

TLN WRO Specification type Document

< Requirement specification for AO STB Video On Demand (**VoD**) subsystem to enable usage of TLN ROTV >



Document Housekeeping

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(i)DTV	SPEC	TLN-WRO-TA-I-S-PIAD	Specification type documents (-SPEC) are documents specifying logical / physical interfaces / protocols, etc., to which AO equipment/systems need to comply

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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-PIAD-A> contains :
 - 1) Appendix A1 - <AO VSP to TLN.CSP-AO interface protocol>
 - 2) Appendix A2 - <TLN VDP RTSP streaming control interface specifications>
- B. Appendix B, <APP-I-C-PIAD-B> contains :
 - 3) Appendix_B1 - <TLN CAS for VoD interface specifications>

The appendix(es) referred to in this section List of Appendixes, contain(s) detailed technical information which is only relevant when a Beneficiary enters in a concrete implementation project to become Beneficiary of the Telenet Reference Offer and/or Annex.

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-PIAD
- Reference 2 : TLN WRO CAT: (i)DTV : TLN-WRO-TA-I-S-PIAA
- Reference 3 : TLN WRO CAT: (i)DTV : TLN-WRO-TA-B-S-PAAD
- Reference 4 : TLN WRO CAT: (i)DTV : TLN-WRO-TA-I-S-PAAH
- Reference 5 : TLN WRO CAT: TPRC : TLN-WRO-TA-T-T-PAAB
- Reference 6 : TLN WRO CAT: (i)DTV : TLN-WRO-TA-I-S-PAAB

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1 Abstract

This document describes the VoD building block an AO STB must have in order to be able to successfully interoperate with the TLN iDTV VoD service.

This document has a corresponding certification document with reference: **TLN-WRO-TA-I-C-PIAD** 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

VoD: Video On Demand
CDN: Content Delivery Network
VDP: Video Delivery Platform
NCP: Network Control Platform
VHE: Video Head End
AAA: Authentication, Authorization and Accounting
CRM: Customer Relationship Management
CPPS: CAS Proxy Provisioning Server
CAS: Conditional Access System
CFE: Customer Field Equipment
BSS: Business Support Systems
OSS: Operations Support Systems
GRE : Generic Routing Encapsulation
NIU : Network Interface Unit
CMTS : Cable Modem Termination System
VSP: VoD Service Proxy
CSP: Core Services Platform
IPSec: Internet Protocol Security
PKI: Public Key Information
VSA: VoD Serving Area
TSN: Transaction Sequence Number
RTSP: Real Time Streaming Protocol
RTP: Real-time Transport Protocol
QoS: Quality of Service
MPTS: Multi-Program Transport Stream
PID: Packet Identifier
DHCP: Dynamic Host Configuration Protocol
LDAP: Lightweight Directory Access Protocol
RADIUS: Remote Authentication Dial in User Service
QAM: Quadruple Amplitude Modulation
NOC-M: Network Operations Center-Mechelen
NOC-H: Network Operations Center-Hoboken
POI: Point of Interconnect

3 AO STB Video on Demand(VoD) subsystem Functional Description

- (1) The function of the AO STB VoD subsystem (see red-dotted area in figure below) 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).

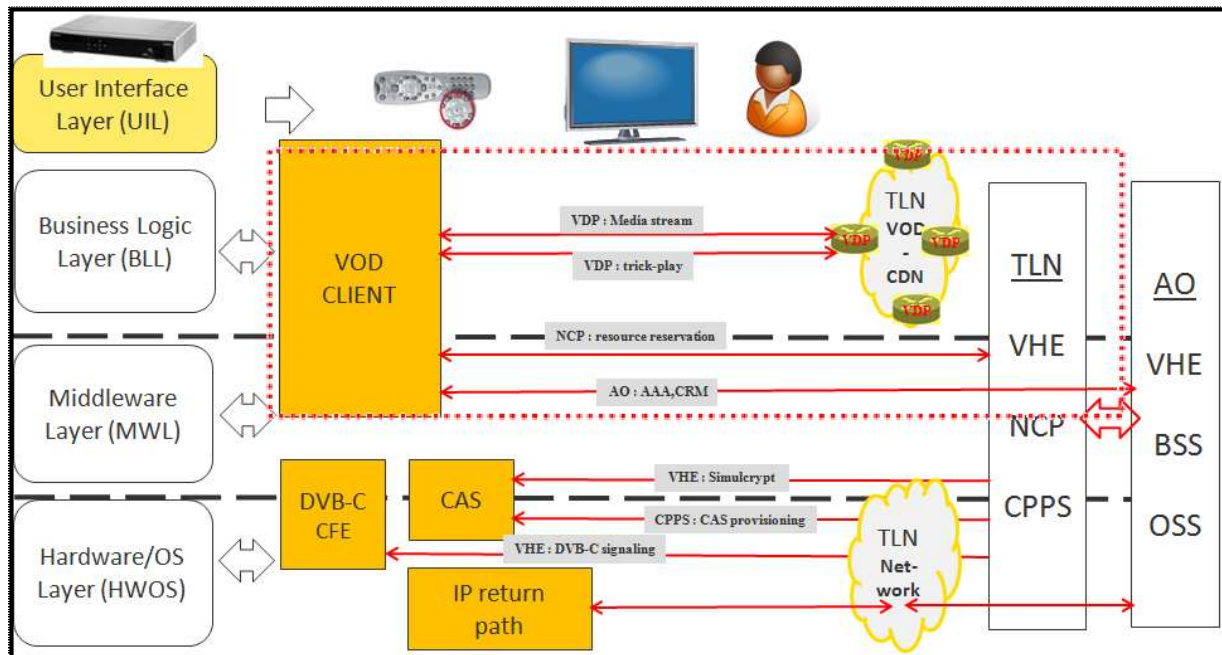


Figure 3-1

4 AO STB Video on Demand(VoD) subsystem Functional Requirements

4.1 VoD System Setup General Overview

- (2) The VoD system set-up is described in the figure below. The purpose of each major building block is briefly described in the sub-sections below and the building blocks that require explicit interfacing towards AO equipment and systems are detailed in further sections in this document.

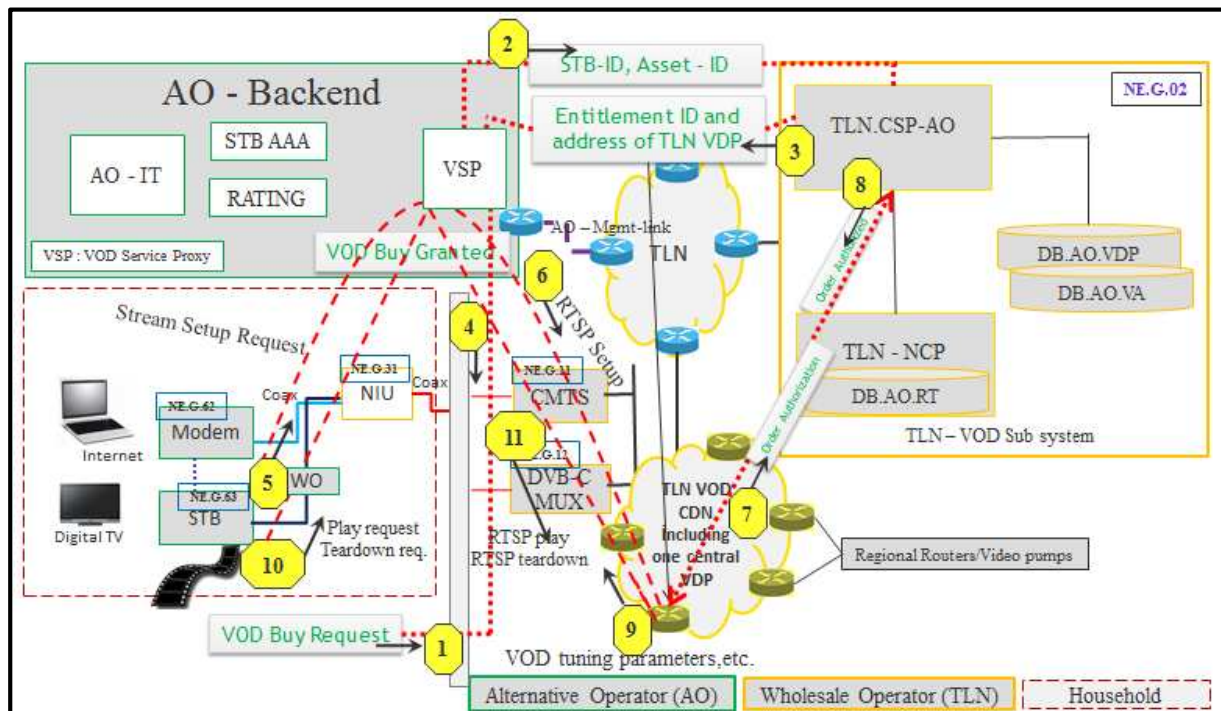


Figure 4-1

Flow :

- The VoD buy request from AO.STB goes via AO.VSP to TLN.CSP-AO, and includes STB-ID and asset-ID
- TLN.CSP-AO may grant or deny the request (valid STB-ID, asset-ID?). When granted it will return an Entitlement-ID and the address of the TLN.VDP that will accept stream setup requests
- AO.STB requests stream setup from AO.VSP, which sends an RTSP SETUP on behalf of the AO.STB to the appointed TLN.VDP. The SETUP request includes the STB-ID, VoD Serving Area and Entitlement-ID.
- TLN.VDP checks authorisation (entitlement) and network resources, and instructs TLN.CDN to prepare the stream, and returns to AO.VSP the VoD tuning parameters and the TLN.CDN server where trick play can be performed (and which session-id to use).
- AO.STB (via AO.VSP) effectively starts the stream playout by sending RTSP PLAY request to the appointed TLN.CDN server.
- The stream will continue playing until AO.STB (via AO.VSP) sends RTSP TEARDOWN to TLN.VDP (or other conditions cause TLN.VDP to terminate the stream, such as pause time-out or end-of-stream reached).

4.1.1 AO VoD Service Proxy (VSP) and back-end

- (3) The VoD Service Proxy (VSP) which is located in AO-Backend provides the transmission of a VoD Buy Request and stream control requests between AO STB and TLN VoD Subsystem. Response to the STB after a VoD Buy Granted/Denial is also provided by VSP. In this way it acts as main intermediate between the VoD client software on the AO STB's and the Telenet VoD related back-end systems.

4.1.2 TLN VoD Core Services Platform for AO (TLN.CSP-AO)

- (4) The TLN Core Services Platform (CSP-AO) for AO is located in TLN-VoD Subsystem. After a VoD Buy Request is received, VSP transmits STB-ID and Asset-ID to the TLN CSP-AO which will do appropriate controls and send back the Entitlement-ID and addressing information of the TLN.VDP to VSP for transmitting to the AO STB.

4.1.3 TLN VoD-CDN including VDP

- (5) TLN VoD CDN is the content network having central resource management (VDP) and several regional routers/video pumps which will route and stream the content towards the AO STB (via DVB-C MUX for VoD) which has been requested by transmission of RTSP requests (setup, trick-play etc.) by this AO STB. In addition it will send order (entitlement) verification requests to the TLN-VoD Subsystem and check and perform allocation of streaming resources.

4.1.4 TLN - NCP

- (6) NCP is the Network Control Platform which takes care of session set-up/tear-down and control in the broad sense using protocols like DHCP, Radius, LDAP, etc. TLN -NCP provides virtualization for multiple AO environments, clear separation between TLN and AO traffic/addresses, simple operations & easy scalability. It also acts as an intermediate with "similar" AO platforms.

4.1.5 TLN DVB-C MUX for VoD

- (7) The TLN DVB-C MUX provides downstream transport services for the VoD media streams started on request of AO STB's.

4.1.6 AO STB IP data return path

- (8) This is an IP path that can be used by the AO STB only for interactive communication between the AO STB and the AO back-end systems for purpose of this annex. The IP return path does not have to be provided by Telenet (i.e. it is an option).

4.2 AO VoD Service Proxy (VSP)

4.2.1 General

- (9) The VSP (VoD Service Proxy) is located in AO-Backend and communicates to the TLN-VoD subsystem on behalf of the AO STB's. VSP acts as an aggregation proxy on behalf of all AO STB's, aggregating all requests from AO STB customers engaging in the ordering of a VoD movie and keeping session state. It typically sends STB-ID, VoD serving area and VoD Asset-ID to the TLN.CSP-AO and VDP in TLN-VoD subsystem and receives, upon successful authorization CDN parameters from there. Further it performs the role of main interface function to the AO CRM systems.

4.2.2 AO VSP to TLN physical transport connection

- (10) The Telenet Network will have "Management link" connections for each AO. These will be realized with a standard IP connection over the AO-IP-mgmt interconnect link. Since the link carries sensitive traffic, it is secured with IP-VPN (IPSEC and PKI protected).
- (11) The VSP accesses the TLN-VoD systems on a secure (pre-configured) IP-VPN (IPSEC and PKI protected) over the "Management link". A Secure LOG process on all transactions is enabled using this PKI infrastructure.

4.2.3 VSP Protocol definition

- (12) During the "Buy VoD Asset" process, Asset (STB-ID, asset-ID, VSA) request and grant are exchanged between AO-VSP and AO-STB, serving as identifiers of a particular asset by a particular AO STB in a particular VoD serving area. The AO-VSP interacts as a proxy with the TLN VoD systems (CSP-AO, VDP and CDN).
- (13) In case of any error, VDP Resource Reservation will fail. Some of the possible error situations are listed below :
- STB-ID is not on white list.
 - Asset-ID does not belong to AO.
 - VSA is incorrect vs. AO STB network discovery path.

- (14) The formal protocol definition which include the programming API's that will allow AO VSP to interact with the TLN.CSP-AO will be made available during implementation phase to the beneficiary.

4.2.4 AO VSP AAA/Rating functions

- (15) The presence of the AO VSP in the flow allows an AO to perform AAA and rating functions required for Network Authentication, Authorization, Accounting and billing purposes. By means of these functions, it is possible to know for AO which customers are on the network, keep in control of actions, create raw usage and audit information- and rate the VoD asset orders. Hence it gives the AO the necessary freedom to control its customer experience and create its own pricing and billing approaches for VoD.

4.2.5 TLN VoD orders control checks

- (16) Following checks are applied by TLN.CSP-AO on transactions send by AO VSP:
- Is the AO STB-ID on white list?
 - Does the requested asset-ID belong to AO?

4.3 TLN VoD Resource Manager

4.3.1 General

- (17) The VoD resource management system (VDP) 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.

4.3.2 TLN VoD Content Data Network (CDN) architecture

- (18) Provisioning of AO hosted content (media, meta data) catalogue space, including management (upload, add/change/remove assets) and media distribution to regional network delivery points are performed via the TLN CDN, acting as a distributed content network.
- (19) Access to TLN VoD service includes delivery under session control by AO of AO customer initiated media streams from this regional TLN CDN egress point until AO STB (via DVB-C MUX for VoD) according to same principles on QOS level (Network stream resource management provided by TLN) as applied to streams initiated by TLN retail customers.

4.3.3 TLN VoD CDN monitoring

- (20) TLN monitors the used VoD capacity via a semi-manual process at TLN side based on network/server monitoring. CDR(Call Detailed Record) and ADR(Audit Detailed Record) files are generated on a per period basis (at least daily) sorted on a per AO basis.

(21)

4.3.4 VoD Capacity Management

- (22) The VoD resource management system will treat AO customers on a fair and equal basis. This implies that the resource management 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.
- (23) AO VoD media assets will be encoded conform existing TLN parameter and bandwidth, currently SD or HD. No bandwidth/encoding quality variants will be allowed different from TLN standards. (Reason is to keep bandwidth resource management consistent). Catalogue publishing windows (updates becoming available to STB) will be the same as for TLN.
- (24) The TLN resource manager has a real-time and accurate view at any moment in time on the available VoD streaming resources on a per video pump and a per HFC VoD serving area level. VoD order requests may not always be granted since a CDN server typically has a fixed boundary for the rate of request it can handle or the number of simultaneous streams that it can send out at any time. In addition boundaries at HFC node level exist with respect to the available bandwidth capacity allocated to VoD. SD and HD require different bandwidth

capacity. Pause actions, introduced by the user via RCU trick play commands cannot be applied for an unlimited time as during pause the resources need to be kept reserved. Therefore paused streams are automatically released after a time-out period by the VDP.

4.4 TLN Video Pump (CDN) media stream delivery to AO STB

4.4.1 General

- (25) In summary, the TLN CDN 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.

4.4.2 Physical Transport connections

- (26) When a cable subscriber purchases a VoD asset, the video stream is assigned to a QAM modulator over a specified 8 MHz RF channel on the HFC network dedicated to VoD delivery. The VoD QAMS are using MPTS over DVB-C encoding to ensure reliable transport of the VoD video frames from the VoD edge QAMS serving the VSA's towards the STB's.

4.4.3 Protocol messages

- (27) The VoD delivery system uses the Real Time Streaming Protocol (RTSP) protocol for controlling set-up and playback control of VoD streams. The signaling for the stream setup and trick play functionality (pause, slow-motion, wind/rewind etc.) is assured by RTSP using the IP return path. The signaling messages used to notify the AO VSP which TLN.VDP to contact and which entitlement id to use are using a HTTP based TLN proprietary.

4.4.4 VoD Media Stream Delivery

- (28) Technically, when the customer selects the movie, a point-to-point unicast connection is set up to the customer's STB from the delivering streaming server (CDN). This unicast connection is "emulated" over the DVB-C "broadcast" VoD QAM using dynamically generated Program ID's (PID). The codec's used for video are MPEG-2, MPEG-4 in MPTS transport containers. The signaling used to notify the AO STB in which VoD QAM and on which MPTS PID it will find the VoD movie it ordered is carried in the response to the RTSP SETUP request (TLN.VDP)
- (29) The role of the VoD QAM in the video-on-demand set-up is to receive an IP unicast stream containing MPEG transport stream packets over IP from the CDN after transport over the TLN IP backbone and then to re-produce that transport stream on the correct RF output for transmission over the hybrid fiber-coax cable plant. The PID remapping capability is used so that the QAM can guarantee that the IP unicast stream is converted into an MPTS with the correct PID and with the correct TSID as per instruction of the resource manager (VDP).

4.4.5 VoD regional serving areas (VRSA)

- (30)The Telenet VoD CDN currently contains 8 VoD regional serving areas. In each of those areas one or more CDN servers are located serving the total population of STB´s present in that area.

4.5 VDP VoD Transaction Authentication

4.5.1 General

- (31) The TLN VDP will “authenticate” requests to start playing a particular VoD asset that it receives from AO STB`s by contacting the TLN VoD back-end to verify if the request parameters correspond to a prior reservation request it received from the AO VSP. TLN makes some specific controls triggered by the reception of the RTSP SETUP request on the VDP by contacting the TLN VoD back-end in order to verify if this is a valid request.

4.5.2 Transaction Authentication Results codes

- (32) In normal conditions and when AO STB VoD client software behaving properly a transaction authentication should not fail, because appropriate reservation (entitlement) has been set-up prior to the request. However AO STB VoD client might generate transaction for which it did not do prior reservations, hence transactions may fail to be authenticated for reasons like :
- Unknown STB_ID
 - Unknown Asset_ID
 - Invalid Entitlement-ID
 - Wrong VDP address (trying to use other VDP then with which reservation request was made
 - General network errors

4.6 CA system for VoD transactions

4.6.1 General

- (33) TLN uses an efficient network based mechanism to protect VoD content via a Conditional Access system.

4.6.2 Main principles of operation

- (34) The AO will have to “enable” a given STB for participation in the TLN VoD service if it desires so by sending a “VoD CA” provisioning command towards the TLN CPPS for AO, just like it would do to enable access to a certain pay TV package for that subscriber on the CA system. Please refer to [TLN-WRO-TA-I-S-PAAB](#).
- (35) Telenet uses group tokens (security encryption keys) that are rotated on continuous basis to protect “bundles” of VoD streams. The security keys are generated by the CA system (3rd party CA system in case of AO VoD streams) and fed to the regional VoD edge QAM’s where they are inserted in the dynamically generated transport streams containing individual VoD sessions.
- (36) No further details are given in this public section of the document as this directly relates to security and content protection.

4.6.3 Detailed interface specification for TLN VoD CA usage

- (37) The formal protocol definition which include the programming API’s that will allow the AO STB and the AO 3rd party CA system to interact with the TLN VoD CA platforms will be made available during implementation phase to the beneficiary.

4.7 AO STB to TLN VDP and CDN RTSP Interface

4.7.1 General

- (38) Further processing of a successful VoD buy request will result in AO STB to TLN VDP and CDN interaction (via AO.VSP) which is implemented by means of RTSP at this interface. The AO STB to TLN VDP and CDN RTSP interface can be examined in figure 4-1 above.

4.7.2 Physical Transport connection

- (39) Video servers are located in TLN VoD CDN areas. The TLN.VDP servers are centrally located. All can be addressed by AO STB's using RTSP protocol over a standard IP connection between the TLN and the AO network.

4.7.3 Protocol messages

- (40) The TLN VoD platform uses MPTS over DVB-C for video streams and stream control is done using the Real Time Streaming Protocol over the IP data return path.

- (41) The Real Time Streaming Protocol (RTSP) is a network control protocol designed for use in entertainment and communications systems to control streaming media servers. The protocol is used for establishing and controlling media sessions between end points. Clients of media servers issue VCR-like commands, such as play and pause, to facilitate real-time control of playback of media files from the server.

- (42) The high level description of RTSP commands used by the TLN VoD service is as follows:

SETUP

A SETUP request is used to request a video pump controller (such as the TLN VDP) to allocate network resources and provide the client (such as the AO STB via AO VSP) with the transport parameters of the actual video stream. The TLN VDP also provides in the SETUP response the address of the CDN server and corresponding session-id for trick play.

PLAY

A PLAY request will cause the media streams to be played. A range can be specified. If no range is specified, the stream is played from the beginning and plays to the end, or, if the stream is paused, it is resumed at the point it was paused. A scale (speed) can be specified to control the playback speed (including speed 0 for pausing) and direction. PLAY requests are sent to the TLN CDN server assigned by the TLN VDP.

TEARDOWN

A TEARDOWN request is used to terminate the session. It stops all media streams and frees all session related data on the server.

GET_PARAMETER

GET_PARAMETER requests are sent periodically to the TLN VDP as long as the VoD session is active and is used as a form of keep-alive. The TLN VDP will terminate a stream if several keep-alives have been missed to free up network resources.

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- (43) The formal protocol definition which includes the programming API's that will allow AO VSP to interact with the TLN VDP will be made available during implementation phase to the beneficiary.

TLN makes some specific controls during RTSP SETUP request. e.g.: Check : STB-ID on white list; VSA (is correct vs. network discovery), Entitlement-ID is valid.

4.8 VoD order and play-back message flow

- (44) At the start of a VoD order (Buy VoD asset), the AO-STB sends a VoD buy request to its own VSP which includes AAA and Rating functions in AO-backend. The STB-ID and Asset-ID are added to the asset request by the VSP before it's sent to the TLN VoD System from AO VSP. This communication between TLN VoD and AO VSP occurs over a secured connection by IPSEC, KPI, to provide secure logging of the transaction.
- (45) At TLN side, it is checked if the STB-ID is on white list and if the asset-ID belongs to AO or not. In case all checks are OK, then the VoD order request is approved and an entitlement is created of which the ID is returned to VSP.
- (46) The VSP can then request stream preparation using RTSP SETUP, including the STB-ID, Entitlement-ID and VoD serving area of the AO-STB. The TLN VoD system then verified the validity of the entitlement and network resource reservation is started.
- (47) The resource reservation module will check in its data tables if sufficient capacity is still available to play out the newly ordered stream on the designated Video server and within the VSA where the AO STB that issued the request resides. If this check is positive, the reservation is made and the stream preparation is completed and a positive reply is sent to the VSP in the AO Backend, which will on its turn, after having completed the necessary AAA and Rating logic, pass on the answer to the AO STB.
- (48) Now the AO STB can start the play request. RTSP PLAY command is used for this and this command is sent directly to the TLN CDN. Video stream play clearance is now released to the AO STB and it's possible to send further trick-play commands from this AO STB. These are again RTSP PLAY commands and carry the user-interaction via its RCU directly to TLN CDN.

4.9 Restrictions

- (49) The TLN VoD offer does not include any VAS services on VoD like (but not limited to) : Asset viewing window entitlement management (24H/48H); SD/HD compatibility check with STB; Bookmarking (AO must manage : restart viewing from bookmark point themselves)
- (50) Value added services on the iTV return path, like (but not limited to) extended EPG data (2 weeks), STB management and supervision, 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 its own means.
- (51) TLN will not provide iVoD (possibility to launch a VoD movie from inside an application). The AO has the capability to develop this by its own means.

4.10 Operational Procedures

(52) Telenet will execute from time to time operational changes on the VoD infrastructure. An AO making use of the TLN ROTV VoD part should be prepared at all time to adapt its infrastructure, devices and systems, as well as its operational procedures to handle those changes. In addition it is strongly recommended by TLN that AO will take this into account in the design of its solution, so that impact of future changes will be limited. Below a non exhaustive list is given, showing some examples of operational changes that TLN has executed in the past and which will be repeated likely in the future :

- Creation of new VoD regional service areas, or re-organization of existing ones
- Updates to the VoD security algorithms on the VoD CA systems
- Re-organization of the VoD catalogue data structures
- Introduction of additional VoD QAM's
- Re-allocation of VoD QAMs in the HFC spectrum
- Changes in the configuration of mapping QAMs to HFC nodes
- Changes in VoD catalogue publishing schedules
- Changes in CDN distribution and propagation schedules and delays
- Changes in the RTSP dialect

4.11 AO Device Management by TLN Requirements

The applicable requirements are described in [TLN-WRO-TA-I-S-PIAA](#).

5 AO STB - Non Functional Requirements

The applicable requirements are described in [TLN-WRO-TA-I-S-PIAA](#).