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TELECOMMUNICATION
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Digital terminal equipments – Principal characteristics of multiplexing equipment for the synchronous digital hierarchy

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Recommendation ITU-T G.780/Y.1351

Terms and definitions for synchronous digital hierarchy (SDH) networks

Summary

Recommendation ITU-T G.780/Y.1351 provides terms, definitions, and abbreviations used in synchronous digital hierarchy (SDH) Recommendations. Physical layer terminology, synchronization-related terminology, and terms applicable to multiple technologies in addition to SDH are not included. The goal of this Recommendation is to be a single normative source for terms in this subject area.

Source

Recommendation ITU-T G.780/Y.1351 was approved on 29 March 2008 by ITU-T Study Group 15 (2005-2008) under Recommendation ITU-T A.8 procedure.

Keywords

Definitions, Synchronous Digital Hierarchy (SDH), terminology.

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Recommendation ITU-T G.780/Y.1351

Terms and definitions for synchronous digital hierarchy (SDH) networks

1 Scope

This Recommendation contains a list of terms, definitions, and abbreviations used in Recommendations dealing with synchronous digital hierarchy (SDH) networks. SDH terms specific to synchronization or physical layer or characteristics are not a part of this Recommendation.

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.

[ITU-T G.702] Recommendation ITU-T G.702 (1988), *Digital hierarchy bit rates*.

[ITU-T G.703] Recommendation ITU-T G.703 (2001), *Physical/electrical characteristics of hierarchical digital interfaces*.

[ITU-T G.707] Recommendation ITU-T G.707/Y.1322 (2007), *Network node interface for the synchronous digital hierarchy (SDH)*.

[ITU-T G.783] Recommendation ITU-T G.783 (2006), *Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks*.

[ITU-T G.784] Recommendation ITU-T G.784 (1999), *Synchronous digital hierarchy (SDH) management*.

[ITU-T G.803] Recommendation ITU-T G.803 (2000), *Architecture of transport networks based on the synchronous digital hierarchy (SDH)*.

[ITU-T G.805] Recommendation ITU-T G.805 (2000), *Generic functional architecture of transport networks*.

[ITU-T G.806] Recommendation ITU-T G.806 (2006), *Characteristics of transport equipment – Description methodology and generic functionality*.

[ITU-T G.826] Recommendation ITU-T G.826 (2002), *End-to-end error performance parameters and objectives for international, constant bit-rate digital paths and connections*.

[ITU-T G.828] Recommendation ITU-T G.828 (2000), *Error performance parameters and objectives for international, constant bit-rate synchronous digital paths*.

[ITU-T G.829] Recommendation ITU-T G.829 (2002), *Error performance events for SDH multiplex and regenerator sections*.

[ITU-T G.841] Recommendation ITU-T G.841 (1998), *Types and characteristics of SDH network protection architectures*.

[ITU-T G.842] Recommendation ITU-T G.842 (1997), *Interworking of SDH network protection architectures*.

[ITU-T G.870] Recommendation ITU-T G.870/Y.1352 (2008), *Terms and definitions for optical transport networks (OTN)*.

[ITU-T G.7712] Recommendation ITU-T G.7712/Y.1703 (2008), *Architecture and specification of data communication network*.

[ITU-T M.3010] Recommendation ITU-T M.3010 (2000), *Principles for a telecommunications management network*.

[ITU-T X.710] Recommendation ITU-T X.710 (1997) | ISO/IEC 9595:1998, *Information technology – Open Systems Interconnection – Common Management Information service*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 Terms defined in [ITU-T G.805]:

– access point (AP)
– adaptation
– characteristic information (CI)
– connection
– connection point (CP)
– network connection (NC)
– subnetwork connection (SNC)
– trail
– trail termination function (TT)

3.1.2 Terms defined in [ITU-T G.806]:

– alarm
– all ONEs
– defect
– failure
– function
– management information (MI)
– path
– process
– signal degrade (SD)
– signal fail (SF)

3.1.3 Term defined in [ITU-T G.7712]:

– embedded control channel (ECC)

3.1.4 Terms defined in [ITU-T G.870]:

– bridge

– head-end

– null signal

– switch

– tail-end

3.1.5 Term defined in [ITU-T M.3010]:

– telecommunications management network (TMN)

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 active trail/path/section/SNC/NC: The trail/path/section/SNC from which the signal is selected by the protection selector.

3.2.2 adapted information (AI): The information passing across an AP.

3.2.3 add traffic: Normal or extra traffic inserted into working, protection, or non-pre-emptible unprotected channels on the ring at a ring node.

3.2.4 add/drop multiplexer (ADM): Network element that provides access to all, or some subset of the constituent signals contained within an STM-N signal. The constituent signals are added to (inserted), and/or dropped from (extracted) the STM-N signal as it passes through the ADM.

3.2.5 administrative unit group (AUG): One or more administrative units occupying fixed, defined positions in an STM payload are termed an administrative unit group (AUG).

An AUG-1 consists of a homogeneous assembly of AU-3s or an AU-4.

3.2.6 administrative unit-n (AU-n): An administrative unit 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 virtual container) and an administrative unit pointer which indicates the offset of the payload frame start relative to the multiplex section frame start.

Two administrative units are defined. The AU-4 consists of a VC-4 plus an administrative unit 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 administrative unit pointer which indicates the phase alignment of the VC-3 with respect to the STM-N frame. In each case, the administrative unit pointer location is fixed with respect to the STM-N frame.

3.2.7 administrative unit-n (AU-n) pointer: Administrative unit pointer which indicates the offset of the payload frame start relative to the multiplex section frame start. See [ITU-T G.707].

3.2.8 agent: Part of the MAF which is capable of responding to network management operations issued by a manager and may perform operations on managed objects, issuing events on behalf of managed objects. The managed objects can reside within the entity or in another open system. Managed objects from other open systems are controlled by a distant agent via a local manager. All S.NEs will support at least an agent. Some S.NEs will provide managers and agents (being managed). Some S.NEs (e.g., regenerators) will only support an agent.

3.2.9 alarm indication signal (AIS): A code sent downstream in a digital network as an indication that an upstream failure has been detected and alarmed. It is associated with multiple transport layers.

NOTE – See [ITU-T G.707] for specific AIS signals.

3.2.10 asynchronous interface: These interfaces provide an output signal with frequency that is not traceable to a primary reference clock (PRC) and that meets the frequency offset requirements given in [ITU-T G.703].

3.2.11 automatic protection switching (APS) controller: That part of a node that is responsible for generating and terminating information carried in the APS protocol and implementing the APS algorithm.

3.2.12 automatic protection switching (APS) request: That set of signals into an APS controller that determines its behaviour. An APS request can be either an externally initiated command or an automatically initiated command.

3.2.13 automatic protection switching (APS): Autonomous switching of a signal between and including two MSn_TT, Sn_TT, or Sm_TT functions, from a failed working trail/SNC to a protection trail/SNC and subsequent restoration using control signals carried by the K-bytes in the MSOH, HO POH, or LO POH.

3.2.14 automatically initiated command: An APS request that is initiated by any one of the following:

1) multiplex section performance criteria;

2) local equipment performance criteria; or

3) received bridge requests.

3.2.15 auto-provisioning: The assignment of values to parameters within a network element, without those values being specifically entered externally by a user.

3.2.16 background block error (BBE): An errored block not occurring as part of an SES.

3.2.17 background block error ratio (BBER): The ratio of BBE in available time to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.

3.2.18 bidirectional protection switching: A protection switching architecture in which, for a unidirectional failure (i.e., a failure affecting only one direction of transmission), both directions (of the "trail", "subnetwork connection", etc.) including the affected direction and the unaffected direction, are switched to protection.

3.2.19 bidirectional ring: In a bidirectional ring, normal routing of the normal traffic signals is such that both directions of a bidirectional connection travel along the ring through the same nodes, but in opposite directions.

3.2.20 bit interleaved parity-X (BIP-X): BIP-X code is defined as a method of error monitoring. With even parity an X-bit code is generated by the transmitting equipment over a specified portion of the signal in such a manner that the first bit of the code provides even parity over the first bit of all X-bit sequences in the covered portion of the signal, the second bit provides even parity over the second bit of all X-bit sequences within the specified portion, etc. Even parity is generated by setting the BIP-X bits so that there is an even number of 1s in each monitored partition of the signal. A monitored partition comprises all bits which are in the same bit position within the X-bit sequences in the covered portion of the signal. The covered portion includes the BIP-X.

3.2.21 block (generic definition): A block is a set of consecutive bits associated with the path; each bit belongs to one, and only one, block. Consecutive bits may not be contiguous in time.

3.2.22 bridge request: A message sent from a tail-end node to the head-end node requesting that the head-end perform a bridge of the normal traffic signals onto the protection channels.

3.2.23 bridge request status: A message sent from a tail-end node to all other nodes within the protection system indicating that the tail-end has requested a bridge.

3.2.24 concatenation: The process of summing the bandwidth of a number of smaller containers into a larger bandwidth container. Two versions exist:

– Contiguous concatenation: maintains the contiguous bandwidth throughout the whole transport. Contiguous concatenation requires concatenation functionality at each network element.

– Virtual concatenation: breaks the contiguous bandwidth into individual VCs, transports the individual VCs and recombines these VCs to a contiguous bandwidth at the end point of the transmission. Virtual concatenation requires concatenation functionality only at the path termination equipment.

NOTE – See [ITU-T G.707].

3.2.25 container-n (n = 1-4): A container is the information structure which forms the network synchronous information payload for a virtual container. For each of the defined virtual containers, 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 [ITU-T G.702]. Further adaptation functions will be defined in the future for new broadband rates.

3.2.26 controller failure: The condition during which a node is no longer able to correctly operate the APS protocol, but still generates a correctly formatted SDH frame.

3.2.27 crossing K-bytes: When a node sees ring bridge requests of equal priority on both "sides" (this includes a switching node receiving a ring bridge request from the other end).

3.2.28 data communications channel (DCC): Within an STM-N signal there are three DCC channels, comprising bytes D1-D3, giving a 192 kbit/s channel, bytes D4-D12, giving a 576 kbit/s channel, and (in STM-256 only) D13-D156, giving a 9216 kbit/s channel. D1-D3 (DCC_R) are accessible by all S.NEs whereas D4-D12 (DCC_M) and D13-D156 (DCC_{MX}), not being part of the regenerator section overhead, are not accessible at regenerators. It is recommended to have both DCC_M and DCC_R available in backbone STM-16 (and higher order) network sections and DCC_{MX} in STM-256 network sections. DCC_M and DCC_{MX} are used to forward data over the multiplex sections (using the OSI-routing protocols), and DCC_R is used to forward data to the regenerators within the destination MS span. DCC_M and DCC_{MX} can be regarded as the backbone, while DCC_R and LAN are used to interconnect this backbone to equipment that cannot be accessed through DCC_M/DCC_{MX}, e.g., regenerators and non-SDH equipment.

DCC_M/DCC_{MX} and DCC_R can be used to carry two independent, possibly proprietary management applications. An S.NE can choose to throughconnect DCC_M/DCC_{MX} on the physical level, or to terminate the DCC_M/DCC_{MX} and route the PDUs, while using the DCC_R for interconnection within a subnetwork.

3.2.29 dedicated protection: A protection architecture that provides capacity dedicated to the protection of traffic-carrying capacity.

3.2.30 default APS code: This term refers to the APS bytes transmitted with the source node ID equal to the destination node ID.

3.2.31 desynchronizer: The desynchronizer function smoothes out the timing gaps resulting from decoded pointer adjustments and VC payload de-mapping in the time domain.

3.2.32 diverse routing of [trail/SNC] protection pair: Diverse routing of a working trail/SNC and its associated protection trail/SNC, where the working trail/SNC (in both directions of transmission) takes one (physical) route, and the protection trail/SNC (in both directions of transmission) takes another.

3.2.33 diverse routing of go and return: Bidirectional transport entity/signal (i.e., go and return) is set up on/routed over different physical facilities. Such routing may apply to individual trails, subnetwork connections, or signals.

3.2.34 drop traffic: Normal or extra traffic extracted from working, protection, or non-pre-emptible unprotected channels on the ring at a ring node.

3.2.35 drop-and-continue: A function within a ring node where traffic is both extracted from the working channels on the ring (drop), and transmitted onwards on the ring (continue).

3.2.36 dSTM-12*NMi* interface: An SDH transmission interface which transports one or more TU-12, with SHDSL-based section overhead. dSTM-12*NMi* interfaces are defined for SHDSL transport technologies. The number (N) of TU-12 in dSTM-12*NMi* interfaces provided by [ITU-T G.707] is limited to $N = 1$ to 9 inclusive. The number (M) of SHDSL wire pairs over which the dSTM-12*NMi* signal is transported is limited to $M = 1$ to 4 inclusive. The number (i) represents the presence or absence of an ($M \times i \times 8$) kbit/s DCC in the dSTM-12*NMi* signal; it is limited to $i = 0, \ldots, 7$ (single-pair mode), $i = 0, \ldots, 4$ (2-pair mode), $i = 0, \ldots, 3$ (3-pair mode) and $i = 0, 1, 2$ (4-pair mode) or 1. Not all combinations of N and M are allowed. Refer to Table G.1 of [ITU-T G.707].

3.2.37 dual hubbed: Dual hubbed traffic can be routed to either or both of two central offices (or similar sites). Dual hubbed traffic is survivable under a failure of one of the two hubs.

3.2.38 embedded control channel (ECC): An ECC provides a logical operations channel between S.NEs, utilizing a data communications channel (DCC) as its physical layer.

3.2.39 dual node interconnection: An architecture between two rings where two nodes in each ring are interconnected.

3.2.40 errored block (EB): A block in which one or more bits are in error.

3.2.41 errored second (ES): A one-second period with one or more errored blocks or at least one defect.

NOTE – See [ITU-T G.828] for a list of defects.

3.2.42 errored second ratio (ESR): The ratio of ES in available time to total seconds in available time during a fixed measurement interval.

3.2.43 externally initiated command: An APS request that is initiated by either an OS or a craftsperson.

3.2.44 extra traffic: Traffic that is carried over the protection channels when that capacity is not used for the protection of normal traffic. Extra traffic is not protected. Whenever the protection channels are required to protect the normal traffic, the extra traffic is pre-empted.

3.2.45 full pass-through: The action of transmitting the same K1, K2, and protection channels that are being received. Full pass-through may be either unidirectional or bidirectional as specified in the text. When a node enters unidirectional full pass-through, it shall continue sourcing the previously sourced K-bytes in the opposite direction, with the exception that K2 bits 6-8 shall reflect the appropriate status code.

3.2.46 generator polynomial: The polynomial that is used for encoding of any cyclic codes. The remainder after division of the information polynomial by generating polynomial is the redundancy part of the encoded code word.

3.2.47 hypothetical reference path: A hypothetical reference path (HRP) is defined as the whole means of digital transmission of a digital signal of a specified rate, including the path overhead, between equipment at which the signal originates and terminates. An end-to-end hypothetical reference path spans a distance of 27 500 km.

3.2.48 idle: A node that is not generating, detecting, or passing-through bridge requests or bridge request status information.

3.2.49 isolated node: A single node that is isolated from a traffic perspective by ring switches on each of its two spans by its adjacent nodes.

3.2.50 K-byte pass-through: The action of transmitting the same K1 and K2 bytes that are being received. Protection channels are not passed through. K-byte pass-through is bidirectional.

3.2.51 layer: A concept used to allow the transport network functionality to be described hierarchically as successive levels; each layer being solely concerned with the generation and transfer of its characteristic information.

3.2.52 long path: The path segment away from the span for which the bridge request is initiated. Typically there are other intermediate nodes along this path segment.

3.2.53 loss of frame (LOF): An LOF state of an STM-N signal is considered to have occurred when an OOF state persists for a defined period of time.

NOTE – See [ITU-T G.783].

3.2.54 loss of signal (LOS): The LOS state is considered to have occurred when the amplitude of the relevant signal has dropped below prescribed limits for a prescribed period.

NOTE – See [ITU-T G.783].

3.2.55 lower order VC access: The termination of a higher order VC for the purpose of adding, dropping, or cross-connecting any individual lower order VC or VC group.

3.2.56 managed object (MO): The management view of a resource within the telecommunication environment that may be managed via the agent. Examples of SDH managed objects are: equipment, receive port, transmit port, power supply, plug-in card, virtual container, multiplex section and regenerator section.

3.2.57 managed object class (MOC): An identified family of managed objects that share the same characteristics, e.g., "equipment" may share the same characteristics as "plug-in card".

3.2.58 management application function (MAF): An application process participating in system management. The management application function includes an agent (being managed) and/or manager. Each network element (NE) and operations system or mediation device (OS/MD) must support a management application function that includes at least an agent. A management application function is the origin and termination for all TMN messages.

3.2.59 manager: Part of the MAF which is capable of issuing network management operations (i.e., retrieve alarm records, set thresholds) and receiving events (i.e., alarms, performance). S.NEs may or may not include a manager while SDH OS/MDs will include at least one manager.

3.2.60 message communications function (MCF): The message communications function provides facilities for the transport of TMN messages to and from the MAF, as well as facilities for the transit of messages. The message communications function does not originate or terminate messages (in the sense of the upper protocol layers).

3.2.61 misconnection: A condition in which traffic destined for a given node is incorrectly routed to another node and no corrective action has been taken.

3.2.62 most significant bit: The "leftmost" bit position, or first transmitted bit position in a byte.

3.2.63 multiplex section (MS): A multiplex section is the trail between and including two multiplex section trail termination functions.

3.2.64 multiplex section overhead (MSOH): (See definition of "section overhead".)

3.2.65 network connection protection: A scheme that protects the largest possible subnetwork connection of a trail.

3.2.66 network element (NE): A stand-alone physical entity that supports at least network element functions (NEFs) and may also support outgoing signal fail (OSF) and/or mediation function (MF). It contains managed objects, a management communications function (MCF) and a management application function (MAF).

3.2.67 network element function (NEF): A function within an SDH entity that supports the SDH based network transport services, e.g., multiplexing, cross-connection, regeneration. The network element function is modelled by managed objects.

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

3.2.69 non-pre-emptible unprotected channel: A channel in a MS shared protection ring provisioned bidirectionally to provide transport without MS shared protection ring automatic protection switching. Non-pre-emptible unprotected channels are provisioned from (corresponding) working and protection channel pairs.

3.2.70 non-pre-emptible unprotected traffic: Unprotected traffic carried on protection locked-out channel which may not be pre-empted (e.g., by protection switches).

3.2.71 normal traffic: Traffic that is normally carried in the working channels/sections, except in the event of a protection switch, in which case it is restored on the protection channels/sections. Normal traffic is protected.

3.2.72 operations system function or mediation function (OSF/MF): A telecommunications management network (TMN) entity that processes management information to monitor and control the SDH network. In the SDH sub-portion of the TMN, no distinction is made between the operations system function and the mediation function; this entity being a MAF containing at least a manager.

3.2.73 operations system or mediation device (OS/MD): A stand-alone physical entity that supports OSF/MFs but does not support NEFs. It contains a message communications function (MCF) and a MAF.

3.2.74 outgoing signal fail (OSF): A signal fail indication output at the AP of a tandem connection termination function.

3.2.75 overhead access (OHA): The OHA function provides access to transmission overhead functions.

3.2.76 pass-through: The action of transmitting the same information that is being received for any given direction of transmission.

3.2.77 path overhead (POH): (See definition of "section overhead".)

3.2.78 path selector: Within an SNCP architecture, the node function that selects a tributary which is extracted from the working channels arriving from one side of the node or from the other side of the node, according to path level criteria.

3.2.79 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 pointer value to signify a frequency justification.

3.2.80 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.

3.2.81 primary node: Within an MS-shared protection ring interworking architecture, the node which provides the service selection and drop-and-continue functions for a tributary. Different tributaries may have different designated primary nodes.

3.2.82 propagation of switching: One protection switch leading to another. Propagation of switching is often, though not always, undesirable from a maintenance point of view.

3.2.83 protection channels: The channels allocated to transport the normal traffic during a switch event. Protection channels may be used to carry extra traffic in the absence of a switch event. When there is a switch event, normal traffic on the affected working channels is bridged onto on the protection channels.

3.2.84 reference point: The delimiter of a function.

3.2.85 regenerator section (RS): A regenerator section is the trail between and including two regenerator section terminations.

3.2.86 regenerator section overhead (RSOH): (See definition of "section overhead".)

3.2.87 restoral threshold: For automatically initiated commands, a hysteresis method is used when switching normal traffic from the protection channels back to the working channels. This method specifies a BER threshold for the multiplex section that is carrying the working channels. This threshold is commonly referred to as "restoral threshold". The restoral threshold is set to a lower BER than the signal degrade threshold.

3.2.88 ring: A collection of nodes forming a closed loop whereby each node is connected to two adjacent nodes via a duplex communications facility. A ring provides redundant bandwidth or redundant network equipment, or both, so distributed services can be automatically restored following a failure or degradation in the network. Thus, a ring can be self-healing.

3.2.89 ring failure: A failure for which restoration can only be accomplished by a ring switch.

3.2.90 ring interconnection: An architecture between two rings where one or more nodes in each ring are interconnected.

3.2.91 ring interworking: A network topology whereby two rings are interconnected at two nodes on each ring, and the topology operates such that a failure at either of these two nodes will not cause loss of any working traffic, except possibly that dropped or inserted at the point of failure.

3.2.92 ring switching: Protection mechanism that applies to both two-fibre and four-fibre rings. During a ring switch, the traffic from the affected span is carried over the protection channels on the long path.

3.2.93 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.

3.2.94 SDH digital path: An SDH digital path is a trail carrying an SDH payload and associated overhead through the layered transport network between the path terminating equipment. A digital path may be bidirectional or unidirectional and may comprise both customer owned portions and network operator owned portions.

3.2.95 SDH higher-order path layer networks: Those layer networks with characteristic information of VC-3 (see Note), VC-3-Xv (X = 1 … 256), VC-4, VC-4-Xc (X = 4, 16, 64, 256) or VC-4-Xv (X = 1 … 256).

NOTE – The VC-3 is considered to be a higher-order path if it is supported directly by an AU-3 in a multiplex section layer network; it is considered a lower-order path if it is supported by a TU-3 in a VC-4 layer network.

3.2.96 SDH lower-order path layer networks: Those layer networks with characteristic information of VC-11, VC-11-Xv (X = 1 … 64), VC-12, VC-12-Xv (X = 1 … 64), VC-2, VC-2-Xc (X = 2 … 7) (see Note), VC-2-Xv (X = 1 … 64) or VC-3-Xv (X = 1 … 256).

NOTE – Transported in one higher order VC-3.

3.2.97 SDH management network (S.MN): An SDH management network is a subset of a TMN that is responsible for managing those parts of a network element that contain SDH layer network entities. An S.MN may be subdivided into a set of SDH management subnetworks.

3.2.98 SDH management subnetwork (S.MSN): An SDH management subnetwork (S.MSN) consists of a set of separate SDH ECCs and associated intra-site data communication links which have been interconnected to form a data communications network (DCN) within any given SDH transport topology. An S.MNS represents an SDH specific local communications network (LCN) portion of a network operator's overall data communications network or TMN.

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

3.2.100 SDH multiplex section layer: A layer network with characteristic information of STM-N, i.e., with a bit rate of STM-N and the multiplex section overhead as defined in [ITU-T G.707].

3.2.101 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.

3.2.102 SDH network element (S.NE): That part of a network element that contains entities from one or more SDH layer networks. An S.NE may therefore be a standalone physical entity or a subset of a network element. It supports at least network element functions and may also support an operations system function (OSF) and or a mediation function (MF). It contains managed objects, a message communications function (MCF) and a management application function (MAF). The functions of an S.NE may be contained within and NE that also supports other layer networks. These layer network entities are considered to be managed separately from SDH entities. As such they are not part of the S.MSN or S.MN.

3.2.103 SDH path layer: A transport assembly composed of the SDH higher-order path layer network and lower-order path layer network together with the associated adaptation functions.

3.2.104 SDH regenerator section layer: A layer network with characteristic information of STM-N, i.e., with a bit rate of STM-N and the regenerator section overhead as defined in [ITU-T G.707].

3.2.105 SDH section layer: A transport assembly composed of the SDH multiplex section layer network and regenerator section layer network together with the associated adaptation functions.

3.2.106 secondary circuit: Within an MS-shared protection ring interworking architecture, this is the alternate routing that traffic travelling from one ring to another follows. This alternate additional routing is used when the service circuit is interrupted.

3.2.107 secondary node: Within an MS-shared protection ring interworking architecture, the node which provides the alternate interworking route for a tributary.

3.2.108 section overhead: SOH information is added to the information payload to create an STM-N. It includes block framing information and information for maintenance, performance monitoring and other operational functions. The SOH information is further classified into regenerator section overhead (RSOH) which is terminated at regenerator functions and multiplex section overhead (MSOH) which passes transparently through regenerators and is terminated where the AUGs are assembled and disassembled. The rows 1-3 of the SOH are designated as RSOH while rows 5-9 are designated to be MSOH.

NOTE – See [ITU-T G.707].

3.2.109 section: A trail in a section layer.

3.2.110 segmented ring: A ring that is separated into two or more segments, either externally using forced switches (FS-R), or automatically as a result of signal fail-ring switches (SF-R).

3.2.111 service circuit: Within an MS-shared protection ring interworking architecture, this is the preferred original routing that traffic travelling from one ring to another normally follows.

3.2.112 service selector: Within an MS-shared protection ring architecture, the node function used for ring interworking. It selects traffic from either the channels arriving from one side of the node, or from traffic entering the ring, according to some criteria.

3.2.113 severely errored period (SEP): A sequence of between 3 to 9 consecutive SESs. The sequence is terminated by a second which is not a SES.

NOTE – The severely errored period (SEP) event is identical to the consecutive severely errored second (CSES) event contained in [ITU-T G.784] on condition that the lower threshold is fixed at three consecutive SESs.

3.2.114 severely errored period intensity (SEPI): The number of SEP events in available time, divided by the total available time in seconds. (See Notes 1, 2 and 3.)

NOTE 1 – The SEPI parameter has a unit of (1/s). This is to enable the SEPI objective to be easily translated to the equivalent number of SEP events over a specific measurement interval. It should be noted that the SEP event has no significance over a time interval of less than three seconds.

NOTE 2 – Ongoing studies of the SEP event and the SEPI parameter shall prove their usefulness in complementing the SESR parameter. Any objectives for the SEPI parameter (presently under study) shall empirically demonstrate this value.

NOTE 3 – The impact of SEP/SEPI on customer services has to be investigated.

3.2.115 severely errored second (SES): A one-second period which contains ≥ X% errored blocks or at least one defect. SES is a subset of ES.

NOTE – The value of X is specified for SDH in [ITU-T G.826], [ITU-T G.828], and [ITU-T G.829].

3.2.116 severely errored second ratio (SESR): The ratio of SES to total seconds in available time during a fixed measurement interval.

3.2.117 short path: The path segment over the span for which the bridge request is initiated. This span is always the one to which both the head-end and tail-end are connected. The short path bridge request is the bridge request sent over the span for which the bridge request is initiated.

3.2.118 shortened binary-BCH: A shortened version of the class of the block linear cyclic codes. These shortened binary BCH codes have the following common properties, i.e.,:

$$n = 2^m - 1 - s$$

$$k = n - t \times m$$

$$d = 2 \times t + 1$$

where:

n the size of the whole code word;

k the number of the information bits;

m the parameter of the BCH code;

t the number of the corrected errors within the block of the BCH code;

d the minimum code distance;

s the amount of information eliminated as part of the code shorting.

3.2.119 single node interconnection: An architecture between two rings where one node in each ring is interconnected.

3.2.120 single point failure: Failure located at a single physical point in a ring. The failure may affect one or more fibres. A single point failure may be detected by any number of NEs.

3.2.121 span switching: Protection mechanism similar to 1:1 linear APS that applies only to four-fibre rings where working and protection channels are contained in separate fibres and the failure only affects the working channels. During a span switch, the normal traffic is carried over the protection channels on the same span as the failure.

3.2.122 span: The set of multiplex sections between two adjacent nodes on a ring.

3.2.123 squelched traffic: An all "1"s signal resulting from the squelching process.

3.2.124 squelching: The process of inserting AU-AIS in order to prevent misconnections.

3.2.125 subnetwork connection protection (SNCP): A working subnetwork connection is replaced by a protection subnetwork connection if the working subnetwork connection fails, or if its performance falls below a required level.

3.2.126 survivable network: A network that is capable of restoring traffic in the event of a failure. The degree of survivability is determined by the network's ability to survive single line system failures, multiple line system failures, and equipment failures.

3.2.127 switch completion time: The interval from the decision to switch to the completion of the bridge and switch operation at a switching node initiating the bridge request.

3.2.128 switching node: The node that performs the bridge or switch function for a protection event. In the case of a multiplex section switched ring network architecture, this node also performs any necessary squelching of misconnected traffic for VC-3/4 or higher rate paths.

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

3.2.130 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 μs. 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 this basic rate. STM capacities for N = 4, N = 16, N = 64 and N = 256 are defined; higher values are under consideration.

The STM-0 comprises a single administrative unit of level 3. The STM-N, N ≥ 1, comprises a single administrative unit group of level N (AUG-N) together with the SOH. The STM-N hierarchical bit rates are given in [ITU-T G.707].

3.2.131 synchronous: The essential characteristic of time-scales or signals such that their corresponding significant instants occur at precisely the same average rate.

3.2.132 systematic code: The original data bits for binary codes are unchanged by the encoding procedure. Redundant bits or symbols (parity) are added separately to each code block.

3.2.133 termination node: The node (other than a primary or secondary node) where a tributary enters or exits the ring.

3.2.134 time slot interchange (TSI): For purposes of this Recommendation, TSI is the capability of changing the time slot position of through-connected traffic (i.e., traffic that is not added or dropped from the node).

3.2.135 trail protection: Normal traffic is carried over/selected from a protection trail instead of a working trail if the working trail fails, or if its performance falls below a required level.

3.2.136 trail segment: A segment for which one end is a trail termination.

3.2.137 transport: Facilities associated with the carriage of STM-1 or higher level signals.

3.2.138 tributary unit-n (TU-n): A tributary unit 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 virtual container) and a tributary unit pointer which indicates the offset of the payload frame start relative to the higher-order virtual container frame start.

The TU-n (n = 11, 12, 2, 3) consists of a VC-n together with a tributary unit pointer.

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

A TUG-2 consists of a homogeneous assembly of identical TU-11s, TU-12s or a TU-2.

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

3.2.140 undefined bit: If a bit is undefined, its value is set to a logical "0" or a logical "1".

3.2.141 undefined byte: If a byte is undefined, it contains eight undefined bits.

3.2.142 undetected failure: Any equipment defect which is not detected by equipment maintenance functions, hence does not initiate a protection switch or provide the appropriate OA&M notification. These types of failures do not manifest themselves until a protection switch is attempted.

3.2.143 unidirectional protection switching: A protection switching architecture in which, for a unidirectional failure (i.e., a failure affecting only one direction of transmission), only the affected direction (of the "trail", "subnetwork connection", etc.) is switched to protection.

3.2.144 unidirectional ring: In a unidirectional ring (path switched or multiplex section switched), normal routing of the normal traffic is such that both directions of a bidirectional connection travel around the ring in the same direction (e.g., clockwise). Specifically, each bidirectional connection uses capacity along the entire circumference of the ring.

3.2.145 uniform routing of go and return: Bidirectional transport entity/signal (i.e., go and return) is set up on/routed over the same physical facilities. Such routing may apply to individual trails, subnetwork connections, or signals.

3.2.146 virtual container-n (VC-n): A virtual container 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 µs. Alignment information to identify VC-n frame start is provided by the server network layer.

Two types of virtual containers have been identified:

– *Lower order virtual container-n: VC-n (n = 11, 12, 2, 3)*

  This element comprises a single container-n (n = 11, 12, 2, 3) plus the lower order virtual container POH appropriate to that level.

– *Higher order virtual container-n: VC-n (n = 3, 4)*

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

3.2.147 working channels: The channels over which normal traffic is transported when there are no switch events.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

ADM	Add-Drop Multiplexer
AI	Adapted Information
AIS	Alarm Indication Signal
AP	Access Point
APS	Automatic Protection Switching
AUG	Administrative Unit Group
AU-n	Administrative Unit, level n
BBE	Background Block Error
BBER	Background Block Error Ratio
BIP-X	Bit Interleaved Parity-X
CI	Characteristic Information
CP	Connection Point
CSES	Consecutive Severely Errored Second
DCC	Data Communications Channel
EB	Errored Block
ECC	Embedded Control Channel
ES	Errored Second
ESR	Errored Second Ratio
FS-R	Forced Switched normal traffic to Protection-Ring
HO	Higher Order
HRP	Hypothetical Reference Path
LO	Lower Order
LOF	Loss of Frame
LOS	Loss of Signal
MAF	Management Application Function
MCF	Message Communications Function
MD	Mediation Device
MF	Mediation Function
MI	Management Information
MO	Managed Object
MOC	Managed Object Class
MS	Multiplex Section
MSn_TT	Multiplex Section layer, level n_Trail Termination
MSOH	Multiplex Section Overhead

NC	Network Connection
NEF	Network Element Function
NNI	Network Node Interface
OHA	Overhead Access
OS	Operations System
OSF	Operations System Function
OSF	Outgoing Signal Fail
OSI	Open Systems Interconnection
PJE	Pointer Justification Event
POH	Path Overhead
PRC	Primary Reference Clock
RS	Regenerator Section
RSOH	Regenerator Section Overhead
SD	Signal Degrade
SDH	Synchronous Digital Hierarchy
SEP	Severely Errored Period
SEPI	Severely Errored Period Intensity
SES	Severely Errored Second
SESR	Severely Errored Second Ratio
SF	Signal Fail
SF-R	Signal Fail-Ring
Sm	Lower order VC-m layer (m = 11, 12, 2, 3)
Sm_TT	Lower order VC-m layer (m = 11, 12, 2, 3)_Trail Termination
S.MN	SDH Management Network
S.MSN	SDH Management SubNetwork
Sn	higher order VC-n layer (n = 3, 4)
Sn_TT	higher order VC-n layer (n = 3, 4)_Trail Trace
SNC	Subnetwork Connection
SNCP	Subnetwork Connection Protection
S.NE	SDH Network Element
SOH	Section Overhead
STM	Synchronous Transport Module
STM-N	Synchronous Transport Module-N
TMN	Telecommunications Management Network
TSI	TimeSlot Interchange
TT	Trail Termination function
TUG	Tributary Unit Group

TU-n	Tributary Unit-n
VC	Virtual Container
VC-n	Virtual Container-n

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