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SERIES Y: GLOBAL INFORMATION
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS
AND NEXT GENERATION NETWORKS

Internet protocol aspects – Interworking

TDM-MPLS network interworking – User plane interworking

ITU-T Recommendation Y.1413

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**GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT
GENERATION NETWORKS**

GLOBAL INFORMATION INFRASTRUCTURE	
General	Y.100–Y.199
Services, applications and middleware	Y.200–Y.299
Network aspects	Y.300–Y.399
Interfaces and protocols	Y.400–Y.499
Numbering, addressing and naming	Y.500–Y.599
Operation, administration and maintenance	Y.600–Y.699
Security	Y.700–Y.799
Performances	Y.800–Y.899
INTERNET PROTOCOL ASPECTS	
General	Y.1000–Y.1099
Services and applications	Y.1100–Y.1199
Architecture, access, network capabilities and resource management	Y.1200–Y.1299
Transport	Y.1300–Y.1399
Interworking	Y.1400–Y.1499
Quality of service and network performance	Y.1500–Y.1599
Signalling	Y.1600–Y.1699
Operation, administration and maintenance	Y.1700–Y.1799
Charging	Y.1800–Y.1899
NEXT GENERATION NETWORKS	
Frameworks and functional architecture models	Y.2000–Y.2099
Quality of Service and performance	Y.2100–Y.2199
Service aspects: Service capabilities and service architecture	Y.2200–Y.2249
Service aspects: Interoperability of services and networks in NGN	Y.2250–Y.2299
Numbering, naming and addressing	Y.2300–Y.2399
Network management	Y.2400–Y.2499
Network control architectures and protocols	Y.2500–Y.2599
Security	Y.2700–Y.2799
Generalized mobility	Y.2800–Y.2899

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ITU-T Recommendation Y.1413

TDM-MPLS network interworking – User plane interworking

Summary

This Recommendation addresses required functions for network interworking between TDM networks up to DS3 or E3 rates and MPLS networks. This Recommendation addresses user plane interworking mechanisms and procedures. Details of the interworking model and required interworking functions are described.

Source

ITU-T Recommendation Y.1413 was approved on 15 March 2004 by ITU-T Study Group 13 (2001-2004) under the ITU-T Recommendation A.8 procedure.

Keywords

Interworking, MPLS, Network, TDM, user plane.

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CONTENTS

Page

1	Scope	1
2	References.....	1
3	Definitions	3
4	Abbreviations.....	3
5	Conventions	4
6	TDM-MPLS interworking	4
7	General requirements.....	6
7.1	User plane requirements	6
7.2	Control plane aspects.....	7
7.3	Fault management aspects	7
7.4	Traffic management aspects	8
7.5	Connection admission control for the IWF	8
8	Functional group considerations for TDM-MPLS network interworking.....	9
8.1	Transport label.....	9
8.2	Interworking label	9
8.3	Common interworking indicators.....	9
8.4	Optional timing information.....	12
9	Payload formats	12
9.1	Structure-agnostic transport.....	12
9.2	Structure-aware transport	13
10	Timing aspects	16
10.1	Timing distribution scenarios	16
11	Packet loss aspects.....	18
12	Support of CAS and CCS signalling	18
12.1	Support of CAS signalling.....	18
12.2	Support of CCS signalling.....	18
13	Security considerations	18
	Appendix I – Alternative methods for TDM-MPLS interworking	19
I.1	Use of ITU-T Rec. Y.1411	19
I.2	Use of AAL type 2	19
	Appendix II – Optional processing of HDLC-based CCS signals.....	19
	Appendix III – Examples of functional diagrams	20
	Appendix IV – MPLS network performance metrics	21
IV.1	Errors in the MPLS network that impact TDM service	22
IV.2	Relationship to TDM service impairment metrics	22
IV.3	Availability requirements	23
IV.4	Voice quality requirements.....	23

	Page
Appendix V – Suggested common clock frequencies for RTP	23
Appendix VI – Suggested payload sizes for structure-agnostic transport	24
Appendix VII – Suggested number of AAL1 SAR PDUs per packet	24

Introduction

There is a need to define interworking between conventional synchronous or plesiochronous networks (hereafter denoted TDM networks) with MPLS networks. Such interworking must ensure that TDM timing, signalling, voice quality, and alarm integrity be maintained.

ITU-T Recommendation Y.1413

TDM-MPLS network interworking – User plane interworking

1 Scope

This Recommendation focuses on required functions for network interworking between TDM and MPLS, specifically the user plane interworking mechanisms and procedures for transport. In particular it specifies a list of requirements, interworking scenarios and interworking encapsulation formats and semantics for TDM-MPLS network interworking. Since TDM connections are inherently point-to-point, this interworking defines a single connection between two IWFs. This Recommendation only addresses TDM rates up to and including T3 and E3.

2 References

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

- [1] ITU-T Recommendation G.705 (2000), *Characteristics of plesiochronous digital hierarchy (PDH) equipment functional blocks*.
- [2] ITU-T Recommendation G.702 (1988), *Digital hierarchy bit rates*.
- [3] ITU-T Recommendation G.704 (1998), *Synchronous frame structures used at 1544, 6312, 2048, 8448 and 44 736 kbit/s hierarchical levels*.
- [4] ITU-T Recommendation G.751 (1988), *Digital multiplex equipments operating at the third order bit rate of 34 368 kbit/s and the fourth order bit rate of 139 264 kbit/s and using positive justification*.
- [5] ANSI T1.107-2002, *Digital Hierarchy, Formats Specification*.
- [6] ETSI TS 100 592 V8.0.0 (2000-06), *Digital cellular telecommunications system (Phase 2+) (GSM); Base Station Controller – Base Transceiver Station (BSC – BTS) interface; General aspects*. (GSM 08.51 version 8.0.0 Release 1999.)
- [7] ITU-T Recommendation Y.1411 (2003), *ATM-MPLS network interworking – Cell mode user plane interworking*.
- [8] IETF RFC 3031 (2001), *Multiprotocol Label Switching Architecture*.
- [9] ITU-T Recommendation G.805 (2000), *Generic functional architecture of transport networks*.
- [10] ITU-T Recommendation V.36 (1988), *Modems for synchronous data transmission using 60-180 kHz group band circuits*.
- [11] ITU-T Recommendation V.37 (1988), *Synchronous data transmission at a data signalling rate higher than 72 kbit/s using 60-108 kHz group band circuits*.
- [12] ITU-T Recommendation I.231.1 (1988), *Circuit-mode bearer service categories: Circuit-mode 64 kbit/s unrestricted, 8 kHz structured bearer service*.
- [13] ITU-T Recommendation Q.700 (1993), *Introduction to CCITT Signalling System No. 7*.

- [14] ITU-T Recommendation Q.931 (1998), *ISDN user-network interface layer 3 specification for basic call control*.
- [15] ITU-T Recommendation G.823 (2000), *The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy*.
- [16] ITU-T Recommendation G.824 (2000), *The control of jitter and wander within digital networks which are based on the 1544 kbit/s hierarchy*.
- [17] ITU-T Recommendation Y.1711 (2004), *Operation & Maintenance mechanism for MPLS networks*.
- [18] IETF RFC 3270 (2002), *Multi-Protocol Label Switching (MPLS) Support of Differentiated Services*.
- [19] IETF RFC 3209 (2001), *RSVP-TE: Extensions to RSVP for LSP Tunnels*.
- [20] IETF RFC 3032 (2001), *MPLS Label Stack Encoding*.
- [21] IETF RFC 3550 (2003), *RTP: A Transport Protocol for Real-Time Applications*.
- [22] ITU-T Recommendation I.363.1 (1996), *B-ISDN ATM Adaptation Layer specification: Type 1 AAL*.
- [23] ATM af-vtoa-0078.000 (1997), *Circuit Emulation Service (CES) 2.0*.
- [24] ITU-T Recommendation G.802 (1988), *Interworking between networks based on different digital hierarchies and speech encoding laws*.
- [25] ITU-T Recommendation I.363.2 (2000), *B-ISDN ATM Adaptation Layer specification: Type 2 AAL*.
- [26] ITU-T Recommendation I.366.2 (2000), *AAL type 2 service specific convergence sublayer for narrow-band services*.
- [27] ITU-T Recommendation G.826 (2002), *End-to-End error performance parameters and objectives for international, constant bit-rate digital paths and connections*.
- [28] ITU-T Recommendation Q.921 (1997), *ISDN user network interface – Data link layer specification*.
- [29] ITU-T Recommendation G.703 (2001), *Physical/electrical characteristics of hierarchical digital interfaces*.
- [30] ITU-T Recommendation G.827 (2003), *Availability performance parameters and objectives for end-to-end international constant bit-rate digital paths*.
- [31] ITU-T Recommendation G.1020 (2003), *Performance parameter definitions for quality of speech and other voiceband applications using IP networks*.
- [32] ITU-T Recommendation P.562 (2004), *Analysis and interpretation of INMD voice-service measurements*.
- [33] 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*.
- [34] ITU-T Recommendation G.114 (2003), *One-way transmission time*.

3 Definitions

This Recommendation defines the following terms:

3.1 TDM: A term that conventionally refers to the isochronous bit streams used in telephony networks; in particular those belonging to PDH (plesiochronous digital hierarchy) as described in ITU-T Rec. G.705 [1]. The bit rates traditionally used in various regions of the world are detailed in ITU-T Rec. G.702 [2].

3.2 structured TDM: TDM with any level of structure imposed by a FA (Frame Alignment Signal), such as that defined in [3], [4], [5], or [6].

3.3 unstructured TDM: A TDM bit stream with no structure imposed, so that all bits are available for user data.

3.4 structure-agnostic transport: Transport of unstructured TDM, or of structured TDM when the structure is completely disregarded by the transport mechanism. Structure-agnostic transport maintains the precise bit sequence of data and any structure overhead that may be present. The encapsulation provides no mechanisms for the location or utilization of a FA.

3.5 structure-aware transport: Transport of structured TDM taking at least some level of the structure into account. In structure-aware transport, it is not required to carry all bits of the TDM bit-stream over the MPLS network; specifically, FAS may be stripped at ingress and regenerated at egress.

3.6 structure-locked encapsulation: Encapsulation utilized for structure-aware TDM transport where TDM structure boundaries are indicated by packet payload boundaries.

3.7 structure-indicated encapsulation: Encapsulation utilized for structure-aware TDM transport where TDM structure boundaries are indicated by pointers.

3.8 TDM segment: Octets extracted from a continuous TDM stream. Each octet in the TDM segment is filled with bits starting from its most significant bit, and octets are placed in the segment in the order received.

3.9 interworking: See ITU-T Rec. Y.1411 [7].

3.10 Interworking Function (IWF): See ITU-T Rec. Y.1411 [7].

3.11 ingress IWF: The IWF where a continuous TDM stream is segmented and encapsulated into MPLS packets (TDM-to-MPLS direction).

3.12 egress IWF: The IWF where the TDM segments are extracted from MPLS packets and reassembled into a continuous TDM stream (MPLS-to-TDM direction).

4 Abbreviations

This Recommendation uses the following abbreviations:

AAL	ATM Adaptation Layer
AIS	Alarm Indication Signal
AP	Access Point
ATM	Asynchronous Transfer Mode
CAS	Channel Associated Signalling
CCS	Common Channel Signalling
CES	Circuit Emulation Service
CP	Connection Point

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