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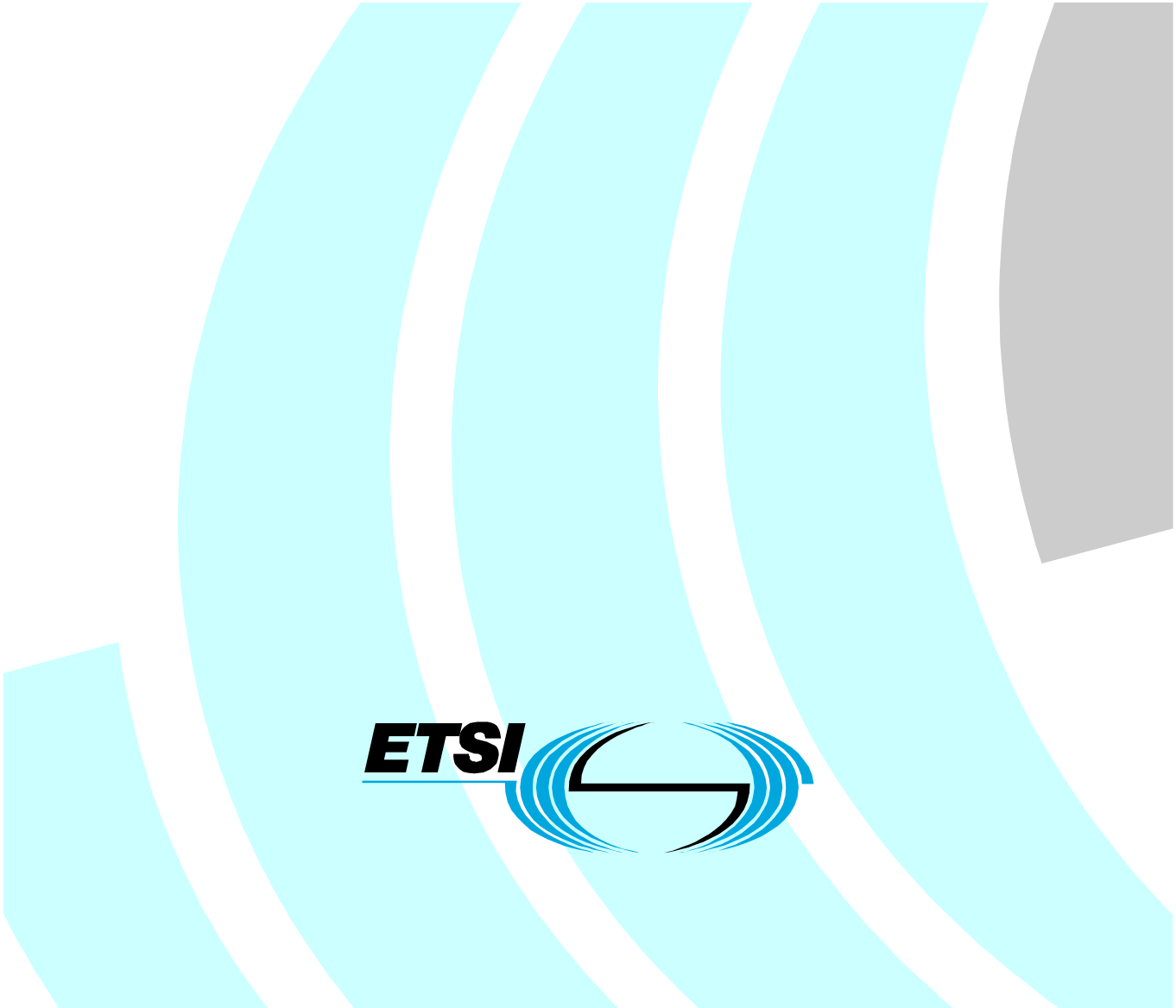
ETSI Standard

Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); PSTN/ISDN Emulation Subsystem (PES); NGN Release 1 H.248 Profile for controlling Access and Residentail Gateways



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Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN), and is now submitted for the ETSI standards Membership Approval Procedure.

1 Scope

The present document defines a profile of the Gateway Control Protocol (H.248.1), for controlling access and residential gateways connecting analog lines and ISDN primary and basic accesses, in order to emulate PSTN/ISDN services over IP.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] ETSI ES 282 001: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Functional Architecture Release 1".

[2] ETSI ES 282 002: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Release 1: Functional architecture for PSTN/ISDN Emulation".

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

[4] 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".

[5] 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".

[6] ETSI ETS 300 099: "Integrated Services Digital Network (ISDN); Specification of the Packet Handler access point Interface (PHI)".

[7] ETSI EN 301 141-1: "Integrated Services Digital Network (ISDN); Narrowband Multi-service Delivery System (NMDS); Part 1: NMDS interface specification".

[8] ETSI ETS 300 402-2: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Data link layer; Part 2: General protocol specification [ITU-T Recommendation Q.921 (1993), modified]".

[9] ETSI EN 300 367: "Integrated Services Digital Network (ISDN); Explicit Call Transfer (ECT) supplementary service; Service description".

[10] ETSI TS 102 333: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Gate control protocol".

[11] ETSI TS 183 022: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN);.MGC Information Package".

[12] ETSI TS 102 332: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Bachauling of ISDN Q.921 (Transport of DSS1 over IP); ISDN Q.921-User Adaptation Layer (IUA) [Endorsement of RFC 3057 (2001), modified]".

[13] ETSI TBR 003: "Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment to connect to an ISDN using ISDN basic access".

[14] ETSI TBR 004: "Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment to connect to an ISDN using ISDN primary rate access".

[15] ITU-T Recommendation H.248.1 + Corrigendum 1: "Gateway control protocol: Version 2".

[16] ITU-T Recommendation H.248: "Gateway control protocol: Facsimile, text conversation and call discrimination packages".

[17] ITU-T Recommendation H.248.4 + Corrigendum 1: "Gateway control protocol: Transport over Stream Control Transmission Protocol (SCTP)".

[18] ITU-T Recommendation H.248.7: "Gateway control protocol: Generic announcement package".

[19] ITU-T Recommendation H.248.1: "Gateway control protocol: Media gateway overload control package".

[20] ITU-T Recommendation H.248.13: "Gateway control protocol: Quality Alert Ceasing package".

[21] ITU-T Recommendation H.248.14: "Gateway control protocol: Inactivity timer package".

[22] ITU-T Recommendation H.248.16 + Corrigendum 1: "Gateway control protocol: Enhanced digit collection packages and procedures".

[23] ITU-T Recommendation H.248.23: "Gateway control protocol: Enhanced Alerting packages".

[24] ITU-T Recommendation H.248.26 (01/2005) + Amendment 1 (01/2005): "Gateway control protocol: Enhanced analog line packages + Corrigendum 1 (03/2004)".

[25] ITU-T Recommendation H.248.34: " Gateway control protocol: Stimulus analogue line package".

[26] ITU-T Recommendation Q.1950: "Bearer independent call bearer control protocol".

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

[28] ITU-T Recommendation G.711 Appendix I: "A high quality low-complexity algorithm for packet loss concealment with G.711".

[29] ITU-T Recommendation G.711 Appendix II: "A comfort noise payload definition for ITU-T G.711 use in packet-based multimedia communication systems".

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

[31] ITU-T Recommendation V.150.1: "Modem-over-IP networks: Procedures for the end-to-end connection of V-series DCEs ".

[32] ITU-T Recommendation V.152: "Procedures for supporting voice-band data over IP networks".

[33] ITU-T Recommendation E.180: "Technical characteristics of tones for the telephone service".

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

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

[36] IETF RFC 2401: "Security Architecture for the Internet Protocol".

[37] IETF RFC 2833: "RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals".

[38] IETF RFC 2784: "Generic Routing Encapsulation (GRE)".

[39] IETF RFC 4040: "RTP Payload Format for a 64 kbit/s Transparent Call".

[40] IETF RFC 3555: "MIME Type Registration of RTP Payload Formats".

[41] ITU-T Recommendation G.168: "Digital network echo cancellers".

[42] RFC 2733: "An RTP Payload Format for Generic Forward Error Correction".

[43] RFC 2198: "RTP Payload for Redundant Audio Data".

[44] ITU-T Recommendation Q.115.0: "Protocols for the control of signal processing network elements and functions".

[45] ITU-T Recommendation Q.115.1: "Logic for the control of echo control devices and functions".

[46] ITU-T Recommendation Q.921: "ISDN user-network interface - Data link layer specification".

[47] ETSI ETS 300 297: "Integrated Services Digital Network (ISDN); Access digital section for ISDN basic access".

[48] ETSI ETS 300 233: "Integrated Services Digital Network (ISDN); Access digital section for ISDN primary rate".

[49] ITU-T Recommendation H.248.17: "Gateway control protocol: Line test package".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document the terms and definitions given in ITU-T Recommendation H.248.1 [50] and the following apply:

Access Gateway (AG): Media Gateway that interworks a significant number of analogue lines to a packet network and is located at the operator's premises. See also clause 3.1of ITU-T Recommendation H.248.1.

Media Gateway (MG): refers both to Access Media Gateways and to Residential Media Gateways

NOTE: See ITU-T Recommendation H.248.1.

originating Media Gateway: Media Gateway to which the calling party's physical termination is connected

MG Port: A port is a single physical access interface at a Media Gateway. This is always a circuit-oriented interface in the scope of this H.248 Profile

NOTE: There are therefore three port types: analog port, ISDN Basic Rate Access port and Primary Rate Access Port.

IP Port: source and destination port numbers for UDP, SCTP and TCP traffic

Residential Gateway (RGW): Media Gateway that interworks a small number of analogue lines

NOTE: A residential media gateway typically contains one or two analogue lines and is located at the customer premises. See also clause 3.6 of ITU-T Recommendation H.248.1.

terminating Media Gateway: Media Gateway to which the called party's physical termination is connected

3.2 Abbreviations

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

ACO	Address COmplete message
AGCF	Access Gateway Control Function
AGW	Access GateWay
A-MGF	Access-MGF
BA	Basic Access
CN	Comfort Noise
CRC	Cyclic Redundancy Check
DNS	Domain Name System
DTMF	Dual Tone Multi Frequency
ECD	Echo Control Device
FEC	Forward Error Correction
FECD	Full ECD
GRE	Generic Routing Encapsulation
HECD	Half-way ECD
IECD	Incoming ECD
IID	IUA Interface Identifier
IP	Internet Protocol
IPsec	IP Security
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
IUA	ISDN Q.921-User Adaptation
MG	Media Gateway
MGC	Media Gateway Controller
MGF	Media Gateway Function
MID	Message Identifier
NAT	Network Address Translation
NMDS	Narrowband Multi-service Delivery System
NT1	Network Termination (type 1)
NTN	Network Terminating Node
OAM	Operation, Administration and Maintenance
OECD	Outgoing ECD
PBX	Private Branch eXchange
PES	PSTN/ISDN Emulation Subsystem
PLC	Packet Loss Concealment
PRA	Primary Rate Access
PT	Payload Type
QoS	Quality of Service
RGW	Residential GateWay
R-MGF	Residential-MGF
RTP	Real-time Transport Protocol
SCTP	Stream Control Transmission Protocol
SDP	Session Description Protocol
SPNE	Signal Processing Network Equipment
SRV	SeRVer
SSRC	Synchronization SouRCe
TAS	Terminal Alerting Signal
TCP	Transmission Control Protocol
TE	Terminal Equipment
TEI	TE Identifier
TLS	Transport Layer Security
TTL	Time To Live
UDP	User Datagram Protocol
VBD	VoiceBand Data

4 Applicability

4.1 Architecture

Figure 1 illustrates the architecture assumed in the present document. The Media Gateway Controller (MGC) resides in a control subsystem and may be implemented as a stand-alone piece of equipment or as a component of a call server. Access to the IP network is provided to analog terminals, ISDN terminals, analog and ISDN Private Branch Exchanges (PBX) through residential gateways or access gateways, which support one or more of the following reference points:

- The Z reference point for analogue terminations.
- The T reference point for Primary Rate Access.
- The S/T reference point for Basic Rate Access.
- The T* reference point for NMDS Access, as defined in EN 301 141-1 [7].

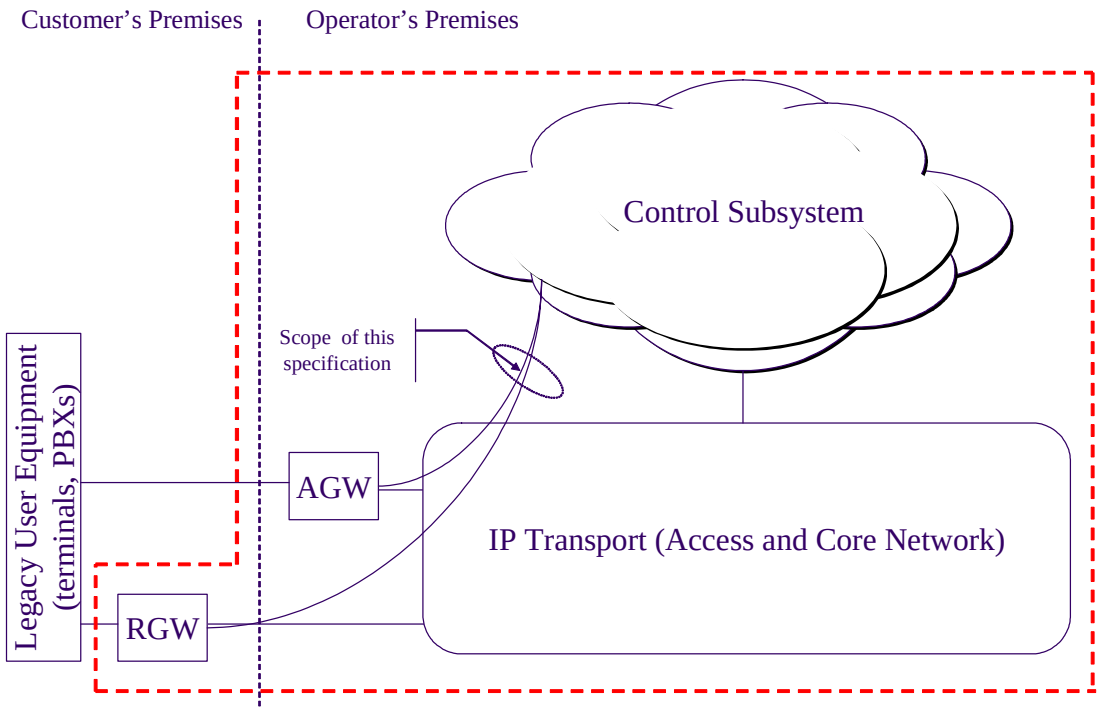

Figure 1: Reference architecture

The present document does not make any assumption on the structure of the control subsystem hosting the MGC functionality. In the context of the TISPAN NGN Architecture (see ES 282 001 [1]), the control subsystem is the PSTN/ISDN Emulation Subsystem (PES) (see ES 282 002 [2]). Within this subsystem, the AGCF plays the MGC role. The RGW and the AGW implement the R-MGF and A-MGF functional entities (respectively).

The area shown within the dashed lines, including part of the equipment placed on customer premises as a RGW, is considered to be under the control of a single operator. The use of IPSec (see RFC 2401 [36] or other security measures to create such a control area is outside the scope of the present document.

4.2 Functional requirements

Support of the packages identified in the profile definition implies support of the underlying functionalities. This clause identifies additional functional requirements that media gateways conforming to the present document shall comply with:

- Media Gateways shall support IPv4 and may support IPv6.
- Media Gateways shall support for ITU-T Recommendation G.711 [27] A-law voice codec and may support other codecs.

NOTE: Other mandatory codecs may also be required depending on the architecture in which media gateways are used.

- Media Gateways shall support autonomous transition from Audio Mode to ITU-T Recommendation G.711 [27]-based VBD Mode (according to ITU-T Recommendation V.152 [32]) upon detection of fax modem, text modem or data modem traffic.
- Media Gateways supporting other codecs than ITU-T Recommendation G.711 [27] shall also support the procedures defined in RFC 2833 [37] to generate, detect and forward DTMF digits. DTMF shall be identified by name (see mode "Named Telephone Events" in clause 3/RFC 2833 [37]), as opposed to their waveform properties.
- All properties of tones requested by the MGC shall be provisioned in the Media Gateway. The MGC is not required to send the physical characteristics of tones to Media Gateways.
- Where a RGW also provides customer access via a Network Address Translation (NAT) device, the design of the NAT function shall be such that it does not interfere with, and explicitly takes account of, the operation of the H.248 gateway function in the RGW.

5 Profile description

5.1 Profile identification

Table 1 provides the name and version of the profile that is sent in the service change command.

Table 1

Profile name:	ETSI_ARGW
Version:	1

5.2 Summary

The profile defined in the present document enables the control of residential and access media gateways connecting analog and ISDN lines to an IP transport domain, in order to emulate PSTN/ISDN services.

5.3 Gateway control protocol version

Version 2 shall be the minimum version supported. Support of this version implies conformance to ITU-T Recommendation H.248.1 Version 2 [15]and Corrigendum 1 [15] to this Recommendation, and implementation of the corrections available in the latest version of the H.248 Implementors' Guide.

Version 3 may be required if automatic metering requires iteration notification and/or if the "one way external" topology configuration is supported. Support of this version implies conformance to ITU-T Recommendation H.248.1 Version 3 (see bibliography). However, only "onIteration" in the NotifyComplete flag, "oneWayExternal" in the Topology Descriptor and "neverNotify" of the NotifyBehaviour parameter are required from this Recommendation.

5.4 Connection model

Media Gateways shall support ephemeral terminations that sink and source RTP traffic. This type of H.248 termination is denoted RTP in the following clauses.

Media Gateways shall also support at least one of the following types of physical terminations:

- ANALOG: H.248 terminations representing analogue lines where the Network Termination Point (NTP) at the customer premises conform to ES 201 970 [3].
- ISDN: H.248 terminations representing ISDN B-Channels of ISDN Primary and Basic Access that conform to TBR 003 [13] and TBR 004 [14].

Support of NMDS is achieved using ISDN terminations, according to EN 301 141-1 [7].

Table 2

Maximum number of contexts:	Provisioned (See note 1)
Maximum number of terminations per context:	2 (See note 2), 3 (See note 3), (See note 4), more than 3 (See note 4) (See note 5)
Allowed terminations type combinations in a context:	Media Gateways shall provide support for creating contexts containing two terminations of the same or different types, i.e., Context[a](ANALOG, ANALOG), Context[b](ANALOG, ISDN), Context[c](ISDN, ISDN), Context[d](ANALOG, RTP), Context[e](ISDN, RTP), Context[f](RTP, RTP). (See note 6) Support for more than two terminations of the same or different types may also be provided for 3-party calls, lawful intercept or both.

NOTE 1: The actual number of supported contexts can be audited by the MGC using the MaxNrOfContexts property defined in the Base Root Package.

NOTE 2: Support of 2 terminations in a context is the basic requirement in the MG. There are two levels of compliance to this basic requirement: a "basic support" and an "advanced support" of the connection model.
Basic Support: This combination only allows Context [d] and Context [e]. It should be noted that in this case an ephemeral termination is never added to a context without the presence of a physical termination within this context.
Advanced Support: Any combination of two termination types in contexts is allowed. There is no restriction as to whether an ephemeral termination can be added to a context other than NULL prior a physical termination also being present in this context.
The distinction between basic and advanced support is configurable in the MGC on a per MG basis.

NOTE 3: Support of 3 terminations in a context is required if the MG supports 3-party conference calls. The combination of terminations types may differ for a basic or advanced support of the connection model.
Basic Support: This level of support allows for one physical termination of type ANALOG or ISDN and two ephemeral terminations.
Advanced Support: Any combination of terminations is allowed of type ANALOG, ISDN and RTP.

NOTE 4: Support of more than 2 terminations in a context is required if the MG supports lawful intercept.

NOTE 5: The actual number of supported terminations can be audited by the MGC using the maxTerminationsPerContext property defined in the Base Root Package.

NOTE 6: Certain actions performed by the MGC may result in a context having one or more ephemeral terminations without any associated physical termination. This occurs for example while an ISDN subscriber has two active calls, each of which associated with two different contexts in the media gateway. Based on a subscriber's decision, the MGC may subtract the physical terminations from their respective contexts and reconnect the ephemeral terminations into a single context, thereby creating a context with two ephemeral terminations (RTP-to-RTP interworking). There are several services that can invoke a similar procedure, one of which is the Explicit Call Transfer service (see EN 300 367 [9]).

5.5 Context attributes

Table 3

Context attribute	Supported	Values supported
Topology	Yes	See clause 5.7.8
Priority Indicator	Yes	1 to 15
Emergency Indicator	Yes	Not Applicable

5.6 Terminations

5.6.1 Termination names

The termination ID structure is provisioned in the MGC and MG and is known by the MG and the MGC at or before start up. A hierarchical naming structure is recommended for physical terminations.

For example, the naming convention for physical terminations representing analog lines could be defined as follows:

al/<subrack>/<card>/<port>

Where, "al/" is a fixed prefix, <subrack>, <card> and <port> are non-zero integer values.

According to this naming scheme, an analog line connected on port 2 of card 1 in subrack 22 would be referred to as **al/22/1/2.**

A similar structure may also be used for ISDN Basic Access and Primary Rate Access, using different prefixes: "ba/" for Basic Access and "pra/" for Primary Rate Access. In such cases, the naming structure shall end with a component identifying a B channel.

For example the naming convention for physical terminations representing ISDN Basic Accesses may be defined as follows:

ba/<subrack>/<card>/<port>/<channel>

Where, "ba/" is a fixed prefix, <subrack>, <card> and <port> are non-zero integer values and <channel> shall uniquely identify each of the 2 B channels.

According to this naming scheme, an ISDN Basic Access B channel number 1 connected on port 7 of card 3 in subrack 15 would be referred to as **ba/15/3/7/1**.

Similarly the naming convention for physical terminations representing ISDN Primary Rate Accesses may be defined as follows:

pra/<subrack>/<card>/<port>/<channel>

Where, "pra/" is a fixed prefix, <subrack>, <card> and <port> are non-zero integer values and <channel> shall uniquely identify each of the ISDN-PRA B channels. The channel number shall be in the range 1 to 15 or 17 to 31 which identifies the time slot on the E1 used for transporting the "B" channel.

According to this naming scheme, an ISDN Primary Rate Access B channel carried in Time Slot 20 connected on port 3 of card 9 in subrack 5 would be referred to as **pra/5/9/3/20**.

5.6.2 Multiplexed terminations

Table 4

Multiplex terminations supported?	NO

NOTE: The MG is not required to support bonding of multiple ISDN B-channels, e.g. for support of ISDN multimedia conferencing. If there are such applications and ISDN teleservices, the MG will handle each B-channel individually. Therefore, this profile is not required to support the multiplex descriptor.

5.7 Descriptors

5.7.1 Stream descriptor

Table 5

Maximum number of streams per termination type	RTP, ANALOG, ISDN	1

5.7.1.1 LocalControl Descriptor

The following tables specify the level of support required with regard to the properties in the local control descriptor.

Table 6

		Termination type	**Stream type**
Reserve group used:	Yes	RTP	Not Applicable
Reserve value used:	Yes	RTP	Not Applicable

ReserveGroup:

The MGC shall set the "ReserveGroup" property to "true" in the case multiple session descriptor blocks are used for specifying multiple "m=" lines and resources are required to be reserved in the MG for the multiple session descriptor blocks. This situation can occur for example where the first session block descriptor contains a "m=" line indicating audio, while the second sessionà descriptor contains a "m=" line indicating T.38 (fax/modem relay). Alternatively, if the MGC when it specifies multiple session descriptor blocks requires the MG to select one of the session descriptor blocks, then it shall set the "ReserveGroup" property to "false".

Another example of where multiple "m=" lines may be specified is where different packetization periods are required for the different audio codecs.

In the situation where the MGC specifies a single session descriptor block, then the "ReserveGroup" property may be omitted or set to "false".

ReserveValue:

The MGC shall set the "ReserveValue" property to "true" when multiple codecs are specified within a single "m=" line of a session descriptor block and resources are required to be reserved in the MG for the multiple codecs. This situation occurs for example for audio calls where a low bit rate codec is specified for transporting voice and a G.711 codec (see ITU-T Recommendation G.711 [27]) is used for fallback (see ITU-T Recommendation V.152 [32]) in case a fax/modem is detected. Alternatively, if the MGC when it specifies multiple codecs requires the MG to select one of the codecs, then it shall set the "ReserveValue" property to "false".

In the situation where the MGC species a single codec within a "m line", then the ReserveValue property shall be omitted or set to "false".

StreamMode:

Table 7

Termination type	Stream type	Allowed StreamMode values
ALL except ROOT	Not Applicable	Send, Receive, Send and Receive, Loopback, Inactive

Table 8

Properties associated with Local Control Descriptor supported:		Yes	
If yes	**Property IDs reported**	**Termination type**	**Stream type**
	nt/jit	RTP	Not Applicable
	tdmc/ec tdmc/gain	ANALOG, ISDN ANALOG	Not Applicable
	mgcinfo/db	ALL	Not Applicable
	dscp/*	RTP	Not Applicable

5.7.2 Events descriptor

Table 9

Events settable on termination types and stream types:	Yes		
If yes	**Event ID**	**Termination type**	**Stream type**
	g/*	ALL	Not Applicable
	ocp/*	ROOT	Not Applicable
	nt/netfail nt/alert	ALL except ROOT RTP	Not Applicable
	rtp/*	RTP	Not Applicable
	xdd/xce, dd/[d0-d9], dd/da, dd/db, dd/dc, dd/dd, dd/do, dd/ds	ANALOG, ISDN (See note)	Not Applicable
	xal/*	ANALOG	Not Applicable
	stimal/*	ANALOG	Not Applicable
	qac/*	RTP	Not Applicable
	it/*	ROOT	Not Applicable
	ctyp/*	ANALOG, ISDN	Not Applicable
	amet/*	ANALOG	Not Applicable
NOTE: Support of the xdd package on ISDN terminations is required by certain types of ISDN-to-analog adaptors that cannot transport DTMF signals in ISDN signalling messages.			

Table 10

Event buffer control used:	No

Table 11

Keepactive used on events:	Yes

Table 12

Embedded events in an event descriptor:	Yes
Embedded signals in an event descriptor:	Yes

Table 13

NotifyBehaviour used on events:		Yes
If yes,	**Supported values**	NeverNotify

5.7.3 EventBuffer descriptor

Table 14

Event buffer descriptor used:	No	
If yes	**Event IDs**	Not Applicable

5.7.4 Signals descriptor

Table 15

Signals settable dependant on termination or streams types:		Yes		
If yes		**Signal ID**	**Termination type**	**Stream type/ID**
		cg/*	ALL except ROOT	Not Applicable
		srvtn/*	ALL except ROOT	Not Applicable
		xcg/*	ALL except ROOT	Not Applicable
		andisp/*	ANALOG	Not Applicable
		an/*	ALL except ROOT	Not Applicable
		xal/*	ANALOG	Not Applicable
		int/*	ALL except ROOT	Not Applicable
		biztn/*	ALL except ROOT	Not Applicable
		stimal/*	ANALOG	Not Applicable
		alert/*	ANALOG	Not Applicable
		amet/*	ANALOG	Not Applicable
		ctyp/*	ANALOG or ISDN	Not Applicable

Table 16

Signals lists supported:	Yes	
If yes	**Termination type supporting lists**	ALL
	Stream type supporting lists	ALL
	Maximum number of signals per signal list	5

Table 17

Signal type and duration supported:	Yes	
If yes	**Signal ID**	**Type or duration override**
	ALL	Both

Table 18

Signal direction supported:	No

Table 19

Notify completion supported:	Yes	
If yes	**Signal ID**	**Type of completion supported**
	ALL	ALL

Table 20

RequestID parameter supported:	Yes

Table 21

Signals played simultaneously:	Yes	
If yes	**Signal Ids that can be played simultaneously:**	ALL

Table 22

Keepactive used on signals:	Yes

5.7.5 DigitMap descriptor

Media Gateways conforming to this profile shall support at least one DigitMap.

Table 23

DigitMaps supported:	Yes		
If yes	**DigitMap name**	**Structure**	**Timers**
	It is recommended that the default initial digit map (i.e. first digit map used for collecting dialled numbers from ordinary subscriber lines) be named InitDM0.	Network operator dependent.	Network operator dependent.

5.7.6 Statistics descriptor

Table 24

Statistics supported on:	Termination

Table 25

Statistics supported on subtract:		Yes	
If yes	**Statistic IDs reported**	**Termination type**	**Stream type**
	nt/dur nt/os nt/or rtp/* amet/*	ALL RTP RTP RTP ANALOG	Not Applicable

5.7.7 ObservedEvents descriptor

When the event is provisioned in the media gateway, the Request Id is set to FFFFFFFF'H.

Table 26

Event detection time supported:	Yes

5.7.8 Topology descriptor

Support of the topology descriptor is optional.

Table 27

Allowed triples:	ALL values defined in ITU-T Recommendation H.248.1 version 3 (see bibliography) shall be supported.

5.7.9 Error descriptor

MGC supported:

Table 28

Supported H.248.8 error codes:	ALL
Supported error codes defined in packages:	All error codes defined in supported packages need to be supported.

MG supported:

Table 29

Supported H.248.8 error codes:	ALL
Supported error codes defined in packages:	All error codes defined in supported packages need to be supported.

5.8 Command API

5.8.1 Add

Table 30

Descriptors used by Add request:	ALL except Mux

Table 31

Descriptors used by Add reply:	ALL except Mux

5.8.2 Modify

Table 32

Descriptors used by Modify request:	ALL except Mux

Table 33

Descriptors used by Modify reply:	ALL except Mux

5.8.3 Subtract

Table 34

Descriptors used by subtract:	Audit

Table 35

Descriptors used by subtract:	Statistics

5.8.4 Move

Table 36

Move command used:	Yes

Table 37

Descriptors used by Move Request:	ALL except Mux
Descriptors used by Move Reply:	ALL except Mux

5.8.5 AuditValue

Table 38

Audited properties:	ALL properties	in ALL descriptors
Audited statistics:	ALL	
Audited signals:	ALL	
Audited events:	ALL	

Package audit possible?	YES

5.8.6 AuditCapabilities

Table 39

Audited properties:	ALL properties	in ALL descriptors
Audited statistics:	ALL	
Audited signals:	ALL	
Audited events:	ALL	

5.8.7 ServiceChange

Table 40

MGC supported:

ServiceChange methods supported:	**ServiceChange reasons supported:**
ALL	900 to 920

Table 41

MG supported:

ServiceChange methods supported:	**ServiceChange reasons supported:**
ALL	900 to 920

Table 42

ServiceChangeAddress used:	No

Table 43

ServiceChangeDelay used:	Yes	
If yes	**Valid time period:**	Provisioned

Table 44

ServiceChange incomplete flag used:	No

Table 45

Version used in ServiceChangeVersion:	ITU-T Recommendation H.248.1 Version 2 [15] shall be the minimum version used in ServiceChangeVersion. ITU-T Recommendation H.248.1 Version 3 (see bibliography) may also be reported by media gateway that support automatic metering with iteration notification and/or the "oneWayExternal" configuration of the topology descriptor and/or setting of notifyBehaviour.

Table 46

Profile negotiation as per H.248.18:	No

5.8.8 Manipulating and auditing context attributes

Table 47

Context attributes manipulated:	ALL supported attributes (See table 3)
Context attributes audited:	ALL supported attributes (See table 3)

5.9 Generic command syntax and encoding

Table 48

Supported encodings:	Text encoding shall be supported by both the MG and the MGC. Both the long and short form of text encoding shall be supported at the receiving side.

5.10 Transactions

Table 49

Maximum number of transaction requests/replies/TransResponseAcks/segment replies per message:	2
NOTE : When two elements are conveyed in one message, it is recommended that this message comprises a transaction request/transaction reply/transaction pending plus a transaction response ACK.	

Table 50

Segmentation supported:	UDP : No SCTP : Inherent in transport
NOTE: The H.248 segmentation package according annex E.14 of H.248.1 Version 3 is intended for H.248 transport technologies without the capability of automatic message segmentation. This method is not required for UDP- or SCTP-based H.248 signalling transport in this Profile.	

Table 51

Maximum number of commands per transaction request:	3

Table 52

Maximum number of commands per transaction reply:	3

Table 53

Commands able to be marked "Optional":	AUDITVALUE, AUDITCAPABILITY

Table 54

Transaction timer:	**Value**
normalMGExecutionTime	Provisioned in the MG
normalMGCExecutionTime	Provisioned in the MG
MGOriginatedPendingLimit	Provisioned in the MG
MGCOriginatedPendingLimit	Provisioned in the MG
MGProvisionalResponseTimerValue	Provisioned in the MG
MGCProvisionalResponseTimerValue	Provisioned in the MG

Transaction timers (as defined in the properties of the Base Root package) shall be in a range between 100 milliseconds and 5 seconds. The MGC may overwrite the provisioned values.

5.11 Messages

It is recommended that MG and MGC names are in the form of fully qualified domain name. For example the domain name of the MGC may be of the form mgc1.whatever.net and the name of the MG may be of the form mg1.whatever.net.

The fully qualified domain name will be used by the MG and MGC as part of the "Message Identifier" (MID) in the H.248 messages which identifies the originator of the message.

The MGC domain name is provisioned in the MG or retrieved from the DNS using SRV records.

The use of a domain name provides the following benefits:

- MGs and MGCs are identified by their domain name, not their network addresses. Several addresses can be associated with a domain name. If a command cannot be forwarded to one of the network addresses, implementations shall retry the transmission using another address.
- MGs and MGCs may move to another platform. The association between a logical name (domain name) and the actual platform are kept in the Domain Name Service (DNS). MG and MGC shall keep track of the record's time-to-live read from the DNS. They shall query the DNS to refresh the information if the time-to-live has expired.
- The domain name may be used by MGC/MG for authentication purposes.
- Can assist in trouble shooting.

5.12 Transport

Table 55

Supported transports:	Transport over UDP shall be supported. Support of SCTP is optional and shall conform to ITU- T Recommendation H.248.4 [17]. Choosing one option or the other is a network operator's decision, based on the network configuration.

For UDP transport the destination IP addresses to be used for delivering the H.248 messages are retrieved through the following means:

- The MGC will store the source IP address retrieved from the message carrying first ServiceChange command. All subsequent messages delivered to the MG will use this IP address.
- The MG will store the source IP address retrieved from the message carrying the reply to the ServiceChange command. All subsequent messages delivered to the MGC will use this IP address.

NOTE: The MG will use the DNS lookup in order to retrieve the initial IP address to send the first ServiceChange command. This IP address may be different than the IP address returned in the reply to ServiceChange command.

Table 56

Control association monitoring supported:	UDP : AuditValue on Root and H.248.14 SCTP : Inherent in Transport,

5.13 Security

Table 57

Supported security:	For the purpose of the present document the control protocols are considered to be inside the secured zone of a single operator as shown in figure 1. The specified H.248 security options should not be used, as these interfaces are considered to be within a secured zone. In clause 7 of the present document protocols other than H.248 are specified and the security issues are dealt with here. No security measures, either IPsec or TLS, shall be used on the IUA interfaces since they too are considered to be within a secured zone. Finally no countermeasures shall be applied to the GRE interface carrying packet data. It is important to note that the context of this clause, and the recommendations in it, only apply to the case where the interfaces, H.248, IUA and GRE specified by the present document all fall within the secure zone shown in figure 1. In any other case a different risk may apply and appropriate countermeasures may be needed.

5.14 Packages

Table 58

Mandatory packages (See note)	
Package name/reference	**Package ID**
Generic (ITU-T Recommendation H.248.1 [15])	G
Base Root (ITU-T Recommendation H.248.1 [15]) Version 2	root
Call Progress Tones Generator (ITU-T Recommendation H.248.1 [15])	Cg
Overload Control Package (ITU-T Recommendation H.248.11 [19])	Ocp
Network (ITU-T Recommendation H.248.1 [15])	Nt
TDM Circuit (ITU-T Recommendation H.248.1 [15])	tdmc
RTP Package (ITU-T Recommendation H.248.1 [15])	Rtp
Extended DTMF Detection (ITU-T Recommendation H.248.16 [22])	Xdd
NOTE: Unless stated otherwise, version 1 of each package shall be supported.	

Table 59

Optional packages (See note 1)		
Package name/reference	**Package ID**	**Support dependent on:**
Basic Services Tones Generator (ITU-T Recommendation Q.1950 [26])	srvtn	This package shall be supported if terminations representing analog lines are supported by the MG.
Expanded Call Progress Tones Generator (ITU-T Recommendation Q.1950 [26])	xcg	This package shall be supported if terminations representing analog lines are supported by the MG.
Enhanced Alerting (ITU-T Recommendation H.248.23 [23]) (See note 2)	alert (version 2)	This package shall be supported if terminations representing analog lines are supported by the MG.
Analog Display Signalling (ITU-T Recommendation H.248.23 [23])	andisp (version 2)	This package shall be supported if terminations representing analog lines are supported by the MG.
Generic Announcement (ITU-T Recommendation H.248.7 [18])	An	Support becomes mandatory if local announcements are available.
Analog Line Supervision (ITU-T Recommendation H.248.1 [15]) (See note 3)	Al	This package shall be supported by the MG if terminations representing analog lines are supported and the Stimal package is not supported.

Optional packages (See note 1)		
Package name/reference	**Package ID**	**Support dependent on:**
Extended Analog Line Supervision (ITU-T Recommendation H.248.26 [24]) (See note 3)	xal (version 2)	This package shall be supported by the MG if terminations representing analog lines are supported AND control of polarity reversal is required by the operator AND the Stimal package is not supported.
Automatic Metering (ITU-T Recommendation H.248.26 [24])	amet (version 2)	Support of Advice of Charge using pulse metering on analog lines.
Intrusion Tones Generation (ITU-T Recommendation Q.1950 [26])	Int	Special types of access gateways (e.g. connecting private networks) or network operator option.
Business Tones Generation (ITU-T Recommendation Q.1950 [26])	biztn	Special types of access gateways (e.g. connecting private networks) or network operator option.
DiffServ (TS 102 333 [10])	ds	Operator option.
Quality Alert Ceasing (ITU-T Recommendation H.248.13 [20])	qac	Quality of Service Monitoring is enabled
Inactivity Timer (ITU-T Recommendation H.248.14 [21])	it	UDP transport is enabled.
Call Type Discrimination (ITU-T Recommendation H.248.2 [16])	ctyp	Used by the MG in situations where it is necessary to inform the MGC of the detected voice-band tone so that the MGC for example can inform non ITU-T Recommendation G.168 [41] compliant MGs to remove any echo cancellers (see note 4).
Stimulus Analog Line (ITU-T Recommendation H.248.34 [25]) (See note 3)	stimal	This package shall be supported by terminations representing analog lines are supported AND the Analog Line Supervision package is not supported.
MGC Information (TS 183 022 [11])	mGCInfo	This package may be supported as an operator option. For this profile the information string shall be limited to 32 octets in length.
NOTE 1: Unless stated otherwise, version 1 of each package shall be supported. NOTE 2: This package overlaps with the Stimulus Analog Line package (see table 60). If the Stimulus Analog Line package is implemented, support of the ringsplash signal of the Enhanced Alerting package is optional. NOTE 3: Table 60 provides an overview of the overlap between the Stimulus Analog Line package and other packages. NOTE 4: The Media Gateways using this profile are required to support ITU-T Recommendation G.168 [41].		

The following table reflects the overlap between al, alert, xal and amet packages against stimal package. If the stimal package is supported by the Media Gateway then only the alert package (ring and call waiting signals) and automatic metering package (enable metering signal) are to be supported while the al and xal packages are not used.

Table 60: Overlap between the stimal package and other packages

Package name	Package ID	Comment on overlapping
Analog Line Supervision	al	offhook = steady-signal, Off hook (loop closed) onhook = steady-signal, On hook flashhook = pulsed signal, Register recall
Enhanced Alerting package	alert	ring = (no overlap) ringsplash = pulsed signal, Initial Ring call waiting = (no overlap)
Extended analog line supervision package	xal	Line-side answer supervision (las) = steady signal, Reversed Polarity Network Disconnect (nd) = pulsed signal, Pulsed No Battery
Automatic Metering package	amet	Enable metering = (no overlap) Metering pulse burst = pulsed signal, Meter Pulse

Package usage information:

Table 61

Package usage information:		
Package name	**Support of properties, parameters, signals, events, statistics, error codes**	**Package usage/provisioned value:**
Generic	ALL	
Base Root	ALL	
Call Progress Tones Generator	ALL	If used, the release tone shall be identical to the congestion tone. Levels, cadences and frequencies of signals shall conform to national specifications. In the absence of such specification, the following rules shall be used. Levels, cadences and frequencies of the following signals shall conform to ES 201 970 [3]: - Dial Tone - Ringing Tone (also known as ringback tone) - Busy Tone - Call Waiting Tone The characteristics of other signals shall conform to ITU-T Recommendation E.180 [33].
Basic Services Tones Generator	ALL	Unless specified otherwise in national specifications, the characteristics of the Message Waiting Tone signal shall be those defined in ES 201 970 [3] for the Special Dial Tone.
Expanded Call Progress Tones Generator	ALL	Unless specified otherwise in national specifications, the characteristics of the Special Condition Dial Tone (spec) shall be those of the Special Dial Tone defined in ES 201 970 [3].
Analog Line Supervision	The ring signal shall not be used. Ringing shall be controlled using the ring signal of the Enhanced Alerting package.	The on-hook and off-hook signals shall respectively conform to the Clear and Seize signals defined in ES 201 970 [3]. The hook-flash signal shall conform to the Register Recall signal defined in ES 201 970 [3].
Enhanced Alerting	ALL	Unless specified otherwise in national specifications, the default ring signal shall conform to ES 201 970 [3]. A minimum of 5 different ring patterns shall be provisioned in the MG. The pattern number 1 shall be the default pattern, used for normal ringing.
Analog Display Signalling	ALL	See clause 7.2.4.
Automatic Metering	ALL	12 kHz or 16 kHz signals shall be supported by the MG. The frequency shall be provisioned on a per MG basis. If acknowledgement of individual pulses is required, this profile shall use H.248 Version 3 rather than H.248 version 2.
Extended DTMF Detection	ALL	DTMF detection shall conform to ES 201 253-3. Recommended default values of the timers defined in ITU-T Recommendation H.248.1 [15] for an initial digit map are: - T = 20 seconds - S = 5 seconds - L = 10 seconds
Extended Analog Line Supervision	ALL	The Line-side answer supervision (xal/las) shall result in the MG applying a reverse polarity. The Network Disconnect (xal/nd) signals shall, as a network option, result in either the MG applying normal polarity or disconnecting the power feed for a short duration.
Overload Control	ALL	

Package usage information:		
Package name	**Support of properties, parameters, signals, events, statistics, error codes**	**Package usage/provisioned value:**
Network	ALL	The MGC should not set the Maximum Jitter Buffer property. Media Gateways shall ignore this property if received from a MGC.
TDM Circuit	ALL	Default value for the Echo Control property is "on".
RTP	ALL	
Generic Announcement	ALL	
Intrusion Tones Generator	ALL	
Business Tones Generator	ALL	
DiffServ	ALL	
Quality Alert Ceasing	ALL	
Inactivity Timer	ALL	
Call Type Discrimination	ALL	
Stimulus Analog Line	ALL	
MGC Information	ALL	

5.15 Mandatory support of SDP and annex C information elements

The v=, o=, s=, m=, c=, t=, a= and b= lines of the SDP (see RFC 2327 [34]) syntax shall be supported. All other lines should be ignored if received.

Table 62

Supported annex C and SDP information elements:		
Information element	**Annex C support**	**SDP support**
Protocol version (v=)	Not Supported	The protocol version (v=) line contains a single field: *v= <version>* and shall be used in accordance with RFC2327 (i.e. v=0).
Origin (o=)	Not Supported	The origin line consists of 6 fields: *o= <user name> <session ID> <version> <network type> <address type> <address>.* The MGC is not required to supply this line but shall accept it. The MG should populate this line as follows or use the value received from the MGC: - <user name> should contain an hyphen. - <session ID> and <version> should contain one or mode digits as described in RFC 2327 [34]. - <network type> shall be set to IN. - <address type> shall be set to IP4 or IP6 The Address Type shall be set to "IP4" or "IP6" depending on the addressing scheme used by the network to which the MG is connected. - <address> should contain the fully qualified domain name of the gateway.
Session Name (s=)	Not Supported	The session name (s=) line contains a single field: *s= <session-name>.* The MGC is not required to supply a session name but shall accept one. This line may be used to convey correlation information for use in CDRs. The MG shall use an hyphen "-" as a session name or the value received from the MGC.

Supported annex C and SDP information elements:		
Information element	**Annex C support**	**SDP support**
Connection data (c=)	Not Supported	The connection data line consists of 3 fields: *c= <network-type> <address-type> <connection-address>* - The <network-type> shall be set to "IN". - The <address-type> shall be set to "IP4" or "IP6" depending on the addressing scheme used by the network to which the MG is connected. - The <connection-address> sent by the MGC in the remote descriptor is the address to which the MG shall send the media flows. - The <connection-address> sent by the MGC in local descriptors may be a unicast IPv4 or IPv6 address or it may be wildcarded to allow the MG to choose an address. In the second case, MGs shall fill this field with a unicast IP address at which they will receive the media stream. Thus a TTL value shall not be present and a "number of addresses" value shall not be present. The field shall not be filled with a fully-qualified domain name instead of an IP address. When the <connection address> is wildcarded (i.e. choose wildcard) by the MGC, the MG allocates an IP address based on the address type. The addressing space for which this address is taken may depend on the termination ID supplied by the MGC.
Media announcements (m=)	Not Supported	Media Announcements (m=) lines consist of 3 fields: *m= <media> <port> <transport> <format>* - The <media> field shall be set to "audio", except in case of T.38 fax transmission where it shall be set to "image". - The <port> field in remote descriptors is provided by the MGC and represents the port to which the MG shall send the media flows. - The <port> field in local descriptors may be provided by the MGC or wildcarded (i.e. choose wildcard) to allow the MG to choose a value for the port on which it wishes to receive the media stream. - The <transport> field shall be set to "RTP/AVP" except in case of T.38 Fax relay and V.150.1 Modem relay, where it shall be set to "udptl" or "udpsprt" (respectively). - The <format> field may be explicitly supplied by the MGC, wildcarded or overspecified. If the MGC wishes to request the MG to choose which media formats it wishes to use for the call then the MGC shall provide a "$" wildcard. If the MGC wishes to suggest that the MG selects a media format from a list of possible media formats then it shall provide a list of appropriate media types in accordance with SDP. All conforming gateways shall support at least format "8" for RTP/AVP (i.e. ITU-T Recommendation G.711 [27] A-Law). Dynamic payloads shall not be used when a static RTP/AVP payload value is defined in RFC 3551 [35].
Bandwidth (b=)	Not Supported	The Bandwitdh (b=) line consists of 2 fields: *b= <modifier>: <bandwidth-value>* Bandwidth information shall be supplied by the MGC if the required bandwidth cannot be immediately derived from the information contained in the m= line. If absent, the MG shall assume a reasonable default bandwidth value for well-known codecs and shall provide this value in the response sent to the MGC. The Modifier field shall be set to "AS". The Bandwidth Value field shall be set to the maximum bandwidth requirement of the media stream in kbit/s. The bandwidth value shall take into account all headers down to the IP layer, including a 5 % bandwidth for RTCP packets.

Supported annex C and SDP information elements:		
Information element	**Annex C support**	**SDP support**
Time (t=)	Not Supported	The time (t=) line consists of two fields: *t= <start-time> <stop-time>.* This line is ignored by both the MGC and the MG if received in local and remote descriptors. The MGC is not required to supply a time description but shall accept one. When supplied, this line shall be set to 0 0.
Attributes (a=)	Not Supported	Attributes (a=) lines consist of two fields: *a= <attribute>: <value>* One or more of the "a" attribute lines specified below may be included, depending on the payload type. An attribute line not specified below should not be used. Only the following attributes are understood by the MG. Other attributes are ignored. *a= rtpmap: <payload type> <encoding name>/<clock rate> [/<encoding parameters>]* *a= fmtp:<format> <format specific parameters>* *a= ptime: <time>*

5.16 Procedures

Procedures for ephemeral H.248 terminations (here IP only) are described in clause 6.

Procedures for physical H.248 terminations are described in clauses 7.2 and 7.3 providing the specifics of ANALOG and ISDN H.248 terminations respectively.

6 Procedures at the IP side

6.1 General procedures

Media Gateways shall discard packets with RTP Payload Types (PT) that do not match the Local Descriptor contents.

NOTE 1: Besides an incorrect RTP PT field might be also other reasons for discarding packets (invalid SSRC field, invalid CRC, etc.).

NOTE 2: The MG has the option to collate statistics on discarded packets.

When sending packets from a termination, Media Gateways shall use the address and port in the Local Descriptor as a source address and port.

6.2 VoiceBand Data (VBD)

Voiceband data refers to traffic from facsimile, modem or text telephony applications.

Upon detection of voiceband data traffic, the Media Gateway shall autonomously switch from Audio mode to VBD mode with G.711 codec if the H.248 Remote Descriptor indicates that ITU-T Recommendation G.711 [27] is supported by the peer entity.

NOTE: This means that ITU-T Recommendation G.711 [27] may be used for audio mode and shall be used for the VBD mode.

Transitioning between Audio mode and VBD mode is possible in both directions. The procedures for transitioning between these two operation modes are described in clause 10 of ITU-T Recommendation V.152 [32]. Any state transition requires the detection of a "VBD stimuli" (see clause 9 of ITU-T Recommendation V.152 [32]). The relevant stimuli for this H.248 Profile are summarized in table 63.

Autonomous state transitioning means that the MGC is not controlling the operation mode changes in the MG. The MG is detecting potential trigger events and deciding itself state transitioning according to ITU-T Recommendation V.152 [32]rules. The MG autonomous mode does not preclude a notification of the MGC by the MG.

The VBD mode of operation shall be implemented as defined in ITU- T Recommendation V.152 [32], which involves:

- disabling Voice Activity Detection and Comfort Noise Generation if any of these had been activated;
- ensuring end-to-end constant latency;
- ensuring that voice packet loss concealment techniques and algorithms that may be employed are suitable for modem and facsimile modulations; and
- disabling any DC removal filters that may be integral with the speech encoder used.

The use of echo cancellers shall be as per ITU-T Recommendation G.168 [41].

No explicit negotiation of the VBD mode is required, beyond the support of ITU-T Recommendation G.711 [27].

ITU-T Recommendation V.152 [32] procedures are applied with the following exceptions:

- Support of ITU-T Recommendation V.152 [32] by the MG does not have to be explicitly notified to the MGC (i.e. the "gpmd" SDP attribute with "vbd=yes" does not need to be supported).
- No specific payload type code is required for signalling ITU-T Recommendation G.711 [27] VBD mode of operation (i.e. one of the static payload codepoints for ITU-T Recommendation G.711 [27] is used).

Voiceband data traffic shall be detected by monitoring the tones described in the following table.

Table 63: VBD mode triggering events

"Tone"	Description
CNG	a T.30 fax calling
V.21flag	a V.21 tone and flags
CIV18	a V.8 CI with V.18 call function
XCI	a V.18 XCI
V18txp	a V.18 "txp"
Belltone	a Bell 103 carrier, either the high or the low frequency channel (as defined in V.18)
Baudot	a Baudot initial tone and character (as defined in V.18)
Edt	an EDT initial tone and character (as defined in V.18)
CIdata	a V.8 CI with any data call function
CT	a V.25 calling tone
CIfax	a V.8 CI with facsimile call function
V21tone	a V.21 carrier, either the high or the low frequency channel
V23tone	a V.23 carrier, either the high or the low frequency channel
V8bis	a V.8bis modem handshaking signal
ANS (see note)	V.25 ANS, equivalent to T.30 CED from answering terminal
ANSAM (see note)	V.8 ANSam
NOTE: Including both the absence and the presence of phase reversal.	

Payload transitions may be notified to the MGC using the Payload Transition event defined in the RTP package. The Media Gateways may also report the above to the MGC using the Discrimination tone event in the Call Type Discrimination package.

Automatic switch over to VBD mode does not preclude the gateways from negotiating support of other mechanisms such as Forward Error Correction (FEC) (e.g. RFC 2733 [42]) or other forms of Redundancy (e.g. RFC 2198 [43]).

Media Gateways may also support relay mode for fax and modem, based on the procedures described in ITU-T Recommendations T.38 [30] and V.150.1 [31]. Autonomous switch over to such payload types shall only occur if successfully negotiated with the remote side.

6.3 Support of ISDN unrestricted 64 kbit/s

When the MGC determines that a 64 kbit/s unrestricted bearer service is requested, the clearmode codec shall be used. A Dynamic Payload type with CLEARMODE as encoding name shall be included in both the local and remote descriptor.

EXAMPLE:

```
v= 0
c= IN <address type> <connection address>
m= audio <port number> RTP/AVP 99
a= rtpmap: 99 CLEARMODE/80000
a= ptime: 10
```

The behaviour of the MG shall then conform to RFC 4040 [39]. All voice and signal processing functions such as echo cancellation, silence suppression, comfort noise insertion and gain adjustment shall be automatically turned off. The MG shall inherit the same QoS objectives than the ISDN bearer service.

6.4 Comfort noise insertion and silence suppression

If a codec has built-in support for silence suppression and comfort noise insertion, the activation or deactivation of these features shall be indicated using the a= line according to RFC 3551 [35] and RFC 3555 [40].

If the selected codec does not have built in support for silence suppression and comfort noise (CN) insertion, the CN payload code (see RFC 4040 [39]) may be included in the media description.

EXAMPLE (for ITU-T Recommendation G.711):

```
v= 0
c= IN <address type> <connection address>
m = audio <port number> RTP/AVP 0 13
a= ptime: 10
```

If the CN payload is included in the Local Descriptor, the MG shall be prepared to received CN packets during silence periods.

If the CN payload is included in the Remote Descriptor, the MG shall send CN packets during silence periods.

Comfort noise analysis, voice activity detection and discontinuous transmission algorithms are outside the scope of the present document.

6.5 DTMF transmission

When a G.711 codec is used (see ITU-T Recommendation G.711 [27]), Media Gateways shall be able to generate, detect and forward DTMF tones inband.

When other codecs are used, the MGC should request the use of the procedures defined in RFC 2833 [37] to send and receive DTMF tones:

- If the Local Descriptor sent by the MGC includes the support for RFC 2833 [37], Media Gateways shall be prepared to receive DTMF tones in the form of named events and relay the appropriate audio signal to the physical terminations.

- If the Remote Descriptor indicates that RFC 2833 [37] is supported, Media Gateways shall be prepared to relay in the form of named events, any DTMF tone received from the physical terminations.

A Dynamic Payload type shall be used to indicate support of RFC 2833 [37] for DTMF relay.

EXAMPLE:

```
v= 0
c= IN <address type> <connection address>
m= audio <port number> RTP/AVP 18 110
a= ptime: 10
a= rtpmap: 110 telephone-event/8000
a= fmtp: 110 0-15
```

6.6 Call progress tones

Call progress tones shall be sent in-band using a voice codec.

6.7 Support of G.711 variants

6.7.1 G.711 encoding law

Media Gateways conforming to this specification are required to support ITU-T Recommendation G.711 [27] A-Law and may also support μ-Law
in order to avoid call failure or transcoding in case the remote entity supports μ-Law only. How and where to perform transcoding in IP networks in case both terminals/gateways do not support the same variant is outside the scope of this profile.

6.7.2 G.711 silence suppression mode

ITU-T Recommendation G.711 [27]-over-IP may be operated with or without silence suppression. In case of silence suppression, comfort noise generation shall be based on ITU-T Recommendation G.711 Appendix II [29]. These features may be enabled/disabled on a per session basis, using the procedure described in clause 6.4.

6.7.3 G.711 packet loss concealment

ITU-T Recommendation G.711 [27]-over-IP may be operated with or without error loss concealment. Typically is that decision dependent on the IP packet loss rate conditions. ITU-T Recommendation G.711 [27] error loss concealment is based on RTP packet granularity, therefore called as packet loss concealment (PLC). ITU-T Recommendation G.711 Appendix I [28] provides a framework for ITU-T Recommendation G.711 [27] PLC mode.

6.8 MG-Internal redirection of RTP traffic

There might be situations where both RTP session endpoints will be located in the same media gateway (e.g. for a local call). This is related to the case where the two corresponding H.248 RTP terminations, of a single RTP session, belong to two different H.248 Contexts. If RTP traffic turn around is not supported by the edge routers, it is recommended that the MG try to redirect internally the corresponding RTP/RTCP bearer traffic. This function is related to routing and forwarding of IP packet traffic. The function is therefore also known as MG-embedded IP Router function (figure 2).

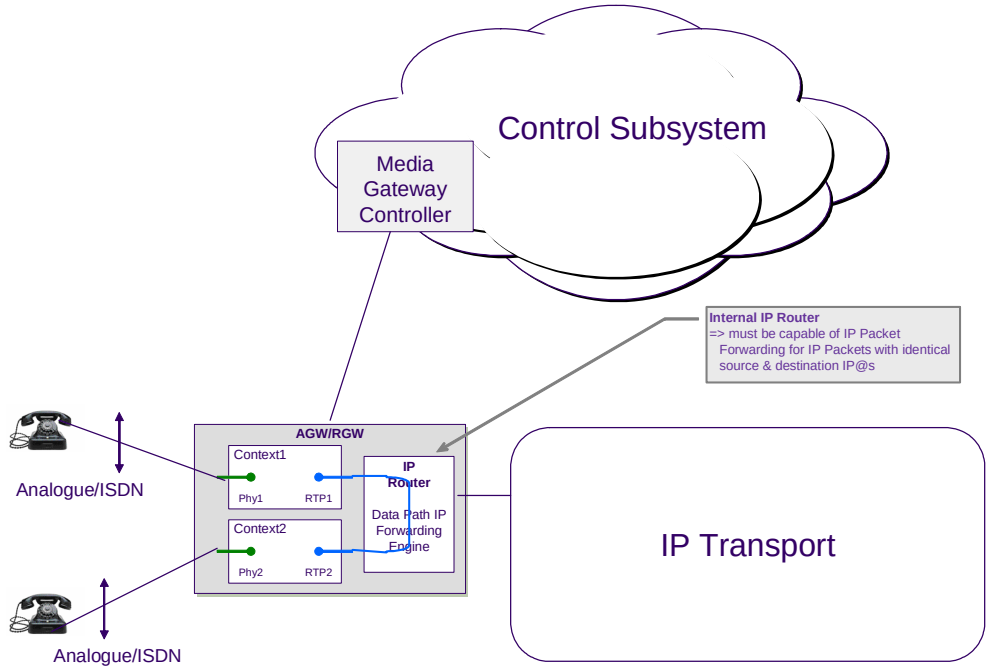

Figure 2: Single RTP session - internal bearer redirection via embedded IP router

The MGC may resolve such a two-Context configuration by appropriate H.248 Commands. This may be done in a very early stage, i.e., already during call/bearer establishment phase, or in a later stage during active call phase.

7 Procedures for Physical H.248 terminations

7.1 General procedures

7.1.1 Initial configuration

A default digit map shall be provisioned in the MG, so that it can be referred to by name rather than by value.

7.1.2 DTMF detection

When a series of digit maps is used during called party's number dialling, it is recommended that the values of the timers defined in ITU-T Recommendation H.248.1 [15] be set in such a way that the T timer of the subsequent digit maps be set the same value than the L timer.

7.1.3 Sending of tones

Signals shall be sent to the exterior of the gateway, according to the following principles:

- When sending a tone to the calling party from the originating MG, the signal shall be applied to the physical termination.
- When sending a tone to the calling party from the terminating MG, the signal shall be applied to the ephemeral termination.
- When sending a tone to the called party from the terminating MG, the signal shall be applied to the physical termination.
- When sending a tone to the called party from the originating MG, the signal shall be applied to the ephemeral termination.

The following table summarizes where usual tones are generated.

Table 64

Tone	Generation side	Perceived by	Signal
Dial tone	Local	Calling Party	cg/dt
Ring tone	Local or Remote	Calling Party	cg/rt
Busy tone	Local	Calling Party	cg/bt
Release tone	Local	Calling Party	cg/ct
Special Dial Tone	Local	Calling Party	xcg/spec
Special Information Tone	Local or Remote	Calling Party	cg/sit
Call Waiting tone	Local	Called Party	cg/cw or alert/cw (See note)
Congestion tone	Local or Remote	Calling Party	cg/ct
Caller Waiting Tone	Remote	Calling Party	cg/cr
Message Waiting Tone	Local	Calling Party	srvtn/mwt
Confirmation Tone	Local	Calling Party	srvtn/conf
Negative Acknowledgment	Local	Calling Party	xcg/nack
Off-Hook warning tone	Local	Both	xcg/roh
Vacant Tone (Number Unobtainable)	Local	Calling Party	xcg/vac
NOTE: The call waiting tone may also be embedded in the andisp/dwa signal if associated with display information.			

In an originating MG, the context topology and the termination modes shall be configured in such a way that in-band information can be received from the remote side before the called party's answer. This setting shall occur not later than the receipt of the ACO message (or an equivalent message from another signalling protocol that ISUP).

7.1.4 Sending of announcements

Residential Gateways are not required to store recorded announcements nor to support the generic announcement package.

Access Gateways may be able to store recorded announcements and shall support the generic announcement package. However, Access Gateways are not required to support variable announcements.

When the announcement to be delivered is not available in the gateway and cannot be autonomously retrieved by the gateway from a remote repository, the MGC shall initiate a connection to an external announcement machine, by temporarily adding a termination into the context. Instructions to play announcements are sent directly from the MGC to the server. The announcement server may itself be implemented as an MG, controlled using the H.248 protocol. However, this interface is outside the scope of the present document. In an originating MG, the context topology and the termination modes shall be configured in such a way that in-band information can be received from the remote side before the called party's answer. This setting shall occur not later than the receipt of the ACO message (or an equivalent message from another signalling protocol that ISUP).

7.1.5 Support of emergency calls

The MGC is responsible for detecting emergency calls and setting the Emergency Call context property when creating the associated context. Prior to the context being created the MG makes no assumption on the priority of the events that take place.

The priority context property shall not be used for emergency calls.

7.1.6 Echo control

Physical terminations are required to support echo cancellation. Echo cancellation is automatically activated on physical terminations by the MG and may be deactivated using the TDM Circuit package (see note 1).

NOTE 1: H.248 TDM Circuit Package Version 1 (see ITU-T Recommendation H.248.1 [15], annex E.13) is providing the basic control capabilities for ECDs in H.248 MGs. The SPNE Control Package (see ITU-T Recommendation Q.115.0 [44], clause 7.2) is extending the tdmc Version 1 package by further ECD control possibilities. The SPNE Control Package is not required and is beyond the scope of Version 1 of this profile.

Deactivation by the MGC occurs on ISDN physical terminations in case of Unrestricted 64 kbit/s calls and on ANALOG terminations in case the PSTN subscriber line is marked as supporting data calls only. Echo cancellation may also be deactivated by the MG when entering the VBD mode.

An Echo Control Device/Function (ECD; see ITU-T Recommendation Q.115.1 [45], clause 3.1) is therefore always associated with a physical H.248 termination (notes 2 and 3).

NOTE 2: A VoIP Media Gateway defined by this H.248 Profile is a so-called "type 1 exchange/node" from ECD point of view (see ITU-T Recommendation Q.115.1 [45], clause A.2.4.3.1).

NOTE 3: The configuration of the HECD (or ECD) in a media gateway is the "reverse associated" mode (see ITU-T Recommendation Q.115.1 [45], clause A.1.1, note 1 and figures A.2a, A.2b, A.3).

An ECD is responsible for a single echo path, therefore also known as half-way ECD (HECD) (notes 4 and 5). The ITU-T RecommendatioG.168 [41] Digital Network ECD is required for the echo generated at "legacy terminal" side of the MG. This is the echo path on which the HECD is intended to operate, called as G.168 Cancelled End (or formerly as Near End). The required ECD tail length capacity is given by the echo path at the cancelled end.

NOTE 4: A local call, resulting in a single H.248 Context with two physical H.248 terminations (Phy-to-Phy bearer interworking) may result in the allocation of two HECDs, one per direction. Such two complementary HECDs representing a full-way ECD (called full ECD (FECD), see ITU-T Recommendation. Q.115.1 [45], clause 3.7). A FECD configuration for Phy-to-Phy H.248 Context types is not required and supported in this Profile version. It is rather anticipated from MG side, that the MGC is disabling the ECD resources for such a Context type, due to the small end-to-end propagation delay here.

NOTE 5: More detailed ECD notation: In case of an outgoing call the ECD in the originating media gateway, responsible for the hybrid echo generated by the calling party, is playing the role of the outgoing ECD (OECD, see ITU-T Recommendation Q.115.1 [45], clause 3.12). In case of an incoming call the ECD in the terminating media gateway, responsible for the hybrid echo generated by the called party, is playing the role of the incoming ECD (IECD, see ITU-T Recommendation Q.115.1 [45], clause 3.11).

7.2 Specific procedures for analog lines

7.2.1 Autonomous actions

Normally the MG detects and applies analogue signals to the analogue line under the instructions of the MGC. However, a MG may be provisioned to perform the following time critical autonomous actions:

- Apply normal power feed when the analogue line state changes from On-Hook to Off-Hook.
- Apply idle voltage/current feed when the analogue line state changes from Off-Hook to On-Hook.
- Apply reduced power feed when the analogue line continues to remain Off-Hook after a certain period of time without being associated to any connection.
- Remove the ringing when the line goes Off-Hook. This action is performed irrespective of the setting of the keep active flag associated with the "off-hook" event. This action is intended to avoid causing an acoustic shock to the end user.

7.2.2 Alerting

The signal to be used (**andisp/dwa** or **alert/ri**) depends on whether or not information need to be displayed to the terminal. See also clause 7.2.4.

7.2.3 Automatic metering

The pulses in the automatic metering package have to be accurately reflected between the MGC and the MG. In order to achieve that accuracy the following procedures have to be followed.

The MG stops the enable metering signal from the automatic metering package in the event of an H.248 control link failure. The MGC is aware that the enable metering signal was stopped if it determines that the H.248 control link is down or if ServiceChange on Root is received indicating disconnected method. The enable metering signals is not reinitiated if the H.248 control link is re-established. The MGC has then the option to reinitialize the enable metering signal and continue charging or not charge for the call anymore.

7.2.4 Display service

7.2.4.1 On hook data transmission

If "data transmission during ringing or prior to ringing" as described in EN 300 659-1 [4] is required (e.g. for the calling number display service), then the MGC shall use the **andisp/dwa** signal without or with the "TAS" parameter. The **andisp/dwa** signal without "TAS" parameter is used when the default method (i.e. "during ringing" or "prior to ringing" and the corresponding TAS) provisioned (e.g. globally or on a termination-basis) within the MG is to be used. The **andisp/dwa** signal with a "TAS" parameter is used when the default method provisioned in the MG is to be overridden by the MGC. The indication of "nt" (no TAS) in the TAS parameter informs the MG to apply data transmission during ringing.

If "data transmission not associated with ringing" (e.g. for visual message waiting indicator service) as described in EN 300 659-1 [4] is required, then the MGC shall use the **andisp/data** signal without or with the "TAS" parameter. The former mechanism is used when the default TAS provisioned within the MG is to be used. The latter mechanism is used when the default TAS signal provisioned in the MG is to be overridden by the MGC.

7.2.4.2 Off hook data transmission:

For Off-Hook display the procedures for shall conform to EN 300 659-2 [5].

If data transmission is invoked after the initial Call Waiting Tone "Subscriber Alert Signal" (e.g. for the calling number display service), then the MGC shall use the **andisp/dwa** signal without or with the "TAS" parameter. The former mechanism is used when the default TAS provisioned within the MG is to be used. The latter mechanism is used when the default TAS signal provisioned in the MG is to be overridden by the MGC.

If data transmission is invoked without the presence of a "Subscriber Alert Signal" (e.g. for the advice of charge service), then the MGC shall use the **andisp/data** signal without or with the "TAS" parameter. The former mechanism is used when the default TAS provisioned within the MG is to be used. The latter mechanism is used when the default TAS signal provisioned in the MG is to be overridden by the MGC.

7.3 Specific procedures for ISDN interfaces

7.3.1 General

Support of ISDN Basic Access, Primary Rate Access and NMDS requires the use of a backhaul mechanism in conjunction with H.248. In particular H.248 shall be used for handling the adaptation of the B channels to RTP media streams, for applying tones and announcements, and for inband DTMF digit collection.

7.3.2 ISDN-BA signalling

An AGW or RGW shall support ISDN Q.921 (see ITU-T Recommendation Q.921 [46]) -User Adaptation (IUA) over SCTP (see TS 102 332 [12]) as a backhaul mechanism for transporting D-channel (s-type frames) information to the MGC. It is recommended that the IUA interface identifier (IID) is mapped from the H.248 termination ID.

An AGW or RGW shall support Raw Frame Relay over Generic Routing Encapsulation (see RFC 2784 [38]) as a backhaul mechanism for D-channel p-type frames to the required destination as defined in ETS 300 099 [6].

Media Gateways shall support Raw Frame Relay over Generic Routing Encapsulation (see RFC 2784 [38]) as a backhaul mechanism for D-channel f-type frames to a Frame Relay Gateway to the required destination as defined in ETS 300 099 [6].

The LAP-D state machine (including TEI assignment and management procedures) shall reside within the AGW or RGW and shall conform to ETS 300 402-2 [8]. Automatic TEI may only be requested by the terminal equipment (TE). Non-automatic TEI shall be autonomously assigned by the AGW or RGW upon activation of the layer 1 and these values can then be used by either the TE or the MGC. The range of automatic and non-automatic TEI is defined in ETS 300 402-2 [8].

The "point to point" or "point to multi-point" procedures are solely under the control of the MGC and have no impact on the AGW or RGW.

The AGW or RGW shall support either permanent activation of the layer 1 or activation of layer 1 on a per call basis and this mode shall be configurable via a management interface.

Activation of loop backs within the access digital section (e.g. loopback at the NT1) shall be under the control of the AGW or RGW. When a loopback is applied it will also be necessary for the AGW or RGW to inform the MGC that the ISDN access is unavailable for the presentation of incoming calls. This can be achieved by using the H.248 ServiceChange procedures.

7.3.3 ISDN-PRA signalling

The RGW and AGW requirements for ISDN-PRA are the same as for an ISDN-BA line as detailed above, with the following exceptions:

- "Point to point" procedures are only applicable.
- Relaying of p-type and f-type frames is not applicable.

Unlike ISDN-BA, any OAM procedures related to the access digital section (e.g. Loopback at the NT1) are handled entirely within the AGW or RGW, where time slot "0" is terminated.

7.3.4 NMDS

Where the AGW or RGW supports NMDS, there are specific behaviours for the ISDN Basic Access at both Layer 1 and Layer 2. At Layer 1 permanent activation shall be supported. At layer 2 the range of Automatic TEI values available to be requested by the Terminal Equipment (TE) and TEIs used for the signalling for PSTN ports shall be as defined in EN 301 141-1 [7]. TEIs used for the signalling for the PSTN ports associated with the Network Terminating Node (NTN) shall be operated using "point-to-point" procedures under the control of the MGC. Further details of these Layer 1 and Layer 2 procedures are defined in EN 301 141-1 [7].

7.3.5 ISDN management

The operation and maintenance of an ISDN-BA access digital section (as defined in ETS 300 297 [47]) and an ISDN-PRA access digital section (as defined in ETS 300 233 [48]) is performed by the MG. The MG controls the access digital section for the whole ISDN access and not individual "B" channels. Therefore the MG shall indicate failure or return to service of the ISDN access digital section to the MGC, via a H.248 ServiceChange. The ServiceChange shall have a TerminationID that specifies the affected ISDN port, but with a wildcarded identifier to indicate that the command applies to the entire ISDN Access. Upon receipt of this ServiceChange the MGC shall assume that the command applies to all the configured "B-channels", as well as the "D-channel", whose signalling is transported via IUA/SCTP.

It should be noted that all other H.248 commands (e.g. Add, Modify, Move, Notify, Subtract) sent by the MG/MGC which are associated with the establishment of a bearer shall apply to an individual "B-channel". In addition it is possible to send a ServiceChange identifying a specific B-channel when for example a B-channel is taken in and out-of-service via the MG/MGC Element Management Systems.

8 MG and MGC management

8.1 Overload control

MG overload control procedures are supported using the Overload Control package (H.248.11).

In the case of MGC overload the MGC will give preference to emergency calls and priority lines. Priority lines do not need any special H.248 handling since the MGC has the information and can use regular call setup procedures for those subscribers. Detection of emergency calls requires special handling whilst minimizing the MGC load. The special handling requires support of version 3.

At detection of off-hook in the MG a Notify message is delivered to the MGC. The MGC checks its own congestion state in order to determine how to process the call. If the MGC is overloaded then the following procedures may be taken into effect. A Modify command is sent to the applicable termination in NULL context to start dialtone and monitor events which allow detection of emergency calls or non-emergency calls. The MGC uses two digit maps. The first digit map includes only the allowed emergency numbers (i.e. EmergencyDialPlan). The second digit map is used to identify if any non emergency number (i.e. NotEmergencyDialPlan) is dialed and automatically issue congestion tone. The NotifyBehaviour event parameter is set to "NeverNotify" for the second digit map. This ensures that the Notify messages reporting non emergency numbers are suppressed, while Notify messages reporting emergency numbers can progress as in normal conditions.

An example of the Modify command is indicated below:

```
Context = - {
   Modify = aln/1/1/1 {
       Events = 888 {xdd/xce {DigitMap = EmergencyDialPlan},
                   ; If emergency report to MGC
               {xdd/xce {DigitMap = {NotEmergencyDialPlan},
                   NotifyBehaviour = NeverNotify}},
                   Embed {Signals {cg/ct}}}
                   ; If any other number issue congestion tone and report to MGC
       Signals {cg/dt}}}
                   ; This applies dial tone prior to any digits being entered
               }
           }
```

8.2 IP QoS control and monitoring

The Quality of Service (QoS) of network connections can be monitored using the quality alert event of the network package. It is up to the MGC to set the threshold value that will trigger the notification of this event. The threshold value is expressed as a percentage of measured quality loss. The Media Gateway does this by taking into account packet loss, jitter and delay, according to a provisioned algorithm. The Quality Alert Ceasing event of the Quality Alert Ceasing package enables the Media Gateway to notify the MGC when the network connections return to an acceptable quality.

8.3 Testing of analog and digital lines

It shall be possible to trigger "metallic" line testing on physical terminations via the MG OAM interface. This profile does not support H.248-controlled line tests (e.g. line tests defined in ITU-T Recommendation H.248.17 [49]).

A service change procedure shall be initiated by the MG, when a termination is placed in test. If the line test is required to be performed immediately, then the MG shall issue a ServiceChange with a method of "forced". The MGC shall not attempt to make any calls on the termination and release any existing context on the termination. If the line test is to be performed after release of any current connections, then the MG shall issue a ServiceChange with a method of "graceful".

Annex A (informative): Bibliography

- ETSI TR 101 183: "Public Switched Telephone Network (PSTN); Analogue ringing signals".
- ETSI EN 300 403-1: "Integrated Services Digital Network (ISDN);
  Digital Subscriber Signalling System No. one (DSS1) protocol; Signalling network layer for circuit-mode basic call control; Part 1: Protocol specification [ITU-T Recommendation Q.931 (1993), modified]".
- ETSI ES 201 235-3: "Access and Terminals (AT); Specification of Dual-Tone Multi-Frequency (DTMF) Transmitters and Receivers; Part 3: Receivers".
- IETF RFC 2402: "IP Authentication Header".
- IETF RFC 3550: "RTP: A Transport Protocol for Real-Time Applications".
- IETF RFC 768: "User Datagram Protocol".
- IETF RFC 3389: "Real-time Transport Protocol (RTP) Payload for Comfort Noise (CN)".
- ITU-T Recommendation H.248.1 (Version 3): "Gateway control protocol".

NOTE: To be approved.

History

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