

# TLN WRO Specification type Document

< General building block requirement  
specification for AO Set Top Box (STB) to enable  
usage of TLN Annex Interactive Services  
Wholesale Reference Offer (*TLN AIDTV*) >



## Document Housekeeping

### Document Category and type

CAT	TYPE	DOC ID	Comment
iDTV	SPEC	TLN-WRO-TA-I-S-PIAA	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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Telenet has appealed the CRC decisions of the VRM, BIPT and CSA of 1 July 2011 concerning the market analysis of the broadcasting market in Belgium and it consequently reserves all its rights in relation to this document."

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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 with appendixes of this document:

- A. Appendix A, <APP-I-C-PIAA-A> contains :
  - 1) Appendix A1 - <Surge and lightening protection>
- B. Appendix B, <APP-I-C-PIAA-B> contains :
  - 2) Appendix B1 - <AO STB minimum MIB definition>

## 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: (i)DTV : TLN-WRO-TA-I-C-PIAA

Reference 2 : TLN WRO CAT: (i)DTV : TLN-WRO-TA-I-S-PDAA

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# 1 Abstract

This document describes on a conceptual level the major building blocks an AO STB must have in order to be able to successfully interoperate with the TLN AIDTV. Each required building block is briefly described explaining it's expected functional behavior.

In addition the non functional requirements for the AO STB are also described in this document.

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

Note : this document describes the interactive variant (iDTV variant) of the STB that is a two way STB with IP data return path. The non interactive variant is described in the document with identification **TLN-WRO-TA-I-S-PDAA**

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

AAA: Authentication, Authorization and Accounting  
ADR: Audit Detailed Record  
BER: Bit Error Rate  
BSS: Business Support Systems  
CAS: Conditional Access Systems  
CDN: Content Delivery Network  
CDR: Call Detailed Record  
CE: European Conformity  
CFE: Cable Front End  
CoC: Code of Conduct  
CPE: Customer Premises Equipment  
CPPS: CAS Proxy Provisioning Service  
DEMUX: Demultiplexer  
E2E: End to end  
ECM: Entitlement Control Message  
EMM: Entitlement Management Message  
FSCK: File System Consistency Check  
GRE: Generic Routing Encapsulation  
IRD: Integrated Receiver/Decoder  
IP: Internet Protocol  
LED: Light Emitting Diode  
MIB: Management Information Base  
MPEG: Moving Picture Experts Group  
MPTS: MPEG Transport Stream  
MUX: Multiplexer  
OSS: Operational Support System  
PSI: Program Specific Information  
PVR: Personal Video Recorder  
QAM: Quadruple Amplitude Modulation  
RCU: Remote Control Unit  
RF: Radio Frequency  
RoHS: Restriction of Hazardous Substances  
RPOI: Regional Point of Interconnect  
RTSP: Real Time Streaming Protocol  
SC: Smartcard  
SI: Service Information  
SNMP: Simple Network Management Protocol  
SNR: Signal-to-Noise Ratio  
STB: Set-top-box  
TS: Transport Stream  
UI: User Interface  
UTP: Unshielded Twisted Pair  
VDP: Video Data Pumps  
VHE: Video Head-end  
VSA: VOD Serving Area  
VSP: VOD Service Proxy  
WEEE: Waste Electrical and Electronics Equipment

### 3 AO STB General Functional Description

- (1) The conceptual block diagram of an AO STB is shown in figure 1 below.
- (2) In summary the AO STB needs to capture, descramble and decode TV signals and related program information transmitted over the TLN cable network and present this on its output interfaces towards the TV set. Further it provides interaction capabilities with the customer by implementing a graphical user interface allowing interaction via an RCU.

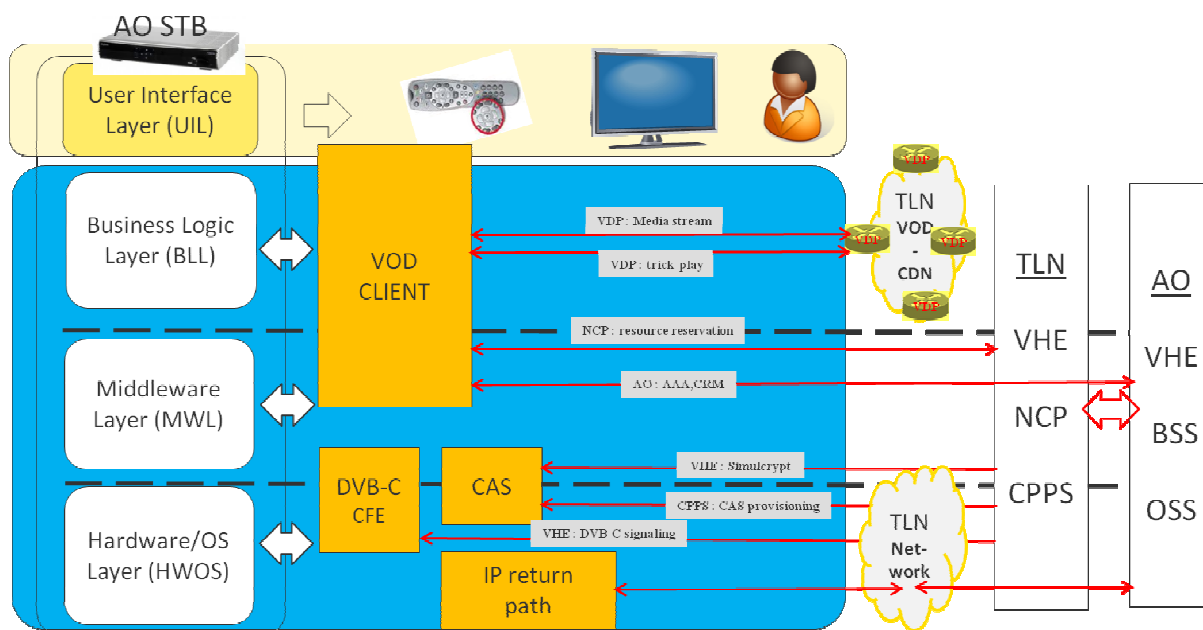


Figure 3-1



## **4     AO STB General Functional Requirements**

### **4.1 AO STB Hardware and OS**

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

### **4.2 AO STB Middleware**

- (4) The middleware typically supports a number of common platform services that can be accessed by the Business Logic Layer (BLL).  
TLN does not impose specific requirements on middleware; the AO is free to choose any type of STB middleware as long as the overall solution can support the complete set of requirements for the TLN AIDTV.

### **4.3 AO STB Business Logic Layer**

- (5) The Business Logic Layer (BLL) typically supports the applications that run on the STB, like EPG, User Preferences settings, Recording functions, Reminders, etc...  
TLN does not impose specific requirements on the BLL; the AO is free to choose any type of BLL as long as the overall solution can support the complete set of requirements for the TLN AIDTV.

### **4.4 AO STB User Interface Layer**

- (6) The User Interface Layer (UIL) defines the way the customer can interact via its RCU with the applications offered by the service.  
TLN does not impose specific requirements on the UIL; the AO is free to choose any type of UIL as long as the overall solution can support the complete set of requirements for the TLN AIDTV.

### **4.5 AO STB DVB-C cable front-end**

- (7) The AO-STB must be equipped with a DVB-C front-end module that allows “tuning” into DVB-C QAM modulated signals carrying TLN DTV signals. It consists of following major sub-components :
- QAM tuner module
  - MPTS DEMUX module
  - DVB-C PSI/SI signalling decoding module

#### **4.5.1 QAM tuner module**

- (8) The digital television audio and video signals are coded in MPEG transport streams. Different MPEG transport streams are multiplexed and modulated, using a QAM (Quadruple Amplitude Modulation) scheme to allow transport of the digital information over the analogue cable network. The QAM tuner module allows the STB to lock-into the different modulated transport multiplexers, de-modulate the signals and extract the digital frames for feeding into the de-multiplexer module. The common forms of QAM include 16QAM, 32QAM, 64QAM, 128QAM and 256QAM. Telenet uses 256QAM modulation for the transport of its digital TV signal MUXes.

#### **4.5.2 MPTS DEMUX module**

- (9) When an AO STB tunes into a TLN DTV MUX , it will select the correct MPTS services for decoding in function of the end-user channel selections. In order to do this, AO STB must contain a MPTS demux module. A de-multiplexer (or demux) is a device taking a single input signal and selecting one of many data-output-lines, which is connected to the single input. A multiplexer is often used with a complementary de-multiplexer on the receiving end. In digital television and digital radio systems, several variable bit-rate data streams are multiplexed together to a fixed bit-rate transport stream by means of statistical multiplexing. This makes it possible to transfer several video and audio channels simultaneously over the same frequency channel, together with various services. The device that accomplishes this is called a statistical multiplexer. In several of these systems, the multiplexing results in an Multi-program transport stream(MPTS).

#### **4.5.3 DVB-C PSI/SI signalling decoding module**

- (10) DVB Service Information (SI) is an enhancement of MPEG PSI (Program Specific Information). It provides extra information which the receiver can use. Where there are several TS available, in order to successfully demultiplex a program (i.e. Channel), the decoder must be notified of both transport stream id (to find the correct multiplex) and the program number of the service (to find the correct program within the multiplex).

## 4.6 AO STB CAS subsystem

- (11) The AO-STB must be equipped with a CAS module that allows descrambling of encrypted MPTS service streams and can handle CAS entitlement messages to add/remove rights to a given STB to access certain services. It consists of following major sub-components :
- Descrambler
  - CAS control message(ENM/ECM) handling module
  - Smart Card (SC)

### 4.6.1 Descrambler

- (12) A conditional access system (CAS) uses a combination of *scrambling* and *encryption* to prevent unauthorized reception. Scrambling is the process of rendering the sound, pictures and data unintelligible. Encryption is the process of protecting the secret keys that have to be transmitted together with the scrambled signal in order for the *descrambler* to work. The responsibility of the descrambler module is de-scrambling the signals, to which the individual STB is properly entitled so that they can be viewed.

### 4.6.2 CAS control message (EMM/ECM) module

- (13) The EMM (Entitlement Management Message) allows a single decoder to view the programme material which is scrambled via a DVB 'common scrambling algorithm' by providing the key to the code word which is involved in the scrambling. The code word is sent via the ECM(Entitlement Control Message).

### 4.6.3 Smart Card

- (14) Each CA system provides a security module that scrambles and encrypts data. This security module is either embedded within the STB ("software" Smart card) or is insertable in the form of a Smart card. The Smart card contains the subscriber's authorization codes required to de-scramble the signals and the EMM/ECM messages.

## 4.7 IP return path

### 4.7.1 IP Return Path (via Cable) physical connection

- (15)The physical connection from the AO STB to the AO cable modem will be typically Ethernet, implemented with a UTP cable or via Power-line transport. The cable modem then further carries via Docsis the STB return path traffic over the network for delivery in the AO interconnects points.

### 4.7.2 IP Return Path (via Cable) Data plane

- (16)The IP data plane layer is connected via the cable modem over a GRE (generic routing encapsulation) IP tunnel to TLN network under control of TLN Network Control Platform and all data is transmitted and delivered to the AO domain.

### 4.7.3 IP Return Path (via Cable) Control plane messages

- (17)The connection path between the AO STB IP control plane and the TLN Network is handled by the Network Control Platform which on its turn acts as an intermediate towards AO systems involved in session set-up and tear-down, handling and allocation of IP - addresses, etc..

### 4.7.4 Restriction IP Return path (via Cable)

- (18)Following restrictions apply :
- IP return path has a designated bandwidth (US/DS) and does not provide guaranteed QOS.
  - Value added services on the iDTV return path, like (but not limited to) extended EPG data (2 weeks), STB management and supervision, VOD trick-play control are not provided. As the return path offers a direct IP path between the AO STB and the AO back-end, the AO has the freedom to implement this by itself.
  - The use is strictly limited to providing TV related interactivity services in the framework of the ROTV.

### 4.7.5 Alternative return path (non cable)

- (19)TLN presents the option for an AO to provide its own iDTV return path over an alternative (non cable) access infrastructure. In this case the TLN and AO will set-up a managed interconnect link to allow communication at the RPOI's where the AO aggregates all alternative return path traffic and for which interaction is required with TLN network infrastructure (e.g. VOD stream management (trick play, ...))

## 4.8 VOD client subsystem

### 4.8.1 General

- (20)The function of VOD client subsystem is to allow AO STB interaction with the AO iDTV technical and CRM back-end systems (located in the AO VHE), the TLN back-end systems dedicated to VOD service delivery (located in the TLN VHE) and the TLN IP network components involved in delivering the VOD service (e.g. TLN Video Data pumps in TLN CDN).

### 4.8.2 AAA and interaction with AO CRM

- (21)The AO STB VOD client logic will need to support interaction with the AO CRM systems. The presence of the AO CRM (typically via an intermediate proxy platform) in the VOD order flow allows an AO to perform AAA and rating functions required for Network Authentication, Authorization and Accounting and billing purposes.

### 4.8.3 Resource management

- (22)The VOD resource management system is responsible for monitoring and dynamically reserving streaming capacity to deliver a VOD stream to a given customer. It will treat AO and TLN customers on a fair and equal basis. This implies that the resource management system will take into account that the bandwidth that can be allocated dynamically by a number of simultaneous streams generated on a node and VOD serving area is in proportion to the relative weight of the AO customer base on that node/area.

### 4.8.4 VOD asset order flow

- (23)During the “Buy VOD Asset” process, Asset (STB-ID, asset-ID, VSA) request and grant are exchanged between AO CRM(AO-VSP) and AO-STB, serving as identifiers of a particular asset by a particular AO STB. In case of any error, i.e :Asset-ID does not belong to AO ,VDP Resource Reservation will fail.

### 4.8.5 VOD media streaming

- (24)TLN VDP delivers media streams to the STB`s of individual AO customers via one or more DVB\_C QAM`s dedicated to VOD containing dynamically generated MPTS`s.

### 4.8.6 Trick-play commands

- (25)The signaling for the trick-play functionality (pause, play etc.) is assured by RTSP (Real Time Streaming Protocol). When RTSP request is sent for trick-play, VDP routers/video pumps will route and stream the content towards the AO STB. Pause action cannot be applied for a limitless time. The streams are released after a time-out period.

#### **4.8.7 CDR and billing**

(26)CDR (Call Detailed Record) files are generated on a per period basis.

(27)CDR record files are fed on a per period basis into the TLN-IT wholesale billing/rating engines to allow the TLN wholesale department to produce bill per AO, including consumption details for AO individual customers.

## 4.9 AO Device Management by TLN Requirements

### 4.9.1 Concept and purpose

(28) TLN requires that it has remote management access with a minimum basic capability set on AO CPE devices. This access is required to allow TLN to ensure network integrity and assist the AO in efficient troubleshooting on complex E2E network problems, by being capable of integrating a basic management view of the AO devices in TLN's troubleshooting tools.

### 4.9.2 Device management Functions

(29) Following minimum remote device management functions are required :

- STB Data-link loop back test: allows to test data path connectivity from a central network location until STB Ethernet interface- STB DVB-C QAM tuner level test (SNR, BER, ERRPKT, lock mode,); allows to test the current condition and performance of the STB tuner on the signal quality level.
- VOD null stream E2E loopback test: allows testing if a VOD stream can be received.
- STB status parameter test: allows reading the essential parameters on the STB that will reflect its operational status.

### 4.9.3 SNMP MIB specifications

(30) 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.

(31) 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 Appendix B (see List of Appendixes section).

### 4.9.4 Reset and Factory Reset specifications

(32) Different reset scenario need to be performed.

- Via UI menu
  - Reset settings
  - Reset settings with full disk (PVR only)
  - Reset setting and keep recordings (PVR only)
- Via SNMP (MIB Navigator-Telenet-Trigger)
  - Full factory reset
  - Factory reset keep recording (PVR only)
  - Soft reset and keep setting

- Soft reset and perform FSCK
- Via SNMP (MIB Core-CoreReset)
  - Reinit
  - Reset
- Via IRD (STB)
  - Full factory reset
  - Factory reset keep recording (PVR only)
  - Soft reset and keep setting
  - Soft reset and perform FSCK
  - Reinit
  - Reset
- Via STB front panel
  - Reinit
  - Reset



## 5 AO STB general - Non Functional Requirements

### 5.1 Mechanical Requirements

#### 5.1.1 *Housing*

(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.

#### 5.1.2 *Diagnostic Leds*

(34) Below are the minimum LED indication requirements that should be supported by AO STB in order to assist in efficient troubleshooting.

- Alert LED
  - Not active during normal mode
  - Not active when tuned on blocked channel
  - Not active when Ethernet cable is disconnected
  - Active when coax removed
  - Active when tuned on faked channel
  - Active when box not paired
- Recording LED
  - Active during recording
  - Deactivated when recording finished
- Power LED
  - Green in operational mode
  - Orange in standby mode

#### 5.1.3 *Labels*

(35) 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. 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 AO's.

#### 5.1.4 *Connectors*

(36) TLN imposes requirements only for the Antenna-in connector towards the WO, the rest is AO choice and responsibility, but TLN strongly recommends to follow industry standards.

- All RF connectors must be F (IEC169-24), 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

## 5.2 Environmental Requirements

### 5.2.1 Packaging

(37) 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

(38) 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. 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

(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 and any requirements in this domain imposed by law should be met.

## 5.3 Safety Requirements

### 5.3.1 Surge and Lightning protection

(40) Telenet will execute a group of tests to be able to determine the immunity level of the various interface ports of the AO STB (sometimes in combination with the AO CM and TLN NIU) against voltages over -surges and lightning strikes. Common mode tests will be carried out up to a test level of 10 kV. Ground will be either the premises earth of the customer or in case of absence of the latter the braid of the CATV cable. Tests that will be carried out are destructive, using a different (new) modem at each stage to avoid "exhausting" phenomena. The connection between STB and modem (if applicable) will be made using a UTP RJ45. After each test the functionality of the modem will be verified. Detailed info can be obtained in the reference document.

(41) This section has a corresponding appendix document with reference : Appendix A (see List of Appendixes section).

### **5.3.2 *Temperature and Humidity***

- (42) 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***

- (43) Fire resistance rating means the time that a material or assembly of materials will resist the effects of fire as determined by the appropriate standard fire test prescribed in the NBC.
- (44) This rating 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 about fire resistance.

## **5.4 EU Consumer Goods label Requirements**

### **5.4.1 *CE - mark***

- (45) 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").
- (46) 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 about CE labeling.