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SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

Packet over Transport aspects – Mobile network transport aspects

Architecture of the metro transport network

Recommendation ITU-T G.8310

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Recommendation ITU-T G.8310

Architecture of the metro transport network

Summary

Recommendation ITU-T G.8310 describes the functional architecture of the metro transport network (MTN) using the modelling methodology described in Recommendations ITU-T G.800 and ITU-T G.805. MTN is primarily intended to support transport of distributed radio access network (D-RAN) and cloud radio access network (C-RAN) traffic. The MTN functionality is described from a network level viewpoint, taking into account the client characteristic information, client/server layer associations, networking topology, and layer network functionality that provide multiplexing, routing and supervision of the digital clients.

MTN consists of two non-recursive layers, the MTN path layer, and the MTN section layer. The MTN path layer uses the MTN section layer as its server layer. The MTN path layer provides configurable connection-oriented connectivity. The server layer for the MTN section layer is provided by 50GBASE-R, 100GBASE-R, 200GBASE-R, and 400GBASE-R Ethernet interfaces.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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1 Scope

This Recommendation describes the functional architecture of the metro transport network (MTN) using the modelling methodology described in [ITU-T G.800], [ITU-T G.805] for the digital layer networks and [ITU-T G.807] for the optical media network.

The MTN functionality is described from a network-level viewpoint. This takes into account the characteristic information (CI) of the client (Ethernet MAC frames), the client/server layer associations, network topology, the network structure, and the layer network functionalities that provide multiplexing, routing, supervision, performance assessment and network survivability for the client. The digital layers of the MTN use the frame formats defined in [ITU-T G.8312]. The media portion of the network is defined in [IEEE 802.3] and is described, in this Recommendation, in terms of media constructs described in [ITU-T G.807].

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.800] Recommendation ITU-T G.800 (2016), *Unified functional architecture of transport networks.*

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

[ITU-T G.807] Recommendation ITU-T G.807 (2020), *Generic functional architecture of the optical media network.*

[ITU-T G.808.1] Recommendation ITU-T G.808.1 (2014), G*eneric protection switching - Linear trail and subnetwork protection.*

[ITU-T G.959.1] Recommendation ITU-T G.959.1 (2018), *Optical transport network physical layer interfaces*.

[ITU-T G.7712] Recommendation ITU-T G.7712/Y.1703 (2019), *Architecture and specification of data communication network.*

[ITU-T G.8312] Recommendation ITU-T G.8312 (2021), *Interfaces for the metro transport network.*

[IEEE 802.3] IEEE Std 802.3 (2018), *IEEE Standard for Ethernet*.

[OIF FLEXE IA] Optical Internetworking Forum (OIF), *Flex Ethernet Implementation Agreement 2.1* (2019).

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 access point (AP): See [ITU-T G.805]

3.1.2 adaptation: See [ITU-T G.805]

3.1.3 adapted information (AI): See [ITU-T G.805]

3.1.4 characteristic information (CI): See [ITU-T G.805]

3.1.5 connection supervision: See [ITU-T G.805]

3.1.6 connection: See [ITU-T G.805]

3.1.7 connection point: See [ITU-T G.805]

3.1.8 forwarding point: See [ITU-T G.800]

3.1.9 forwarding end point: See [ITU-T G.800]

3.1.10 layer network: See [ITU-T G.805]

3.1.11 link: See [ITU-T G.805]

3.1.12 optical tributary signal (OTSi): See [ITU-T G.959.1]

3.1.13 optical tributary signal group (OTSiG): See [ITU-G.807]

3.1.14 subnetwork: See [ITU-T G.805]

3.1.15 topological component: See [ITU-T G.805]

3.1.16 transport entity: See [ITU-T G.800]

3.1.17 transport processing function: See [ITU-T G.805]

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AI	Adapted Information
AIS	Alarm Indication Signal
AP	Access Point
CI	Characteristic Information
CP	Connection Point
C-RAN	Cloud Radio Access Network
D-RAN	Distributed Radio Access Network
ETH	Ethernet MAC layer
FEC	Forward Error Correction
FlexE	Flex Ethernet
FP	Forwarding Point

FwEP Forwarding End Point

IPG Inter-packet Gap

M-AI Modulator Adapted Information

MTN Metro Transport Network

MTNP MTN Path

MTNS MTN Section

NMC Network Media Channel

NMCG NMC Group

OCI Open Connection Indication

OSME Optical Signal Maintenance Entity

OTSi Optical Tributary Signal

OTSiG OTSi Group

PCS Physical Coding Sublayer

PMA Physical Medium Attachment

PMD Physical Medium Dependent

PTP Precision Time Protocol

SSF Server Signal Fail

TTI Trail Trace Identifier

5 Conventions

This Recommendation uses the diagrammatic conventions defined in [ITU-T G.800], [ITU-T G.805] and [ITU-T G.807].

The forwarding point (FP), defined in [ITU-T G.800], is used in this Recommendation and is equivalent to the connection point (CP), defined in [ITU-T G.805].

This Recommendation uses the following textual conventions to identify information elements:

Block: A 66-bit information element. The first two bits are a sync header which identifies the type of block; the remaining 64 bits carry data or control information. The 64B/66B block coding format is described in clause 82 of [IEEE 802.3].

Sequence: A series of information elements for which sequential arrangement must be maintained during transmission, but the time interval between information elements need not be maintained.

Stream: A sequence where the time interval between information elements is maintained.

6 Functional architecture of the MTN

The metro transport network (MTN) consists of two non-recursive digital layer networks; the MTN path (MTNP) layer and the MTN section (MTNS) layer. The rates and formats used in the MTN are defined in [ITU-T G.8312].

The MTNS is supported by an MTN optical media layer. The MTN media layer provides fixed point-to-point connections between Ethernet interfaces. The layer structure of the MTN is shown in Figure 6-1.

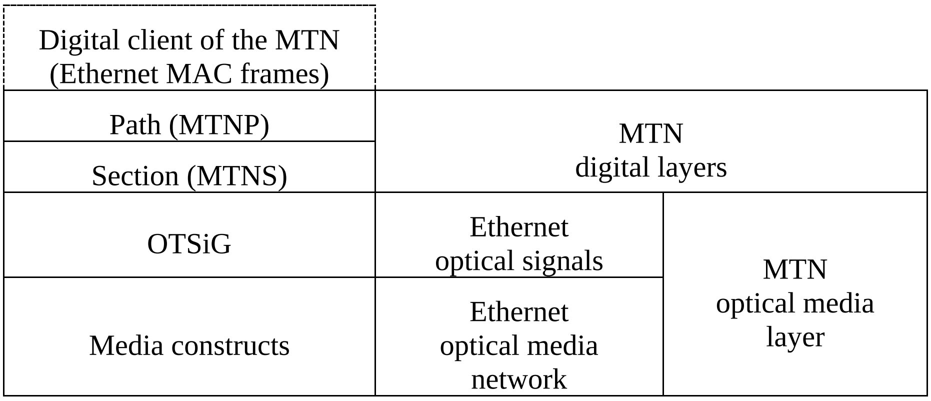

Figure 6-1 – MTN layer structure

The only client defined for the MTN is Ethernet MAC frames which are encoded into 64B/66B blocks as defined in clause 82 of [IEEE 802.3] for transport across the MTN.

The MTNP layer provides channel forwarding, as described in clause 6.3.1 of [ITU-T G.800], for Ethernet MAC frames.

The MTNP layer does not transfer client Ethernet MAC frame timing information. Any link status indication blocks (e.g., LF, RF, LPI) present on the UNI links are terminated by the UNI interface and are not transferred across the MTN layer networks.

The only server layer defined for the MTNP is the MTNS. An instance of a MTNP layer network cannot be a client or server for another instance of a MTNP layer network.

The only client defined for the MTNS layer is the MTNP layer. The MTNS layer provides fixed point to point connectivity for its MTNP layer clients at bitrates in multiples of ~5 Gb/s. The MTNS is based on Flex Ethernet (FlexE) as defined in [OIF FLEXE IA].

The server layer for the MTNS layer is provided by any of the Ethernet physical layers that use the encoding defined in clause 82 of [IEEE 802.3]. The Ethernet interfaces defined at the time this Recommendation was published are: 50GBASE-R, 100GBASE-R, 200GBASE-R and 400GBASE-R [IEEE 802.3].

The MTNS characteristic information (CI) is adapted to a modulator input by the lower functions of the physical coding sublayer (PCS) defined in clause 82 of [IEEE 802.3], the physical medium attachment (PMA) defined in clause 83 of [IEEE 802.3] and corresponding physical medium dependent (PMDs) of [IEEE 802.3]. The processing includes; scrambling, lane distribution, insertion of alignment markers, forward error correction (FEC) (except for some 100GBASE-R interfaces) and mapping to one or more digital lanes for modulation.

Annex A provides a description of the relationship between the MTN layer networks and Ethernet [IEEE 802.3] and FlexE [OIF FLEXE IA].

The MTN digital layers are described in clause 7, the MTN optical media network is described in clause 8.

7 MTN digital layer networks

The client/server associations of the MTN digital layers are shown in Figure 7-1.

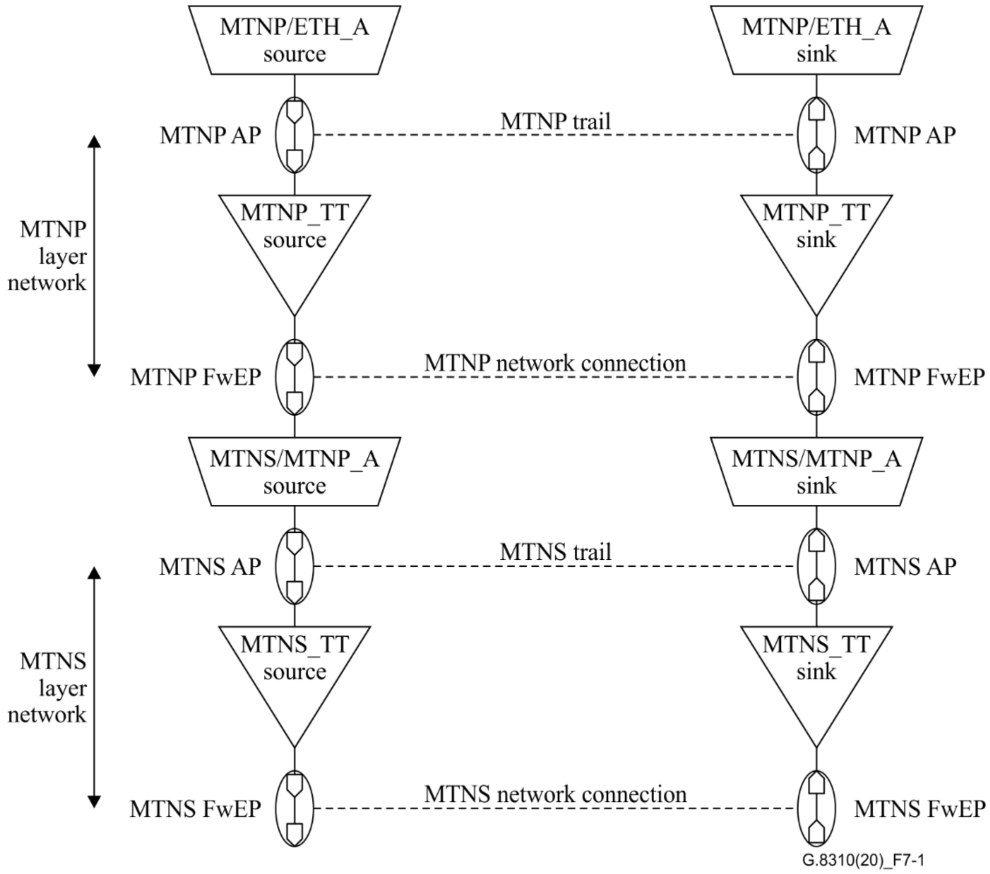

Figure 7-1 – Client/server layer associations of the MTN digital layer networks

7.1 MTNP layer network

The MTNP layer network provides a MTNP trail transport entity to support the transport of Ethernet MAC frames across the MTN. The MTNP trail is supported by zero or more MTNS trail(s) as shown in Figures 7-2 and 7-3. The MTNS trail is described in clause 7.2. The MTNP trail transport entity supports only bidirectional, symmetrical, point to point connectivity. The description of the supported client layer network is outside the scope of this Recommendation.

The MTNP trail transport entity provides channel forwarding, as described in clause 6.3.1 of [ITU-T G.800], for the client Ethernet MAC frames.

The MTNP layer network provides configurable connectivity between path forwarding end points (FwEPs), or between a path FwEP and a path FP or between path FPs.

The MTNP layer network is non-recursive i.e., a MTNP layer cannot be a client of another MTNP layer network. The only server layer for the MTNP layer is the MTNS layer described in clause 7.2.

The CI of a MTNP layer network is a sequence of 64B/66B blocks encoded as defined in clause 82 of [IEEE 802.3] and is composed of:

– A contiguous sequence of 64B/66B blocks that carry a MAC frame (called a packet) with a minimum gap between packets (called the inter-packet gap (IPG)).
– MTNP overhead encoded into 64B/66B blocks.

The duration of the IPG can be modified to provide rate adaptation between the client MAC frames and the MTNP. Therefore, the MTNP layer network does not transfer client timing information. Also, any link status indications blocks (e.g., LF, RF, LPI) present on the UNI links are terminated by the UNI interface and are not transferred across the MTN layer networks.

Details of the format of the MTNP CI are provided in [ITU-T G.8312].

To provide end-to-end networking, the following capabilities are included in the MTNP layer network:

– MTNP connection rearrangement for flexible network routing;

– MTNP overhead processes to verify the integrity of the client adapted information (AI);

– MTNP operations, administration and maintenance functions, including network survivability.

The MTNP layer network, shown in Figure 7-2, contains the transport processing functions, transport entities, and topological components described in clauses 7.1.1, 7.1.2 and 7.1.3 respectively. The interlayer adaptation functions are described in clause 7.3.1.

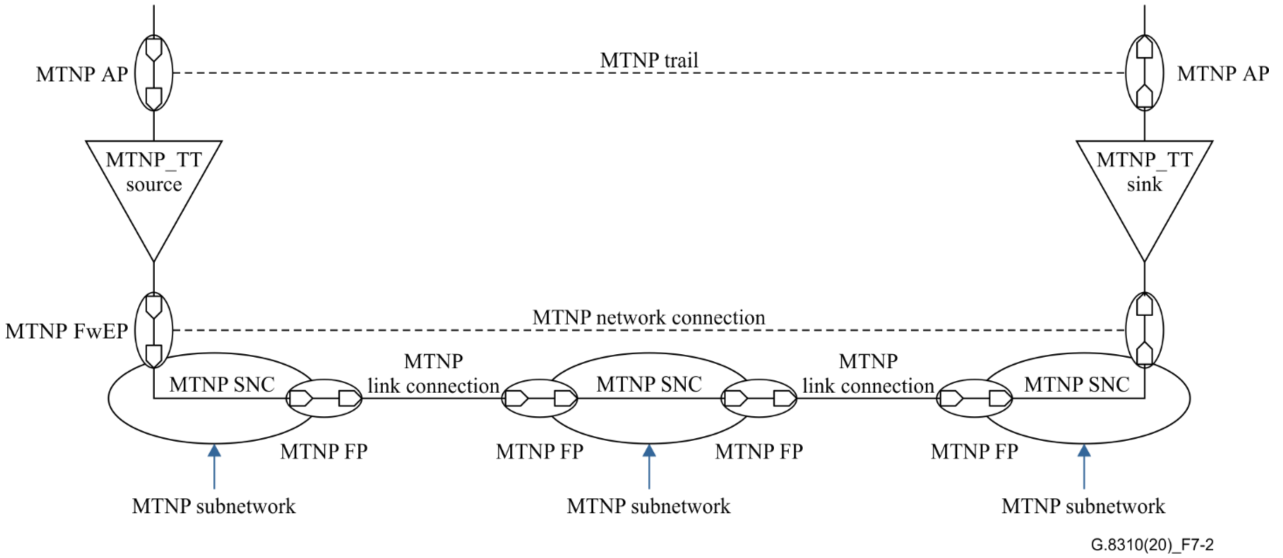

Figure 7-2 – MTNP layer network

As described in [ITU-T G.800], the MTNP subnetwork may represent the aggregation of contained subnetworks and links or, it may represent the limit of subnetwork recursion which is a matrix.

A MTNP subnetwork may provide a subnetwork connection directly between MTNP FwEPs without adaptation to an MTN section layer. This is illustrated in Figure 7-3.

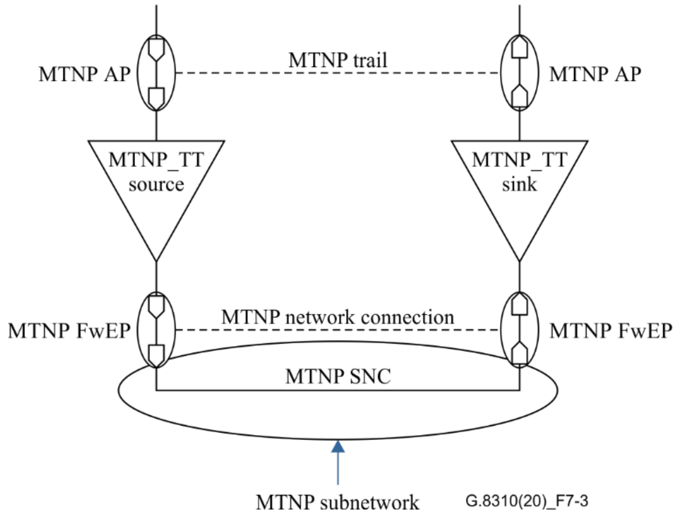

Figure 7-3 – MTNP subnetwork example

7.1.1 MTNP trail termination

The following generic processes are assigned to the MTNP trail termination:

– validation of connectivity integrity;
– assessment of transmission quality;
– transmission defect detection and indication.

The requirements for these processes are outlined in clause 9.

There are three types of MTNP trail termination:

– MTNP bidirectional trail termination: consists of a pair of collocated MTNP trail termination source and sink functions;
– MTNP trail termination source: accepts AI from a client layer network at its input, generates and inserts the MTNP trail overhead as a separate and distinct logical data stream and presents the CI of the MTNP layer network at its output;
– MTNP trail termination sink: accepts the CI of the MTNP layer network at its input, extracts and processes the separate and distinct logical data stream containing the MTNP trail overhead and presents the AI at its output.

7.1.2 MTNP transport entities

Network connections, subnetwork connections, link connections and trails are as described in [ITU-T G.800]. Tandem connections are not supported.

7.1.3 MTNP topological components

Layer network, subnetworks, links and access groups are as described in [ITU-T G.800].

The MTNP subnetwork provides configurable subnetwork connections between an input forwarding point (FP) or forwarding end point (FwEP) and an output FP or FwEP.

7.2 MTNS layer

The MTNS layer network provides a fixed point-to-point MTNS trail transport entity, that is bidirectional and symmetrical to support the transport of the MTNP client. The MTNS trail is supported by an optical signal tributary group (OTSiG). The OTSiG is implemented by one or more Ethernet optical interfaces as described in clause 8.2.

The MTNS layer network is non-recursive and the only client for the MTNS layer network is the MTNP layer network.

The CI of an MTNS layer network is a stream of 64B/66B blocks encoded as defined in clause 82 of [IEEE 802.3] and is composed of:

– Client MTNP CI; and
– MTNS overhead encoded into 64B/66B blocks.

The format of the MTNS is based on FlexE that is defined in [OIF FLEXE IA], details of the format are provided in [ITU-T G.8312]. The MTNS is structured as a set of calendar slots each with a capacity of ~5Gbit/s. The number of calendar slots supported by the MTNS is dependent on the OTSiG that supports the MTNS. A MTNP client is allocated one or more calendar slots.

The duration of the IPG (in the MTNP CI) can be modified by adding or removing 64B/66B blocks (in the IPG) to provide rate adaptation between the MTNP CI and the calendar slots allocated to it in the MTNS.

The capabilities of the MTNS layer network include:

– MTNS overhead processes to confirm the integrity of the client AI and conditioning for its transport over an OTSiG;

– MTNS operations, administration and maintenance functions.

The MTNS layer network, shown in Figure 7-4 contains the transport processing functions, transport entities, and topological components described in clauses 7.2.1, 7.2.2 and 7.2.3 respectively. The interlayer adaptation functions are described in clause 7.3.2.

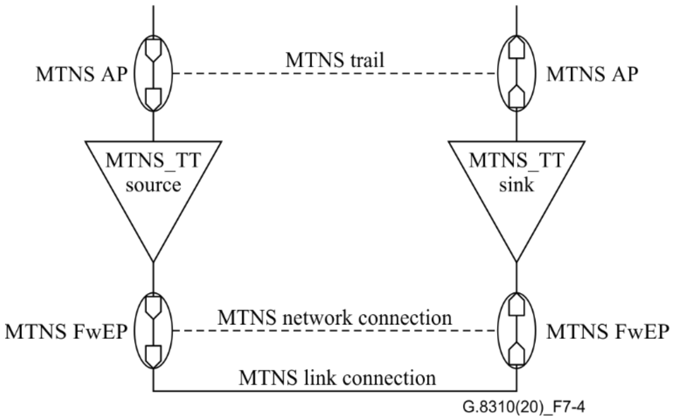

Figure 7-4 – MTNS layer network

The MTNS network connection is supported by an OTSiG as described in clause 8.2.

7.2.1 MTNS trail termination

The following generic processes are assigned to the MTNS trail termination:

– Validation of connectivity integrity.

The requirements for these processes are outlined in clause 9.

There are three types of MTNS trail termination:

– MTNS bidirectional trail termination: consists of a pair of collocated MTNS trail termination source and sink functions;

– MTNS trail termination source: accepts AI from the MTNP client layer network at its input, generates and inserts the MTNS trail overhead as a separate and distinct logical data stream and presents the CI of the MTNS layer network at its output. If bonding is supported (see clause 8.2.2) it inverse multiplexes the client AI onto a group of homogenous Ethernet interfaces;

– MTNS trail termination sink: accepts the CI of the MTNS layer network at its input, extracts and processes the separate and distinct logical data stream containing the MTNS trail overhead and presents the MTNP AI at its output. If bonding is supported (see clause 8.2.2) it accepts the input from a group Ethernet interfaces, aligns the members of the group and reconstructs the payload at the aggregate line rate.

7.2.2 MTNS transport entities

Network connections, link connections and trails are as described in [ITU-T G.800]. Subnetwork connections and tandem connections are not supported.

7.2.3 MTNS topological components

Layer network and access groups are as described in [ITU-T G.800]. Subnetworks are not supported.

7.3 Client/server associations

7.3.1 MTNP/Ethernet MAC frame (ETH) adaptation

The bidirectional MTNP/ETH adaptation function is performed by a collocated pair of source and sink MTNP/ETH adaptation functions.

The MTNP/ETH adaptation source performs the following processes between its input and its output:

– all the processing required to encode the client MAC frame into a contiguous sequence of 64B/66B blocks as defined in clauses 81 and 82 of [IEEE 802.3];

– generation of management/maintenance signals as described in clause 9.

The MTNP/ETH adaptation sink performs the following processes between its input and its output:

– recovery of the client MAC frames from the contiguous sequence of 64B/66B blocks as defined in clauses 81 and 82 of [IEEE 802.3];

– termination of management/maintenance signals as described in clause 9.

7.3.2 MTNS/MTNP adaptation

The bidirectional MTNS/MTNP adaptation function is performed by a collocated pair of source and sink MTNS/MTNP adaptation functions.

The MTNS/MTNP adaptation source performs the following processes between its input and its output:

– all the processing required to map 664B/66B blocks of the MTNP CI into a defined number of calendar slots;

– generation and termination of relevant management/maintenance signals as described in clause 9.

The MTNS/MTNP adaptation sink performs the following processes between its input and its output:

– recovery of the MTNP CI from the assigned calendar slots;

– generation and termination of management/maintenance signals as described in clause 9.

8 Architecture of the media network supporting the MTN

The architecture of the media network, defined in [IEEE 802.3], is described using the media constructs listed in clause 8.1 to represent the different functions that are present in the media network. Media constructs operate on the signal envelope (e.g., constrain or direct the media channel, etc.) and are not aware of the information being carried. Media constructs do not modulate or demodulate the signal and therefore do not process the digital information that is carried by the signal.

A full description of the generic functional architecture of the media network is provided in [ITU-T G.807].

The media network that support the MTNS only provides fixed point to point media associations and does not support the optical signal maintenance entity (OSME) described in [ITU-T G.807].

8.1 Media constructs

The following media constructs used to describe the architecture of the media network are described in [ITU-T G.807]:

– media port;

– media channel;

– media channel group;

– fibre.

8.2 Optical tributary signal group (OTSiG)

The MTNS is supported by an OTSiG. The OTSiG is a management/control abstraction that represents a group of one or more optical tributary signals (OTSi), see [ITU-T G.807]. The OTSiG consists of one or more Ethernet physical layer interfaces defined in [IEEE 802.3]. Each unidirectional optical tributary signal (OTSi) is carried in an independent network media channel (NMC). The NMC is described in clause 7.1.2.1 of [ITU-T G.807]. The digital information stream from the MTNS present at the FwEP is mapped and encoded by an adaptation source function.

NOTE – The encoding process in the M-AI/MTNS adaptation may include the computation and insertion of a forward error correction (FEC) code.

The resultant modulator adapted information (M-AI) is used by a modulator source to create an OTSi. The OTSi is converted back to M-AI by a demodulator sink according to a specific modulation/demodulation mechanism. The adaptation sink function processes the M-AI to recreate the MTNS digital information stream. As illustrated in Figure 8-2, the MTNS client may be carried by more than one OTSi (depending on the particular Ethernet interface that is used).The functional models for these interfaces are provided in Figures 8-1 and 8-2. Note that in most Ethernet interfaces the modulators and filters are not configurable.

At the time of publication of this Recommendation the Ethernet interfaces, defined in [IEEE 802.3], that can be used in the MTN media network are: 50GBASE-R, 100GBASE-R, 200GBASE-R and 400GBASE-R.

8.2.1 MTNS carried over a single Ethernet interface

The case where the MTNS is carried by one Ethernet interface that uses a single OTSi is shown in Figure 8-1. The OTSi is carried from the media port on the modulator source to the media port on the demodulator sink by a network media channel (NMC).

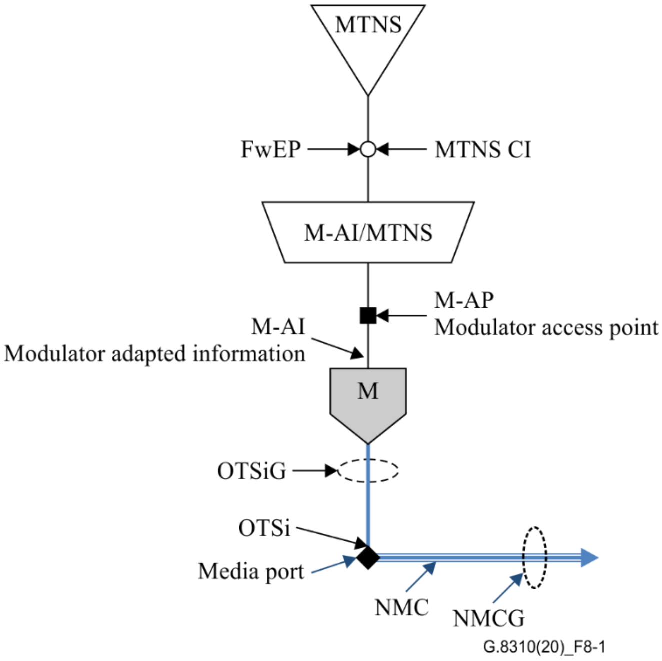

Figure 8-1 – Mapping an MTNS to an OTSiG that contains one OTSi

The case where an MTNS is carried by one Ethernet interface that uses more than one OTSi is illustrated in Figure 8-2.

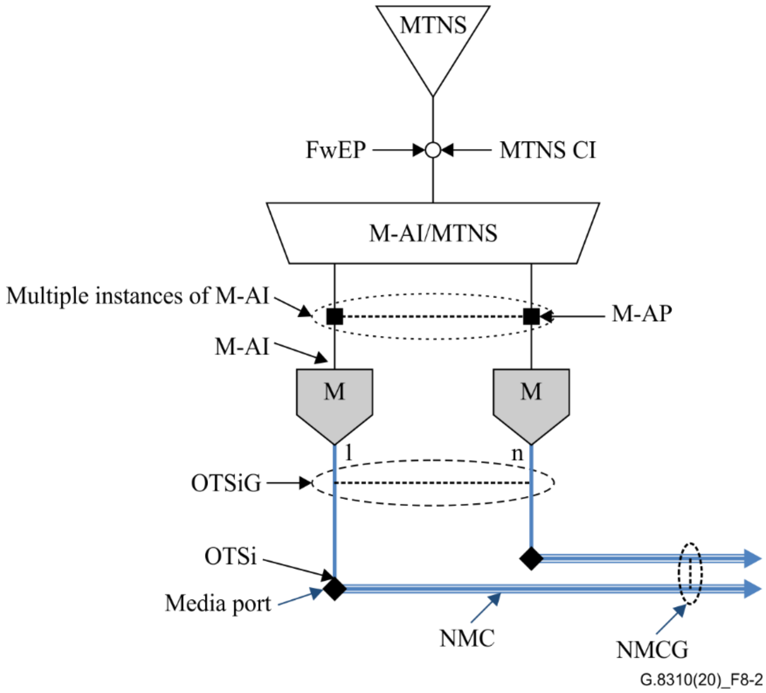

Figure 8-2 – Mapping an MTNS to an OTSiG that contains more than one OTSi

The differential delay between members of the OTSiG must be controlled, this is represented by placing all of the NMCs in a single NMC group (NMCG). Normally these functions are supported by an Ethernet interface and all members of the OTSiG are carried over the same fibre.

8.2.2 MTNS carried over more than one Ethernet interface

The MTNS may be carried by a group of two or more Ethernet interfaces. In the description of FlexE in [OIF FLEXE IA] this is referred to as bonding. This is modelled by expanding the MTNS trail termination to provide an inverse multiplexing sub-layer as described in clause 5.3.3.1.2 of [ITU-T G.805]. This is shown in Figure 8-3, in this example each Ethernet interface is supported by a single OTSi. Each of the Ethernet interfaces may be supported by more than one OTSi as shown in Figure 8-2.

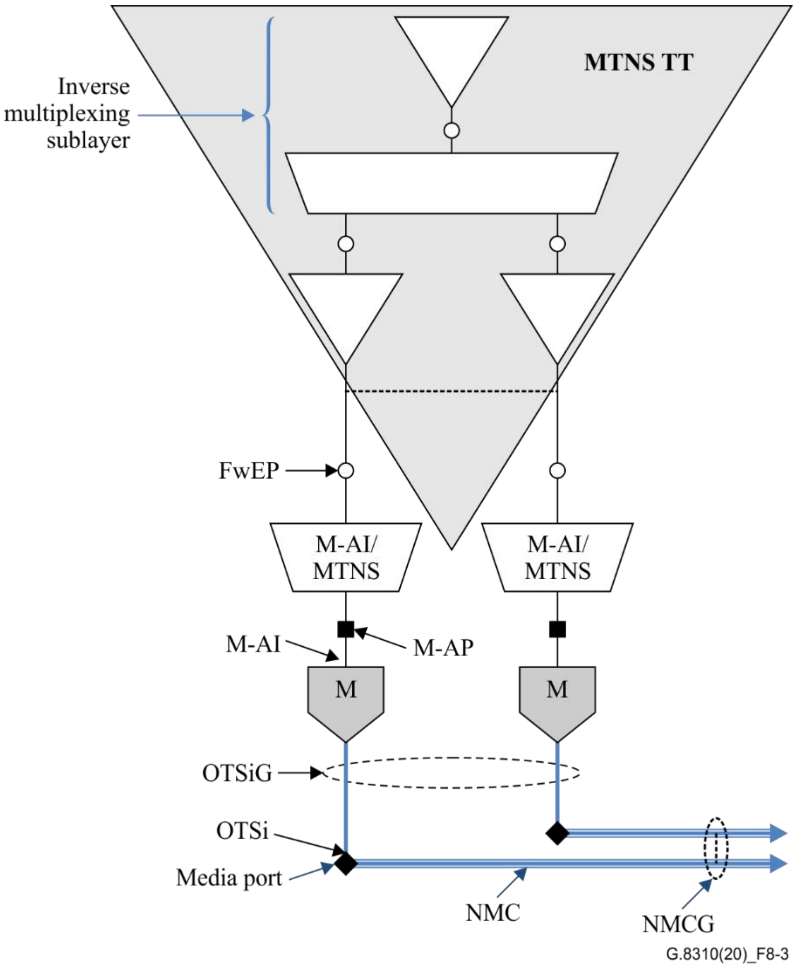

Figure 8-3 – Mapping an MTNS to a set of bonded Ethernet interfaces

In this case the OTSi that supports each of the Ethernet interfaces is in the same OTSiG and the differential delay of the members of the OTSiG must be constrained.

8.3 Client/server associations

8.3.1 M-AI/MTNS adaptation

The bidirectional M-AI/MTNS adaptation function is performed by a collocated pair of source and sink M-AI/MTNS adaptation functions.

The M-AI/MTNS adaptation source performs the following processes between its input and its output:

– all the processing required to encode and map the MTNS client into one or more instances of M-AI. These processes include scrambling, lane distribution, insertion of alignment markers, forward error correction (FEC), PMA and physical medium dependent (PMD) sublayers. FEC is required on all Ethernet interfaces except for some legacy 100GBASE-R Ethernet interfaces. These processes are described in [IEEE 802.3].

The M-AI/MTNS adaptation sink performs the following processes between its input and its output:

– All the processes necessary to recover the MTNS client from one or more instances of M-AI. These processes are described in [IEEE 803.3].
– If the Ethernet interface uses FEC:
  – ensure that all blocks in an uncorrectable FEC codeword are error marked;
  – replace all 64B/66B blocks with an invalid sync header with a /E/ block.

9 Management capabilities

This clause provides an overview of the fault, performance and configuration management capabilities provided by the MTN. The capabilities are described in [ITU-T G.8312].

NOTE – Further details will be provided in the MTN equipment Recommendation.

The MTN digital layers (MTNP, MTNS) use digital overhead to provide OAM, which can report on the status of the layer and may be used to infer the status of the server layer.

The media network that is deployed as a part of an MTN network uses point-to-point Ethernet links and is not expected to support fault, performance and configuration management.

9.1 Capabilities

9.1.1 Fault, configuration and performance management

The MTNP layer network provides the capabilities to:

– configure the interconnection of reference points e.g., FPs, FwEPs;
– detect faults and initiate recovery actions where applicable;
– support single-ended maintenance;
– detect and report misconnections;
– detect performance degradation and verify quality of service.

The MTNS layer network provides the capabilities to:

– interconnect the FwEP reference points;
– detect faults;
– support single-ended maintenance;
– detect and report misconnections.

9.1.2 Client/server interaction

The server detects and indicates to the client layer when a digital stream or optical signal is not present.

To avoid unnecessary, inefficient or conflicting survivability actions, escalation strategies (e.g., introduction of hold-off times and alarm suppression methods) may be required:

– within a layer;
– between a server and client layer.

9.1.3 Adaptation management

Adaptation management refers to the set of processes for managing the adaptation of a client layer network to/from the server layer network.

9.1.4 Connection supervision

9.1.4.1 Continuity supervision

Continuity supervision refers to the set of processes for monitoring the continuity of a transport entity (e.g., trail).

In general, a continuity fault in a server is indicated to a client through server signal fail (SSF) indication.

9.1.4.2 Connectivity supervision

Connectivity supervision refers to the set of processes for monitoring the integrity of the routing of a connection between the source and sink trail terminations.

Connectivity supervision is necessary to confirm proper routing of a connection between trail termination source and sink during the connection set-up process. Furthermore, connectivity supervision is needed to ensure that connectivity is maintained while the connection is active.

Trail trace identifier (TTI) is necessary to ensure that the signal received by a trail termination sink originates from the intended trail termination source:

– TTI is provided by the trail transport entity for the MTNS layer to ensure proper MTNS layer connections.
– TTI is provided by the trail transport entity for the MTNP layer to ensure proper MTNP layer connections.

9.1.4.3 Maintenance information

Maintenance information refers to the set of processes for indicating defects in a connection, which is part of a trail. The defect indications are given in the downstream and upstream directions of a bidirectional trail.

The capabilities are described in [ITU-T G.8312].

NOTE – Further details will be provided in the MTN equipment Recommendation.

Two maintenance information processes are identified for the digital layers:

– alarm indication signal (AIS);
– open connection indication (OCI).

These processes enable defect localization and single-ended maintenance.

9.1.5 Connection quality supervision

Connection quality supervision refers to the set of processes for monitoring the performance of a connection. Generic processes include parameter measurement, collection, filtering and processing. Connection quality supervision is supported for the MTNP layer network. Delay measurement is also supported by the MTNP layer.

9.1.6 Management communications

Management communications are transported via an embedded communication channel as specified in [ITU-T G.7712]. The MTNS provides a management communications channel (MCC), the MTNP does not support management communications.

9.1.7 Frequency and time synchronization

The communication of time and frequency information using either precision time protocol (PTP) as defined in [b-ITU-T G.8265.1] or in [b-ITU-T G.8275.1] or synchronization status message (SSM) as defined in [b-ITU-T G.8264] may be supported by the MTNS (using the FlexE synchronization messaging channel).

9.2 Connection supervision techniques

Connection supervision is the process of monitoring the integrity of a given connection in the digital layers of the MTN. The integrity may be verified by means of detecting and reporting connectivity and transmission performance defects for a given connection. Only inherent monitoring defined in [ITU-T G.805] is supported.

9.3 Connection supervision applications

9.3.1 Unused connections

In order to detect the inadvertent opening of a MTNP subnetwork connection a distinct replacement signal (open connection indication (OCI)) is used.

9.3.2 Connection monitoring

Only the MTNP and MTNS trail transport entities are monitored.

10 Survivability techniques

It is expected that survivability techniques will only be used in the MTN for the trail transport entity in the MTNP layer network. It is only envisioned that 1+1 linear path protection as described in [ITU-T G.808.1] will be used. The MTNP overhead is used to detect faults or performance degradations (see clause 9) and these events may be used to trigger the replacement of the failed transport entity with a protection transport entity. Details of the mechanism are out of the scope of this Recommendation.

Annex A

Relationship of MTN to other technologies

(This annex forms an integral part of this Recommendation.)

Figure A.1 shows the relationship between the MTN layer networks, Ethernet as defined in [IEEE 802.3] and FlexE as defined in [OIF FLEXE IA].

The MTN path to Ethernet client adaptation is defined by reference to [IEEE 802.3]. The AI at the MTNP_AP consists of a sequence of [IEEE 802.3] clause 82-compliant 64B/66B blocks. The adaptation of the MTN section to media is described by [IEEE 802.3]. The CI at the MTNS FwEP consists of a stream of [IEEE 802.3] clause 82-compliant 64B/66B blocks. The use of [IEEE 802.3] clause 82-compliant 64B/66B blocks allows the MTN section layer to be carried over Ethernet PHYs that use [IEEE 802.3] clause 82 PCS. Figure A.1 shows the relationship of MTN to [IEEE 802.3] and [OIF FLEXE IA] for the case where the Ethernet signal is carried by a single OTSi (see Figure 8-1) and bonding (described in clause 8.2.2) is not used.

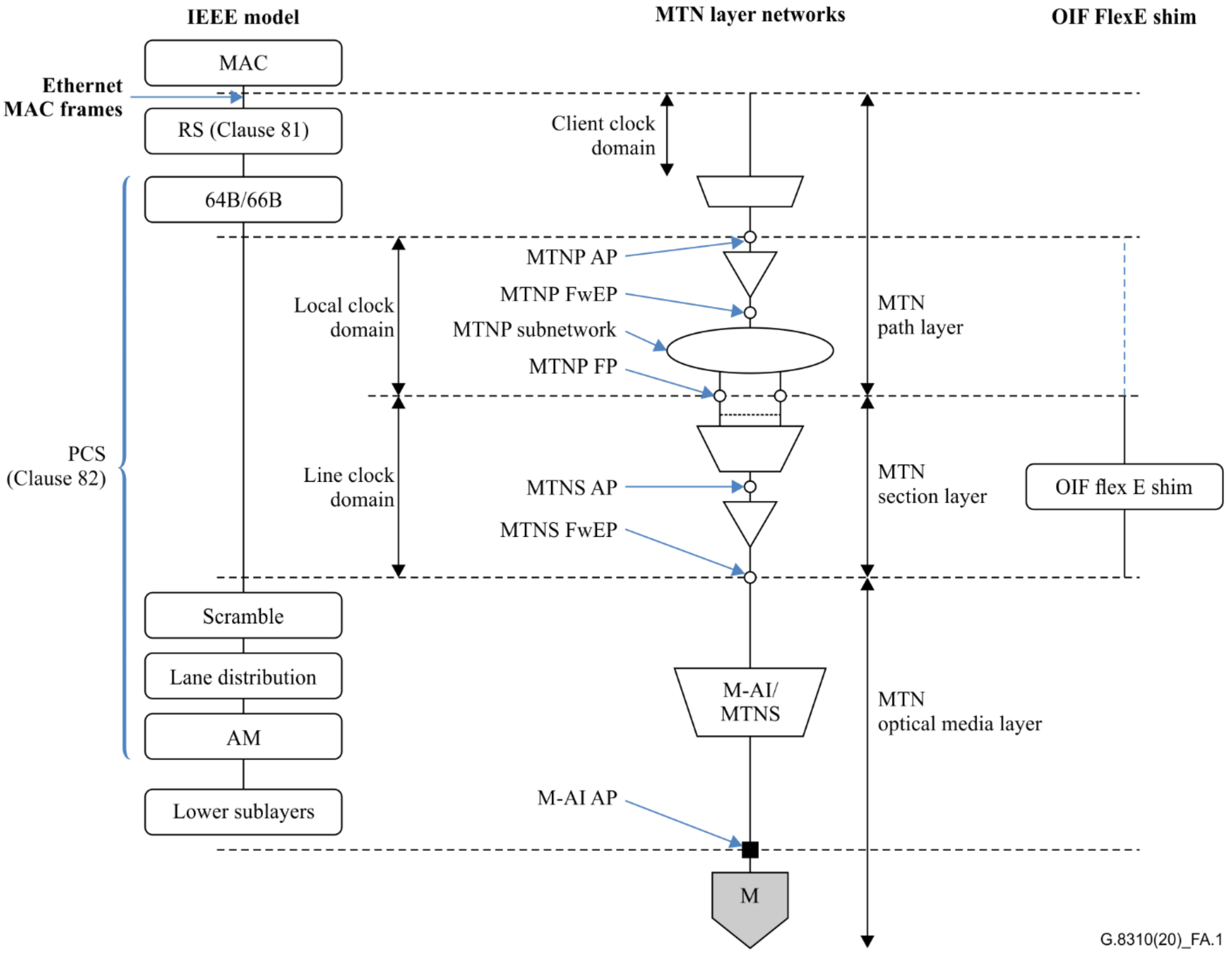

Figure A.1 – Relationship of MTN to [IEEE 802.3] Ethernet and [OIF FLEXE IA] FlexE

Bibliography

[b-ITU-T G.8264] Recommendation ITU-T G.8264/Y.1364 (2017), *Distribution of timing information through packet networks.*

[b-ITU-T G.8265.1] Recommendation ITU-T G.8265.1/Y.1365.1 (2014), *Precision time protocol telecom profile for frequency synchronization.*

[b-ITU-T G.8275.1] Recommendation ITU-T G.8275.1/Y.1369.1 (2020), *Precision time protocol telecom profile for phase/time synchronization with full timing support from the network.*

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