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GENERAL ASPECTS OF DIGITAL TRANSMISSION SYSTEMS

VOCABULARY OF TERMS FOR SYNCHRONOUS DIGITAL HIERARCHY (SDH) NETWORKS AND EQUIPMENT

ITU-T Recommendation G.780
Superseded by a more recent version

(Previously "CCITT Recommendation")

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The 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 Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation G.780 was prepared by ITU-T Study Group 15 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 1st of November 1994.

NOTE

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

Superseded by a more recent version

SUMMARY

This Recommendation lists abbreviations and describes terms used in ITU-T Recommendations on synchronous digital hierarchy (SDH) networks and equipment.

In cases where specific SDH terms are used only in one Recommendation, they will be described in that Recommendation.

Plans are to enhance Recommendation G.780 in the future with abbreviations and terms related to SDH network architecture and management.

The following abbreviations and terms are used in some of the Recommendations dealing with SDH networks and equipment (G.707, G.708, G.709, G.781, G.782, G.783, G.784, G.957 and G.958).

Recommendation G.780

VOCABULARY OF TERMS FOR SYNCHRONOUS DIGITAL HIERARCHY (SDH) NETWORKS AND EQUIPMENT

(Geneva, 1994)

1 Abbreviations

For the purposes of this Recommendation, the following abbreviations apply:

APS	Automatic Protection Switching
AU-n	Administrative Unit
AUG	Administrative Unit Group
BIP	Bit Interleaved Parity
C-n	Container
CV	Code Violation
DCC	Data Communications Channel
FERF	Far End Receive Failure
HOVC	Higher Order Virtual Container
HPA	Higher Order Path Adaptation
HPC	Higher Order Path Connection
HPT	Higher Order Path Termination
LOP	Loss of Pointer
LOVC	Lower Order Virtual Container
LPA	Lower Order Path Adaptation
LPC	Lower Order Path Connection
LPT	Lower Order Path Termination
MS	Multiplex Section
MSA	Multiplex Section Adaptation
MSOH	Multiplex Section Overhead
MSP	Multiplex Section Protection
MST	Multiplex Section Termination
NDF	New Data Flag
NNI	Network Node Interface
NU	National Use
PJE	Pointer Justification Event
POH	Path Overhead
PT	Path Termination
RS	Regenerator Section
RSOH	Regenerator Section Overhead
RST	Regenerator Section Termination
SDH	Synchronous Digital Hierarchy
SDXC	SDH Cross-Connect
SETG	Synchronous Equipment Timing Generator
SETPI	Synchronous Equipment Timing Physical Interface

SETS	Synchronous Equipment Timing Source
SMN	SDH Management Network
SMS	SDH Management Subnetwork
SOH	Section Overhead
SPI	SDH Physical Interface
STM	Synchronous Transport Module
STM-N	Synchronous Transport Module – level N
TU-n	Tributary Unit
TUG	Tributary Unit Group
VC-n	Virtual Container

2 Vocabulary for SDH networks and equipment

For the purposes of this Recommendation, the following definitions apply:

2.1 administrative unit (AU): An AU is the information structure which provides adaptation between the higher order path layer and the multiplex section layer. It consists of an information payload (the higher order VC) and a AU pointer which indicates the offset of the payload frame start relative to the multiplex section frame start. Two AUs are defined. The AU-4 consists of a VC-4 plus an AU pointer which indicates the phase alignment of the VC-4 with respect to the STM-N frame. The AU-3 consists of a VC-3 plus an AU pointer which indicates the phase alignment of the VC-3 with respect to the STM-N frame. In each case the AU pointer location is fixed with respect to the STM-N frame. One or more AUs occupying fixed, defined positions in an STM payload is termed an AU Group (AUG). An AUG consists of a homogeneous, byte interleaved, assembly of AU-3s or an AU-4.

2.2 automatic protection switching (APS): Autonomous switching of a signal between and including two MST functions, from a failed working channel to a protection channel and subsequent restoration using control signals carried by the kbytes in the MSOH.

2.3 concatenation: A procedure whereby a multiplicity of virtual containers is associated one with another with the result that their combined capacity can be used as a single container across which bit sequence integrity is maintained.

2.4 container [C-n (n = 1-4)]: A container is the information structure which forms the network synchronous information payload for a VC. For each of the defined VCs there is a corresponding container. Adaptation functions have been defined for many common network rates into a limited number of standard containers. These include those rates already defined in Recommendation G.702. Further adaptation functions will be defined in the future for new broadband rates.

2.5 data communications channel (DCC): Within an STM-N signal there are two DCC channels, comprising bytes D1-D3, and bytes D4-D12 (DCC_R and DCC_M respectively). D1-D3 are accessible by all SDH NEs whereas D4-D12, not being part of the regenerator section overhead, are not accessible at regenerators. D1-D3 are allocated for SDH NE use. The D4-D12 channel can be used as a wide area, general purpose, communication channel to support TMN including non-SDH applications. This would include both communication between OSs and communication between an OS and a network element (including SDH network elements). The applications of the D4-D12 channel require study for general TMN applications and also for SDH network element management applications.

2.6 higher order (HO) path: In an SDH network, the higher order path layers provide a server network for the lower order (LO) path layers. The comparative terms “lower” and “higher” refer only to the two participants in such a client/server relationship. VC-1/2 paths may be described as “lower order” in relation to VC-3 and VC-4, while the VC-3 path may be described as 'lower order' in relation to VC-4.

2.7 higher order path adaptation (HPA): The HPA function adapts a lower order VC (VC-1/2/3) to a higher order VC (VC-3/4) by processing the TU pointer which indicates the phase of the VC-1/2/3 POH relative to the VC-3/4 POH and assembling/disassembling the complete VC-3/4.

2.8 higher order path connection (HPC): The HPC function provides for flexible assignment or interconnection of higher order VCs (VC-3/4).

2.9 higher order path termination (HPT): The HPT function terminates a higher order path by generating and adding the appropriate VC POH to the relevant container at the path source and removing the VC POH and reading it at the path sink.

2.10 loss of pointer (LOP): The LOP state is one resulting from a defined number of consecutive occurrences of certain conditions which are deemed to have caused the value of the pointer to be unknown.

2.11 lower order (LO) path: See Higher order path above.

2.12 lower order path adaptation (LPA): The LPA function adapts a PDH signal to an SDH network by mapping/demapping the signal in to/out of a synchronous container. If the signal is asynchronous, the mapping process will include bit level justification.

2.13 lower order path connection (LPC): The LPC function provides for flexible assignment or interconnection of lower order VCs.

2.14 lower order path termination (LPT): The LPT function terminates a lower order path by generating and adding the appropriate VC POH to the relevant container at the path source and removing the VC POH and reading it at the path sink.

2.15 multiplex section adaption (MSA): The MSA function processes the AU-3/4 pointer to indicate the phase of the VC-3/4 POH relative to the STM-N SOH and assembles/disassembles the complete STM-N frame.

2.16 multiplex sections alarm indication signal (MS-AIS): MS-AIS is an STM-N signal that contains a valid RSOH and an all ONEs pattern for the remainder of the signal.

2.17 multiplex section overhead (MSOH): The MSOH comprises rows 5 to 9 of the SOH of the STM-N signal.

2.18 multiplex section protection (MSP): The MSP function provides capability for switching a signal between and including two MST functions, from a “working” to a “protection” channel.

2.19 multiplex section termination (MST): The MST function generates the MSOH in the process of forming an SDH frame signal and terminates the MSOH in the reverse direction.

2.20 network node interface (NNI): The interface at a network node which is used to interconnect with another network node.

2.21 pointer: An indicator whose value defines the frame offset of a virtual container with respect to the frame reference of the transport entity on which it is supported.

2.22 pointer justification event (PJE): A PJE is an inversion of the I- or D-bits of the pointer, together with an increment or decrement of the point value to signify a frequency justification opportunity.

2.23 regenerator section overhead (RSOH): The RSOH comprises rows 1 to 3 of the SOH of the STM-N signal.

2.24 regenerator section termination (RST): The RST function generates the RSOH in the process of forming an SDH frame signal and terminates the RSOH in the reverse direction.

2.25 synchronous digital hierarchy (SDH): The SDH is a hierarchical set of digital transport structures, standardized for the transportation of suitably adapted payloads over physical (primarily optical) transmission networks.

2.26 SDH aligning: A procedure by which the frame offset information is incorporated into the tributary unit (or the administrative unit) when adapting to the frame reference of the supporting layer.

2.27 SDH cross-connect (SDXC): An SDH cross-connect equipment is any cross-connect equipment that provides controlled transparent connection and re-connection of VCs constructed according to Recommendation G.708 between its interface ports. These interface ports may be at the SDH rates defined in Recommendation G.707 and/or PDH rates defined in Recommendation G.702. Additionally, it shall support the control and management functions as defined in Recommendation G.784.

2.28 SDH mapping: A procedure by which tributaries are adapted into virtual containers at the boundary of an SDH network.

2.29 SDH multiplexing: A procedure by which multiple lower order path layer signals are adapted into a higher order path or the multiple higher order path layer signals are adapted into a multiplex section.

2.30 SDH physical interface (SPI): The SPI function converts an internal logic level STM-N signal into an STM-N line interface signal.

2.31 synchronous equipment management function (SEMF): The SEMF converts performance data and implementation specific hardware alarms into object-oriented messages for transmission over the DCC(s) and/or a Q-interface. It also converts object-oriented messages related to other management functions for passing across the Sn reference points.

2.32 synchronous equipment timing generator (SETG): The SETG function filters the timing reference signal from those selected in the SETS to ensure that the timing requirements at the TO reference point are met.

2.33 synchronous equipment timing physical interface (SETPI): The SETPI function provides the interface between and external synchronization signal and the synchronous equipment timing source.

2.34 synchronous equipment timing source (SETS): The SETS function provides timing reference to the relevant component parts of a synchronous equipment and represents the SDH network element clock.

2.35 synchronous transport module (STM): An STM is the information structure used to support section layer connections in the SDH. It consists of information payload and section overhead (SOH) information fields organized in a block frame structure which repeats every 125 microseconds. The information is suitably conditioned for serial transmission on the selected media at a rate which is synchronized to the network. A basic STM is defined at 155 520 kbit/s. This is termed STM-1. Higher capacity STMs are formed at rates equivalent to N times multiples of this basic rate. STM capacities for N = 4 and N = 16 are defined; higher values are under consideration.

The STM-1 comprises a single administrative unit group (AUG) together with the SOH.

The STM-N contains N AUGs together with SOH. Values of N corresponding to the SDH levels are given in Recommendation G.707.

2.36 tributary unit (TU): A TU is an information structure which provides adaptation between the lower order path layer and the higher order path layer. It consists of an information payload (the lower order VC) and a TU pointer which indicates the offset of the payload frame start relative to the higher order VC frame start.

The TU-n (n = 1, 2, 3) consists of a VC-n together with a TU pointer.

One or more TUs, occupying fixed, defined positions in a higher order VC payload is termed a tributary unit group (TUG). TUGs are defined in such a way that mixed capacity payloads made up of different size TUs can be constructed to increase flexibility of the transport network.

A TUG-2 consists of a homogeneous assembly of identical TU-1s or a TU-2.

A TUG-3 consists of a homogeneous assembly of TU-2s or a TU-3.

2.37 virtual container (VC): A VC is the information structure used to support path layer connections in the SDH. It consists of information payload, and path overhead (POH) information fields organized in a block frame structure which repeats every 125 or 500 microseconds. Alignment information to identify VC frame start is provided by the server network layer.

Two types of VCs have been identified:

– Lower order VC: VC-n (n = 1, 2, 3)

  This element comprises a single C-n (n = 1, 2, 3) plus the lower order VC POH appropriate to that level.

– Higher order VC: VC-n (n = 3, 4)

  This element comprises either a single C-n (n = 3, 4) or an assembly of tributary unit groups (TUG-2s or TUG-3s), together with VC POH appropriate to that level.