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Access Extensions for ANCP
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Abstract

The purpose of this document is to specify extensions to ANCP (Access Node Control Protocol) (RFC6320) to support PON as described in RFC6934 and some other DSL Technologies including G.fast. This document updates RFC6320 by modifications to terminologies, flows and specifying new TLV types.

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Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

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1. Introduction

RFC6934 introduces application of ANCP to PON. However, RFC6320 [RFC6320] haven't been updated to support PON. Besides, DSL technology is also evolving. G.fast, VDSL2 Vectoring and VDSL2 Annex Q were introduced as upgraded versions to provide higher bandwidths for the last mile..

This document considers all existing Access technologies used in a Telco network, yet not supported by RFC6320 and specifies new TLVs accordingly.

2. Terminology

This section repeats some definitions from RFC6320 and RFC6934 [RFC6934], but also updates some definitions where appropriate.

Access Node (AN): [RFC5851] Network device, usually located at a service provider central office or street cabinet that terminates access (local) loop connections from subscribers. In case the access loop is a Digital Subscriber Line (DSL), the Access Node provides DSL signal termination and is referred to as a DSL Access Multiplexer (DSLAM). In case the access loop is a Passive Optical Network (PON), the Access Node is referred to as an Optical Line Terminal (OLT).

Optical Line Terminal (OLT): is located in the service provider's central office (CO) or street cabinet. It terminates and aggregates multiple PONs (providing fiber access to multiple premises or neighborhoods) on the subscriber side and interfaces with the Network Access Server (NAS) that provides subscriber management.

Optical Network Terminal (ONT): terminates PON on the network side and provides PON adaptation. The subscriber side interface and the location of the ONT are dictated by the type of network deployment. For an FTTP deployment (with fiber all the way to the apartment or living unit), ONT has Ethernet (Fast Ethernet (FE) / Gigabit Ethernet (GE) / Multimedia over Coax Alliance (MoCA)) connectivity with the Home Gateway (HGW) / Customer Premises Equipment (CPE). In certain cases, one ONT may provide connections to more than one Home Gateway at the same time.

Optical Network Unit (ONU): a generic term denoting a device that terminates any one of the distributed (leaf) endpoints of an Optical Distribution Network (ODN), implements a PON protocol, and adapts PON PDUs to subscriber service interfaces. In the case of a multi-

dwelling unit (MDU) or multi-tenant unit (MTU), a multi-subscriber ONU typically resides in the basement or a wiring closet (FTTB case) and has FE/GE/Ethernet over native Ethernet link or over xDSL (typically VDSL2) connectivity with each CPE at the subscriber premises. In the case where fiber is terminated outside the premises (neighborhood or curb side) on an ONT/ONU, the last-leg-premises connections could be via existing or new copper, with xDSL physical layer (typically VDSL2). In this case, the ONU effectively is a "PON-fed DSLAM". In new FTTdp based deployments the access node is named DPU (Distribution Point Unit). Basically from ANCP perspective this node provides the same functionality. Besides VDSL2, G.fast is beginning to play an important role.

3. Modification to ANCP - General Aspects

ANCP message formats remain the same as described in section 3.5.1 of RFC6320 when it is applied to PON. However, some message descriptions need to be modified to make them applicable to variant Access Networks, other than DSL specific.

The ANCP Adjacency message is extended to other Access Technologies than DSL. Generalize the message format to following:

The following capabilities are defined for ANCP:

o Capability Type: Access Topology Discovery = 0x01

Access technology: ANY

Length (in bytes): 0

Capability Data: NULL

For the detailed protocol specification of this capability, see Section 6 of RFC6320.

o Capability Type: Access Line Configuration = 0x02

Access technology: ANY

Length (in bytes): 0

Capability Data: NULL

For the detailed protocol specification of this capability, see Section 7 of RFC6320.

o Capability Type: Access Remote Line Connectivity Testing = 0x04

Access technology: ANY

Length (in bytes): 0

Capability Data: NULL

For the detailed protocol specification of this capability, see Section 8 of RFC6320.

4. Modification to DSL-Type TLV 0x0091

Add following new DSL-Type values.

Value: 32-bit unsigned integer

G.fast = 8

VDSL2 Annex Q = 9

SDSL bonded = 10

VDSL2 bonded = 11

G.fast bonded = 12

VDSL2 Annex Q bonded = 13

5. Extension to DSL Sub TLV

DSL sub TLVs are listed in Section 6.5 of RFC6320. G.Fast requires beside existing TLVs the following new TLVs.

5.1. Expected Throughput (ETR) TLV

Type: 0x009B Expected Throughput at L2 (ETR) upstream

Description: Reports the expected throughput upstream after retransmission (ITU-T G.997.2, clause 7.11.1.2)

Length: 4 bytes

Value: Rate in kbits/s as a 32-bit unsigned integer

Type: 0x009C Expected Throughput at L2 (ETR) downstream

Description: Reports the expected throughput downstream after retransmission (ITU-T G.997.2, clause 7.11.1.2)

Length: 4 bytes

Value: Rate in kbits/s as a 32-bit unsigned integer

5.2. Attainable expected throughput (ATTETR) TLV

Type: 0x009D Attainable Expected Throughput (ATTETR) upstream

Description: Reports the attainable expected Throughput upstream at L2 (ITU-T G.997.2, clause 7.11.2.2)

Length: 4 bytes

Value: Rate in kbits/s as a 32-bit unsigned integer

Type: 0x009E Attainable Expected Throughput (ATTETR) downstream

Description: Reports the attainable expected Throughput downstream at L2 (ITU-T G.997.2, clause 7.11.2.2)

Length: 4 bytes

Value: Rate in kbits/s as a 32-bit unsigned integer

5.3. Gamma Data Rate (GDR) TLV

Type: 0x009F Gamma data rate (GDR) upstream

Description: Reports the Gamma data rate (GDR) upstream (ITU-T G.997.2, clause 7.11.1.3)

Length: 4 bytes

Value: Rate in kbits/s as a 32-bit unsigned integer

Type: 0x00A0 Gamma Data Rate (GDR) downstream

Description: Reports the Gamma data rate (GDR) downstream(ITU-T G.997.2, clause 7.11.1.3)

Length: 4 bytes

Value: Rate in kbits/s as a 32-bit unsigned integer

5.4. Attainable Gamma Data Rate (ATTGDR) TLV

Type: 0x00A1 Attainable Gamma data rate (ATTGDR) upstream

Description: Reports the Attainable Gamma data rate upstream (ATTGDR) (ITU-T G.997.2, clause 7.11.2.3)

Length: 4 bytes

Value: Rate in kbits/s as a 32-bit unsigned integer

Type: 0x00A2 Attainable Gamma data rate (ATTGDR) downstream

Description: Reports the Attainable Gamma data rate (ATTGDR) (ITU-T G.997.2, clause 7.11.2.3) downstream

Length: 4 bytes

Value: Rate in kbits/s as a 32-bit unsigned integer

6. ANCP-Based PON Topology Discovery

This section describes topology discovery messages applied for PON. TLVs not addressed here remain the same as applied for DSL.

6.1. ANCP Port Up and Port Down Event Message Descriptions

The format of the ANCP Port Up and Port Down Event messages is shown in Figure xx1. It has the same format as the one described in section 6.3 of RFC6320. The only difference is that DSL-Line-Attributes TLV is updated as Access-Line-Attributes TLV.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           TCP/IP Encapsulating Header (Section 3.2)           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                ANCP General Message Header                    |
+                      (Section 3.6.1)                          +
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
~                    Unused (20 bytes)                          ~
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|x|x|x|x|x|x|x|x| Message Type  |   Tech Type   |  Reserved     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     # of TLVs                 | Extension Block length (bytes)|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
~                 Access line identifying TLV(s)                ~
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                ACCESS-Line-Attributes TLV                     |
~        (MANDATORY in Port Up, OPTIONAL in Port Down)          ~
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Format of the ANCP Port Up and Port Down Event Messages for PON Topology Discovery

NOTE: TLVs MAY be in a different order from what is shown in this figure.

Figure xx1: Format of the ANCP Port Up and Port Down Event Messages for PON Topology Discovery

See Section 3.6.1 of RFC6320 for a description of the ANCP general message header. The Message Type field MUST be set to 80 for Port Up, 81 for Port Down. It is applicable to both DSL and PON based access systems. The 4-bit Result field MUST be set to zero (signifying Ignore). The 12-bit Result Code field and the 24-bit Transaction Identifier field MUST also be set to zeroes. Other fields in the general header MUST be set a as described in Section 3.6 of RFC6320.

The five-word Unused field is a historical leftover. The handling of unused/reserved fields is described in Section 3.4 of RFC6320.

The remaining message fields belong to the "extension block", and are described as follows:

Extension Flags (8 bits): The flag bits denoted by 'x' are currently unspecified and reserved.

Message Type (8 bits): Message Type has the same value as in the general header (i.e., 80 or 81).

Tech Type (8 bits): MUST be set to 0x01 (PON).

Reserved (8 bits): set as described in Section 3.4 of RFC6320.

# of TLVs (16 bits): The number of TLVs that follow, not counting TLVs encapsulated within other TLVs.

Extension Block Length (16 bits): The total length of the TLVs carried in the extension block in bytes, including any padding within individual TLVs.

TLVs: One or more TLVs to identify a PON Access line and zero or more TLVs to define its characteristics.

6.2. PON Access Line Identification

Most ANCP messages involve actions relating to a specific access line. Thus, it is necessary to describe how PON access lines are identified within those messages. This section defines four TLVs for that purpose and provides an informative description of how they are used in PON. TLVs not addressed here remain unchanged as applied for DSL.

6.2.1. Access-Loop-Circuit-ID TLV

Type: 0x0001

Description: A locally administered human-readable string generated by or configured on the Access Node, uniquely identifying the corresponding access loop logical port on the user side of the Access Node, as described in Section 5.7 of [TR-156]..

Length: Up to 63 bytes

Value: ASCII string

6.2.2. Access-Loop-Remote-ID TLV

Type: 0x0002

Description: An operator-configured string that uniquely identifies the user on the associated access line, as described in Section 5.7 of [TR-156].

Length: Up to 63 bytes

Value: ASCII string

6.3. TLVs for PON Access Line Attributes

6.3.1. PON-Access-Line-Attributes TLV

Type: 0x0012

Description: This TLV encapsulates attribute values of a PON access line serving a subscriber.

Length: Variable (up to 1023 bytes)

Value: One or more encapsulated TLVs corresponding to PON access line attributes. The PON-Access-Line-Attributes TLV MUST contain at least one TLV when it is present in a Port Up or Port Down message. The actual contents are determined by the AN control application. Technology-independent attributes of RFC6320, such as TLV0x0090, are valid for PON and not repeated here.

6.3.2. PON-Access-Type TLV

Type: 0x0097

Description: Indicates the type of PON transmission system in use.

Length: 4 bytes

Value: 32-bit unsigned integer

OTHER = 0

GPON = 1

XG-PON1 = 2

TWDM-PON = 3

XGS-PON = 4

WDM-PON = 5

Unknown = 7

6.3.3. ONT/ONU-Average-Data-Rate-Downstream TLV

Type: 0x00b0

Description: ONT/ONU downstream average data rate L2

Length: 4 bytes

Value: Rate in kbits/s as a 32-bit unsigned integer

6.3.4. ONT/ONU-Peak-Data-Rate-Downstream TLV

Type: 0x00b1

Description: ONT/ONU downstream peak data rate L2

Length: 4 bytes

Value: Rate in kbits/s as a 32-bit unsigned integer

6.3.5. ONT/ONU-Maximum-Data-Rate-Upstream TLV

Type: 0x00b2

Description: ONT/ONU upstream maximum data rate L2

Length: 4 bytes

Value: Rate in kbits/s as a 32-bit unsigned integer

6.3.6. ONT/ONU-Assured-Data-Rate-Upstream TLV

Type: 0x00b3

Description: ONT/ONU upstream assured data rate L2

Length: 4 bytes

Value: Rate in kbits/s as a 32-bit unsigned integer

6.3.7. PON-Tree-Maximum-Data-Rate-Upstream TLV

Type: 0x00b4

Description: PON Tree upstream maximum data rate L2

Length: 4 bytes

Value: Rate in kbits/s as a 32-bit unsigned integer

6.3.8. PON-Tree-Maximum-Data-Rate-Downstream TLV

Type: 0x00b5

Description: PON Tree downstream maximum data rate L2

Length: 4 bytes

Value: Rate in kbits/s as a 32-bit unsigned integer

6.3.9. Reserved TLV

Type: 0x00b6

Description: Reserved

Length: tbd

Value: tbd

6.3.10. Reserved TLV

Type: 0x00b7

Description: Reserved

Length: tbd

Value: tbd

7. IANA Actions

7.1. ANCP TLV Type Registry

This document defines following sets of TLVs for PON, some of them have defined by RFC6320 and are referenced here for completeness:

Type Code	TLV Name	Reference
0x0000	Reserved	RFC 6320
0x0001	Access-Loop-Circuit-ID	RFC 6320
0x0002	Access-Loop-Remote-ID	RFC 6320
0x0003	Access-Aggregation-Circuit-ID-ASCII	RFC 6320
0x0005	Service-Profile-Name	RFC 6320
0x0006	Access-Aggregation-Circuit-ID-Binary	RFC 6320
0x0011	Command	RFC 6320
0x0012	PON-Access-Line-Attributes	RFC xxxx
0x0097	PON-Access-Type	RFC xxxx
0x0098	Reserved	RFC xxxx
0x0099	Reserved	RFC xxxx
0x009A	Reserved	RFC xxxx
0x009B	Expected Throughput (ETR) upstream	RFC xxxx
0x009C	Expected Throughput (ETR)-downstream	RFC xxxx
0x009D	Attainable Expected Throughput (ATTETR) upstream	RFC xxxx
0x009E	Attainable Expected Throughput (ATTETR)-downstream	RFC xxxx
0x009F	Guaranteed Data Rate (GDR)-upstream	RFC xxxx
0x00A0	Guaranteed Data Rate (GDR) downstream	RFC xxxx

0x00A1	Attainable Guaranteed Data Rate (ATTGDR)-upstream	RFC xxxx
0x00A2	Attainable Guaranteed Data Rate (ATTGDR)-downstream	RFC xxxx
0x00B0	ONT/ONU-Average-Data-Rate-Downstream	RFC xxxx
0x00B1	ONT/ONU-Peak-Data-Rate-Downstream	RFC xxxx
0x00B2	ONT/ONU-Maximum-Data-Rate-Upstream	RFC xxxx
0x00B3	ONT/ONU-Assured-Data-Rate-Upstream	RFC xxxx
0x00B4	PON-Tree-Maximum-Data-Rate-Upstream	RFC xxxx
0x00B5	PON-Tree-Maximum-Data-Rate-Downstream	RFC xxxx
0x00B6	Reserved	RFC xxxx
0x00B7	Reserved	RFC xxxx
0x0106	Status-Info	RFC 6320
0x1000	Target (single access line variant)	RFC 6320
0x1001 -	Reserved for Target variants	RFC 6320

8. Security Considerations

There are no new security considerations beyond what is described in RFC6320 and RFC6934.

9. Acknowledgements

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10. References

10.1. Normative References

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10.2. Informative References

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