International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Y.1413
Corrigendum 1
(10/2005)

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

Internet protocol aspects – Interworking

TDM-MPLS network interworking – User plane interworking

Corrigendum 1

ITU-T Recommendation Y.1413 (2004) – Corrigendum 1

ITU-T

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ITU-T Recommendation Y.1413

TDM-MPLS network interworking – User plane interworking

Corrigendum 1

Source

Corrigendum 1 to ITU-T Recommendation Y.1413 (2004) was approved on 14 October 2005 by ITU-T Study Group 13 (2005-2008) under the ITU-T Recommendation A.8 procedure.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

ITU-T Recommendation Y.1413

TDM-MPLS network interworking – User plane interworking

Corrigendum 1

1) Summary

Replace:

This Recommendation addresses required functions for network interworking between TDM networks up to DS3 or E3 rates and MPLS networks.

With:

This Recommendation addresses required functions for network interworking between TDM networks and MPLS networks whereby TDM up to T3/E3 rates is transported over an MPLS network.

2) Introduction

Replace the second sentence:

Such interworking must ensure that TDM timing, signalling, voice quality, and alarm integrity be maintained.

With:

Such interworking must ensure that TDM timing, signalling, telephony voice quality, and alarm integrity be maintained.

3) Clause 2 – References

Replace:

[32] ITU-T Recommendation P.562 (2004), *Analysis and interpretation of INMD voice-service measurements*.

With:

[32] ITU-T Recommendation P.800 (1996), *Methods for subjective determination of transmission quality*.

Add the following new reference:

[35] ITU-T Recommendation G.811 (1997), *Timing characteristics of primary reference clocks*.

4) Clause 3 – Definitions

Replace:

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].

With:

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

Replace:

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.

With:

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 an FAS.

Add the following two new definitions:

3.13 transport LSP: A label-switched path used for the transport of traffic between two IWFs.

3.14 interworking LSP: A label-switched path used for the transport of TDM traffic. Multiple interworking LSPs can coexist inside a single transport LSP. The interworking LSP is only significant to the IWFs, and is not used by forwarding devices in the MPLS network.

5) Clause 6 – TDM-MPLS interworking

Replace the first paragraph:

The multi-protocol label switching (MPLS) technology [8] allows multiple services (such as IP, ATM, frame relay, and TDM) to be supported over a single networking infrastructure.

With:

Multi-protocol label switching (MPLS) technology [8] allows multiple services (such as Ethernet, IP, ATM, frame relay, and TDM) to be supported over a single networking infrastructure.

Replace the second sentence in the third paragraph:

For the TDM-to-MPLS direction, the continuous TDM stream is segmented and encapsulated into an MPLS packet by the interworking function (IWF).

With:

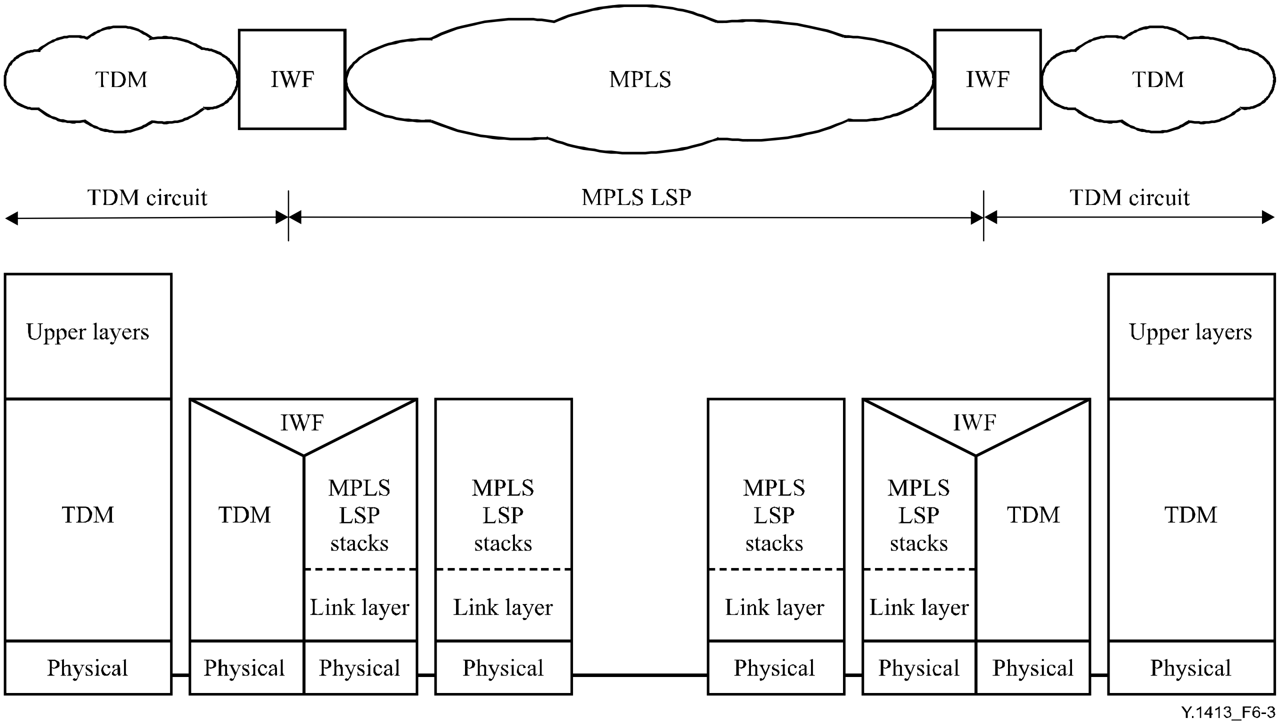
For the TDM-to-MPLS direction, the continuous TDM stream is segmented and encapsulated into MPLS packets by the interworking function (IWF).

Replace:

"circuit bundle" in Figure 6-3

With:

"TDM circuit" as follows:



6) Clause 7.1 – User plane requirements

Replace:

For transparent transfer of TDM in the user plane, the following capabilities are required:

a) The ability to transport multiple TDM streams in an interworking LSP.

b) Support for bidirectional connections with symmetric bandwidth and binding to the duplex TDM.

c) The ability to transport the following unstructured TDM types:

1) T1 at 1544 kbit/s;

2) E1 at 2048 kbit/s;

3) T2 at 6312 kbit/s;

With:

For transparent transfer of TDM in the user plane, the following capabilities are required:

a) The ability to transport multiple TDM streams in a transport LSP.

b) Support for bidirectional connections with symmetric bandwidth and binding to the duplex TDM.

c) The ability to transport the following unstructured TDM types:

1) T1 at 1544 kbit/s as defined in ITU-T Rec. G.703 [29];

2) E1 at 2048 kbit/s as defined in ITU-T Rec. G.703;

3) T2 at 6312 kbit/s as defined in ITU-T Rec. G.703;

7) Clause 8.1 – Transport label

Replace the first sentence of the second paragraph:

The 4-octet transport label identifies a LSP used to transport traffic between two IWFs.

With:

The 4-octet transport label identifies an LSP used to transport traffic between two IWFs.

Replace the last sentence:

The setting of the EXP and TTL fields of the transport label is outside the scope of this Recommendation.

With:

The setting of the EXP and TTL fields of the transport label is beyond the scope of this Recommendation.

8) Clause 8.3.3 – Length field

Replace:

a) size of the Common interworking indicators;

b) size of the optional timing information; and

With:

a) size of the Common interworking indicators (4 octets);

b) size of the optional timing information (either 0 or 12 octets, see 8.4);

9) Clause 8.3.4.2 – Processing the sequence numbers

Replace the last sentence of the first paragraph:

The mechanism by which a packet is considered lost is implementation specific.

With:

The mechanism for detecting packet loss is implementation specific.

10) Clause 9.1 – Structure-agnostic transport

Add the following new paragraph immediately before the note:

Whenever a packet is lost, or received too late for playout, or is received with the L bit set, then the egress IWF shall generate the appropriate amount of AIS towards its TDM interface.

Remove comma in the last line of the note, i.e. replace:

Examples where this may be beneficial are when interworking with ATM-based circuit emulation systems, or when SRTS-based clock recovery, is used.

With:

Examples where this may be beneficial are when interworking with ATM-based circuit emulation systems, or when SRTS-based clock recovery is used.

11) Clause 9.2 – Structure-aware transport

Replace:

Structure-aware transport maintains correct operation of the remote TDM interface by removing structure overhead at ingress and regenerating it at egress, and preserves integrity of the TDM structure by structure-locking or structure indication.

With:

Structure-aware transport maintains correct operation of the remote TDM interface by regenerating FAS at egress, and preserves the integrity of the TDM structure by structure-locking or structure-indication. Whenever a packet is lost, or received too late for playout, or is received with the L bit set, then the egress IWF shall generate the appropriate amount of filler data in order to maintain TDM timing and FAS. While the insertion of arbitrary filler data may be sufficient to maintain the TDM timing, this may lead to reduced perceived quality of telephony voice channels contained in the TDM. Depending on the expected percentage of packet loss, packet loss concealment mechanisms may need to be employed.

12) Clause 9.2.1 – Structure-locked encapsulation

Replace the last sentence of the third paragraph:

If the packet payload is comprised of M frames, the packetization latency will be M times 125 µs.

With:

If the packet payload is comprised of M frames, the packetization latency will be M times 125 microseconds (µs).

In Figure 9-3, in the last row (box) under "padding"

Replace:

(Note 2)

With:

(Note 3)

13) Clause 10 – Timing aspects

Replace all of clause 10 as follows:

10 Timing aspects

TDM networks are synchronous and hierarchically distribute precise timing in order to maintain the required error performance. MPLS networks, not having been designed for TDM transport, have no inherent timing distribution mechanism, and so some other method of timing distribution must be provided.

Four principal timing distribution scenarios may be identified, that differ in the availability and placement of timing sources. The selection of timing distribution mechanism may be made independently per TDM-MPLS interworking LSP.

10.1 Reference clock available at the TDM end systems

Figure 10-1 depicts the scenario wherein the TDM end systems share a reference clock, distributed by means beyond the scope of this Recommendation. Alternatively, primary reference clocks [35] may be available at both sites and, due to their accuracy, the two clocks may be considered identical.

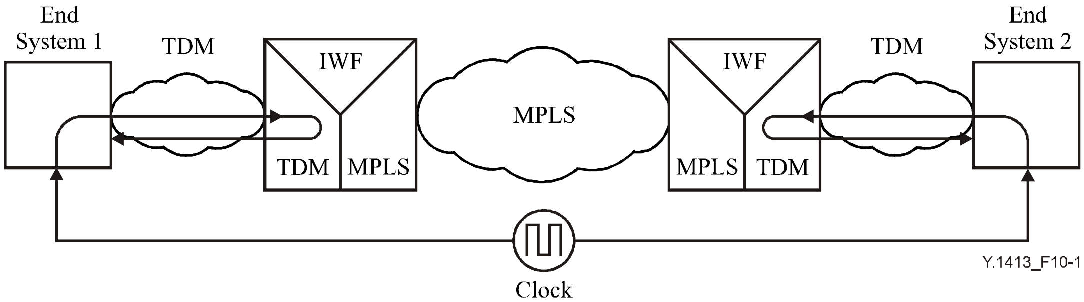


Figure 10-1/Y.1413 – Reference clock available at end systems

In this scenario, each end system uses the reference clock to generate the timing used to transmit TDM data towards the IWF. The IWFs slave their timing circuitry to this TDM input when transmitting TDM towards the end systems.

10.2 Reference clock available at the IWFs

Figure 10-2 depicts the scenario wherein the two IWFs share a reference clock, distributed by means beyond the scope of this Recommendation. Each IWF uses the reference clock to generate the timing used to transmit TDM data towards the end system. The end systems slave their timing circuitry to this TDM input when transmitting TDM towards the IWF.

A scenario wherein one TDM network functions according to 10.1, and the other according to this clause, may also be possible.

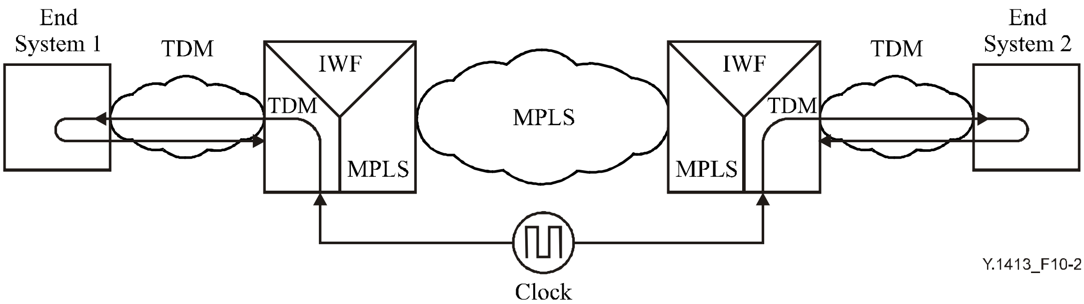


Figure 10-2/Y.1413 – Reference clock available at IWFs

10.3 Common clock available at IWFs

Figure 10-3 depicts the scenario wherein TDM end system 2 is required to slave its timing circuitry to that of TDM end system 1, and the IWFs share a common clock independent of the TDM timing. In this case, the relationship between the frequency of the master TDM clock and the frequency of the common clock may be encoded in some manner, and transmitted across the packet network. The TDM source clock can then be recovered at the remote IWF by correcting the remote clock based on the received information.

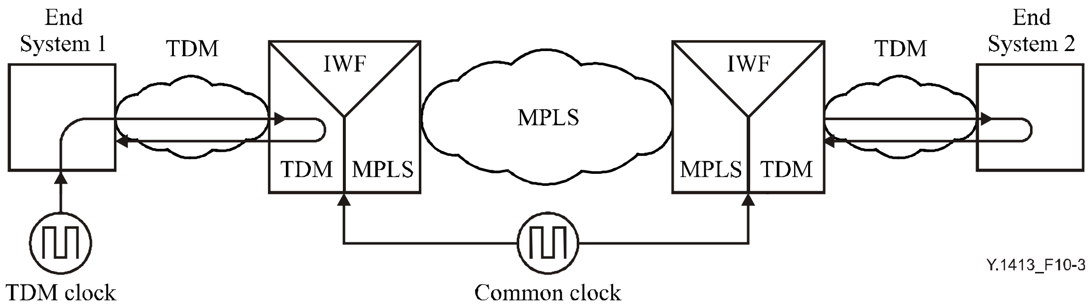


Figure 10-3/Y.1413 – Common clock available at IWFs

Two mechanisms for encoding the relationship between the TDM clock frequency to be recovered, and the common clock frequency, are well known. The Synchronous Residual Time Stamp (SRTS) mechanism, described in 2.5.2.2.2/I.363.1 [22], encodes the residual of the ratio between the TDM source clock and the common clock, while RTP timestamps may be used to encode the difference between the TDM source clock and the common clock.

In a variation of this scenario, both TDM end systems may have accurate, but independent, source clocks and both IWFs may independently derive their clocks based on the encoded relationship received.

10.4 Adaptive clock recovery

Figure 10-4 depicts the scenario wherein TDM end system 2 is required to slave its timing circuitry to that of TDM end system 1, and no common clock is available. In this case, an adaptive clock recovery function must be used at the egress IWF. The adaptive clock recovery function utilizes only observable characteristics of the packets arriving through the MPLS network, such as the precise time of arrival of the packet to the IWF, and the fill-level of the jitter buffer as a function of time. Due to the packet delay variation in the MPLS network, filtering processes that combat the statistical nature of the observable characteristics must be employed. Frequency Locked Loops (FLL) and Phase Locked Loops (PLL) are well suited for this task.

In a variation of this scenario, both TDM end systems may have accurate, but independent, source clocks and both IWFs may utilize adaptive clock recovery.

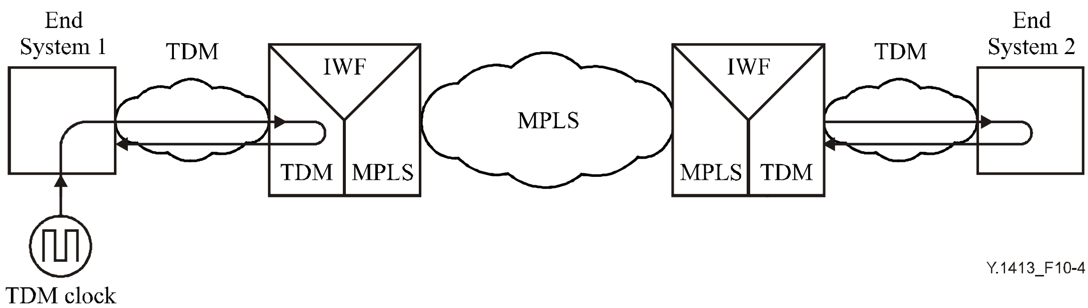


Figure 10-4/Y.1413 – Adaptive clock recovery

14) Clause 11 – Packet loss aspects

Replace:

Some degree of packet loss cannot be avoided in the MPLS network, hence some packet order integrity mechanism shall be provided.

With:

Some degree of packet loss cannot be avoided in the MPLS network, hence some packet integrity mechanism shall be provided.

Replace the third paragraph:

Structure-agnostic transport cannot identify structure overhead, and so transports it transparently in the TDM segments. In the presence of packet loss, it is possible to enhance FAS integrity by appropriately aligning the packet duration with the FAS period. However, the End System interface will still observe a corresponding amount of errored blocks [25].

With:

Structure-agnostic transport cannot identify structure overhead, and so transports it transparently in the TDM segments. Hence, filler data will in general introduce an incorrect FAS. It may be possible to enhance FAS integrity by appropriately aligning the packet duration with the FAS period. However, the End System interface will still observe a corresponding amount of errored blocks [27].

Replace the fifth paragraph:

For TDM carrying telephony channels, the insertion of filler data may lead to reduced perceived audio quality.

With:

For TDM carrying telephony channels, the insertion of filler data will lead to reduced perceived audio quality. Depending on the expected percentage of packet loss, packet loss concealment (PLC) mechanisms may need to be employed. PLC mechanisms are beyond the scope of this Recommendation.

15) Clause I.1 – Use of ITU-T Rec. Y.1411

In the second paragraph replace:

Hence, a valid and locally unique VPI/VCI must be allocated to the TDM bundle before this mode can be utilized.

With:

Hence, a valid and locally unique VPI/VCI must be allocated to the TDM circuit before this mode can be utilized.

16) Clause I.2 – Use of AAL type 2

Replace the title of this clause with the following:

I.2 Use of clause 10/Y.1414

17) Appendix V – Suggested common clock frequencies for RTP

Replace:

There are four principal criteria for selecting the frequency of a common reference clock:

With:

There are four principal criteria for selecting the frequency of a common clock:

Replace:

For systems with access to a common SONET/SDH network, a frequency of 19.44 MHz (2430*8 kHz).

With:

For systems with access to a common SONET/SDH network, a frequency of 19.44 MHz (2430*8 kHz) or 38.88 MHz (4860*8 kHz).

Replace:

For systems with access to a common ATM network, 9.72 MHz (1215*8 kHz) or 19.44 MHz (2430*8 kHz).

With:

For systems with access to a common ATM network, 9.72 MHz (1215*8 kHz) or 19.44 MHz (2430*8 kHz) or 38.88 MHz (4860*8 kHz).

Replace:

For systems using GPS, 8.184 MHz (1023*8 kHz).

With:

For systems using GPS, 8.184 MHz (1023*8 kHz) or 10 MHz (1250*8 kHz).

18) Appendix VII – Suggested number of AAL1 SAR PDUs per packet

Add the following text to the end of the first paragraph:

Suggested values are between 1 and 8 PDUs per packet for E1 and T1 circuits, and between 5 and 15 PDUs per packet for E3 and T3 circuits.

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