90/388/EEC on competition in the markets for telecommunications services (2000/C 369/03), page 3.

[67] Explanatory report on the Convention of 29 May 2000 on Mutual Assistance in Criminal Matters between the Member States of the European Union (Text approved by the Council on 30 November 2000) (2000/C 379/02), page 7.

[68] COM(2000) 393 final 2000/0184 (COD) Proposal for a directive of the european parliament and of the council on a common regulatory framework for electronic communications networks and services.

[69] ETSI ES 201 671: "Telecommunications security; Lawful Interception (LI); Handover interface for the lawful interception of telecommunications traffic".

[70] ETSI TS 101 909-2: "Access and Terminals (AT); 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".

[71] ETSI TR 101 857: "Access and Terminals (AT); Broadband access to the Public Telecommunications Network; Publication of interface specification under Directive 1999/5/EC, art. 4.2; Guidelines for describing Multimedia Cable Network Interfaces".

[72] ITU-T Recommendation P.861:"Objective quality measurement of telephone-band (300-3400 Hz) speech codecs".

[73] ITU-T Recommendation G.107: "The E-Model, a computational model for use in transmission planning".

[74] ITU-T Recommendation G.108: "Application of the E-model: A planning guide".

[75] ITU-T Recommendation G.108.1: "Conversational impacts on end-to-end speech transmission quality - Evaluation of effects not covered by the E-model".

[76] ITU-T Recommendation G.109: "Conversational impacts on end-to-end speech transmission quality - Evaluation of effects not covered by the E-model".

[77] ITU-T Recommendation G.1000: "Communications quality of service: A framework and definitions".

[78] ETSI EN 301 437 Terminal Equipment (TE); Attachment requirements for pan-European approval for connection to the analogue Public Switched Telephone Networks (PSTNs) of TE supporting the voice telephony service in which network addressing, if provided, is by means of Dual Tone Multi Frequency (DTMF) signalling.

[79] ETSI ES 201 970 Access and Terminals (AT); Public Switched Telephone Network (PSTN); Network Termination Point (NTP) analogue interface: Harmonized specification of physical and electrical characteristics at a 2-wire analogue presented NTP.

[80] ETSI EG 201 450: "Guidance on the identification of Harmonized Standards and/or other technical specifications for Radio equipment and Telecommunications Terminal Equipment (R&TTE) covering requirements under Article 3.1 of Directive 1999/5/EC".

[81] Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility.

NOTE: This document is also called EMC directive.

[82] Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.

NOTE: This document is also called LV directive.

[83] ETSI EG 201 185: "Terminal support interface for harmonized analogue PSTN terminals".

[84] PKT-TR-VoIPAR-V01 001128: "VoIP Availability and Reliability Model for the PacketCable™ Architecture Technical Report".

NOTE: See http://www.packetcable.com/specs/pkt-tr-voipar-v01-001128.pdf

[85] ETSI EG 202 086 Speech Processing, Transmission and Quality Aspects (STQ); Objectives and principles for the transmission performance of multiple interconnected networks that aim to provide "traditional quality" telephony services.

[86] ETSI EG 201 050 Speech Processing, Transmission and Quality Aspects (STQ); Overall Transmission Plan Aspects for Telephony in a Private Network.

3 Definitions and abbreviations

3.1 Definitions

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

On-Net(work): voice call or data transmission session in which the originating and terminating devices are connected to a single IPCablecom network which may consist of one or more zones or domains

Off-Net(work): voice call or data transmission session in which either the originating or terminating device is connected to an IPCablecom network which is interconnected to another network which is supporting the second terminal

zone: access devices in one or more HFC access networks, managed by a single functional CMS

NOTE: Interfaces between functional components within a single zone are defined in the IPCablecom specifications.

domain: made up of one or more IPCablecom zones that are operated and managed by a single administrative entity

NOTE: An IPCablecom domain may also be referred to as an administrative domain.

Access Node: is a layer two termination device that terminates the network end of the MAC-layer connection

NOTE: It is technology specific. In ES 200 800 it is called the INA while in ES 201 488 it is the CMTS.

Cable Modem: layer two termination device that terminates the customer end of the MAC-layer connection

Cable Modem Termination System (CMTS): located at the cable television system headend or distribution hub, which provides complementary functionality to the cable modems to enable data connectivity to wide-area network services

Cable Modem Termination System - Network Side Interface (CMTS-NSI): interface between a CMTS and the equipment on the access network side

Circuit Switched Network (CSN): traditional switched telephone system to include both public and private networks

NOTE: See also the definition of the Public Switched Telephone Network (PSTN).

distribution hub: location in a cable television network which performs the functions of a Headend for customers in its immediate area, and which receives some or all of its television program material from a Master Headend in the same metropolitan or regional area

headend: central location on the cable network that is responsible for injecting broadcast video and other signals in the downstream direction

NOTE: See also Master Headend, Distribution Hub.

Interactive Network Adapter (INA): functional component of the cable access network located at the headend or distribution hub; provides management and communication services to the cable modems and enables connectivity to the core network; the equivalent of a CMTS in ES 200 800 compliant cable television networks

interface: According to R&TTE-D, art2. (e): "a network termination point, which is a physical connection point at which a user is provided with access to public telecommunications network, and/or an air interface specifying the radio path between radio equipment and their technical specifications".

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

master headend: headend which collects television program material from various sources by satellite, microwave, fibre and other means, and distributes this material to Distribution Hubs in the same metropolitan or regional area

NOTE: A Master Headend may also perform the functions of a Distribution Hub for customers in its own immediate area.

Network Termination Point (NTP): point at which the network operator describes the characteristics of service provided and beyond which their responsibility for the service ceases

NOTE: See also "interface" according to R&TTE-D.

Network Equipment (NE): equipment forming the Public Operator's Network up to and including NTP, relevant for the provision of telecommunications services

Open Systems Interconnection (OSI): framework of ISO standards for communication between different systems made by different vendors, in which the communications process is organised into seven different categories that are placed in a layered sequence based on their relationship to the user

NOTE: Each layer uses the layer immediately below it and provides a service to the layer above. Layers 7 through 4 deal with end-to-end communication between the message source and destination, and layers 3 through 1 deal with network functions.

Public Network Operator (PNO): anyone providing publicly available telecommunications services over a network to which terminal equipment can be connected, either via a fixed network terminating point or an air interface for radio terminals

Public Service Provider (PSP): provider of publicly available telecommunications service(s) who provides service from one or more sets of apparatus connected to a Public Network, but does not itself operate a network

Public Switched Telecommunications Network (PSTN): telecommunications network used to provide publicly available telecommunications services

NOTE: In the context of the present document, the PSTN is assumed to be based on circuit switched technology. The PSTN mainly provides telephony services, but it is also used for other applications such as facsimile and data transport and may use packet or TDM based transmission systems.

Radio Frequency (RF): in cable television systems, this refers to electromagnetic signals in the range 5 to 1 000 MHz

Telecommunication Terminal Equipment (TTE): According to R&TTE-D, art. 2.b: "a product enabling communication or a relevant component thereof which is intended to be connected directly or indirectly by any means whatsoever to interfaces of public telecommunications networks (that is to say, telecommunications networks used wholly or partly for the provision of publicly available telecommunications services)".

3.2 Abbreviations

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

3PTY	Three ParTY calling
AN	Access Node
ANS	ANnouncement Server
BRI	Basic Rate ISDN (Integrated Services Digital Network)
CC	Call Content
CEC	Commission of the European Communities

CFB	Call Forward Busy
CFU	Call Forward Unconditional
CM	Cable Modem
CMS	Call Management Server
CMTS	Cable Modem Termination System
CPE	Customer Premises Equipment (equivalent to TTE)
CRD	Call Related Data
CSN	Circuit Switched Network
NOTE:	(generally equivalent to PSTN but including private networks)
CW	Call Waiting
DCS	Distributed Call Signalling
DDI	Direct Dialling In
DHCP	Dynamic Host Configuration Protocol
DLE	Digital Local Exchange
DSS1	Digital Subscriber Signalling No1
DTMF	Dual Tone Multi Frequency
DVB	Digital Video Broadcasting
ECCA	European Cable Communications Association
EMC	ElectroMagnetic Compatibility
E-MTA	Embedded Multimedia Terminal Adapter (MTA)
EU	European Union
FQDN	Fully Qualified Domain Name
FSK	Frequency Shift Keying
HFC	Hybrid Fibre Coax
HOLD	call HOLD
IETF	Internet Engineering Task Force
IN	Intelligent (telephony) Network
INA	Interactive Network Adapter
IP	Internet Protocol (internet network-layer protocol)
IRI	Intercept Related Information
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
ISTP	Internet Signalling Transport Protocol
ISUP	Integrated Services digital network User Part
LCS	Line Control Signalling
MAC	Medium Access Control
MDU	Multi-Dwelling Unit (apartment block)
MG	Media Gateway
MGC	Media Gateway Controller
MGCP	Media Gateway Control Protocol
MGW	Media GateWay
MIB	Management Information Base
MOS	Mean Opinion Score
MTA	Multimedia Terminal Adapter
NAT	Network Address Translation
NCS	Network Call Signalling
NRA	National Regulation Authority
NSI	Network Side Interface
NTP	Network Termination Point
ONP	Open Network Provision
OPTA	Onafhankelijke Post en Telecommunicatie Autoriteit (the Netherlands regulatory body)
OSI	Open Systems Interconnection
OSS	Operational Support System
PNO	Public Network Operator
POTS	Plain Ordinary Telephone Service
PSP	Public Service Provider
PSQM	Perceptual Speech Quality Measurement
PSTN	Public Switched Telephone Network
QoS	Quality of Service
R&TTE	Radio Equipment and Telecommunications Terminal Equipment
R&TTE-D	Directive 1999/5/EC, commonly designated R&TTE Directive

RF	Radio Frequency
RFI	Request For Information
SCN	Sub-Channel Number
SCP	Service Control Point
SG	Signalling Gateway
SIGTRAN	SIGnalling TRANsport
SIP	Session Initiation Protocol
SS7	Signalling System No. 7

NOTE: (also known as ITU-T No. 7 Signalling System)

SSP	Signalling Switching Point
STP	Signalling Transport Protocol
TCAP	Transaction Capabilities Application Part (SS7)
TGCP	Trunking Gateway Control Protocol
TTE	Telecommunications Terminal Equipment (equivalent to CPE)
VoIP	Voice over Internet Protocol

4 Fundamental Service Definition

The European cable operator's service definition is based broadly on the IPCablecom Reference Architecture (ITU-T Draft Recommendations J.160, J.162 and J.112, see bibliography). Within this architecture, several networks of differing types may be interconnected to offer an end-to-end service, e.g. telephony. This clause is specifically concerned with the European cable operator's service definition for the exchange of data and signalling messages within the IPCablecom domain and between the IPCablecom domain and other network domains.

NOTE: Several participants in the study were concerned that the possibility of 'engineering scope creep' and that this might result in excessive complexity of some of the features provided, with a corresponding cost impact on the hardware or software. Particular concern has been expressed about increased complexity (and cost) of the MTA, particularly as millions of these will be deployed in the operators' networks resulting in a major increase in network deployment costs. Even when the Cable Modem becomes a consumer item, increased end-user cost in this area may act as a disincentive to network roll-out and service uptake. All features and options need to consider the cost of the MTA as a major factor; new features will be backward compatible to avoid where possible the replacement of MTAs.

4.1 General

The fundamental need of the european cable operators is to have the ability to deliver over their HFC networks, voice telephony services which are indistinguishable to the end-user in performance and functionality from those delivered from modern DLEs over conventional PSTN or CSN. There is the need to compete with the incumbent PNOs in Europe, whilst the many cable operators with existing voice networks need to be able to demonstrate equivalent or superior capability compared with their existing networks. At the present time, there is no desire to enhance these services unless this can be accomplished without a significant cost penalty.

Secondly, there is an important challenge to vendors; it is essential that the problem of backwards service compatibility is properly understood before their solutions are defined. It has been said that there are over 3 000 features in a modern DLE, some legacy, but many derived from years of implementing subscriber needs, government mandates and operator marketing analysis (see "The Pulver Report", J. Pulver, 2000 [3]). It is alarming to hear that some vendors are talking of porting the twenty-five most-needed features, or the seventy-five most-revenue-producing features of the DLE. It is not sufficient to simply port subsets of the whole feature set, without an understanding of the problem which caused the feature to be created in the first place. Potential IPCablecom operators consider a more complete feature set as their goal, with feature availability phased in over time based on the commercial needs of subscribers and operators.

Thirdly, cable operators need to have a clear migration path from the provision of voice services via their HFC networks to the provision of advanced multimedia services using the same access network and headend infrastructure.

Finally, the report of the ECCA working party on IPCablecom expresses the view that wherever possible the standards employed should be readily translatable to other broadband access media, e.g. xDSL or wireless, in order to avoid a multiplicity of standards and incompatible service offerings (though it is well recognized that in many of these areas appropriate standards already exist) except where traffic characteristics, availability goals, operator needs, or new services for cable (example: broadcast video, interactive video, video on demand) require new, enhanced, or specific standards.

The operators' plans are grouped in the three phases defined below, each relating to an estimate of the required time to market.

- **Phase 1** indicates that a feature or characteristic is needed for immediate implementation by network operators and should therefore be defined in the first release of the specification.
- **Phase 2** indicates features which are needed to be capable of being implemented by network operators not later than the end of 2003.
- **Phase 3** indicates features which are not expected to be needed for implementation before the end of 2003.

If no Phase is indicated for a given feature, then that feature is needed immediately with the first release (equivalent to Phase 1). It should also be noted that the stated dates are latest at which the service or feature is needed to be available to the customer. Any earlier provision of some or all of the functionality of a feature may be an advantage to or specifically requested by some operators.

4.2 Additional core network interface functionality

4.2.1 QoS (Phase 1)

National specific regulatory voice quality licence requirements may be applicable in some European Countries but in general IPCablecom voice quality must be equivalent or better than existing PSTN service in order to gain acceptance in the marketplace. This level of voice quality is sometimes referred to as "Carrier Quality Voice". IPCablecom is not expected to outperform the PSTN; it is sufficient that the voice quality capability of the IP-based network is comparable to the existing PSTN, as perceived by the end-user.

Carrier Quality voice service has been quantified by the use of the Mean Opinion Score (MOS) measurement system. In most administrations a MOS score of four (4) or higher is considered "Carrier Quality". An alternative quantitative method is called Perceptual Speech Quality Measurement (PSQM) that is roughly based on ITU-T Recommendation P.861 [72]. In the PSQM system a score of 1,69 is the approximate equivalent to a MOS score of 4. Note that higher MOS scores indicate better voice quality whilst lower PSQM scores indicate better voice quality.

EG 201 377-2 (see bibliography), when published, will describe aspects of Mouth-to-Ear speech transmission quality over networks including terminals. The present document should in the future be the base for voice quality of PSTN-like voice services. In the mean time EG 201 050 [86] can be used for the most relevant aspects of Cable networks as far as they will not be fully integrated in PSTN.

EG 202 086 [85] establishes objectives and principles for the transmission performance of multiple interconnected networks that aim to provide "traditional quality" telephony services.

NOTE: Most recent ITU-T Recommendations, e.g. G.107 [73], G.108 [74], G.108.1 [75], G.109 [76], G.1000 [77] may be of particular value in this area.

Analogue Voice Service levels - Definitions:

Primary Line service - This service level is generally defined as "Carrier quality" (prioritized) voice with the system being designed for specific (low) call blocking rates and most importantly with high availability goals (requiring the network equipment to have battery backup, and network power feeding or dedicated battery backup for customer located equipment). High levels of supplementary service (calling feature) provision are also expected by customers (see clause 10).

Secondary Line service - This service is not clearly defined by any recognized standard. In general it appears to refer to voice services which are not necessarily of "Carrier quality", perhaps with higher call blocking rates, lower levels of feature provision, inferior MOS or PSQM values and/or lower availability goals (best effort, non-battery backup). Customer expectations would also include a lower cost for such a service.

Practical networks should be designed to meet the quality definitions of all IPCablecom real-time services, including voice. It should be ensured that packet loss rate, jitter and latency (delay) performance of the HFC Access and Managed IP networks are such as can meet the user's perception of adequate service quality. This will usually be influenced by a combination of these parameters; overall network performance should be such as to meet the needs of all IPCablecom real-time services. Acceptable jitter and packet loss performance are for further study as is the need to specify an overall measure of QoS. As an option, some operators may choose to provide a secondary line service (at lower cost) if the end users can be convinced that the quality versus price versus service trade off to be acceptable.

Availability (of service to the end user) is an important customer expectation. There is no universally accepted standard for this, different operators setting their own goals which seem generally to be in the range 99,95 % to 99,999 %, corresponding to outages of between 265 and 5 minutes per annum. Figures from Telcordia (formerly Bellcore) suggest that systems might, be expected to attain 99,94 % (315 minutes) whilst a report (PKT-TR-VoIPAR-V01 001128 [84]) from the CableLabs PacketCable group on the expected performance of an HFC-IP network suggests that availability in the access network might be about 99,942 % (305 minutes outage per annum). Note that these figures include an allowance for core network unavailability, this aspect of IPCablecom clearly requires clarification of operators' (and their customers') expectations and further study as to how these might be achieved in practical networks.

The present edition of this report includes only voice services and intentionally makes no attempt to specify the QoS requirements for any other services.

4.2.2 Supporting trunking gateways to PSTN (Phase 1)

While the support of SS7 trunks to the PSTN is mandated by national specific regulations, interfacing to support internal MG to MGC interfaces is an option. This interface may be based on either
ITU-T Draft Recommendation J.171 (see bibliography), recently published as TS 101 909-13 [12] which is expected to allow for options of a profile based on MGCP or one based on ITU-T Recommendation H.248 (MEGACO) [14]. The latter is assigned to Phase 2 of the network operators' service definitions and is for further study.

4.2.3 Supporting signalling gateways to SS7 networks

The following functionality is also necessary in the indicated time scales (as defined above):

- Full support of SS7 signalling protocol including connectivity to STP and SCP for the circuit connection and provision of number translation services and other Intelligent Network (IN) facilities (Phase 1)

  - Transactions (TCAP) to the public network SCPs: specifically, Freephone translation and Pre-paid card verification IN features. Support as defined in specific national implementations (Phase 1).

  - Signalling (ISUP) to the public network SSPs: within the SS7 ITU-T Recommendation Q.767 [15], i.e. ETSI ISUP V.2, (EN 300 356 [17]). Support as defined in specific national implementations (Phase 1).

- Where practicable within the framework of IPCablecom, support of the appropriate protocols as needed for the above functionality defined for SIGTRAN [8], [10] may be seen as Phase 3. Interfacing to support this functionality is already under study for annex B of ITU-T Draft Recommendation J.165 (see bibliography), shortly to be published as TS 101 909-12 (see bibliography).

4.3 Reference networks

The needs of the European cable industry are based on the IPCablecom Reference Architecture (see bibliography). Within this architecture, several types of networks are interconnected to offer an end-to-end service. This clause is concerned with the needs of European cable operators for the exchange of data and signalling messages between the IPCablecom domain and other network domains. Figure 1 shows the components of the IPCablecom domain in relation to other networks and the end-to-end service domain.

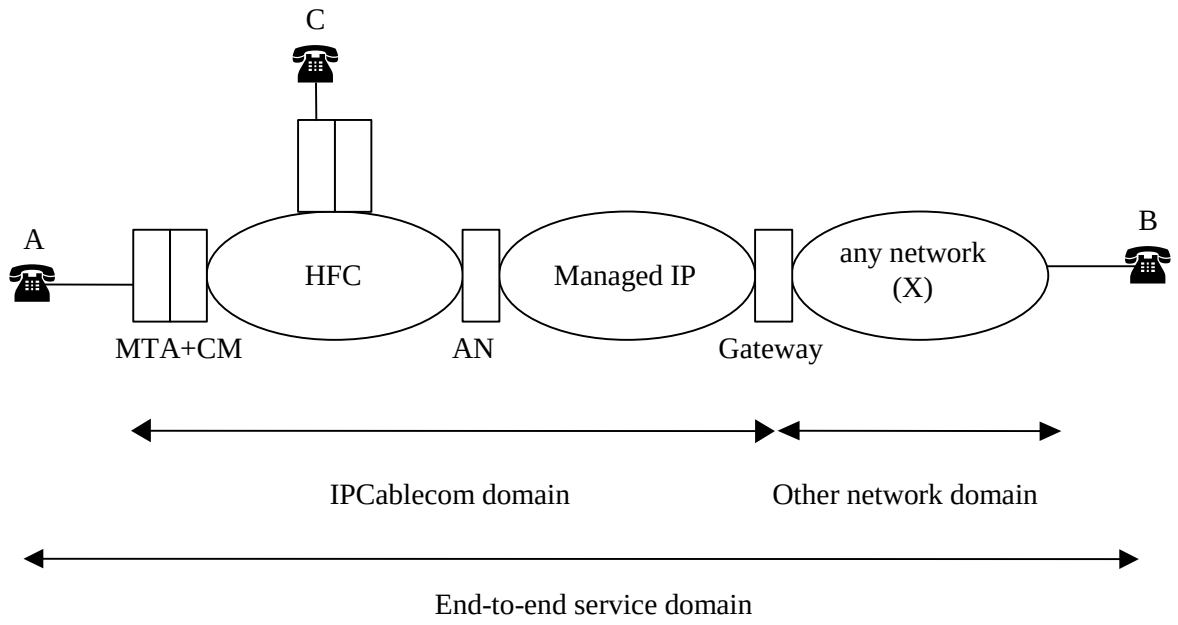


Figure 1: Network interconnection for IPCablecom

In this scenario, the IPCablecom domain is one part of the end-to-end service domain. There are two networks within the IPCablecom domain: the Hybrid Fibre/Coax cable television network (HFC) and a managed portion of the IP network. Both networks are used to connect the functional components of the IPCablecom architecture. The AN between the two networks will be a CMTS if the HFC network complies with ES 201 488 [5] (DOCSIS and Euro-DOCSIS) or an INA in the case of an HFC network according to ES 200 800 [4] (DVB-RCC). The present document does not preclude the use of other broadband access media or standards as the underlying transport layer.

The IPCablecom objective is to support two possible architectures:

While the initial service offerings in IPCablecom are anticipated to be Packet Voice and Packet Video, the long-term project vision encompasses a large family of packet-based services.

1) Network Control Signalling (NCS) - this supports a set of distributed components inside the Managed IP network that provide integrated multimedia services to the cable subscriber; intelligence is mostly in the Managed IP network.

2) Line control signalling (LCS) - this supports a remote digital line (V5) interface a DLE; the services provided are the services supported by that interface and the DLE; intelligence is mostly in the DLE.

Between the IPCablecom domain and the domain of any other network there will be a gateway device, providing the appropriate interface.

4.3.1 Off-network calls using NCS

In the first phase of NCS, on-network IP to IP calls is assumed to be restricted to one zone and one domain. For off-network calls, the PSTN will be used. In this case interworking is necessary between the IP network and the CSN/PSTN. Within the IPCablecom architecture this function is carried out by a PSTN Gateway. Applicable protocols are defined in TS 101 909-12 (see bibliography) and TS 101 909-13 [12].

The PSTN-gateway consists of three functional parts:

- SG (Signalling Gateway) - provides a signalling connection between the networks;
- MG (Media Gateway) - provides the bearer connection between the networks;
- MGC (Media Gateway Controller) - controls the overall behaviour of the CSN/PSTN Gateway.

A MG can provide partial or full features that are requested by a MGC.

4.3.2 Off-network using IPCablecom network

In this situation interworking is not necessary. Packets will be travelling through the IP networks without bearer conversion. However, there is a need for the interchange of signalling information between Call Management Servers.

As in the case of a circuit switched network, the gateway will need to support part or all of the feature set of the CMS.

4.3.3 LCS: V5.2 Gateway connection to PSTN

An alternative implementation of a PSTN gateway is to use a V5.2 access to a DLE, which in turn handles all on-network and off-network calls, including calls to the PSTN. In the case, the implementation may be based on the mapping of the NCS protocol to V5.2. For details see clause 5.2.

4.3.4 Packet switched network

In this situation interworking is not required. Packets will be travelling through the IP networks without bearer conversion. The gateway in this case could be a router configuration, but due to issues such as IP number plans, latency, standard interfaces, etc, this needs further study. There is a need for the interchange of signalling information between Call Management Servers. The existing IPCablecom specifications describe only the first case, that of connections from an IP network to the CSN or PSTN. As operators' IP-based networks develop, application of the IP/CSN case will inevitably diminish and the IP/IP interconnection case will need to be given further attention.

Network interfaces between two IP networks will use protocols such as SIP, MGCP, MEGACO/H.248 [14], H.323 and SIGTRAN.

SIP (Session Initiation Protocol) is for interfacing between call servers [6].

To control Media Gateways, there are:

- MGCP (Media Gateway Control Protocol) [7];
- ITU-T H.248 [14], equivalent to IETF MEGACO [9].

SIGTRAN (SIGnalling TRANsport) describes signalling requirements and protocols [8], [10]

4.4 IPCablecom architecture framework

At a very high level, the IPCablecom architecture contains three network types: the "HFC Access Network", one or more "Managed IP Networks" and the PSTN (or other CSN). The Access Node (AN) provides connectivity between the Access Network and the IP Network. The Signalling Gateway (SG) and the Media Gateway (MG) provide the signalling and media connectivity between the "Managed IP Network" and the PSTN. The reference architecture for IPCablecom is shown in figure 2.

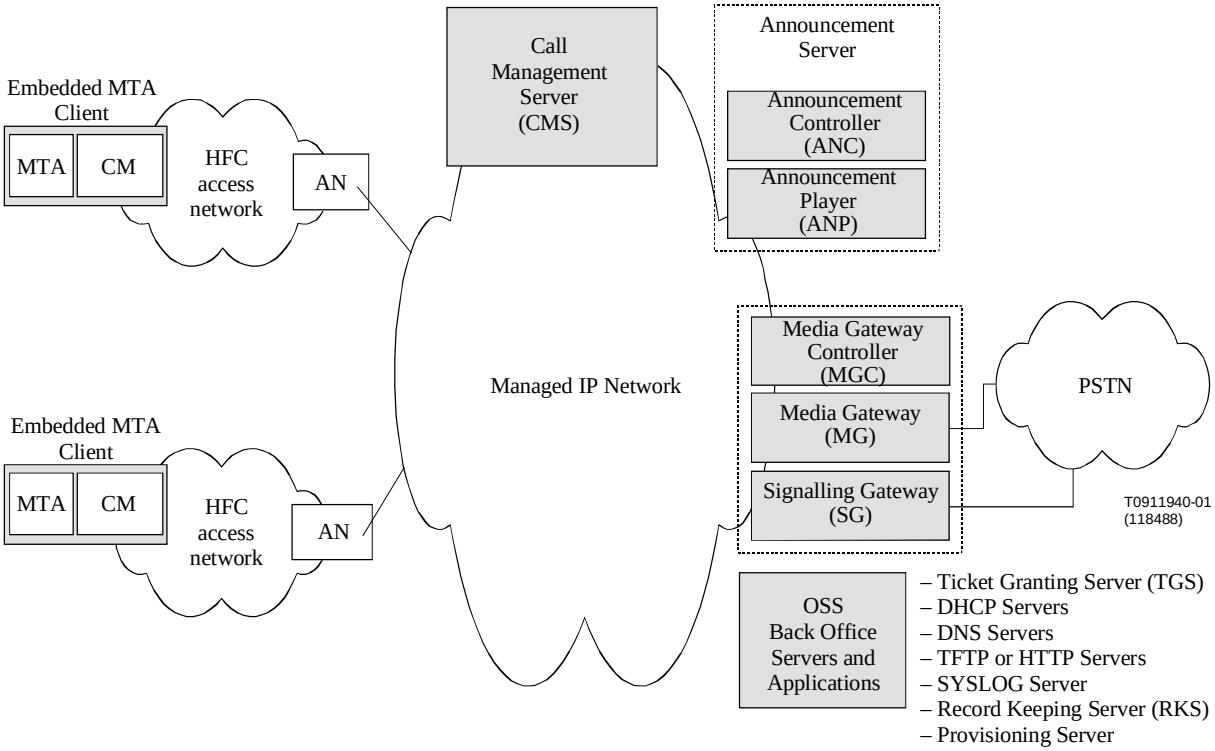


Figure 2: IPCablecom reference architecture

The HFC access network provides high-speed, reliable, and secure transport between the customer premise and the cable headend. This access network may provide all capabilities including Quality of Service. The HFC access network includes the following functional components: the Cable Modem (CM), Multimedia Terminal Adapter (MTA), and the Access Node (AN).

The Managed IP network serves several functions. First, it provides interconnection between the basic IPCablecom functional components responsible for signalling, media, provisioning, and quality of service establishment. In addition, the managed IP network provides long-haul IP connectivity between other Managed IP and HFC networks. The Managed IP network includes the following functional components: Call Management Server (CMS), Announcement Server (ANS), several Operational Support System (OSS) back-office servers, Signalling Gateway (SG), Media Gateway (MG), and Media Gateway Controller (MGC).

Implementations of this architecture will support the functional component capabilities. Various functional components may be bundled into single pieces of physical equipment or software. Thus TGCP and ISTP can be considered 'internal' interfaces or requested to be interoperable and open based on the operator's RFI requests

The interface between CMS and CMS could be also be considered as either internal or as an open interoperable interfaces.

4.5 IPCablecom zones and domains

An IPCablecom zone consists of the set of MTAs in one or more HFC access networks that are managed by a single functional CMS as shown in figure 3. Interfaces between functional components within a single zone are defined in the IPCablecom specifications. Interfaces between zones (e.g. CMS-CMS) have not been defined and will be addressed in future phases of the IPCablecom architecture.

An IPCablecom domain is made up of one or more IPCablecom zones that are operated and managed by a single administrative entity. An IPCablecom domain may also be referred to as an administrative domain. Interfaces between domains have not been defined in IPCablecom and are for further study.

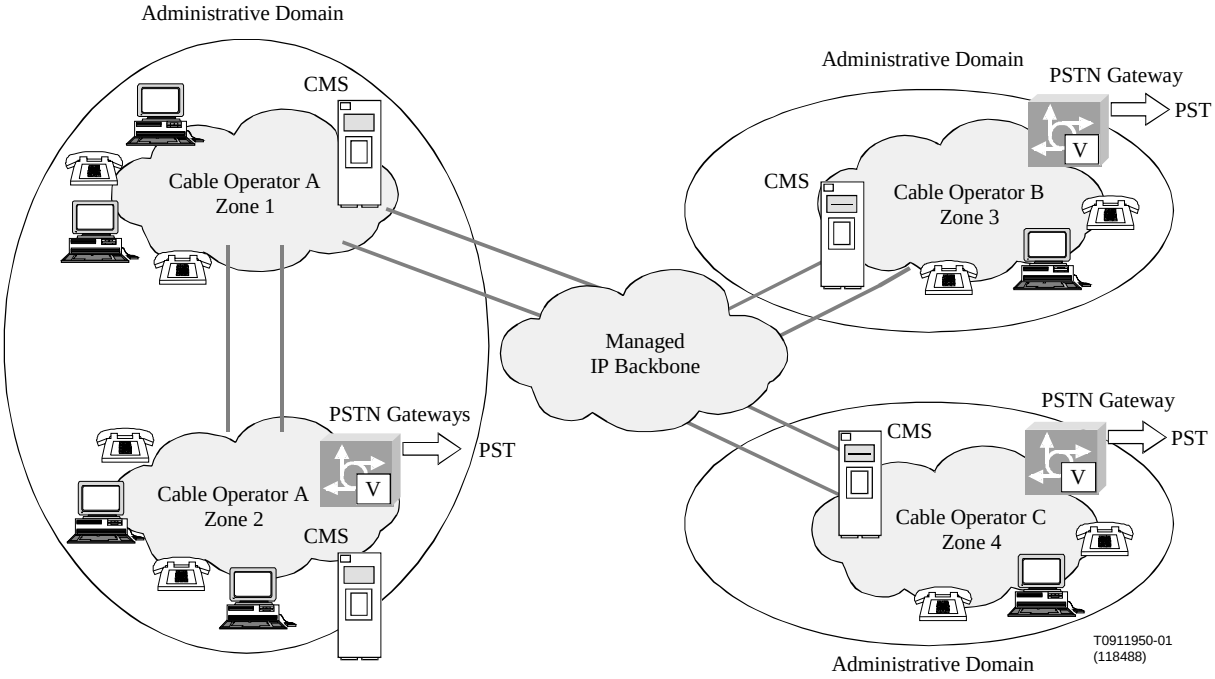


Figure 3: Zones and administrative domains

4.6 Detailed network functionality

4.6.1 IPCablecom network interfaces

Between the IPCablecom zones or domains and the domain of another network there will need to be a gateway for interfacing purposes. For telephony services, network X could be a conventional circuit switched network or another packet switched network using either IPCablecom or some other packet switched technology.

4.6.1.1 Circuit switched network

For off-network calls, interworking is necessary between IP and CSN and vice versa. Within the IPCablecom architecture this function is carried out by a CSN/PSTN Gateway. Applicable protocols are defined in TS 101 909-12 (see bibliography) and TS 101 909-13 [12].

As noted above, this gateway consists of three functional parts:

- SG (Signalling Gateway) - provides a signalling connection between the networks;
- MG (Media Gateway) - provides the bearer connection between the networks;
- MGC (Media Gateway Controller) - controls the overall behaviour of the Gateway.

4.6.1.2 IPCablecom packet switched network

For off-network calls, conversion will not usually be necessary but in some instances the MGW may need to perform bearer informational conversion functions such as vocoder, transcoder and/or echo cancellation functions on voice payloads at the network boundaries. Data Packets will be carried seamlessly through multiple IP networks without the need for bearer conversion.

The gateway in this case might simply be a router configuration, but due to the fact that there is a need for interchange of both signalling and media information between the networks, in order to offer telephony and, eventually, other time critical services it is expected to be more complex than this in practice.

Readers should be aware that this gateway interface is **not** equivalent to the call signalling interface 'Pkt-c2' of the IPCablecom reference architecture (ITU-T Recommendation J.160, see bibliography). Pkt-c2 interface is between CMS and CMS and, thus, wholly within the IPCablecom domain (intra-networking). This clause is concerned with definition of the interface for traffic leaving the IPCablecom domain, that is, the case of a call terminating in the circuit switched network (CSN) after originating or passing through a packet based network (inter-networking).

An example might be that of traffic between two cable networks administered by different cable operators. If the traffic is transiting another network or is going directly from the first operator's domain into the others is of no importance. Each cable operator maintains its own domain and there is no direct connection at the CMS level between these domains. As in the case of a circuit switched network, the gateway may need to support any or all of the features of the CMS.

4.6.1.3 IPCablecom Phase 1 (NCS/MGCP), Phase 2 (H.248/MEGACO) and other packet switched network inter-working (phasing for further study)

It is evident that today's circuit-switched traffic will eventually migrate to an all packet switched environment and the case now described will require attention in later revisions of the specifications.

In such cases, end users will communicate with end users and bypass the operators almost entirely at the higher network levels. The DCS architecture will consider such cases, although many issues, such as privacy, security, codes, billing, lawful intercept, maintenance, subscriber ownership and support, etc. have not been considered. This work must be considered for future discussion.

As an likely alternative, gateways that support both the IPCablecom protocols and another protocol (such as H.323 or IETF) can be created, but in this case some signalling and or bear conversion will be necessary.

Network interfacing to and from IP networks may use protocols such as SIP, MGCP, MEGACO/H.248 [14], H.323, SIGTRAN and others.

SIP (Session Initiation Protocol) is for interfacing between call management servers (RFC 2543 [7]).

To control Media Gateways, there are:

- MGCP (Media Gateway Control Protocol) (RFC 2705 [8]);
- ITU-T Recommendation H.248 [14], equivalent to IETF MEGACO (RFC 3015 [10]).

SIGTRAN (SIGnalling TRANsport) describes signalling requirements and protocols (RFC 2719 [9] and RFC 2960 [11], etc.).

4.7 Number portability

Within Europe and other markets where the suite of ETSI IPCablecom specifications may be implemented there is already a high penetration of fixed line telephone installations. Experience indicates that users are extremely reluctant to change their subscription if this necessitates the allocation of a new telephone number. Where a new operator provides a replacement telephone service, a change in number is often necessary since the new operator has been allocated a range of national numbers, different from that of the incumbent operator. This differentiation of numbers is necessary for technical reasons related to the routing of calls in the national PSTN.

A major reason for the reluctance of users to move to new operators is the need for the user to change to a new number associated with the new subscription. Number Portability is being implemented in most deregulated markets, especially in Europe. The driving force is legislation, following the recognition that in the transition to full competition, numbers are becoming an important national resource.

Cable operators must be able to offer telephony service subscriptions that enable users to retain the telephone numbers already associated with their current services. Most European cable operators who already operate an alternative SCN are already able to offer this facility. Number portability to and from the SCN and IPCablecom networks is therefore seen as a Priority 1 function, to ensure true and fair competition.

Number Portability between IPCablecom and mobile networks will be necessary when that facility is generally available to SCN subscribers. Where portability of non-geographic numbers (e.g. free phone) is generally available, the facility will also be necessary on IPCablecom networks, though it is recognized that this is generally an IN issue.

SS7 based IN services may be used to implement number portability and free phone services where this is permitted or required by national regulatory authorities.

5 MTA

5.1 General

The Media Terminal Adapter (MTA) is the device with interfaces between the end user equipment and the IPCablecom network. Although real time multimedia services will shortly comprise more services than voice telephony the scope of the present document is limited to consideration only of telephony equipment.

An Embedded MTA (E-MTA) is a hardware device incorporated in a cable modem or similar device. In some cases, it may also have additional functionality, e.g. router, NAT, firewall or wireless connectivity, beyond the scope of the present document. IPCablecom specifications currently only require support for embedded MTAs within a cable modem. In the present document, unless otherwise noted, the term MTA refers equally to an embedded or stand alone MTA. Issues and requirements on the data part of a MTA (or CM) are not covered in the present document.

The following clauses suggest implementation details that are not normally included in ETSI documents, since it is considered that ETSI standards should not impede the support CE approved equipment by the single MTA. It remains a business decision for both the equipment vendors and cable operators as to the precise specification of an individual MTA.

The MTA may, in principle, have to support all analogue (POTS) and digital (ISDN) terminal equipment that is commonly in use within the European market in general and in the individual European countries separately. Such equipment includes telephones, fax machines and modems. However a alternative POTS only MTA with the basic functionality should support a very high percentage of the installed base of telephones, fax machines, modems and of DTMF and FSK equipment. This includes all equipment conforming to TBR 021 [40], TBR 038 [42] and EN 301 437 [78], and other terminals previously approved by national authorities in Europe. This goal should be met using a single standard MTA hardware device, covering the needs of as many European countries as possible, differing software being remotely loaded in order to meet national differences and where appropriate by a business case or by government mandate; it should not be part of the general MTA since it may add unnecessary cost for the vast majority of users.

Because of the complexities of various country specific specifications for POTS terminals (including connectors) it is not proposed to include all relevant references in the present document; country specific non-harmonized historical variants are registered in EN 300 001 [48]. Therefore, only an overview of the general European specifications and some examples of country specific specifications and regulations are included in this report. ISDN terminals are mainly harmonized but their deployment varies widely in differing European countries.

Since, by definition, the MTA will be located in or very close to the customers' premises, it will only be necessary to support only short loop lengths, usually less than 100 m. Single user MTAs will usually be fitted in a protected environment making it unnecessary for them to be capable of operating under the full range outdoor climatic conditions. This condition may not apply if a vendor chooses to supply a Multi-line, MDU/business variant of the MTA.

It is not the intention of this clause to describe how the realization of the stated functionality should be achieved. It will describe the functionality that every POTS MTA should meet in order to satisfy the main needs of the operators. Optional functionality and additional features might be implemented by use of additional plug-in modules or, in a small percentage of cases, by more sophisticated, and therefore more expensive, models covering a small percentage of installations.

The following guidance is offered on some of the relevant ETSI documents that may be found useful in engineering the relevant interfaces.

- EG 201 188 [47] gives guidance on the design of an analogue interface meeting harmonized analogue POTS/PSTN terminals requirements, including many national variants.
- The forthcoming publication of ES 201 970 [79] which will replace EG 201 185 [83] and EG 201 188 [47], is expected to offer a more updated basis for this purpose.
- The support of loop disconnect dialling is described in ES 201 187 [43] and register recall facilities in ES 201 729 [44] (e.g. for conference services).
- EN 300 001 [48] contains some country specific information on PSTN analogue interfaces and may be used as an historical reference document, but due to the lack of updated care should be taken on the validity of the data.
- EG 201 188 [47] and TBR 021 [40] also contain relevant interface information but it is not clear for which countries this is sufficient, particularly in defining the ringing and ringing tone cadences. This matter is for further study, but is clearly one in which software (rather than hardware) variants of the standard MTA are to be preferred.
- TR 101 973 which is expected to be published shortly will also be useful in defining these interfaces.

The ECCA report specified the following minimum functionality:

- DTMF end to end transmission as specified in ES 201 235 [45];
- fulfilment of EN 300 659 requirements to support EN 300 778 terminals and enable the implementation of supplementary services (Phase 2).

Recognized important optional functionality that may be necessary in some countries include:

- battery back-up and life line support;
- ITU-T Recommendation T.38 [39] support for fax transmissions;
- pulse metering (including national variants);
- basic rate ISDN interfaces (including national variants);
- programmable tones and tone cadences (to conform with national requirements).

NOTE 1: Battery Backup - If a battery back-up is provided, optionally or otherwise, there are two options. The preferred option is that for a battery and its mains powered charger to be incorporated within the CPE/MTA. The battery pack should be easily replaceable by the end user. A less attractive option is that of an external battery and charger package. In both cases, national variants of the ac mains power plug should be recognized.

NOTE 2: Pulse Metering - Some European operators appear to have introduced a facility by which a number of meter pulse can be sent as a group, in addition to the time-related pulses. The objective of this is to provide a facility for 'top-up' or 'add-on' charges to be correctly notified to the end-user. It is not clear if any operators have yet implemented this facility but as it became known only late in the study, further work is required to determine its application in the cable environment. This area is therefore for further study.

NOTE 3: Tones and Tone Cadences - MTAs will need to support a range of tones and tone cadences according to varying national requirements. Late in the study, it was noted that existing designs may be inadequate to provide the number of cadences which may be necessary and that the granularity of their timing may be such that it is not possible to faithfully reproduce all the tone sequences. This subject may require specific study during the preparation of the planned specifications.

5.2 Specific functionality of the MTA

As noted, MTAs reside at the end user premises and are connected to the other IPCablecom network elements via the HFC access network. IPCablecom MTAs should support the Network Call Signalling (NCS) protocol, ITU-T Recommendation J.162 (see bibliography) as being developed by the TS 101 909 series. The MTA is an IPCablecom client device that also contains the subscriber-side interface to CPE and a network-side signalling interface to call control elements in the network. The MTA also include support for one or more codec types and the encapsulation functions defined for media transport and call signalling.

An Embedded MTA (E-MTA) is a single hardware device that incorporates a cable modem as well as an IPCablecom MTA component. Figure 4 shows a representative functional diagram of the DOCSIS version of an E-MTA. The DVB version is similar. See ITU-T Recommendation J.112 [54].

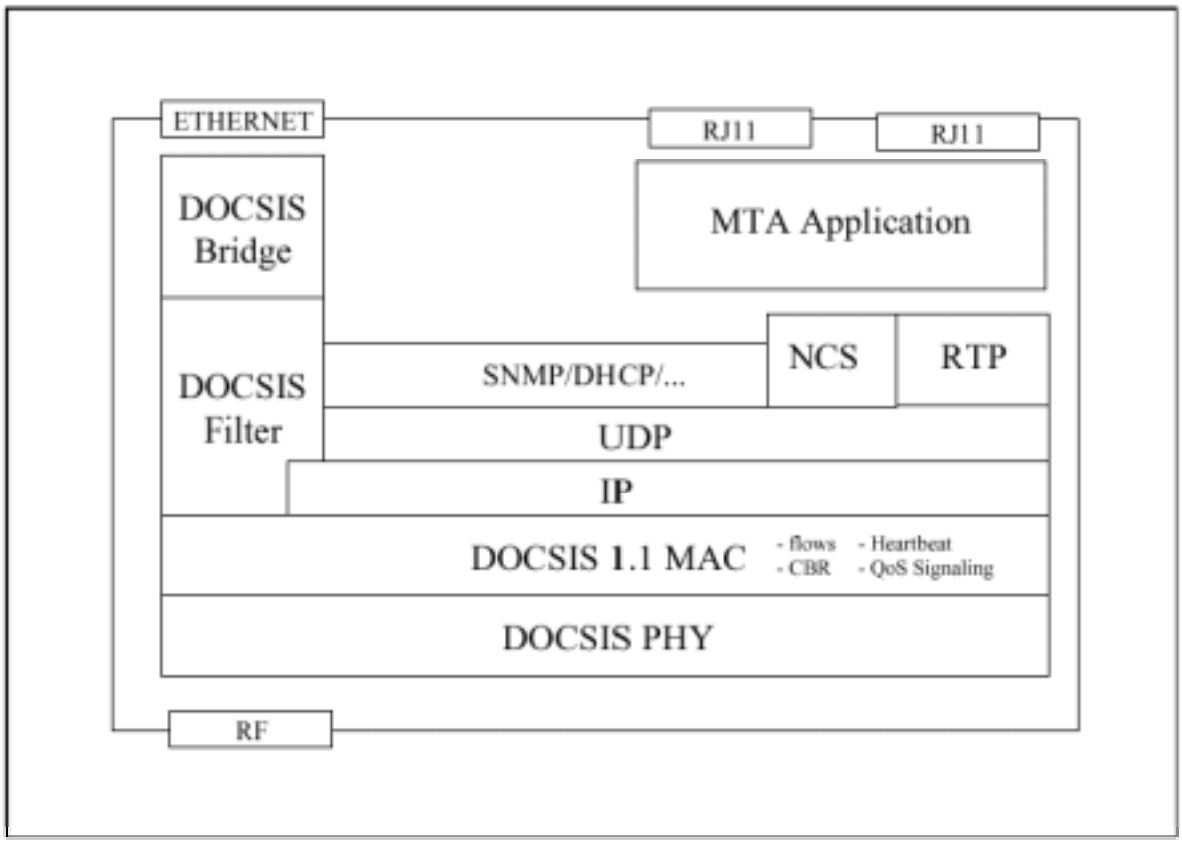


Figure 4: Functional diagram of MTA (DOCSIS version)

IPCablecom specifications currently only define support for embedded MTAs within a cable modem. In the present document, unless otherwise noted, the term MTA refers equally to an embedded MTA. Issues and requirements on the data part of a MTA are outside the scope of the present document.

5.2.1 MTA functionality

An MTA is responsible for the following functionality:

- NCS call signalling with the CMS;
- QoS signalling with the CMS and the AN;
- authentication, confidentiality and integrity of messages between the MTA and other IPCablecom network elements;
- mapping media streams to the MAC services of the access network;
- encoding and decoding of media streams;

- providing appropriate electrical signals to telephones and other terminal devices to provide an audible indication of call progress or other information to users;
- providing appropriate electrical signals to other terminal devices to provide an indication of call progress or other information;
- providing emulation of standard analogue line signalling for audio tones, voice transport, caller-id signalling, DTMF, meter pulse and message waiting indicators. This functionality will be subject to a number of national variations;
- the G.711 [38] audio codec (alternative standard codecs may be specified in some circumstances and the MTA should be capable of implementation of these without the need for a visit to the customers' premises by operator staff);
- optionally, one or more ISDN BRI interfaces. However, this interface is subject to commercial considerations. Practical experience in deployed cable networks indicates that most users move to low cost POTS devices when broadband data access is available.

Additional MTA functionality is defined in other IPCablecom specifications.

5.2.2 MTA identifiers

The following identifiers characterize the E-MTA:

- a CM with an embedded MTA has at least two MAC addresses, one for the CM itself and one or more for the MTA;
- a CM with an embedded MTA will have or be allocated at least two IP addresses, one for the CM itself and one or more for the MTA. These addresses may be allocated on a semi-permanent basis or on a dynamic basis, e.g. by a DHCP server;
- a CM with an embedded MTA will have two Fully Qualified Domain Names (FQDN), one for the CM itself and a second for the MTA;
- an embedded MTA should be capable of supporting at least one telephone number per configured physical analogue or BRI port;
- the capabilities of an embedded MTA will be known to the MTAs associated CMS.

5.3 Support of ISDN Functionality on the MTA

If ISDN functionality is implemented by the Cable Operator the following basic functionality should be implemented on the ISDN Basic Rate Interfaces of the MTA:

- support of multi-point layer one passive bus configuration at the coincident S and T reference point;
- Basic Rate Interface should have bearer channels with a capacity of 64 kbit/s synchronous bit rate and support of a signalling channel of 16 kbit/s;
- there should be no restriction in operation of teleservices or bearer services using B-channels or of supplementary services for the ISDN access. Packet mode services through D-channels and packet-data in B-channels may also be supported;
- power feeding from the MTA to support at least one terminal device may be required in order to comply with national regulations in certain countries; details of this are subject to further study.

Bit rates lower than 64 kbit/s are not required to be supported directly. These are regarded as user applications operating within one of the available 64 kbit/s B-channels. Consideration has been given to the possibility of limiting the access network bandwidth according to that is necessary for the actual application. Whilst this approach has not been ruled out, there are fears that this might add to the complexity (and therefore the cost) of the MTA.

For an indication of the applicable ITU-T Recommendations and ETSI standards that should be used for implementation of the ISDN BRI interface refer to the References clause. The list of specifications given there should be seen only as indicative. The ISDN DSS1 ETSI specifications (or as 'Euro-ISDN' standard) should be followed for implementation. In certain countries special ISDN enhancements might also be needed to match current implementations by incumbent operators.

6 Cable Modem (CM) functionality

The definition of the functionality of Cable Modems does not form any part of the scope of the present document.

7 Access Node (AN) functionality

The definition of the functionality of the Access Node does not form any part of the scope of the present document.

8 Gateway functionality

8.1 V5.2 Interface

8.1.1 Support of Access Interface V5.2 on the Gateway

The V5.2 interface gives the opportunity to use all the features and functionality of a traditional public switch (PSTN DLE). For Phase 1 of the implementation of IPCablecom it is expected that not all NCS network features and regulatory requirements will be available within the IPCablecom network. Therefore there is a need to use the functionality of the traditional telephone switch to offer the initial set of telephone features.

Recommendation V5.2 specifies the connection of an access network to a Digital Local Exchange (DLE) with a concentrating functionality. The V5.2 interface is specified in ITU-T Recommendation G.965 [13]. The ETSI specification for V5.2 is EN 300 347-1 [16].

The V5 protocol stack is used for the connection of an access network to a Local Exchange (LE). It is used for the following access methods:

- analogue telephone access;
- ISDN basic rate access;
- ISDN primary rate access (V5.2);
- other analogue or digital access methods for semi-permanent connections without associated out-of-band signalling information.

V5 uses 2 048 kbit/s links. A single V5.2 route may use up to sixteen such links. For analogue access, CSN or PSTN user port signalling on the LE side is converted into a functional part of the V5 protocol for signalling to the access network. For ISDN services, a control protocol for the exchange of individual functions and messages necessary for the co-ordination with the call control procedures in the Local Exchange is defined in the V5 standard.

In order to support multiple lines (ports) via the dynamic allocation of bearer channels, the V5.2 standard contains has several additions protocols:

- a bearer channel connection protocol establishes and releases bearer connections on demand, identified by the signalling information, under the control of the Local Exchange;
- a link control protocol is defined for the multi-link management to control link identification, link blocking and link failure conditions;

- a protection protocol, operated on two separate data links for security reasons, is defined to manage the protection switching of communication channels in case of link failures.

The following protocols are defined for the various protocol layers:

- LAPV5-EF, LAPV5, V5-Link Control, V5-BCC, V5-PSTN, V5-Control and V5-Protection, details of all of which are defined by EN 300 347-1 [16].

8.2 SS7 interface

8.2.1 Supporting signalling gateways to SS7 networks

It is expected that the key signalling interface for the majority of interconnections between IPCablecom and the conventional PSTN will be SS7. Recognizing that this protocol exists in a large number of national variants, it is not possible to specify the precise details in a document of this nature. The key features are to support the following services between networks, irrespective of the national variant in use.

9 Basic Rate ISDN

9.1 Minimum set of features on the ISDN BRI

Following is the minimum set of features to be used by the ISDN BRI interface on the MTA where BRI is to be offered by the cable operator. With this feature set it is possible to connect ISDN telephone sets, ISDN adapters and PABXs. These features should interwork with the IPCablecom Call Management Server and the V5.2 gateway. Additional features may be supported by specific implementations at vendor's discretion:

- Call Forward Busy (CFB) [31].
- Call Forward Unconditional (CFU) [32].
- Call HOLD (HOLD) [28].
- Call Waiting (CW) [22].
- Calling Line Identification (CLIP and CLIR) [24] and [25].
- Three ParTY calling (3PTY) [30].
- Generic keypad protocol [16].
- MSN number support (MSN) [21].
- Direct Dialling In (DDI) [35].
- Call Completion (CCBS) [35].
- Direct Dialling In (for PBX support).
- Multiple BRI lines (for PBX support).
- Line hunting for BRI lines (for PBX support).

10 Support for call signalling features

The features and services given in this clause are identified by operators as desirable. A PICS document will need to be produced providing details on the compliance of the IPCablecom systems.

10.1 Objectives

This clause describes custom calling features and other enhanced services together with their related priority that are defined by European cable operators and therefore, should be integrated into the IPCablecom specifications. The IPCablecom reference architecture (ITU-T Recommendation J.160, see bibliography) specifies certain calling features and enhanced services as high-level design goals for the call signalling area and assigns the responsibility of delivery to the Call Management Server (CMS) respectively to its Call Agent (CMS/CA). Priority levels are assigned to each of the telephony services indicating the urgency for their implementation. Nevertheless, IPCablecom specifications should indicate that a later extension of this list to widen this offer of services and a later change of the priority level should be made possible by the equipment design chosen by the manufacturer. IPCablecom specifications should allow new services to be added to the list and allow for changes in the priority specified for individual features.

10.2 Support of additional telephony services

From the point of view of European cable operators, telephony services should be made available end-to-end by call signalling for the following call scenarios:

- calls that originate from a CSN or PSTN and terminate on the cable network;
- calls from the cable network and via the interconnection with the PSTN or another CSN, terminate within a CSN or on the PSTN;
- calls that originate and terminate on a single cable network;
- calls that originate on one cable network and terminate on another cable network within a single IPCablecom domain.

Other scenarios which are out of the scope of the present document and are therefore for further study, may include but are not limited to, the following:

- any form of concentrating interface between networks; this is considered to be a network specific feature;
- gateways to mobile networks via standardized interfaces;
- gateways to IP-based mobile networks;
- direct interfacing with other access media (e.g. xDSL);
- cable networks acting as transit networks.

The IPCablecom standards need to provide detailed technical specifications relevant for all the services to be supported by the involved components. These specifications should include protocol message flows between MTA, CM, AN, CMS, MGC and PSTN local exchange (DLE). The level of detail of these specifications is expected to be essentially similar to ETSI ISDN supplementary services standards (e.g. [31] to [34]).

10.2.1 Classical services

Abbreviated Dialling/Speed Dialling	Phase 1
Call Wait/Call Hold*	Phase 1
Cancel Call Waiting*	Phase 1
Three-way (or more) Conference Calling*	Phase 1
Wake-up Call	Phase 1
NOTE: Bold features marked with an asterisk (*) have already been specified within IPCablecom (ITU-T Recommendation J.160, see bibliography).	

10.2.2 Enhanced services

Barring all outgoing calls (BAOC) (both operator or user controlled)	Phase 1
Barring outgoing national calls (BONC) (both operator or user controlled)	Phase 1
Barring outgoing international calls (BOIC) (both operator or user controlled)	Phase 1
Barring of premium rate numbers (BPRE) (both operator or user controlled)	Phase 1
Barring of information service numbers (BINF) (both operator or user controlled)	Phase 1
Barring of mobile numbers (BMOB) (both operator or user controlled)	Phase 1

10.2.3 Call forwarding services

Call forwarding unconditional (CFU)	Phase 1
Call forwarding unconditional to voice mail	Phase 1
Call forwarding conditional on busy signal (CFB)*	Phase 1
Call forwarding conditional no reply (CFNR)*	Phase 1
Call forwarding conditional to voice mail on busy signal or no reply	Phase 1
Call forwarding conditional to e-mail (Unified Messaging)	Phase 1
Call forwarding to a default number (CFD) (see note 1)	Phase 1
Remotely enabled call forwarding	Phase 2
Call forwarding Indication	Phase 2
NOTE 1: When the user de-activates CFU, the user line reverts back to CFNR and CFB. NOTE 2: Bold features marked with an asterisk (*) have already been specified within IPCablecom (ITU-T Recommendation J.160, see bibliography).	

10.2.4 Identification based services

Calling Line Identity Presentation (CLIP), on-hook data transmission* (see note 1)	**Phase 1**
Calling Line Identity Presentation (CLIP), off-hook data transmission* (see note 2)	**Phase 1**
Calling Line Identity Restriction (CLIR) on a per call basis*	**Phase 1**
Permanent CLIR (via operator)	Phase 1
System Override of Calling Line Identity Restriction (SOCLIR) Description: This feature allows the calling line identity to be presented to emergency services even when restriction is applied to originating line.	Phase 3
Connected Line Identity Presentation (COLP)	Phase 3
Connected Line Identity Restriction (COLPR)	Phase 3
Call return with number announcement	Phase 2
Automatic number recall on busy	Phase 2
Malicious Call Identification (MCID) (see note 3)	Phase 1
Vanity numbers using number translation	Phase 3
Call Screening Description: The user will be able to reject calls from a defined list of sources or those that do not present the Calling Line Identity.	Phase 2
NOTE 1: CLIP functionality should be implemented according to ETSI standards EN 300 659-1 [49], including annex C, EN 300 778-1 [52], including annex A and ETR 206 [46]. NOTE 2: CLIP functionality should be implemented according to ETSI standards EN 300 659-2 [50], ETS 300 778-2 [53] and ETR 206 [46]. NOTE 3: This feature should be implemented according to ETSI standard ETS 300 128 [28]. NOTE 4: Bold features marked with an asterisk (*) have already been specified within IPCablecom (ITU-T Recommendation J.160, see bibliography).	

10.2.5 Call completion services

Completion of calls to busy subscriber (CCBS)	Phase 1
Last Number redial	Phase 1

10.2.6 Common functionality

Message waiting indicator (MWI)*	**Phase 1**
NOTE 1: This facility should be implemented using a stuttered dial tone and/or a visual indication, according to specific operators' or other national requirements. NOTE 2: Bold features marked with an asterisk (*) have already been specified within IPCablecom (ITU-T Recommendation J.160, see bibliography).	

10.2.7 Other services

Pulse metering (see note 1)	Phase 1
Advice of Charge (AOC) (see note 2)	Phase 3
Emergency call	Phase 1
Anonymous Call Rejection*	Phase 1
Tele/memory message	Phase 1
Network Announcements	Phase 3
Closed User Group (CUG)	Phase 3
OLI	Phase 3
Dialable number selection	Phase 3
Changeable number selection	Phase 3
Sniffer possibilities based on national regulation	Phase 3
CTI-functionality	Phase 3
Number Translation Services	Phase 3
NOTE 1: This feature will require implementation in accordance with country specific regulations. NOTE 2: This feature should be implemented according to TR 102 088 [22]). NOTE 3: Bold features marked with an asterisk (*) have already been specified within IPCablecom (ITU-T Recommendation J.160, see bibliography).	

11 European regulatory aspects

11.1 National specific aspects

Many aspects of the regulations applicable to Telecommunication Networks are under the control of the relevant National Regulatory Authorities and are not generally harmonized throughout Europe. In the present document attention is focused on general European regulatory principles. Where appropriate, equipment vendors must take account of the national regime in which the cable operator runs their networks.

11.2 Universal service obligation

The Universal Service (US) obligation as it stands now, entails that a minimum set of services of specified quality should be available to all telephone users independently of their geographical location or means of connection and at an affordable price [59].

The Universal Service provision currently applies to:

- provision of the public fixed telephone network, supporting voice telephony, fax and voice band data transmission via modems;
- provision of the public fixed telephone services i.e. provision to end-users at a fixed location of international and national calls, access to emergency services, etc;
- provision of operator assistance and directory services;
- provision of public pay phones;
- provision of services under special terms and/or the provisions of special facilities for customers with disabilities or with special social needs.

Additional obligations may be imposed by NRAs but these may not be funded by the US funding mechanism.

Member States have conferred the obligations to offer universal service on one or more operators. At least one organization should be responsible for providing universal service at any given location. This obligation is not normally applied to cable television systems operators, as their networks do not generally lend themselves to serving very isolated locations.

The new Universal Service Directive remains applicable to the same services without extending it to e.g. broadband internet access. Thus, for the time being no obligations reside on cable operators to provide for Universal Service.

11.3 Number portability

In the proposed Universal Service Directive (Article 25, clause 1) number portability is foreseen within the EU. More precisely this means that:

> All subscribers of publicly available telephone services, **including mobile services**, who so request can retain their number(s) independently of the undertaking providing the service:
>
> - in case of geographical numbers, at a **specific** location, and
>
> - in case of numbers other than geographical numbers, at any location.

The "old" European provision (Article 12, clause 5, Interconnection Directive 97/33/EC, as amended [57], [58]) stipulates that:

> "… operator number portability whereby subscribers who so request can retain their number(s) on the **fixed public telephone** network and the Integrated Services Digital Network (ISDN) independent of the organization providing service,
>
> in the case of geographic numbers at a specific location and
>
> in the case of other than geographic numbers at any location, …".

This means that today an obligation rests on all - whether or not incumbents - fixed telephone operator (in the future also mobile) in the EU to offer number portability to its customers.

As the Commission states in its Communication on the 1999 Communications review, number portability should in future also be extended to mobile networks. Number portability is deemed to lead to greater competition, which in the end benefits the consumer. Moreover, the emergence of combined fixed-mobile services (one number for all calls) also necessitates the implementation of number portability in this mobile sector.

At the same time the Commission is not convinced that at this moment in time number portability should also be extended between fixed and mobile networks.

It should be noted that in certain Member States the relevant law speaks of "telecommunications network or service". This entails that VoIP may also fall under number portability obligations due to the fact that VoIP is considered a "public telecommunications service".

In the Netherlands the regulatory body (OPTA) maintains the position that no number portability obligation rests on VoIP providers, mainly because such services are not yet offered on the Dutch market.

In the UK, the regulator has made no connection between the method of delivery of telephone services and the need for number portability. It is expected that number portability will be necessary, regardless of the access technology used.

11.4 VoIP versus Voice Telephony

The Commission has argued in its Notice dated 10 January 1998 [66] that Internet voice services do not qualify as voice telephony.

When re-examining this Notice in 2000, the Commission again came to the conclusion that having regard to the technical and commercial reality of today, voice over the internet can still not be considered a service [64] (to decide on the status of VoIP as a service consider [56] and [62]. As a result, Member States should normally continue to allow Internet access/service providers to offer voice over Internet under data transmission general authorizations, and that no mandatory requirement for an individual license is justified. This also exempts it as yet from any eventual universal service status.

In this context it is necessary to distinguish between 'VoIP' which refers to IP based data transmission systems which employ IP based access networks and/or dedicated (closed) IP based interconnection systems and 'Voice over Internet' which uses the public internet to transmit voice services.

11.5 Security of personal data

The directive [58] that applies to voice over internet relates to the processing of personal data in connection with the provision of publicly available analogue or digital telecom services, provided over public telecom networks.

Both telecom service providers and network operators are required to ensure that the network is protected against breaches in security and to inform their customers about residual risks.

Confidentiality should be guaranteed which means that listening, tapping, storing and interception of communications is explicitly prohibited. There are however three exceptions:

1) for national security, defence, public security, prevention, investigation, detection and prosecution of criminal offences or unauthorized use of the telecom system a Member State may restrict such confidentiality;

2) legally authorized recordings of communications in the course of lawful business practices;

3) users concerned give their consent to such practices.

Other issues concerning security that are regulated on the European level are:

a) traffic and billing data;

b) calling line identification;

c) directories; and

d) unsolicited calls.

11.6 Lawful Interception

European cable operators are required to have the capability of intercepting messages passed over their networks system in any form. This capability should be covert, not affect the operation of the system in any discernible way or be detectable by the end user. Therefore, a European implementation of IPCablecom should include the following functionality:

a) the network equipment needs to be capable of copying all Call Content (CC) being carried to and from specified target addresses to an additional delivery address specified by the network operator;

b) in the short term, for practical reasons, identification of voice related calls (including fax and modem calls) may use E.164 addresses;

c) where interception of both data and multi-media content is also required, the delivery address will be specified as an IP address in either the standard IPv4 or IPv6 formats; the target addresses may be either service addresses or IP addresses;

d) the mechanism for lawful interception, where provided, in an IPCablecom system will ideally be capable of correct operation in networks where a customer's IP address is allocated dynamically, e.g. by a DHCP server, by relating the current IP address to the customer's equipment MAC address, or otherwise;

e) it needs to be possible to provide both the Call Content and the Intercept Related Information (IRI) regarding the communication, including that added by the network operator to facilitate correct identification of the intercept to the law enforcement agencies;

f) the mechanism for LI should correctly relate the 'Call Content' and the 'CRD';

g) the capacity of the LI mechanism to provide multiple intercepts should be adequate; this matter is the subject of a study since there is so far no information relating to the need for non call-related data interception;

h) the LI facility should be capable of providing numerous simultaneous intercepts and be capable of providing several independent intercepts of the same target address. Further study is necessary to determine the numbers involved;

i) operation of the intercept should be invisible to any customer, even by the use of 'traceroute', 'ping' and similar utilities;

j) any malfunction or mis-operation of the interception facility should not affect the customer's service;

k) control of the facility needs to be segregated from normal operation of the system;

l) it needs to be possible to address and control the interception facility remotely by secure means.

The above are necessarily generic and should be related to fundamental principles of country specific regulations. Their application in the voice, data and multi-media environments will differ somewhat and depend on the operator's overall network strategy, for example, whether or not he also operates a legacy circuit switched network, and if so, what access technology is used.

NOTE 1: In the case where a Cable Operator employs a solution based upon a V5.2 Gateway as described in clause 5.2, then it may be sufficient to implement Lawful Interception functions in equipment that is on the service provisioning side of the V5.2 interface. This means that the functionality listed in items (c) and (d) above may be met on the service provisioning side of the V5.2 interface.

NOTE 2: It is recognized that attempts at compliance with clause (d) may lead to specific difficulties; these should not be allowed to delay early implementation of systems, though it will be necessary to devise a solution in the longer term. This will need further detailed evaluation.

The Handover Interface Point and Protocol will need to be defined in accordance with national regulations.
ES 201 671 [69] defines such a handover interface, which may be implemented by some of the relevant authorities.

Additional information on this subject can be found in annex B

11.7 R&TTE Directive

The R&TTE Directive (1999/5/EC) [61] applies to various component parts of IPCablecom networks in different ways, depending on whether the devices are considered as TTE in their own right or only as offering an interface to TTE. TR 101 857 [71] helps to determine if a device should be considered as a TTE or as a Network device. If the device under study is a TTE, the R&TTE Directive applies and apart from the essential requirements, EMC and safety aspects (where the use of EG 201 450 [80] may be useful) particular obligations apply to the person responsible for placing the Apparatus on the market, including the needs for provision of user information and declaration of conformity with the essential requirements.

Additional essential requirements, including areas closed to Telecommunications aspects, may also be established by the CEC but at the time of the publication of the present document none were identified. If the device under study offers a public interface to TTE, the R&TTE Directive requires the Network operator to specify the publicly presented interface. TR 101 857 [71] also helps in these aspects.

11.8 EMC aspects

The EMC Directive (89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility; as amended by Council Directive 92/31/EEC of 28 April 1992 and by Council Directive 93/68/EEC of 22 July 1993" [81]) applies to both Network and Terminal equipment.

EG 201 450 [80] helps in these area but has focus on TTE and Radio equipment. Recently, a new mandate M/313 was issued by the CEC 98/34 committee to produce 'EMC harmonized standards for telecommunication networks' covers all Telecom wire line Network or Terminal installations (excluding TTE) but requests special attention to broadband systems. This mandate concerns the preparation of harmonized standards covering EMC aspects of wire-line telecommunication networks including their in-house extensions. These standards will cover the types of networks, which are currently operational or which are under development, including, but not limited to those using power lines, coaxial cables and classical telephone wires. This mandate does not concern the preparation of harmonized standards relating to the electromagnetic compatibility of equipment to be connected to the networks.

11.9 Safety aspects

The Low Voltage/"Safety" Directive (73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits; as amended by Council Directive 93/68/EEC of 22 July 1993 [82]) covers all type of equipment.

EG 201 450 [80] helps in these area but has focus on TTE and Radio equipment. Note that certain aspects not necessarily linked to electrical phenomena are also covered, e.g. optical power emissions and flammability.

Annex A:
List of IPCablecom Documents

TS 101 909-1 [6] provides a regularly updated list of the corresponding published deliverables in ETSI. A wider overview of the work published and in progress within ETSI, ITU-T and SCTE can be found at http://portal.etsi.org/at/kta/IP_Cable/ipcablecom.asp

ITU-T Draft Recommendation J.160 (J.arch): "Architectural framework for the delivery of time critical services over cable television networks using cable modems". http://www.itu.int/itudoc/itu-t/com9/contr/01-04/006.html

NOTE: Defines architecture framework for IPCablecom networks including all major system components and network interfaces necessary for delivery of IPCablecom services.

ITU-T Recommendation J.161: "Audio codec requirements for the provision of bi-directional audio service over cable television networks using cable modems". To be published. http://www.itu.int/itudoc/itu-t/com9/contr/01-04/006.html

NOTE: Defines the audio and video codecs necessary to provide the highest quality and the most resource-efficient service delivery to the customer. Also specifies the performance required in client devices to support future IPCablecom codecs and describes suggested methodology for optimal network support for codecs.

ITU-T Recommendation J.162: "Network call signalling protocol for the delivery of time critical services over cable television networks using cable modems". To be published.

NOTE: Defines a profile of the Media Gateway Control Protocol (MGCP) for IPCablecom embedded clients, referred to as the Network-based Call Signalling (NCS) protocol. MGCP is a call signalling protocol for use in centralized call control architecture, and assumes relatively simple client devices.

ITU-T Recommendation J.163: "Dynamic quality of service for the provision of real time services over cable television networks using cable modems". To be published.

NOTE: Defines the QoS Architecture for the "Access" portion of the IPCablecom network, provided to requesting applications on a per-flow basis. The access portion of the network is defined to be between the Multimedia Terminal Adapter (MTA) and the Access Node (AN). The method of QoS allocation over the backbone is unspecified in the present document.

ITU-T Recommendation J.164: "IPCablecom event messages". To be published.

NOTE: Defines the concept of Event Messages used to collect usage information for the purposes of billing within the IPCablecom architecture.

ITU-T Draft new Recommendation J.165: "IPCablecom signalling transport protocol".
http://www.itu.int/itudoc/itu-t/com9/contr/01-04/014.html

NOTE: Defines the Internet Signalling Transport Protocol (ISTP) for IPCablecom PSTN Signalling Gateways. ISTP is a protocol that provides a signalling interconnection service between the IPCablecom network control elements (Call Management Server and Media Gateway Controller) and the PSTN C7 Signalling network through the C7 Signalling Gateway.

ITU-T Recommendation J.166: "IPCablecom Management Information Base (MIB) framework". To be published.

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

ITU-T Recommendation J.167: "Media Terminal Adapter (MTA) device provisioning requirements for the delivery of real time services over cable television networks using cable modem". To be published.

NOTE: Defines the protocol mechanisms for provisioning of an IPCablecom embedded-MTA device by a single provisioning and network management provider.

ITU-T Recommendation J.168: "IPCablecom Media Terminal Adapter (MTA) MIB requirements". To be published.

NOTE: Defines the MIB module that supplies the basic management objects for the MTA Device.

ITU-T Recommendation J.169: "IPCablecom network call signalling (NCS) MIB requirements". To be published.

NOTE: Defines the MIB module that supplies the basic management object for the NCS protocol.

ITU-T Draft new Recommendation J.sec: "IPCablecom security specification".
http://www.itu.int/itudoc/itu-t/com9/contr/01-04/021.html

NOTE: Defines the Security architecture, protocols, algorithms, associated functional requirements and any technological requirements that can provide for the security of the system for the IPCablecom network.

ITU-T Draft Recommendation J.171: "IPCablecom Trunking Gateway Control Protocol (TGCP)".
http://www.itu.int/itudoc/itu-t/com9/contr/01-04/022.html

NOTE: Defines a trunking gateway control protocol (TGCP) for use in a centralized call control architecture that assumes relatively simple endpoint devices. TGCP is designed to meet the protocol requirements for the Media Gateway Controller to Media Gateway interface defined in the IPCablecom architecture.

Annex B:
Requirements listed in Council Resolution of 17 January 1995

The following requirements for Telecommunications Network operators to provide assistance to Law Enforcement agencies in the Member States are listed in the European Council Resolution of 17 January 1995 [63] and are included here for information.

Law enforcement agencies require access to the entire telecommunications transmitted, or caused to be transmitted, to and from the number or other identifier of the target service used by the interception subject. Law enforcement agencies also require access to the call-associated data that are generated to process the call.

Law enforcement agencies require access to all interception subjects operating temporarily or permanently within a telecommunications system.

Law enforcement agencies require access in cases where the interception subject may be using features to divert calls to other telecommunications services or terminal equipment, including calls that traverse more than one network or are processed by more than one network operator/service provider before completing.

Law enforcement agencies require that the telecommunications to and from a target service be provided to the exclusion of any telecommunications that do not fall within the scope of the interception authorization.

Law enforcement agencies require access to call associated data such as:

- signalling of access ready status;
- called party number for outgoing connections even if there is no successful connection established;
- calling party number for incoming connections even if there is no successful connection established;
- all signals emitted by the target, including post-connection dialled signals emitted to activate features such as conference calling and call transfer;
- beginning, end and duration of the connection;
- actual destination and intermediate directory numbers if call has been diverted.

Law enforcement agencies require information on the most accurate geographical location known to the network for mobile subscribers.

Law enforcement agencies require data on the specific services used by the interception subject and the technical parameters for those types of communication.

Law enforcement agencies require a real-time, fulltime monitoring capability for the interception of telecommunications. Call associated data should also be provided in real-time. If call associated data cannot be made available in real time, law enforcement agencies require the data to be available as soon as possible upon call termination.

Law enforcement agencies require network operators/service providers to provide one or several interfaces from which the intercepted communications can be transmitted to the law enforcement monitoring facility. These interfaces have to be commonly agreed on by the interception authorities and the network operators/service providers. Other issues associated with these interfaces will be handled according to accepted practices in individual countries.

Law enforcement agencies require network operators/service providers to provide call associated data and Call Content from the target service in a way that allows for the accurate correlation of call associated data with Call Content.

Law enforcement agencies require that the format for transmitting the intercepted communications to the monitoring facility be a generally available format. This format will be agreed upon on an individual country basis.

If network operators/service providers initiate encoding, compression or encryption of telecommunications traffic, law enforcement agencies require the network operators/service providers to provide intercepted communications *en clair*.

Law enforcement agencies require network operators/service providers to be able to transmit the intercepted communications to the law enforcement monitoring facility via fixed or switched connections.

Law enforcement agencies require that the transmission of the intercepted communications to the monitoring facility meet applicable security requirements.

Law enforcement agencies require interceptions to be implemented so that neither the interception target nor any other unauthorized person is aware of any changes made to fulfil the interception order. In particular, the operation of the target service must appear unchanged to the interception subject.

Law enforcement agencies require the interception to be designed and implemented to preclude unauthorized or improper use and to safeguard the information related to the interception.

Law enforcement agencies require network operators/service providers to protect information on which and how many interceptions are being or have been performed, and not disclose information on how interceptions are carried out.

Law enforcement agencies require network operators/service providers to ensure that intercepted communications are only transmitted to the monitoring agency specified in the interception authorization.

According to national regulations, network operators and service providers could be obliged to maintain an adequately protected record of the activation of interceptions.

Based on a lawful inquiry and before implementation of the interception, law enforcement agencies require:

1) the interception subject's identity, service number or other distinctive identifier;

2) information on the services and features of the telecommunications system used by the interception subject and delivered by network operators/service providers; and

3) information on the technical parameters of the transmission to the law enforcement monitoring facility.

During the interception, law enforcement agencies may require information and/or assistance from the network operators/service providers to ensure that the communications acquired at the interception interface are those communications associated with the target service. The type of information and/or assistance required will vary according to the accepted practices in individual countries.

Law enforcement agencies require network operators/service providers to make provisions for implementing a number of simultaneous intercepts. Multiple interceptions may be required for a single target service to allow monitoring by more than one law enforcement agency. In this case, network operators/service providers should take precautions to safeguard the identities of the monitoring agencies and ensure the confidentiality of the investigations. The maximum number of simultaneous interceptions for a given subscriber population will be in accordance with national requirements.

Law enforcement agencies require network operators/service providers to implement interceptions as quickly as possible (in urgent cases within a few hours or minutes). The response requirements of law enforcement agencies will vary by country and by the type of target service to be intercepted.

For the duration of the interception, law enforcement agencies require that the reliability of the services supporting the interception at least equals the reliability of the target services provided to the interception subject. Law enforcement agencies require the quality of service of the intercepted transmissions forwarded to the monitoring facility to comply with the performance standards of the network operators/service providers.

Annex C: Bibliography

ETSI TS 101 909-12 (draft): "Access and Terminals (AT); Digital Broadband Cable Access to the Public Telecommunications Network; IP Multimedia Time Critical Services; Part 12: Internet Signalling Transport Protocol".

ITU-T Draft Recommendation J.171: "IPCablecom Trunking Gateway Control Protocol (TGCP)".

ITU-T Draft Recommendation J.165: "IPCablecom signalling transport protocol".

ITU-T Draft Recommendation J.160: "Architectural framework for the delivery of time critical services over cable television networks using cable modems".

NOTE: See http://www.itu.int/itudoc/itu-t/com9/contr/01-04/006.html

ITU-T Draft Recommendation J.162: "Network call signalling protocol for the delivery of time critical services over cable television networks using cable modems".

ETSI EG 201 377-2: "Speech Processing, Transmission and Quality aspects (STQ); Specification and measurement of speech transmission quality; Part 2: Mouth-to-Ear speech transmission quality including terminals".

History

Document history		
V1.1.1	April 2002	Publication