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**SERIES G: TRANSMISSION SYSTEMS AND MEDIA,
DIGITAL SYSTEMS AND NETWORKS**

Digital terminal equipments – Principal characteristics of
transcoder and digital multiplication equipment

**SERIES Y: GLOBAL INFORMATION
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS
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Internet protocol aspects – Architecture, access, network
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Circuit multiplication equipment optimized for IP-based networks

ITU-T Recommendation G.769/Y.1242

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ITU-T Recommendation G.769/Y.1242

Circuit multiplication equipment optimized for IP-based networks

Summary

This Recommendation contains principles and examples of multiplication schemes of voice, facsimile and voiceband data between the International Switching Centre (ISC) (exchanges) which are connected via IP-based networks.

Source

ITU-T Recommendation G.769/Y.1242 was approved on 13 June 2004 by ITU-T Study Group 15 (2001-2004) under the ITU-T Recommendation A.8 procedure.

FOREWORD

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ITU-T Recommendation G.769/Y.1242

Circuit multiplication equipment optimized for IP-based networks

1 Scope

This Recommendation contains principles and examples of multiplication schemes of voice, facsimile and voiceband data between the International Switching Centre (ISC) (exchanges) (see Note) which are connected via IP-based networks.

Circuit multiplication equipment may have integral echo control and A/ μ -law converter functions. The information in this Recommendation is compatible with the control procedures for such devices.

NOTE – As circuit multiplication equipment may also be used in national networks, the signalling described here could not only be used in International switching centres but also in national exchanges.

This Recommendation applies to digital circuit multiplication equipment optimized for IP-based networks (IP-CME) and specifies the following aspects for IP-CME in order to achieve interworking between them.

a) *Network interface requirements*

- connection configuration;
- trunk and bearer facility interface;
- IP-based networks interface;
- call control signalling;
- IP-CME control signalling which includes definition of coding types;
- echo control.

b) *Functional requirements*

- multiplication schemes optimized for IP-based networks;
- handling of the call signalling transmission between the ISCs;
- handling of the IP-CME control signalling between IP-CMEs;
- multiplexing load control of IP-transmission channels over IP-based networks;
- dynamic load control of calls in PSTN side;
- network management;
- management of voice, facsimile and voiceband data quality transported over IP-based networks;
- system operation (capacity, overload strategy, maintenance, alarm).

c) *Performance criteria of IP-CME system elements*

- speech detector;
- facsimile detector;
- voiceband data detector;
- signalling detector.

2 Normative references

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision;

users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- ITU-T Recommendation G.109 (1999), *Definition of categories of speech transmission quality*.
- ITU-T Recommendation G.168 (2004), *Digital network echo cancellers*.
- ITU-T Recommendation G.177 (1999), *Transmission planning for voiceband services over hybrid Internet/PSTN connections*.
- ITU-T Recommendation G.701 (1993), *Vocabulary of digital transmission and multiplexing and pulse code modulation (PCM) terms*.
- ITU-T Recommendation G.703 (2001), *Physical/electrical characteristics of hierarchical digital interfaces*.
- ITU-T Recommendation G.704 (1998), *Synchronous frame structures used at 1544, 6312, 2048, 8448 and 44 736 kbit/s hierarchical levels*.
- ITU-T Recommendation G.711 (1988), *Pulse code modulation (PCM) of voice frequencies*.
- ITU-T Recommendation G.711 Appendix I (1999), *A high quality low-complexity algorithm for packet loss concealment with G.711*.
- ITU-T Recommendation G.711 Appendix II (2000), *A comfort noise payload definition for ITU-T G.711 use in packet-based multimedia communication systems*.
- ITU-T Recommendation G.723.1 (1996), *Speech coders: Dual rate speech coder for multimedia communications transmitting at 5.3 and 6.3 kbit/s*.
- ITU-T Recommendation G.723.1 Annex A (1996), *Silence compression scheme*.
- ITU-T Recommendation G.726 (1990), *40, 32, 24, 16 kbit/s Adaptive Differential Pulse Code Modulation (ADPCM)*.
- ITU-T Recommendation G.729 (1996), *Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear prediction (CS-ACELP)*.
- ITU-T Recommendation G.729 Annex B (1996), *A silence compression scheme for G.729 optimized for terminals conforming to Recommendation V.70*.
- ITU-T Recommendation G.763 (1998), *Digital circuit multiplication equipment using G.726 ADPCM and digital speech interpolation*.
- ITU-T Recommendation G.957 (1999), *Optical interfaces for equipments and systems relating to the synchronous digital hierarchy*.
- ITU-T Recommendations I.233.x (1991), *Frame mode bearer services*.
- ITU-T Recommendation I.363.1 (1996), *B-ISDN ATM Adaptation Layer specification: Type 1 AAL*.
- ITU-T Recommendation I.363.2 (2000), *B-ISDN ATM Adaptation Layer specification: Type 2 AAL*.
- ITU-T Recommendation I.363.5 (1996), *B-ISDN ATM Adaptation Layer specification: Type 5 AAL*.
- ITU-T Recommendation P.862 (2001), *Perceptual evaluation of speech quality (PESQ): An objective method for end-to-end speech quality assessment of narrow-band telephone networks and speech codecs*.

- ITU-T Recommendation Q.2 (1988), *Signal receivers for automatic and semi-automatic working, used for manual working.*
- ITU-T Recommendation Q.50 (2001), *Signalling between Circuit Multiplication Equipment (CME) and International Switching Centres (ISC).*
- ITU-T Recommendation Q.50.1 (2001), *Signalling between International Switching Centres (ISC) and Digital Circuit Multiplication Equipment (DCME) including the control of compression/decompression.*
- ITU-T Recommendation Q.52 (2001), *Signalling between international switching centres and stand-alone echo control devices.*
- ITU-T Recommendation Q.400 (1988), *Forward line signals.*
- ITU-T Recommendation Q.931 (1998), *ISDN user-network interface layer 3 specification for basic call control.*
- ITU-T Recommendation T.30 (2003), *Procedures for document facsimile transmission in the general switched telephone network.*
- IETF RFC 1661 (1994), *The Point-to-Point Protocol (PPP).*
- IETF RFC 1812 (1995), *Requirements for IP Version 4 Routers.*
- IETF RFC 2131 (1997), *Dynamic Host Configuration Protocol.*
- IETF RFC 2427 (1998), *Multiprotocol Interconnect over Frame Relay.*
- IETF RFC 2460 (1998), *Internet Protocol, Version 6 (IPv6) Specification.*
- IETF RFC 2719 (1999), *Framework Architecture for Signalling Transport.*
- IETF RFC 2833 (2000), *RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals.*
- IETF RFC 2960 (2000), *Stream Control Transmission Protocol.*
- IETF RFC 3550 (2003), *RTP: A Transport Protocol for Real-Time Applications.*
- IEEE 802 (2001), *IEEE Standards for Local and Metropolitan Area Networks: Overview and Architecture.*

3 Definitions

Definitions relating to the IP-CME are as follows:

3.1 IP-based CME (IP-CME): IP-CME constitutes a general class of equipment that permits concentration of a number of IP ports on a reduced number of transmission channels over IP-based networks.

3.2 low rate encoding (LRE): The speech-coding methods with bit rates less than 64 kbit/s, e.g., the 32 kbit/s transcoding process defined in ITU-T Rec. G.726 applied to speech coded according to ITU-T Rec. G.711.

Furthermore, in VoIP systems, coding-decoding device ("codec") that generate encoded blocks of voice signals in each periodical frame are usually adopted. For example, codecs such as the G.729 Annexes and G.723.1 are common in the VoIP field, and the basic intervals of their frames are usually multiples of 10 ms.

3.3 speech activity ratio: The ratio of the time speech and corresponding hangover occupies the trunk to the total measuring time, averaged over the total number of trunks carrying speech.

3.4 trunk: A bidirectional connection consisting of a forward channel and a backward channel between the SW (the International Switching Centre). Each channel in the trunk interface is identified by Trunk channel ID.

3.5 IP port: A bidirectional call stream between the IP-CMEs. An IP port in an IP transmission channel is distinguished by the IP port ID (IPP-ID) based on UDP port number and mapped to correspondent trunk.

3.6 IP transmission channel: A bidirectional multiplexed IP/UDP/RTP stream channel between the IP-CME that transmits speech data and VBD over IP-based networks.

3.7 freeze-out: The temporary condition when a trunk channel becomes active and cannot immediately be assigned to an IP transmission channel, due to lack of available transmission capacity and so on.

3.8 freeze-out fraction: The ratio of the sum of the individual channel freeze-outs to the sum of the active signals and their corresponding hangover times and front end delays, for all trunk channels over a fixed interval of time, e.g., one minute.

4 Abbreviations

This Recommendation uses the following abbreviations.

CME	Circuit Multiplication Equipment
CRTP	Compressed RTP (Real-time Transport Protocol)
DHCP	Dynamic Host Configuration Protocol
DTMF	Dual Tone Multi-Frequency
ECRTP	Enhanced CRTP
GSTN	General Switched Telephone Network
IETF	Internet Engineering Task Force
IFP	Internet Facsimile Protocol
IP	Internet Protocol
IP-CME	Circuit Multiplication Equipment optimized for IP-based networks
IPP-ID	IP port ID
ISC	International Switching Centre
ITU	International Telecommunication Union
MoIP	Modem over IP
MUX RTP	Multiplexing RTP
PCM	Pulse Code Modulation
PPP	Point-to-Point Protocol
PSTN	Public Switched Telephone Network
ROHC	RObust Header Compression
RTCP	RTP Control Protocol
RTP	Real-time Transport Protocol
SIGTRAN	SIGnalling TRANsport
SNMP	Simple Network Management Protocol

SPH	Short Packet Header
SPRT	Simple Packet Relay Transport protocol
SS7	Signalling System No. 7
SW	Switch
TCP	Transmission Control Protocol
TDM	Time Division Multiplexing
TFO	Tandem Free Operation
UDP	User Datagram Protocol
UDPTL	Facsimile UDP Transport Layer protocol
VAD	Voice Activity Detection
VBD	VoiceBand Data
VoIP	Voice over IP

5 Target services to be supported

All kinds of telephony services, such as speech, facsimile (includes ITU-T Rec. T.30) and VBD shall be supported by IP-CME. Facsimile demodulation/remodulation is optionally supported.

NOTE – How to support Modem signal and Tone signal is for further study at this moment.

6 Network reference model

6.1 Connection configuration

Multiplexing/demultiplexing the circuits communicating between an originator and a terminator are on the same or different General Switched Telephone Network (GSTN) by the IP-CMEs located at both ends of the transit IP-based networks. The single connection configuration is shown in Figure 1. The multipoint connection configuration is also shown in Figure 2. And the multipoint connection configuration is a set of single one.

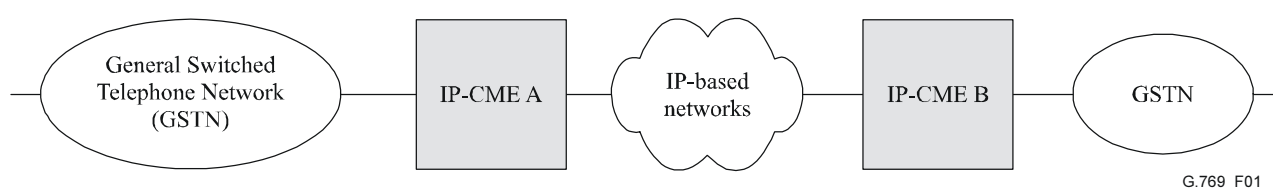


Figure 1/G.769/Y.1242 – Single connection configuration of the IP-CME

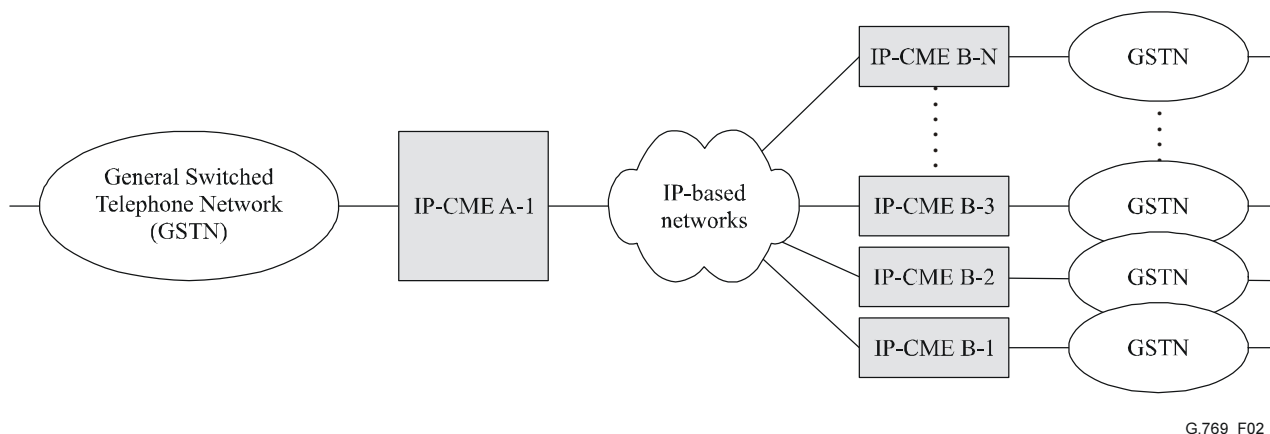


Figure 2/G.769/Y.1242 – Multipoint connection configuration of the IP-CME

6.2 Interfaces

IP-CMEs are connected with the GSTN switches (International Switching Centres (ISCs)). The following two connection configurations are supported by IP-CME.

When the call control signalling is transmitted over IP-based networks via IP-CMEs, there are five interfaces that the IP-CMEs should have, as shown in Figure 3. On the other hand, in the configuration using SS7 networks to transmit the call control, there are four interfaces as shown in Figure 4 below.

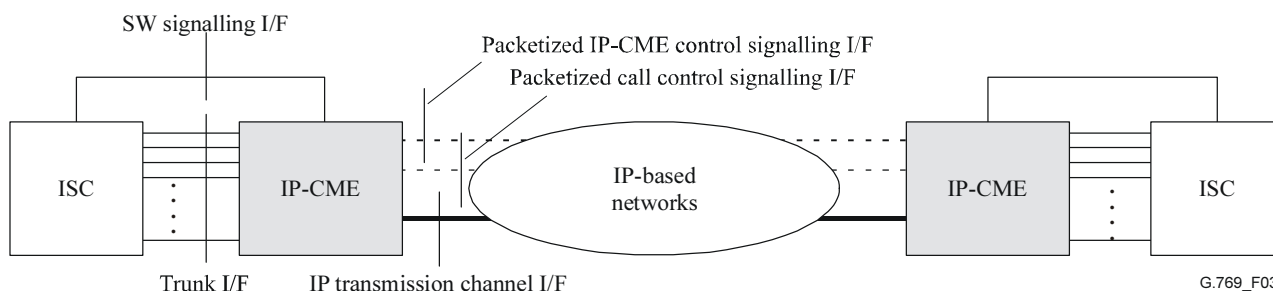


Figure 3/G.769/Y.1242 – Network connection interfaces of the IP-CME

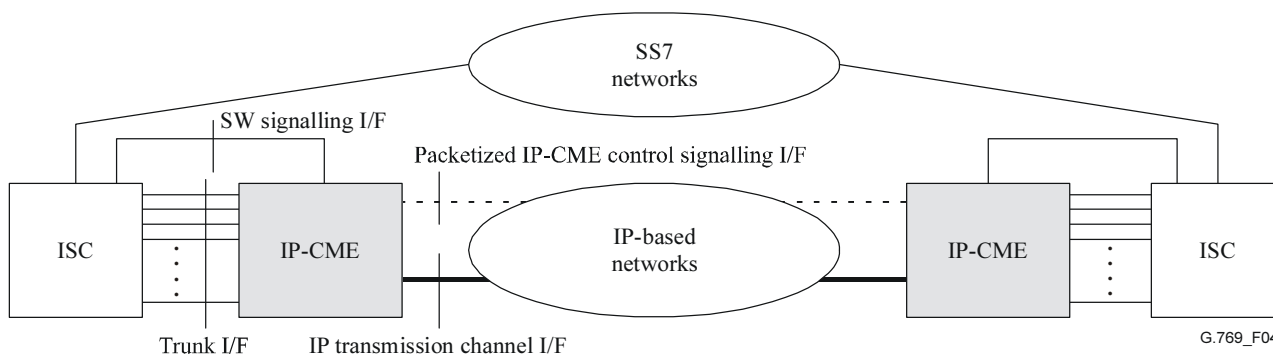


Figure 4/G.769/Y.1242 – Network connection interfaces of the IP-CME using SS7 networks