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Fifth Generation Fixed Network (F5G); Data Models of Telemetry for Access Network

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Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) Fifth Generation Fixed Network (F5G).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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1 Scope

The present document specifies the data models for Telemetry in the Access Network including both configuration and collection, referring to ETSI GS F5G 011 [1] and providing typical examples.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are necessary for the application of the present document.

[1] ETSI GS F5G 011:"Fifth Generation Fixed Network (F5G); Telemetry Framework and Requirements for Access Networks".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] IEEE 802.3-2008™: "IEEE Standard for information technology".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI GS F5G 004 [1] and the following apply:

Access Network Telemetry (ANT): monitoring technology that remotely collects data in push mode from the OLT

alignment error packet: packet with bad FCS and with a non-integral number of octets

NOTE: The definition of this term comes from IEEE 802.3 [i.1].

error packet: error frames include the following data frames:

- Correct and incorrect data frames with a frame length less than 64 bytes.
- Correct and incorrect data frames whose frame size is greater than the maximum MTU.
- Data frames with FCS errors whose frame length ranges from 64 to the maximum MTU.

- Data frames with alignment errors whose frame length ranges from 64 to the maximum MTU.

NOTE: The definition of this term comes from IEEE 802.3 [i.1].

fragment packet: packets with less than 64 octets in length, excluding framing octets but including FCS octets

NOTE 1: These packets have, and had either a bad FCS with an integral number of octets (FCS error) or a bad FCS with a non-integral number of octets (alignment error).

NOTE 2: The definition of this term comes from IEEE 802.3 [i.1].

jabber packet: packet that is greater than 1 518 octets in length, excluding framing octets but including FCS octets

NOTE 1: These packets have, and had either a bad FCS with an integral number of octets (FCS error) or a bad FCS with a non-integral number of octets (alignment error).

NOTE 2: The definition of this term comes from IEEE 802.3 [i.1].

oversized packet: packet with length greater than 1 518 octets

NOTE: The definition of this term comes from IEEE 802.3 [i.1].

sensor group: group of multiple sensor paths

sensor path: data model path of the sensor, which describes the specific ANT objects for collection

service flow: a service flow is a consequence of traffic classification based on the identifiers in the Ethernet packets on a physical port or logical port

EXAMPLE: An identifier can be a VLAN ID, which means Ethernet packets are classified based on VLANs.

NOTE: A service flow can also be a Layer 2 logical channel that carries services between an access node (OLT) and a subscriber (ONU).

undersized packet: packet with length less than 64 octets

NOTE: The definition of this term comes from IEEE 802.3 [i.1].

3.2 Symbols

Void.

3.3 Abbreviations

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

ANT	Access Network Telemetry
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
DOW	Drift Of Window
EPON	Ethernet Passive Optical Network
FCS	Frame Check Sequence
FEC	Forward Error Correction
gNMI	gRPC® Network Management Interface
GPB®	Google Protocol Buffer
GPON	Gigabit-capable Passive Optical Networks
gRPC®	Google Remote Procedure Call
IP	Internet Protocol
JSON	JavaScript Object Notation
KPI	Key Performance Indicator
LOF	Loss Of Frame
MTU	Maximum Transmission Unit
NETCONF	Network Configuration protocol

OAM	Operation Administration and Maintenance
ODN	Optical Distribution Network
OLT	Optical Line Terminal
OMCI	ONU Management and Control Interface
ONU	Optical Network Unit
PM	Performance Monitoring
PON	Passive Optical Network
RPC	Remote Procedure Call
UDP	User Datagram Protocol
UINT	Unsigned Integer
VLAN	Virtual Local Area Network
YANG	Yet Another Next Generation data modelling language

4 Introduction to F5G Telemetry Models

4.1 Overview

Telemetry provides a mechanism to stream collection data from OLT to the telemetry system as shown in ETSI GS F5G 011 [1]. The telemetry system is an automated controller for Access Network telemetry. It shall implement telemetry collection and may have the capability to dynamically configure and generate the telemetry subscriptions. When receiving the collected telemetry data, the telemetry system decodes it with identified encoding format and get subscribed information. For most OAM engineers, telemetry technology streams the collection data for helping access network monitoring and troubleshooting.

Access Network Telemetry contains the information about the applied configuration and uses configuration models to identify the subscription which consists of sensor-path and destinations.

The data layer of telemetry refers to the clause 5 of ETSI GS F5G 011 [1] as shown in Table 1. There are three layers and corresponding models.

Table 1: Data Layer of the Access Network Telemetry

Telemetry Stack		Corresponding Models	Requirements
Data layer	Collection data layer	Telemetry Collection Models	Carry encoded telemetry collection data.
	Telemetry layer	Telemetry Data Header Models	Defines the data header when telemetry data is sent, including sampling path, sampling timestamp, etc.
	RPC layer (only in gRPC® protocol)	gRPC® Protocol Models	Defines the RPC interfaces when the OLT equipment reporting telemetry data as a server.

Combining the two pieces of information (configuration and collection) is the basis for automation and for intent-based networking of access network. The telemetry models define configuration models and data layer models for access network in telemetry collection. Having the same data language of models as the source of telemetry facilitates the OLT streaming data, aggregation and data analytics.

4.2 Objectives of the Telemetry Models

Figure 1 illustrates the telemetry system and telemetry data streaming architecture. The Telemetry models combines configuration models and Telemetry data layer models.

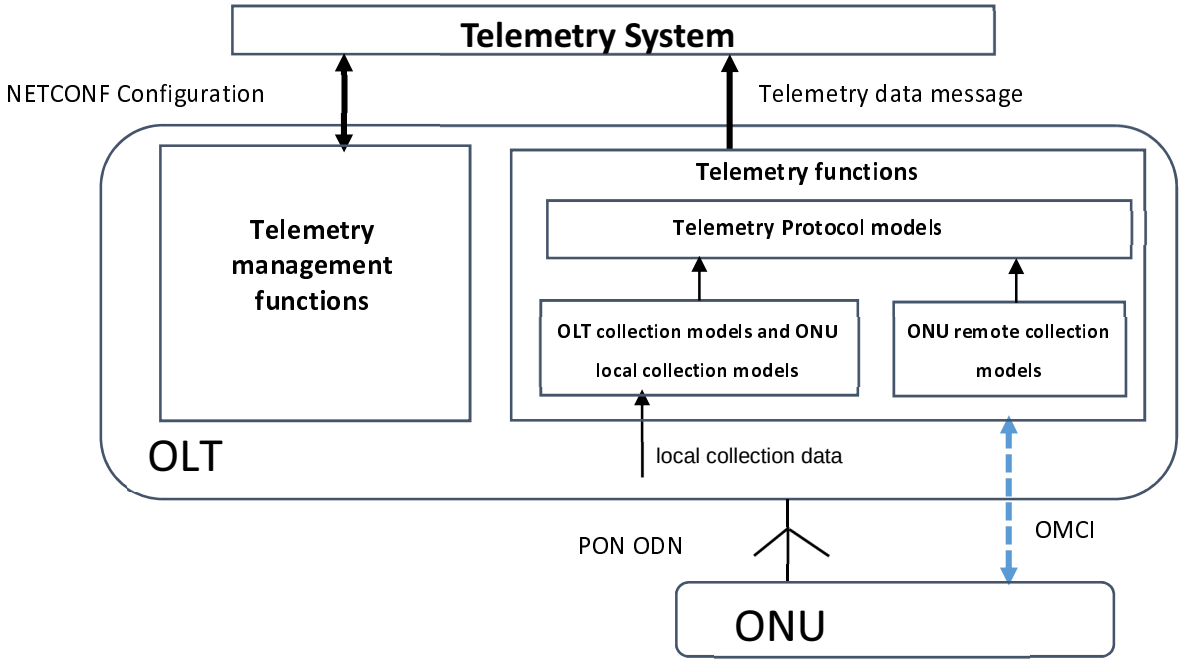

Figure 1: Telemetry Architecture with Combined Mode

The telemetry configuration models are the YANG models to the Northbound OAM Interfaces for telemetry management functions of the OLT. The interfaces of the YANG models exploit good programmability level of the Telemetry management platform. The Telemetry configuration models shall fulfil the following objectives:

- The telemetry configuration models are used in the telemetry management functions of the OLT. The OLT shall have a NETCONF server for its telemetry management function. The Telemetry configuration models and their NETCONF management interfaces are hosted by the OLT.

- The models shall support functions based on ETSI GS F5G 011 [1], clause 7.3.1 which are the essential blocks of the OLT enabling telemetry in Access Network.

The telemetry data layer models contain the Telemetry collection models, the telemetry data header models and the gRPC® protocol models. The Telemetry data header models and the gRPC® protocol models can collectively be called the Telemetry protocol models as shown in Figure 1 and Figure 2. The Telemetry data layer models shall fulfil the following objectives:

- The telemetry data layer models are the protobuf models which are used in the telemetry functions of the OLT and decoding functions in the telemetry system. The encoding format of the telemetry data is based on the telemetry data layer models and their GPB® format. The Telemetry data layer models shall meet the interface requirements in ETSI GS F5G 011 [1], clause 6.

- The gRPC® protocol models are the protobuf models to define the gRPC® interfaces for the gRPC® Static Telemetry mode and gRPC® Dynamic Telemetry mode based on ETSI GS F5G 011 [1], clause 6.2.

- The telemetry collection models contain OLT collection models, local ONU collection models and remote ONU collection models. They shall support the collection parameters for telemetry in the Access Network based on ETSI GS F5G 011 [1], clause 8. The Telemetry collection models can be used in either of the two following modes as shown in Figure 1 and Figure 2:

  - **Telemetry Architecture with Combined Mode:** managing the OLT local collection and ONU remote collection as a combined telemetry functions in the OLT are shown in Figure 1. The telemetry collection models are all hosted in the OLT. The local collection data is sampled by the OLT. The remote ONU collection information can be retrieved through the management interface between the OLT and the ONU which can be OMCI or other protocols and generated according to the ONU remote collection models by the OLT.

- **Telemetry Architecture with Separate Mode:** managing the OLT local collection and ONU remote collection in separate entities is shown in Figure 2. The OLT only hosts the OLT collection models and local ONU collection models. The remote ONU collection models are hosted in the subtending ONU. The local collection data is sampled by the OLT. And when the ONU receives the subscription request from OLT, it collects remote ONU collection information and generates the corresponding telemetry data which encoding format is the same as identified by the telemetry system according to the ONU remote collection models and streams the message to the OLT periodically.

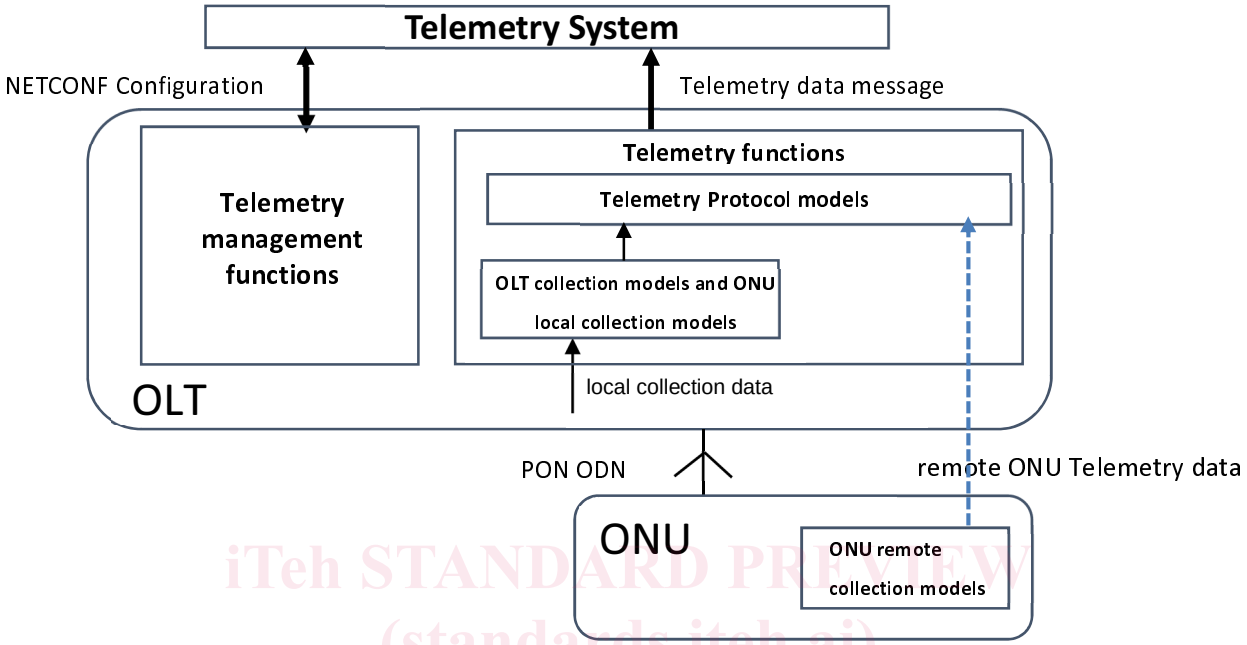

Figure 2: Telemetry Architecture with Separate Mode

5 F5G Telemetry Models

5.1 Fundamentals of Telemetry Configuration Models

5.1.1 Overviews

The YANG modules provide functionality to manage telemetry configuration. These modules are published on the Forge platform at https://forge.etsi.org/rep/f5g/f5g-access-telemetry/-/tree/v1.1.1/Configuration%20Models.

5.1.2 Module an-telemetry

This YANG module contains a collection of YANG definitions for supporting ETSI GS F5G 011 [1] requirements on telemetry functions in Access Network. As such, this module is specific to the OLT.

5.1.3 Module an-inet-types

This YANG module contains a collection of YANG type definitions for a set of Internet address related types for use in telemetry for Access Network. As such, this module is specific to the OLT.

5.1.4 Module an-telemetry-types

This YANG module contains a collection of YANG type and identities definitions used by the module an-telemetry for use in telemetry for Access Network. As such, this module is specific to the OLT.

5.1.5 Module an-telemetry-ext

This YANG module contains a collection of extension YANG definitions for the Telemetry configuration conditions for use in telemetry for access network. As such, this module is specific to the OLT. Specifically, this module augments the module an-telemetry to define these conditions.

5.1.6 Overall Structure

The fundamental parts of the data model are the "sensor-groups" with associated sensor paths, the "destination-groups" with all telemetry collector address and the "subscriptions" list of persistent-subscriptions and dynamic-subscriptions. These can be implemented by the OLT.

The data model has the following overall structure:

```
module an-telemetry
   +--rw telemetry-system
      +--rw sensor-groups
      |  +--rw sensor-group* [sensor-group-id]
      |     +--rw sensor-group-id  leafref
      |     +--rw config
      |     |  +--rw sensor-group-id? string
      |     +--ro state
      |     |  +--ro sensor-group-id? string
      |     +--rw sensor-paths
      |        +--rw sensor-path* [path]
      |           +--rw path                      leafref
      |           +--rw config
      |           |  +--rw path?           string
      |           |  +--rw exclude-filter? string
      |           +--ro state
      |           |  +--ro path?           string
      |           |  +--ro exclude-filter? string
      |           +--rw an-telemetry-ext:filters
      |              +--rw an-telemetry-ext:filter* [name]
      |                 +--rw an-telemetry-ext:name        leafref
      |                 +--rw an-telemetry-ext:config
      |                 |  +--rw an-telemetry-ext:name?              string
      |                 |  +--rw an-telemetry-ext:condition-relation? enumeration
      |                 +--ro an-telemetry-ext:state
      |                 |  +--ro an-telemetry-ext:name?              string
      |                 |  +--ro an-telemetry-ext:condition-relation? enumeration
      |                 +--rw an-telemetry-ext:conditions
      |                    +--rw an-telemetry-ext:condition* [op-field op-type op-value]
      |                       +--rw an-telemetry-ext:op-field  leafref
      |                       +--rw an-telemetry-ext:op-type   leafref
      |                       +--rw an-telemetry-ext:op-value  leafref
      |                       +--rw an-telemetry-ext:config
      |                       |  +--rw an-telemetry-ext:op-field? string
      |                       |  +--rw an-telemetry-ext:op-type?  enumeration
      |                       |  +--rw an-telemetry-ext:op-value? string
      |                       +--ro an-telemetry-ext:state
      |                          +--ro an-telemetry-ext:op-field? string
      |                          +--ro an-telemetry-ext:op-type?  enumeration
      |                          +--ro an-telemetry-ext:op-value? string
      +--rw destination-groups
      |  +--rw destination-group* [group-id]
      |     +--rw group-id      leafref
      |     +--rw config
      |     |  +--rw group-id? string
      |     +--ro state
      |     |  +--ro group-id? string
      |     +--rw destinations
      |        +--rw destination* [destination-address destination-port]
      |           +--rw destination-address  leafref
      |           +--rw destination-port     leafref
      |           +--rw config
      |           |  +--rw destination-address? an-inet:ip-address
      |           |  +--rw destination-port?    uint16
      |           +--ro state
      |              +--ro destination-address? an-inet:ip-address
      |              +--ro destination-port?    uint16
      +--rw subscriptions
         +--rw persistent-subscriptions
         |  +--rw persistent-subscription* [name]
```