

# TLN WRO Specification type Document

<General building block requirement specification  
for AO Euro Docsis 3.0 CPE to enable usage of TLN  
BB Wholesale Services Reference Offer (*TLN  
ROBB*)>



## Document Housekeeping

### Document Category and type

CAT	TYPE	DOC ID	Comment
Broadband	SPEC	TLN-WRO-TA-B-S-PAAA	Specification type documents (-SPEC) are documents specifying logical/physical interfaces/protocols, etc., to which AO equipment/systems need to comply

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### Document Effective Date

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Document History

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## List of Appendixes

This document may refer to further detailed documents that are added in Appendixes to this document.

A reference to an appendix is in this document highlighted with grey background.

The list of appendixes to this document:

Appendix 1: TLN\_WRO\_TA\_B\_S\_PAAA-APP01-Telenet.CNG.AINE-QCR-CM-EMTA- Lightning-REQ-20080730

Appendix 2: TLN\_WRO\_TA\_B\_S\_PAAA-APP02-Telenet.CNG.AINE-MIB-implementation-AO-BB-devices

## List of References

This document may refer to external documents or information sources.

A reference to an external document or information source is in this document highlighted with grey background.

The list of referred external documents or information sources in this document:

Reference 1 : TLN WRO CAT: Broadband: TLN-WRO-TA-B-C-PAAA

Reference 2 : TLN WRO CAT: Broadband: TLN-WRO-TA-B-C-PAAB

Reference 3 : TLN WRO CAT: General: TLN-WRO-TA-G-S-PAAB

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# 1 Abstract

This document describes on a conceptual level the major building blocks an AO Euro-Docsis 3.0 CPE must contain in order to be able to successfully interoperate with the TLN BB WRO. Each required building block is briefly described explaining it's expected functional behavior.

Additionally, non-functional requirements for the AO Euro-Docsis 3.0 CPE are also described in this document.

This document has a corresponding certification document with reference: **TLN-WRO-TA-B-C-PAAA** which is used to test AO WO equipment compliance against this specification

**The feasibility of the technical designs and methods described in this document are subject to verification by a Proof of Concept (POC) test organized by Telenet and may be changed or updated depending on the outcome of this POC.**

## 2 Glossary and Abbreviations

ACK: Acknowledge Packet  
API: Application Programming Interface  
BB: Broadband  
BSS: Billing Support Systems  
BW: Bandwidth  
CE: Conformité Européenne (European Conformity)  
CM: Cable modem  
CMTS: Cable Modem Termination System  
CoC: Code of Conduct  
CPE: Customer Precise Equipment  
DB: Database  
DHCP: Dynamic Host Configuration Protocol  
DOCSIS: Data over Cable Service Interface Specification  
DS: Downstream  
EC: European Committee  
EEA: European Economic Area  
EN: European Standards  
FUP: Fair Use Policy  
GRE: Generic Routing Encapsulation  
GTC: GRE Tunnel Concentrator  
HFC: Hybrid Fiber Coax  
HW: Hardware  
ID: Identifier  
IEC: International Engineering Consortium  
IP: Internet Protocol  
LED: Light Emitting Diode  
MAC: Media Access Control  
MIB: Management Information Base  
MUX: Multiplex  
NCP: Network Control Platform  
NE: Network Element  
NIU: Network Interface Unit  
OAM: Operation and Maintenance  
OSS: Operation Support Systems  
RoHS: Restriction of Hazardous Substances Directive  
RPOI: Regional point of interconnection  
SID: System Identifier  
SNMP: Single Network Management Protocol  
TFTP: Trivial File Transfer Protocol  
US: Upstream  
WEEE: Waste Electrical and Electronic Equipment Directive

### 3 AO Euro-Docsis 3.0 CPE General Functional Description

- (1) The conceptual block diagram of an AO Euro-Docsis 3.0 CPE is shown in figure 1 below.
- (2) In summary, the AO Docsis CPE realizes the set-up of an IP data communication path between the customer premises LAN side of the AO Docsis CPE and the Internet. This operation proceeds by tuning on the Docsis carriers on the TLN network, authenticating the device and obtaining a valid IP address and other data communication parameters to set-up the data path.

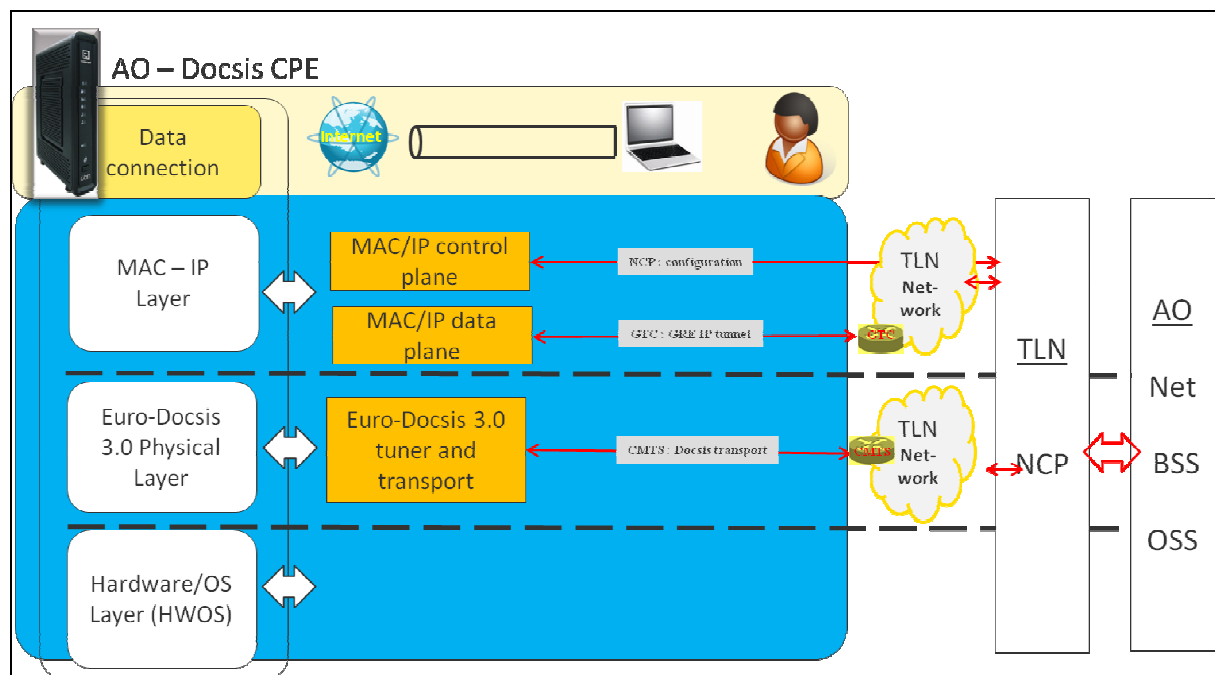


Figure 3-1



## **4 AO Euro-Docsis 3.0 CPE General Functional Requirements**

### **4.1 AO Euro-Docsis 3.0 CPE Hardware and OS**

- (3) TLN does not impose specific requirements on AO Docsis CPE HW and OS. The AO is free to choose any type of HW or OS as long as the overall solution can support the complete set of requirements for the TLN BB WRO.

### **4.2 Euro-Docsis MAC and IP layer**

- (4) This functional block implements the data-plane MAC layer, IP layer as well as the related control plane protocols for initializing, setting-up and securing the MAC and IP data-plane layers.

#### **4.2.1 *MAC layer***

- (5) The first step for an AO Docsis CPE to establish data communication with the TLN network is to build up the MAC layer with the CMTS. Before Data Connection can start, the CPE must communicate with the TLN CMTS to initialize the Docsis layer and get a CMTS SID. After completing this operation, the AO Docsis CPE (Cable Modem) belongs to the CMTS MAC Domain. The MAC Address for allowable CPE is held in a TLN network database for verification and should also be held by the AO in its own databases.

#### **4.2.2 *IP layer***

- (6) Two major functions are implemented on this layer; L3 IP address assignment and AAA (Authentication, Authorization, and Accounting). The AO Docsis CPE launches a DHCP request that sends the related information for Authentication with the AO-NCP passing via the TLN-NCP that will verify and proxy this information. After this process, IP address assignment is provided and the data path is established for AO Docsis CPE traffic that is tunneled via GRE encapsulation through the TLN access network and is terminated on GTC tunnel concentrators.
- (7) Tunnel endpoints for AO Docsis CPE are enforced by TLN-NCP via the modem config file. IP-Ranges (in amount of sufficient IP Addresses) on per RPOI will be configured in appropriate NE.

### 4.2.3 Control plane

- (8) The TLN NCP is the main building block involved in establishing initial the session set-up and steps involved in bringing an AO CM in “on-line” status ready for data transmission. This includes initial CM configuration (dynamic process upon CM “cold” start), acquisition of a CM “management” IP address (the address of the modem itself), acquisition of IP addresses for end-user devices sitting “behind” the CM mode, on the LAN side (for CM’s that contain router functionality and are using NAT (so called Docsis Home Gateways), this is typically the home gateway WAN interface IP address and set-up of the GRE tunnel. The TLN NCP (a collection of several servers and control plane modules in network elements), dialogues with its counterpart the AO NCP (implementation is AO choice) using standard interfaces. The TLN NCP will “relay” relevant end-user session establishment events (such as address acquisition requests) to the AO NCP, so that the AO NCP (which will be coupled to the AO CRM and/or AO OSS/BSS) can participate at maximum in this process with as goal to establish maximum flexibility in the AO service offering.
- (9) The beginning of the CM initialization process is triggered by the AO Docsis CPE (CM) launching a DHCP discovery; that contains among other parameters, at least vendor-type, modem type, DOCSIS capabilities and hfc-mac-id. The TLN-NCP checks the AO-ID by using hfc-mac-id. If it is not white-listed in the TLN AO DB, the modem will not be able to initialize and an error event will be generated.
- (10) Next step is that the TLN-NCP will pick the correct modem configuration file for that AO modem (which has been uploaded to TLN modem file configuration servers upfront via an off-line FTP upload process), apply it to the modem and assign a “management” IP address from TLN’s private address space.
- (11) The CM config file contains end point parameters of GRE tunnel (TLN tunnel concentrator address and credentials). With the help of this info the data path is established. Below one can see this process explained in the figure.

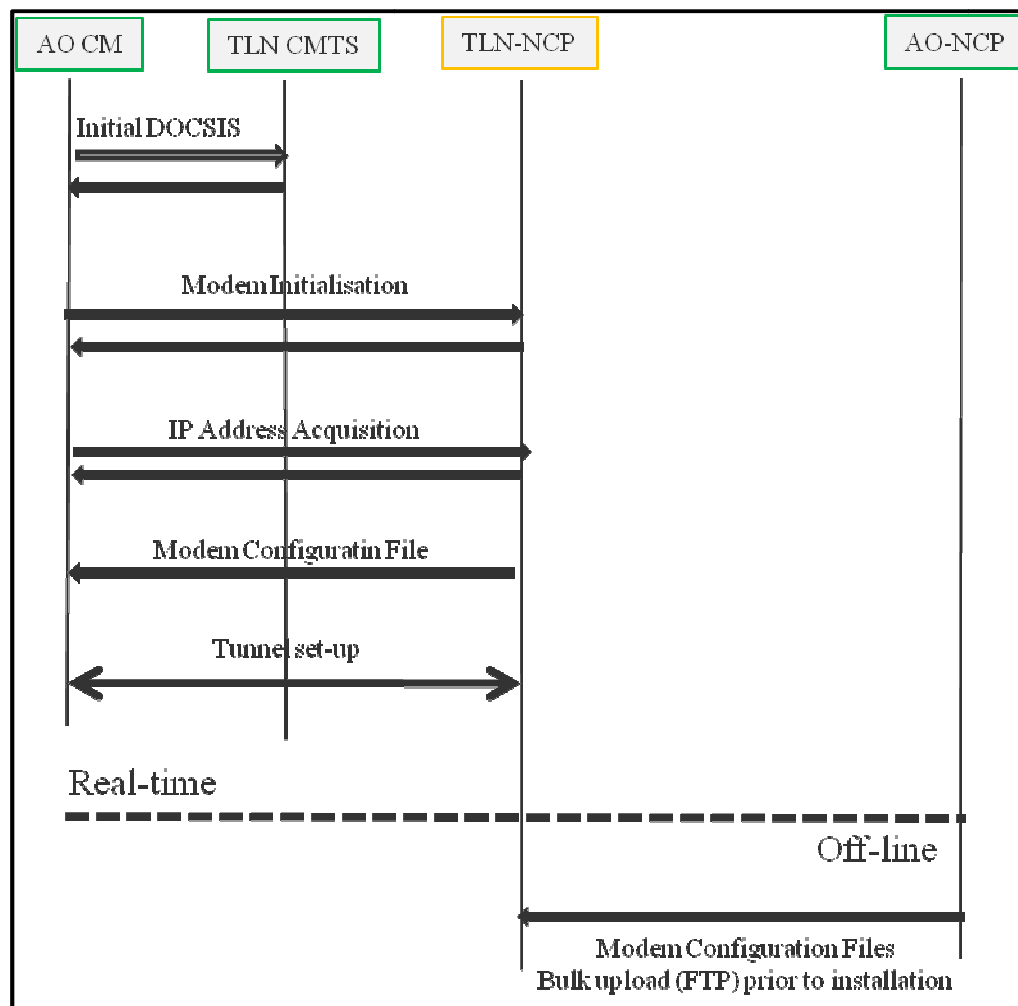


Figure 4-1

## 4.3 AO Device Management by TLN Requirements

### 4.3.1 Concept and purpose

- (12) In order to provide effective support to AO during problem diagnosis, TLN requires a minimum non-intrusive management access to AO CPE devices connected to its HFC network. This will be realized by implementing a “minimum” SNMP MIB and related set of actions on it that can be executed by TLN as described in this section.
- (13) For sake of clarity : device management as described here relates to management of the “modem” or “Docsis” component of the AO CPE device that provides the connectivity and transport service on the Docsis layer towards the TLN CMTS over the TLN HFC network.
- (14) Overall management access by AO to its devices is provided by an API based management proxy server provided by TLN. The possibilities and restrictions of this API management proxy server are described in the document: [TLN-WRO-TA-G-S-PAAB](#). The concept of proxy management is provided as direct access by AO on the AO CPE device could impose unmanageable security risks on the TLN network as the devices are accessing a shared MAC layer.
- (15) Besides API based proxy management, TLN will consider under certain circumstances, and after review that by granting this no security risks will be present, direct “in band” management access by AO to its devices for the “non Docsis” or “non-modem” part of the AO CPE. With “non Docsis” or “non-modem” part is meant e.g. a WIFI module or integrated IP router module that might be present in the AO CPE. This is also described in the document: [TLN-WRO-TA-G-S-PAAB](#)

### 4.3.2 Device management Functions

#### Device management executed by TLN

- (16) Telenet requires following minimum device management capabilities to be available on AO CPE for execution by Telenet (Execution of Telenet of below described management actions will only occur in cases where a particular AO CPE device behaves in a way that Telenet network integrity or security is compromised, a practical example could be, a given modem that launches DOS attacks by generating excessive packet burst, or is identified as being the source of excessive noise injection) :
  - a. Remote modem reset via SNMP
  - b. Remote modem disabling (modem deny) via SNMP
  - c. Remote US en DS FTP upload/download test.
  - d. Remote SNMP query on DOCSIS related MIB as specified in the section 4.3.3 below.

#### Device management available to AO

- (17) Telenet offers via above described API based management proxy server a tool set and environment allowing AO's to implement its own customer OAM and care system. This will allow AO's to build on-line view of their customers and allows some functionalities like view status of AO customer, do a link speed test, suspend/not suspend network access for AO CPE, do connectivity loopback tests, and providing of read/write SNMP access for certain CPE parameters etc.

### 4.3.3 *SNMP MIB specifications*

- (18) Management Information Bases (MIBs) are a collection of objects or definitions that define the properties of managed objects. TLN needs to know the names and types of a subset of objects on AO Docsis CPE (CM) to enable the TLN SNMP manager or management application to perform a minimum subset of operations on AO CPE equipment that are required for successful operation of the network.
- (19) Minimum DOCSIS MIB implementations on AO DOCSIS CPE for access by TLN should be as follows :
- iso.org.dod.internet.mgmt.mib-2.docsisDev (1.3.6.1.2.1.69)
  - [\[RFC 2669\]](#) DOCSIS Cable Device MIB Cable Device Management Information Base for DOCSIS compliant Cable Modems and Cable Modem Termination Systems
  - [\[RFC 2670\]](#) Radio Frequency (RF) Interface Management Information Base for MCNS/DOCSIS compliant RF interfaces.
  - [\[RFC 3083\]](#) Baseline Privacy Interface Management Information Base for DOCSIS Compliant Cable Modems and Cable Modem Termination Systems.
  - Telenet private MIB for US/DS FTP test
- (20) The formal definition of this subset of objects, parameters and the operations on them are provided in the format of an SNMP MIB definition in the appendix 2 to this document.

### 4.3.4 *Reset and Factory Reset specifications*

- (21) The AO Docsis CPE (CM) must have basic reset functions. It is important to have these functions to provide assistance on troubleshooting. The AO device may have a reset button on it, and should provide a factory reset option as well. Reset options may provide a reboot and connection loss for 5 to 30 minutes.

## 5 AO Euro-Docsis 3.0 CPE-Non Functional Requirements

### 5.1 Mechanical Requirements

#### 5.1.1 *Housing*

- (22) TLN does not impose any requirements as this is the responsibility domain of the AO. However it is strongly advised to AO to follow industry standard practices.

#### 5.1.2 *Diagnostic Leds*

- (23) An AO CM should have a minimum of five externally visible LEDs divided into three functional groups.
- (24) BOX: This group should have 1 LED labeled as POWER for the BOX status.
- (25) DOCSIS: This group should have 3 LEDs labeled as DS, US, and ONLINE for the DOCSIS interface status. The LEDs in the DOCSIS group should be in the order: DS, US, and ONLINE, from left to right, or top to bottom, as appropriate for the orientation of the device.
- (26) CPE: This group should have a minimum of 1 LED labeled as LINK for the LINK status. The AO CM may have multiple LEDs in the CPE group to represent individual CPE interface types and parameters. These CM CPE LEDs may be labeled according to their associated interface types.
- (27) An AO CM should support LEDs which have three states: 1) unlit, 2) flash, 3) lit solid

#### 5.1.3 *Labels*

- (28) TLN does not impose any requirements as this is the responsibility domain of the AO. However it is strongly advised to AO to follow industry standard practices.
- (29) In addition the logo of the AO must be clearly visible on the device to facilitate customer support and repair actions, giving as such a clear visual indication if a CPE in a customer's home is owned by TLN or one of the AOs'.

#### 5.1.4 *Connectors*

- (30) Coax connectors, must be F type connectors (IEC169-24). Specifications, for this type of connector, are as follows;
- (31) Torque resistance: 4Nm  
Inner conductor:  
Minimum diameter 0,57mm, clamping force 30 grams  
Nominal diameter 0,8mm, clamping force 50 grams  
Maximum diameter 1,0mm, clamping force 80 grams
- (32) The only connector which has specific requirements imposed by TLN is the coax connector towards the NIU, the rest is AO choice, however TLN recommends following as much as possible industry standards.

## 5.2 Environmental Requirements

### 5.2.1 Packaging

- (33) TLN does not impose any requirements as this is the responsibility domain of the AO. However it is strongly advised to AO to follow industry standard practices.

### 5.2.2 RoHS and WEEE compliancy

- (34) RoHS is defined as the directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment on 2002/95/EC and the abbreviation for Restriction of Hazardous Substances. This directive is closely linked with Waste Electrical and Electronic Equipment Directive (WEEE) - 2002/96/EC.
- (35) These directives are in the responsibility domain of AO, and TLN does not impose any requirements. AO is strongly advised to follow the standards and the requirements imposed by law about RoHS.

### 5.2.3 EU CoC compliancy

- (36) TLN does not impose any requirements as this is the responsibility domain of the AO. However it is strongly advised to AO to follow industry standard practices and any requirements in this domain imposed by law should be met.

## 5.3 Safety Requirements

### 5.3.1 Surge and Lightning protection

- (37) TLN requires that AO CPE devices are protected against over-voltages on their different interfaces. This is to guarantee customer safety under all conditions and to protect other CPE equipment.
- (38) The exact requirements are listed in [Appendix 1:Telenet.CNG.AINE-QCR-CM-EMTA-Lightning-REQ-20080730](#) to this document

### 5.3.2 Temperature and Humidity

- (39) TLN does not impose any requirements as this is the responsibility domain of the AO. However it is strongly advised to AO to follow industry standard practices.

### 5.3.3 Fire resistance

- (40) TLN requires AO to select equipment that has at least protection class 121, and has all parts halogen free / self-extinguishing. In the below figure, some of the important safety requirements standards are listed.

- (41) It should be noted however that being fully compliant with all legal requirements for CPE is the full and sole responsibility of the AO.

EN 41003	1998	Particular safety requirements for equipment to be connected to telecommunications networks
EN 50083-1 / A2	1997	Cabled distribution systems for television, sound and interactive multimedia signals; Part 1: Safety requirements
EN 60950	2000	Safety of information technology equipment, including electrical business equipment

Figure 5-1

## 5.4 EU Consumer Goods label Requirements

### 5.4.1 CE - mark

- (42) CE marking (originally EC mark) is a mandatory conformity mark for products placed on the market in the European Economic Area (EEA). With the CE marking on a product the manufacturer ensures that the product conforms to the essential requirements of the applicable EC directives. The letters "CE" stand for "Conformité Européenne" ("European Conformity").

- (43) This conformity is in the responsibility domain of AO, and TLN does not impose any requirements. AO is strongly advised to follow the standards and the requirements imposed by law.