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Dynamic synchronous Transfer Mode (DTM); Part 13: System description of sub-rate DTM

Reference

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Contents

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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.

The present document is part 13 of a multi-part deliverable covering the Dynamic synchronous Transfer Mode (DTM), as identified below:

ES 201 803-1: "System description";

ES 201 803-2: "System characteristics";

ES 201 803-3: "Physical protocol";

ES 201 803-4: "Mapping of DTM frames into SDH containers";

ES 201 803-5: "Mapping of PDH over DTM";

ES 201 803-6: "Mapping of Synchronous Digital Hierarchy (SDH) over DTM";

ES 201 803-7: "Ethernet over DTM Mapping";

ES 201 803-9: "Mapping of ATM over DTM";

TR 101 803-10: "Routeing and switching of IP traffic over DTM";

ES 201 803-11: "Mapping of video streams over DTM";

ES 201 803-12: "Mapping of MPLS over DTM";

ES 201 803-13: "System description of sub-rate DTM".

Introduction

Dynamic synchronous Transfer Mode (DTM) is a time division multiplex and a circuit-switched network technique that combines switching and transport.

Part 1 describes the general properties of DTM and the DTM service over a unidirectional data channel. The overall system architecture is described and fundamental functions are identified.

Part 2 includes system aspects that are mandatory or optional for nodes from different vendors to interoperate. The interworking granularity should be at node level, such that nodes from different vendors can interoperate with regard to well-defined functions.

Part 3 specifies the physical layer for physical links based on 8B10B encoding.

Part 4 describes how DTM frames are mapped onto SDH containers.

The transport of various tributary signals is specified for PDH (part 5), SDH (part 6), Ethernet (part 7), ATM (part 9), IP (part 10), video streaming (part 11) and MPLS (part 12).

Subrate DTM is described in part 13.

1 Scope

The present document:

- specifies a method for mapping sub-rate time slots over normal time slot channels;
- specifies the characteristics of critical parameters for mapping sub-rate time slots over normal time slot channels;
- gives the terms and definitions for mapping encoding and decoding.

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 201 803-1: "Dynamic synchronous Transfer Mode (DTM); Part 1: System description".

[2] ETSI ES 201 803-2-3: "Dynamic synchronous Transfer Mode (DTM); Part 2: System characteristics; Sub-part 3: Transport network and channel adaptation aspects".

[3] ETSI ES 201 803-2-1: "Dynamic synchronous Transfer Mode (DTM); Part 2: System characteristics; Sub-part 1: Data link aspects".

3 Definitions and abbreviations

3.1 Definitions

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

sub-rate DTM: subsystem of DTM providing a fractional slot capacity as channel capacity resolution

sub-rate time slot: time slot in a sub-rate DTM super-frame

super-frame: multi-frame TDM structure

NOTE: Each frame is usually numbered, starting from the first frame in the multi-frame.

3.2 Abbreviations

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

A	Adaptation function
AP	Access Point
C	Connection function
CHn	CHannel layer type n
CI	Characteristic Information
CK	ClocK
CMI	Channel Multiplex Identifier
CMT	Channel Map Table
CP	Connection Point
D	Data
DTM	Dynamic synchronous Transfer Mode
FS	Frame Start signal
MI	Management Information
MP	Management Point
SMT	Slot Map Table
SSF	Server Signal Fail
TI	Timing Information
TP	Timing Point
TS	Time Slot layer
TSF	Trail Signal Fail
TSs	sub-rate Time Slot sub-layer
TT	Trail Termination

4 Overview

The sub-rate DTM system creates an overlay network over the normal DTM functionality, allowing channels to be created with a fractional capacity resolution compared to that of the normal 512 kb/s of the DTM system (ES 201 803-1 [1]). This enables efficient use of capacity for channels only requiring a fractional of the capacity and enables the same features for these channels as ordinary DTM channels allows. This overlay network is transported in ordinary time slot channels similar to tunnels, but with the distinct difference that the content is time-multiplexed inside the channel. In the overlay network only sub-rate enabled switches will be able to switch on the sub-rate layer, but the transport can occur through any number of normal DTM switches. Signalling of channels occurs using the normal DTM signalling mechanism, but for the overlay network instead of the physical network.

The sub-rate system providing the sub-rate time slot capacity of 8 kb/s will be detailed in the present document. Other sub-rates could be allowed in the future. Interaction between different sub-rates is however not directly achievable. A sub-rate of 8 kb/s will use a 64^{th} part of a normal 512 kb/s slot capacity. In order to maintain the existing protocols, the DTM slot format is unchanged, but the frame rate is changed within the channel.

5 Time Slot sub-rate sub-layer (TSs)

The sub-rate DTM system creates a dedicated hierarchical layer in DTM adding a Time Slot sub-rate (TSs) sub-layer in the Time Slot (TS) (ES 201 803-2-3 [2]) layer (see figure 1). The sub-layer is placed over the normal Time Slot layer, but under the normal Channel layer, such that the existing channel and application functionality's can be utilized, but using a lower rate interface.

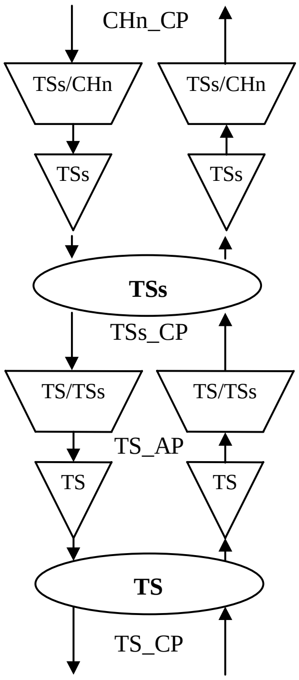

Figure 1: Time Slot sub-rate sub-layer atomic functions

5.1 Access point information

5.1.1 Characteristic Information

The Characteristic Information (CI) of the Connection Point (CP) is:

- the sub-rate time slot TDM frame TSs_CI_D being an integer multiple of sub-rate slots;
- the sub-rate time slot data clock timing TSs_CI_CK;
- the sub-rate time slot data super-frame start TSs_CI_FS;
- the sub-rate time slot data trail signal fail signal TSs_CI_SSF.

5.1.2 Adapted Information

The Adapted Information (AI) of the Adaptation Point (AP) is:

- the sub-rate time slot TDM frame TSs_AI_D being an integer multiple of sub-rate slots;
- the sub-rate time slot data clock timing TSs_AI_CK;
- the sub-rate time slot data super-frame start TSs_AI_FS;
- the sub-rate time slot data trail signal fail signal TSa_AI_SSF.

5.1.3 Management Information

The Management Information (MI) of the Management Point (MP) is:

- the connection function drop switching sub-rate time slot channel map table TSs_C_MI_CMTd;
- the connection function space sub-rate switching time slot channel map table TSs_C_MI_CMTs;
- the connection function sub-rate transport switching time slot channel map table TS_C_MI_CMTsr;

- the trail termination function server signal fail cause TSs_TT_Sk_MI_cSSF;
- the adaptation function source tunnelling slot map table TS/TSs_A_So_MI_SMT;
- the adaptation function sink tunnelling slot map table TS/TSs_A_Sk_MI_SMT.

5.1.4 Timing Information

The Timing Information (TI) of the Timing Point (TP) is:

- the sub-rate time slot data clock timing indication TSs_TI_CK;
- the sub-rate time slot super-frame start timing indication TSs_TI_FS.

5.2 Connection function (TSs_C)

The connection function of the sub-rate time slot layer (TSs_C) provides support for dropping traffic and space switching. The connection function of the time slot layer (TS_C) has an additional functionality added.

5.2.1 Drop switching

The connection function provides for drop switching of a channel by allowing the switching from an incoming channel to a sub-rate time slot trail termination. This switching is performed when the slot is marked for drop switching in the TSs_C_MI_CMTd.

5.2.2 Space switching

The connection function provides for space switching of sub-rate time slot channels TDM frame from an incoming channel to that of an outgoing channel. The channel source for an outgoing channel is specified in the TSs_C_MI_CMTs.

5.2.3 Sub-rate Time Slot Transport switching

The connection function provides for sub-rate time slot transport switching over the underlying time slot channel. It provides a sub-rate time slot channel with associated mapping to allow multiple sub-rate time slot channels to be transported through a single time slot channel.

On the source side is the tunnelled sub-rate time slot channels switched through the source TS/TSs adaptation function and TS trail termination. The output of the trail termination is then switched to the underlying time slot channel which may be space, protected or tunnel switched.

On the sink side is the time slot channel switched to the sink TS trail terminator and sink TS/TSs adaptation function. The output of the TS/TSs adaptation function provides the individual sub-rate time slot channels that where transported. These may be drop or switched.

The sub-rate time slot transport switch is controlled by the management signal TS_C_MI_CMTsr.

5.3 Trail Termination functions (TSs_TT)

The trail termination functions are empty mappings between AI and CI.

5.3.1 Sub-rate Time Slot Trail Termination function (TSs_TT)

The sub-rate time slot sub-rate trail termination provides the supervision of a sub-rate time slot channel over a time slot trail.

5.3.1.1 Sub-rate Time Slot Trail Termination Source function (TSs_TT_So)

Symbol:

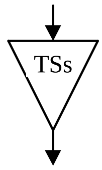

Figure 2: Sub-rate Time Slot Trail Termination Source (TSs_TT_So)

Interfaces:

Table 1: TSs_TT_So Input and output signals

Input(s)	Output(s)
TSs_AI_D	TSs_CI_D
TSs_AI_CK	TSs_CI_CK
TSs_AI_FS	TSs_CI_FS
TSs_AI_TSF	TSs_CI_SSF

Processes and anomalies:

None.

Defects:

None.

Consequent actions:

None.

Defect correlation:

None.

Performance monitoring:

None.

Output mapping:

TSs_CI_D ← TSs_AI_D.

TSs_CI_CK ← TSs_AI_CK.

TSs_CI_FS ← TSs_AI_FS.

TSs_CI_SSF ← TSs_AI_TSF.

Fault management:

None.

Long term performance monitoring:

None.

5.3.1.2 Sub-rate Time Slot Trail Termination Sink function (TSs_TT_Sk)

Symbol:

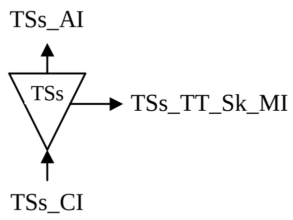

Figure 3: Sub-rate Time Slot Trail Termination Sink (TSs_TT_Sk)

Interfaces:

Table 2: TSs_TT_Sk Input and output signals

Input(s)	Output(s)
TSs_CI_D	TSs_AI_D
TSs_CI_CK	TSs_AI_CK
TSs_CI_FS	TSs_AI_FS
TSs_CI_SSF	TSs_AI_TSF
	TSs_TT_Sk_MI_cSSF

Processes and anomalies:

None.

Defects:

None.

Consequent actions:

aTSF: The Trail Signal Fail action (aTSF) is asserted when the Server Signal Fail (CI_SSF) is asserted.
See ES 201 803-2-3 [2] clause 6.3.1.3.

aTSF ← CI_SSF.

Defect correlation:

cSSF: The Server Signal Fail cause (cSSF) is asserted when the Server Signal Fail (CI_SSF) is asserted.
See ES 201 803-2-3 [2] clause 6.4.6.2.

cSSF ← CI_SSF.

Performance monitoring:

None.

Output mapping:

TSs_AI_D ← TSs_CI_D.

TSs_AI_CK ← TSs_CI_CK.

TSs_AI_FS ← TSs_CI_FS.

TSs_AI_TSF ← aTSF.

TSs_TT_Sk_MI_cSSF ← cSSF.

Fault management:

fSSF (TT_Sk): The Server Signal Fail fault (fSSF) is asserted when the Server Signal Fail cause (cSSF) is asserted consistently for $2{,}5 \pm 0{,}5$ s and deasserted when the cSSF have been deasserted for $10 \pm 0{,}5$ s. See ES 201 803-2-3 [2] clause 6.6.1.4.

Long term performance monitoring:

None.

5.4 Adaptation functions

5.4.1 Time Slot to sub-rate Time Slot Adaptation function (TS/TSs_A)

The time slot to sub-rate time slot adaptation function provides the mapping of channel TDM frames of the sub-rate time slot layer in and out of the time slot layer TDM frame. Any excess slots will have Idle-marker generated.

5.4.1.1 Time Slot to sub-rate Time Slot Adaptation Source function (TS/TSs_A_So)

Symbol:

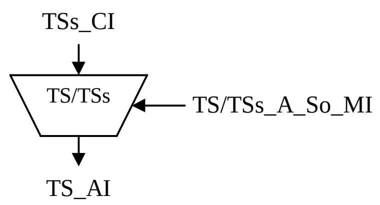

Figure 4: Time Slot to sub-rate Time Slot Adaptation Source (TS/TSs_A_So)

Interfaces:

Table 3: TS/TSs_A_So Input and output signals

Input(s)	Output(s)
TSs_CI_D	TS_AI_D
TSs_CI_CK	TS_AI_CK
TSs_CI_FS	TS_AI_FS
TSs_CI_SSF	TS_AI_TSF
TS/TSs_A_So_MI_SMT	

Processes and anomalies:

Per TSs channel:

The TDM slot assignment of slots in the TSs_CI_D TDM frame to the sD TDM frame slots according to a slot-to-slot mapping given by the management slot table TS/TSs_A_So_MI_SMT. The slot mapping may be either the monotonic rising or arbitrary mapping. See ES 201 803-2-3 [2] clause 6.1.14.3.

The excess TDM slots in the sD TDM frame which have no mapping from the TS_CI_D TDM frame shall continuously (once per frame and slot position) be sent an Idle-marker. A sD TDM slot is marked as an excess slot in the management slot table TS/TSs_A_So_MI_SMT. See ES 201 803-2-3 [2] clause 6.1.14.3.

Common processing:

The multiplexing of slots in the sD TDM frame into the AI_D TDM frame as defined in clause 6.

Defects:

None.

Consequent actions:

None.

Defect correlation:

None.

Performance monitoring:

None.

Output mapping:

TS_AI_D ← AI_D.

TS_AI_CK ← TsS_CI_CK.

TS_AI_FS ← TSs_CI_FS.

TS_AI_TSF ← TSs_CI_SSF.

Fault management:

None.

Long term performance monitoring:

None.

5.4.1.2 Time Slot to sub-rate Time Slot Adaptation Sink function (TS/TSs_A_Sk)

Symbol:

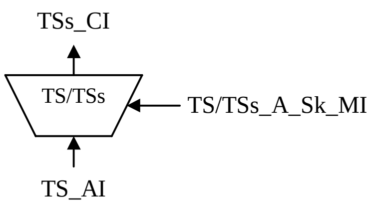

Figure 5: Time Slot to sub-rate Time Slot Adaptation Sink (TS/TSs_A_Sk)

Interfaces:

Table 4: TS/TSs_A_Sk Input and output signals

Input(s)	Output(s)
TS_AI_D	TSs_CI_D
TS_AI_CK	TSs_CI_CK
TS_AI_FS	TSs_CI_FS
TS_AI_TSF	TSs_CI_TSF
TS/TSs_A_Sk_MI_SMT	

Processes and anomalies:

Common processing:

The monitoring of super-frame alignment pattern on data slot 0 in order to identify the initial frame of a multi-frame sub-rate transport stream according clause 6.

The demultiplexing of slots in the AI_D TDM frame into the sD TDM super-frame as defined in clause 6.

Per TSs channel:

The TDM slot access of slots in the sD TDM frame to the TSs_CI_D TDM frame for the channel according to a slot-to-slot mapping given by the management slot table TS/TSs_A_Sk_MI_SMT. The slot mapping may be either the monotonic rising or arbitrary mapping. See ES 201 803-2-3 [2] clause 6.1.14.3.

The excess TDM slots in the TS_CI_D TDM frame which have no mapping from the sD TDM frame shall continuously (once per frame and slot position) be send an Idle-marker. A TS_CI_D TDM slot is marked as an excess slot in the management slot table TS/TSs_A_Sk_MI_SMT. See ES 201 803-2-3 [2] clause 6.1.14.3.

Defects:

None.

Consequent actions:

None.

Defect correlation:

None.

Performance monitoring:

None.

Output mapping:

TSs_CI_D ← CI_D.

TSs_CI_CK ← TS_AI_CK.

TSs_CI_FS ← TS_AI_FS.

TSs_CI_SSF ← TS_AI_TSF.

Fault management:

None.

Long term performance monitoring:

None.

5.4.2 Sub-rate Time Slot to Channel 1 Adaptation function (TSs/CH1_A)

The sub-rate time slot to channel 1 adaptation function provides the mapping of channel TDM frames of the synchronous channel layer in and out of the sub-rate time slot layer TDM frame.

5.4.2.1 Sub-rate Time Slot to Channel 1 Adaptation Source function (TSs/CH1_A_So)

Symbol:

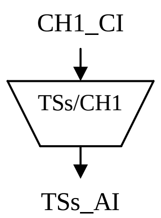

Figure 6: Sub-rate Time Slot to Channel 1 Adaptation Source (TSs/CH1_A_So)

Interfaces:

Table 5: TSs/CH1_A_So Input and output signals

Input(s)	Output(s)
CH1_CI_D	TSs_AI_D
CH1_CI_CK	TSs_AI_CK
CH1_CI_FS	TSs_AI_FS
CH1_CI_SSF	TSs_AI_TSF

Processes and anomalies:

None.

Defects:

None.

Consequent actions:

None.

Defect correlation:

None.

Performance monitoring:

None.

Output mapping:

TSs_AI_D ← CH1_CI_D.

TSs_AI_CK ← CH1_CI_CK.

TSs_AI_FS ← CH1_CI_FS.

TSs_AI_TSF ← CH1_CI_SSF.

Fault management:

None.

Long term performance monitoring:

None.

5.4.2.2 Sub-rate Time Slot to Channel 1 Adaptation Sink function (TSs/CH1_A_Sk)

Symbol:

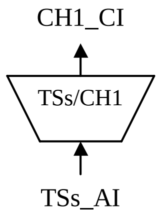

Figure 7: Sub-rate Time Slot to Channel 1 Adaptation Sink (TSs/CH1_A_Sk)

Interfaces:

Table 6: TSs/CH1_A_Sk Input and output signals

Input(s)	Output(s)
TSs_AI_D	CH1_CI_D
TSs_AI_CK	CH1_CI_CK
TSs_AI_FS	CH1_CI_FS
TSs_AI_TSF	CH1_CI_SSF

Processes and anomalies:

None.

Defects:

None.

Consequent actions:

None.

Defect correlation:

None.

Performance monitoring:

None.

Output mapping:

CH1_CI_D ← TSs_AI_D.

CH1_CI_CK ← TSs_AI_CK.

CH1_CI_FS ← TSs_AI_FS.

CH1_CI_SSF ← TSs_AI_TSF.

Fault management:

None.

Long term performance monitoring:

None.

6 Sub-rate Time Slot mapping

The DTM sub-rate time slot mapping creates a super-frame internal to a normal DTM channel. Within this super-frame a virtual slot number scheme is used for DTM slots of lower frame-rate. The super-frame spans M number of DTM frames. M is defined to be 64. A super-frame consisting of M = 64 slots will create a sub-rate slot capacity of 8 kb/s.

NOTE 1: Other super-frame sizes may be chosen, by selecting any other integer size of the super-frame. Integer sized being on the power of two may be preferred.

A super-frame may use one or more normal DTM slots in order to accommodate an aggregate capacity larger than M sub-rate slots. The full number of sub-rate slots is the number N of normal slots used times the super-frame size M.

A sub-rate time slot switch contains one or more virtual interfaces over which the sub-rate channels can be switched. Each virtual interface maps to a sub-rate time slot over normal time slot transport. The number of sub-rate slots on one virtual interface of a sub-rate system may be different from the number on another virtual interface of the same sub-rate system.

NOTE 2: However, switching is only defined between virtual interfaces and/or trail-terminators of the same super-frame size. Thus, if multiple sub-rate size coexists in a system, then they must be treated separately.

The sub-rate transport channels form an overlay network on top of the normal DTM functionality. The transported channel capacity available in this overlay network is quantized to the sub-rate time slot capacity (8 kb/s) rather than to the normal 512 kb/s capacity of a normal time-slot.

The super-frame enumerates the DTM frame in the numbers of 0 to M-1. The N number of slots being used for a virtual interface will be numbered 0 to N-1. Given a sub-rate slot s, the mapped super-frame be m and the mapped slot number n will be such that s = n * M + m. This mapping allows for dynamic changes of N without the need of re-mapping existing traffic.

NOTE 3: This is achieved when n = s DIV M and m = s MOD M.

NOTE 4: The backdraw of this strategy in mapping is that slot order is not necessarily time transfer order. Slot 64 will be transferred before slot 63, whereas slot 0 and slot 64 will be transferred in the same frame.

The slot 0 of the sub-rate super-frame is used as a signalling slot as well as a super-frame marker. The slot 0 usage is described in ES 201 803-2-1 [3] clause 5. By converting idle-traffic between signalling packets with a stream consisting of a dedicated DCAP-1 message providing a super-frame indication marker, encoded in the CMI field, can the super-frame slot-alignment be found and retrieved. The super-frame indication marker message holds no data. In the receiving end the DCAP-1 packets containing the super-frame indication marker shall be replaced with Idle-traffic.

History

Document history		
V1.1.1	October 2004	Membership Approval Procedure MV 20041224: 2004-10-26 to 2004-12-24