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PU	Public	X
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1. Executive Summary

The main goal of this project is to develop an efficient solution for IPTV operators to provide HD video streams to users which have a limited access bandwidth and to optimize bandwidth usage for IPTV video streaming. WP8 deals with the Live Test Plan.

This deliverable is the description of the planning activity that will be performed in WP8 of the OptiBand project.

The objectives of this WP are:

- To demonstrate the operation of the content aware data dropping algorithm, implemented by D3.4.2 and D4.5.2, in the live environment with several tens of end users.
- To evaluate the strengths and weaknesses of the data dropping algorithm, in a live environment.
- To provide feedback from the participating end users with regard to the degradation of the QoE (if any) during the live test period (this will be delivered by WP2 in D2.5).

2. Introduction

The deliverable D8.1 - Live Test Plan describes the planning and procedures for the Live Test phase of the developed components of the IPTV system for achieving the goal of the OptiBand project of providing a HD video streaming solution for limited access bandwidth environments.

In particular the activities planned are described in detail in the T8.1 task: Preparation of the Live Test Plan (M25 – M34):

- Planning of how the prototypes D3.4.2 and D4.5.2 will be integrated into the existing IPTV network of TiS, including a list of test cases to check their correct operation before applying the data drop algorithm to end users.
- Allocation of resources (location, engineering, customer service) to integrate D3.4.2 and D4.5.2 into the existing IPTV network and to support the operation of the live test.
- Plan the selection of the end users that will participate in the live test.
- Plan how to inform the end users about the live test, the dates of the test, the benefits for the end users and what is expected of them.
- Preparation of a fall-back plan in case there is a malfunction in D3.4.2 and D4.5.2
- Planning of the timetable for each of the live test steps.
- Planning the responsibility and allocation of work for each partner that participates in the live plan

3. Preparation of the Live Test Plan

The Live Test Plan describes the planning and procedures for the preparation of the environment for the Live Test phase of the developed components of the IPTV system for achieving the goal of the OptiBand project.

In particular the target for the test planning was to achieve the following goals:

- Planning/Integration of the prototypes into the exiting IPTV network of TiS
- Functional tests of the OptiBand Network
- Model a representative TV watching situation
- Model a household with multiple TV sets
- Model the typical behaviour of the OptiBand packet dropping algorithm
- Apply a valid state-of-the art QoE testing strategy

3.1 Integration of prototypes into the existing IPTV network of TiS

The integration of the prototypes in the TiS IPTV network is described in the deliverable D7.1; following is a list and some pictures of the equipment installed in the OptiBand IPTV network:

Manufacturer	Model Type	Network Interface for Data	Network Interface for Management		
TVN	SDI Baseband Interfaces for TSoIP outputs	1 GE	IP: 172.16.186.37 GW: 172.16.185.33 Mask: 255.255.255.224	1 FastETh	IP: 172.16.185.2 Mask: 255.255.255.224
TVN	H264 Multirate Video Encoder	1 GE	IP: 172.16.186.39 GW: 172.16.185.33 Mask: 255.255.255.224	1 FastETh	IP: 172.16.185.4 **IP:172.16.185.13 Cluster** Mask: 255.255.255.224
TVN	H264 Multirate Video Encoder	1 GE	IP: 172.16.186.40 GW: 172.16.185.33 Mask: 255.255.255.224	1 FastETh	IP: 172.16.185.5 Mask: 255.255.255.224
TVN	MPEG Multiplexer	1 FastETh	IP: 172.16.186.36 GW: 172.16.185.33 Mask: 255.255.255.224	1 FastETh	IP: 172.16.185.7 Mask: 255.255.255.224
CSL	Switch CM4140	1 GE (fiber) 1 GE		1 FastEth	IP: 172.16.185.8 Mask: 255.255.255.224
OPTEC	Encoder2	FastETh	IP: 172.16.186.34 GW: 172.16.185.33 Mask: 255.255.255.224	1 FastETh	IP: 172.16.185.9 Mask: 255.255.255.224
OPTEC	Encoder1	FastETh	IP: 172.16.186.35 GW: 172.16.185.33 Mask: 255.255.255.224	1 FastETh	IP: 172.16.185.10 Mask: 255.255.255.224
IRD	KMS	FastEth	IP: 172.16.185.66 GW: 172.16.185.65 Mask: 255.255.255.224	NO Management	
IRD	KMS	FastEth	IP: 172.16.185.101 GW: 172.16.185.97 Mask: 255.255.255.224	NO Management	
IRD	Key server	FastEth	IP: 172.16.185.67 GW: 172.16.185.65 Mask: 255.255.255.224	NO Management	

IRD	IP scrambler	FastEth	IP: 172.16.185.68 GW: 172.16.185.65 Mask: 255.255.255.224	NO Management	
IRD	IP scrambler	1 GE	IP: 172.16.185.43 GW: 172.16.185.33 Mask: 255.255.255.224	NO Management	
IRD	IP scrambler	1 GE	IP: 172.16.185.99 GW: 172.16.185.97 Mask: 255.255.255.224	NO Management	
INTEROUD	Middleware		IP: 172.16.185.98 GW: 172.16.185.97 Mask: 255.255.255.224		IP: 172.16.185.11 Mask: 255.255.255.224

Table 1: List of the Equipment for Live

ufacturer	Model Type	Network Interface	
HHI	Live SVC Encoder (Emulator PC)	1 FastETh	IP: 172.16.185. 42 GW: 172.16.185.33 Mask: 255.255.255.224
HHI	PDD (PC with 2 network cards)	1 FastETh	IP: 172.16.183.195 GW: 172.16.183.193 Mask: 255.255.255.240
HHI	PDD (PC with 2 network cards)	1 FastETh	IP: 172.16.183.196 GW: 172.16.183.193 Mask: 255.255.255.240
HHI	SVC STB Emulator (Laptop PC)	1 FastETh	Dynamic or: IP: 172.16.183.197 GW: 172.16.183.193 Mask: 255.255.255.240

Table 2: List of the Equipment for VoD

3.1.1 OptiBand Rack

- VoD encoder and VoD PDD
- Live encoder and multiplexer
- KVM
- Live PDD

Figure 1: OptiBand Rack – The equipment are listed on the right side of the picture

The Live PDD

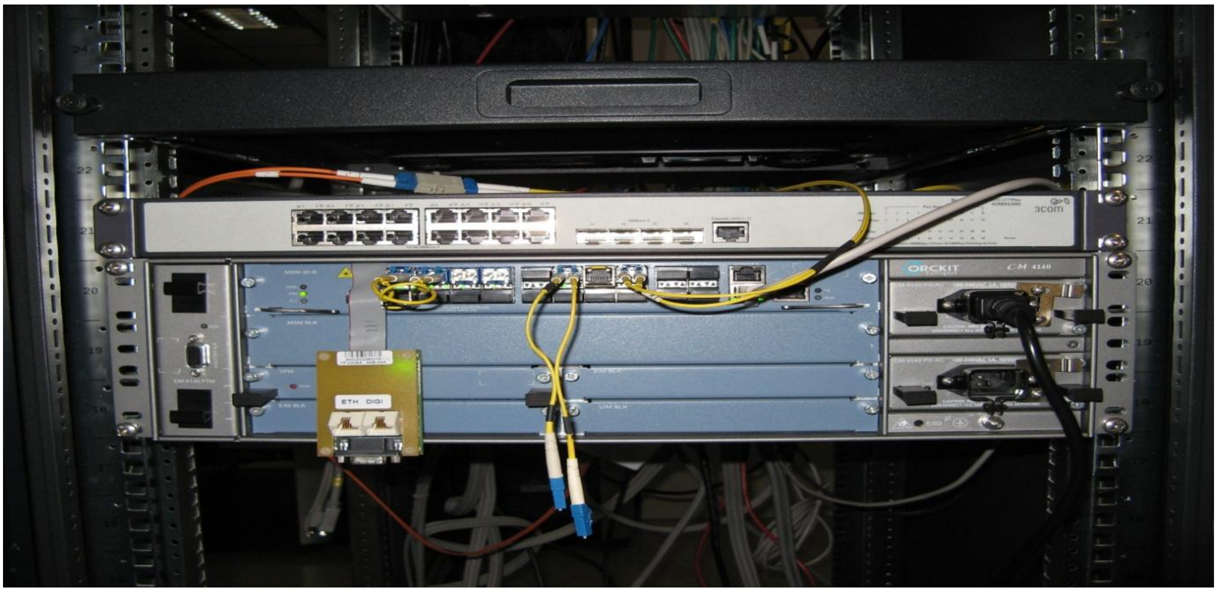


Figure 2: PDD Details

The Live Encoders

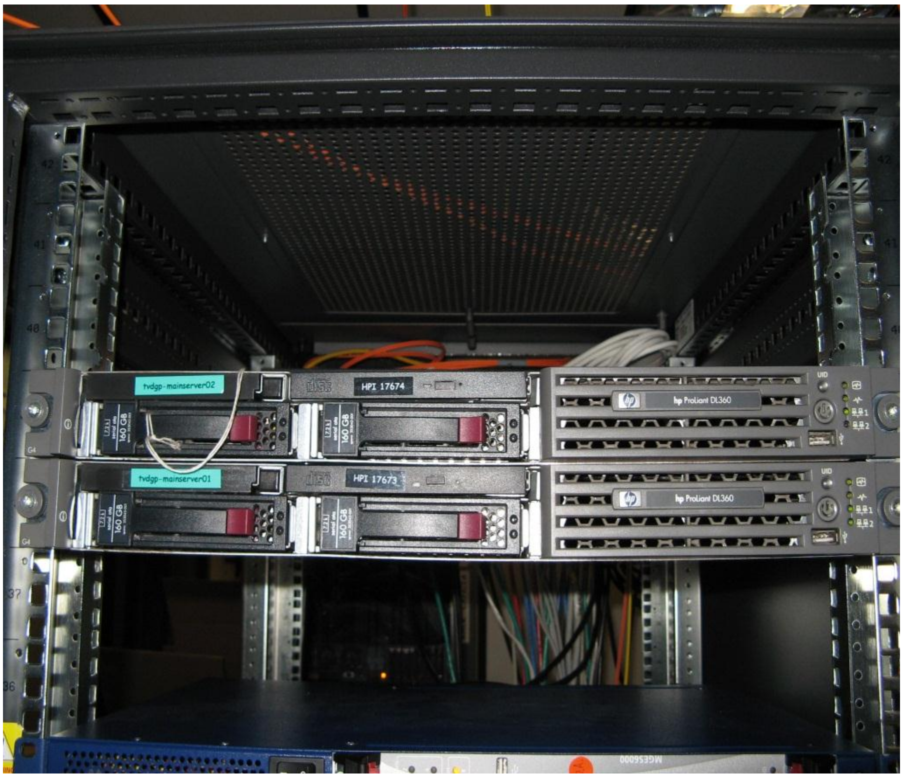
- OPTEC encoders
- TVN Multiplexer
- TVN encoder cluster

Figure 3: Live Encoders - The equipment are listed on the right side of the picture

The Middleware

Figure 4: Middleware – Details: hp ProLiant DL380

VoD Solution



- SVC HEAD-END
- SVC PDD

Figure 5: VoD Solution - The equipment are listed on the right side of the picture

3.2 OptiBand Network Diagram

A detailed diagram for the TiS IPTV network where the OptiBand Project equipment has been integrated, and a detailed description of the network components was provided in D7.1.

Below in fig. 6 and 7 are showed the network diagrams for Live and VoD solution implemented in the TiS lab.

3.2.1 OptiBand Network Diagram for Live

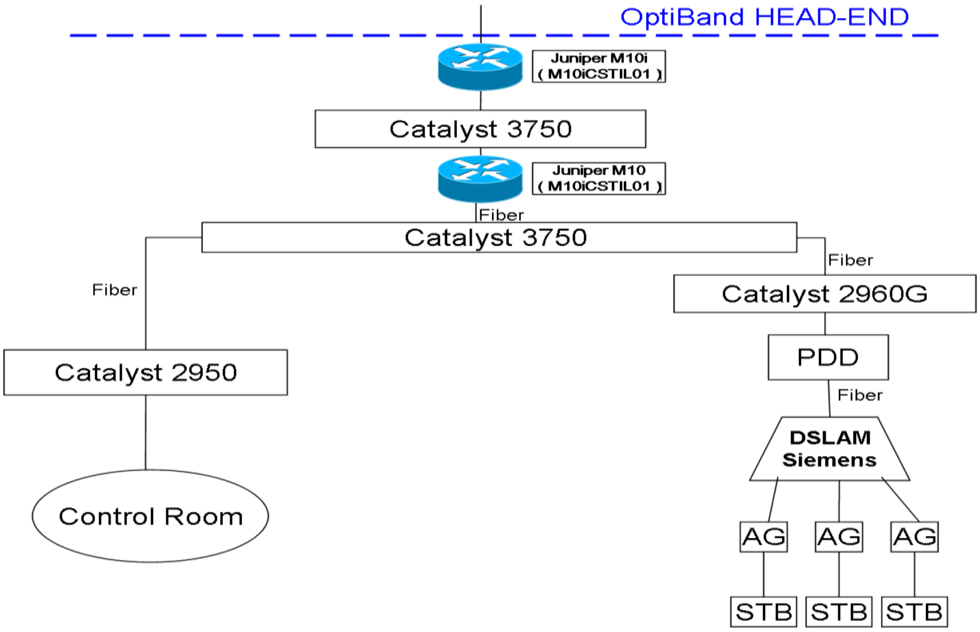


Figure 6: Layer 2 - Architecture of the network, emulating a metro network and access network for STBs of the OptiBand Network Diagram for Live.

Figure 6 shows how the routers Juniper M10i are connected, as well as the PDD, DSLAM and STBs. The STBs are within a VLAN with IP addresses 172.16.183.176/255.255.255.248, i.e. there are 4 addresses to accommodate 4 STBs.

3.2.2 OptiBand Network Diagram for VoD

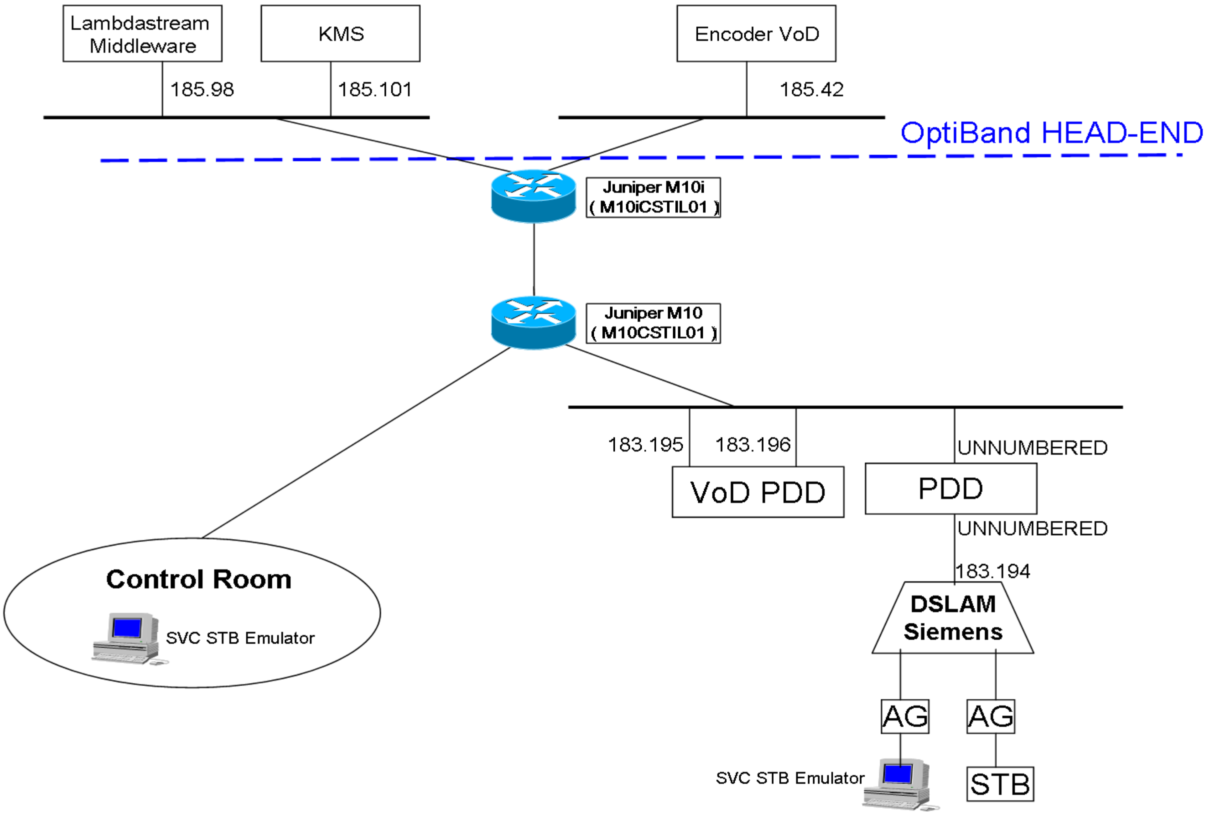


Figure 7: Layer 2 - OptiBand Network Diagram for VoD

Figure 7 shows the network architecture and the assignment of the SVC Head-End, SVC PDD and SVC STB Emulator to VLANs.

The SVC solution have been completed and tested as discussed in D7.2 in section 8.2. The switching patterns shown in D7.2 in section 8.2 were analysed by a small group of experts of HHI and TIS and was checked that the solution was working properly. In order to reduce the load of performing multiple Live Test and taking into account that testing both the AVC solution and SVC solution would result in making duplicated work, although no candidate showed better performance than the other, the OptiBand consortia decided to continue the Live Test with only one solution, which would proof the benefits of both solutions presented within the project for the different prototypes. The AVC based solution has been selected due to the fact that this solution was implemented in hardware, was comprised of live encoders and therefore was closer to a final product for the market.

3.2.3 OptiBand Set-up for Live

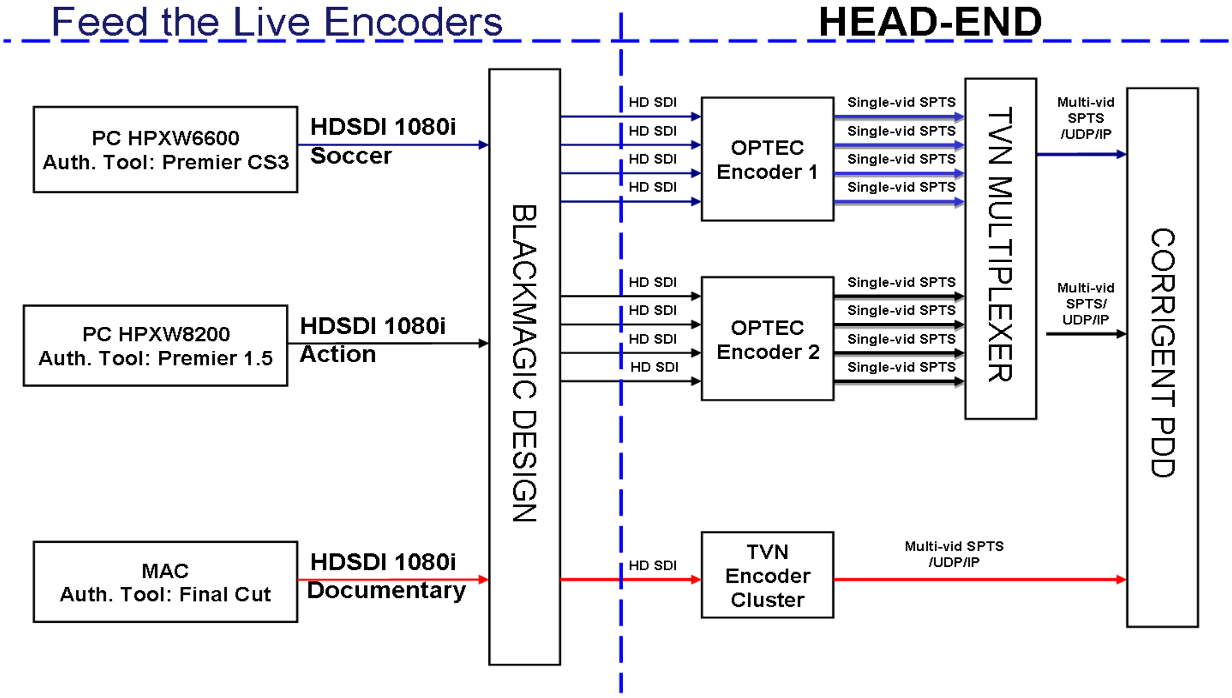


Figure 8: Set-up for Live1/3

The above figure shows the PCs containing the source video material (uncompressed) that feed (through an HDSDI interface) a Blakmagic matrix (one input for each PC). For each input the matrix has four HDSDI outputs feeding the Optec encoders and one HDSDI output feeding the TVN Cluster Encoder.

Figure 9: Feed the Live Encoders - Live2/3

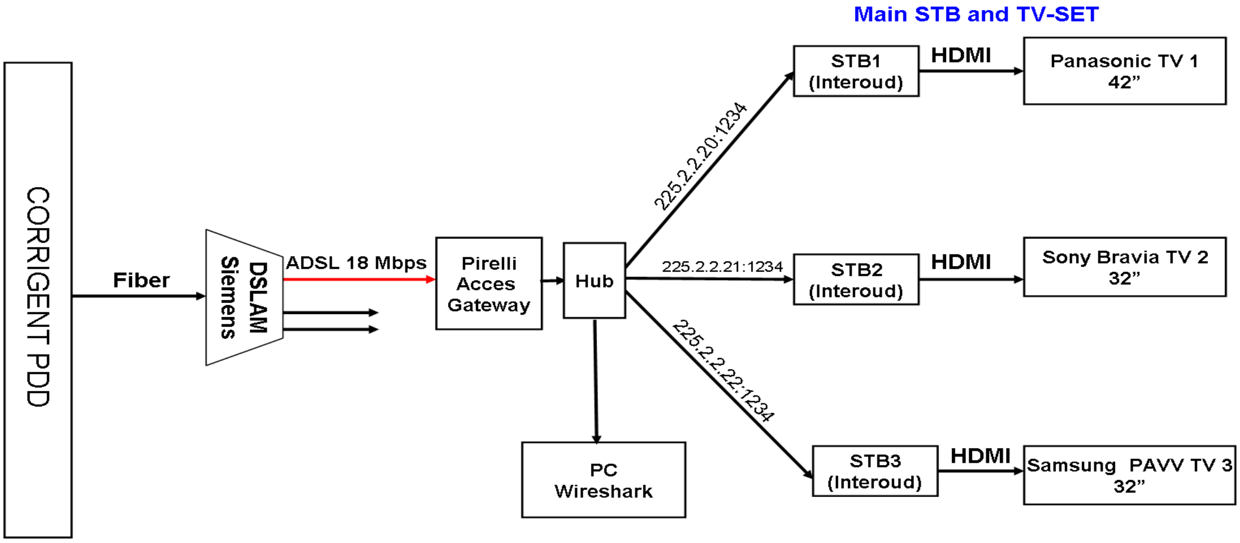


Figure 10: Set-up for Live3/3

Figure 10 shows how the encoded content flows through the PDD to reach the STB and TV-set used for the tests.

The PC connected at the same level of the 3 STBs is used to check used bandwidth, using the Wireshark application (see Figure 11).

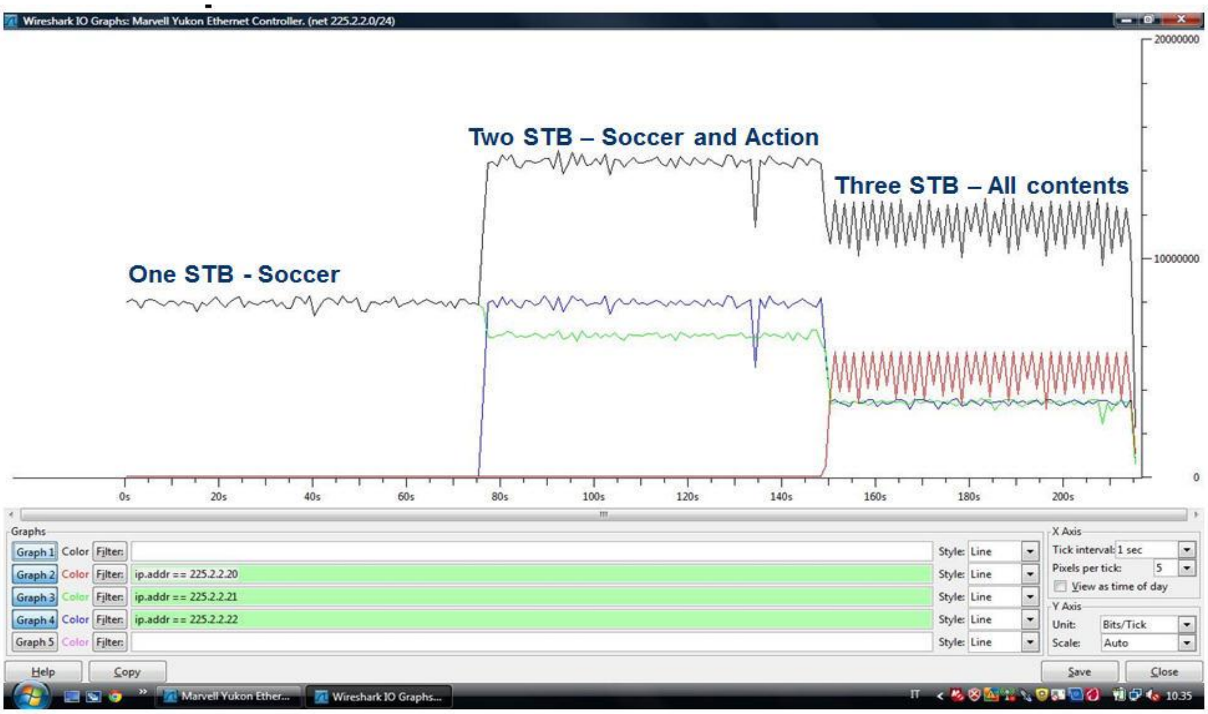


Figure 11: Wireshark acquisition of the used bandwidth by the 3 TV-SETs

3.3 Siemens DSLAM:

- Model: HIX110
- Firmware version: hiX5635/R2.3
- Suitable ADSL2+ profiles will be built to support the bitrates required in the use cases
    - The bit rate is defined at physical level (line alignment)
    - Some amount of error protection is included (INP/Delay)

Some high level presentation of the DSLAM is reprinted from the Siemens documentation: SURPASS hiX 5635 R1.3 System Description (SYD).
The mentioned documentation outlines the implementation of IGMP snooping as follows:

"In IGMP snooping implementations, messages are generated from the STB and from the multicast router located on the edge of the IP network. The DSLAM only snoops the IGMP requests from the users. All messages are forwarded to the multicast/IGMP router. By snooping the messages the DSLAM can notice which channels the users want to subscribe to. By doing so, the DSLAM can replicate channels currently being multicasted."

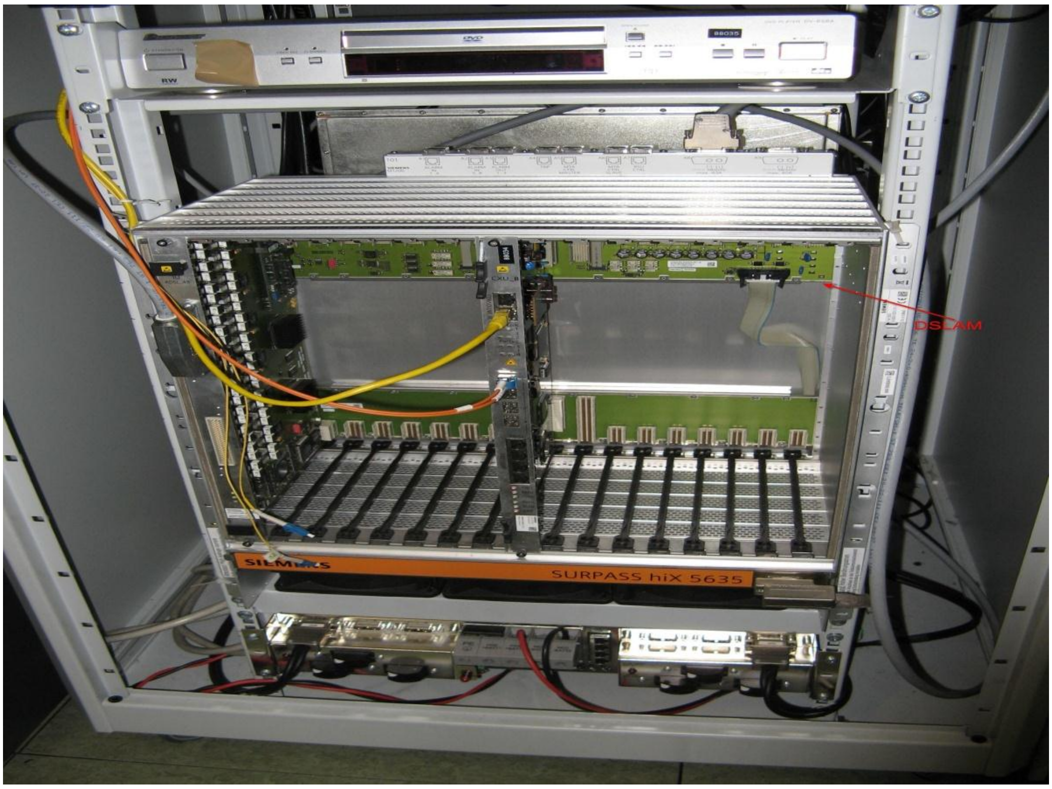


Figure 12: DSLAM (details)

3.4 ADLS 2+ Configuration lines

Currently six lines have been configured on the Siemens DSLAM with the profiles reported below.

- The rate-mode has been chosen to be fixed instead of adaptive to ensure that the expected bitrate is always available
- The maximum downstream bitrate is the parameter which distinguishes each profile and corresponds to the required physical layer bitrate for each defined profile
- The maximum theoretical downstream bitrate will be always the same for any line (22.240 Mbps)

- The upstream bitrate is 1.216 Mbps and is the same for all of the lines
- The noise protection (INP = 0.5 and Delay= 8 ms.) is kept at very low levels to limit the weight of redundancies

See details of each profile in the following:

- Rate adaption fixed
- Target noise margin 6 db
- Min. noise margin 1 db
- Line type interleaved only
- Profile std ADSL2+ Auto
- Annex type Annex A
- INP ½ symbol
- Tx power att. 0
- Interleaved buffer down 1ms, up 125 us
- Rate

Prof. 8M	Max/Min rate down	8 Mb
Max rate up	1216 Kb	
Min rate up	896 Kb	
Max delay down/up	8 ms	
Prof. 12M	Max/Min rate down	12 Mb
Max rate up	1216 Kb	
Min rate up	896 Kb	
Max delay down/up	8 ms	
Prof. 18M	Max/Min rate down	17984 Kb
Max rate up	1216 Kb	
Min rate up	896 Kb	
Max delay down/up	8 ms	

3.5 Encryption

The target result of integration of the components necessary for performing encryption are shown in Figure 13.

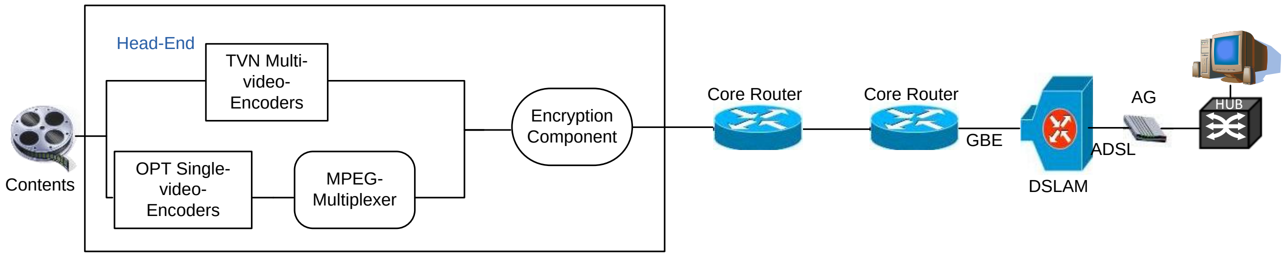


Figure 13: Encryption component installation for the multi-rate approach

Integration of the STB with the encryption system encountered a complication due to lack of support of the smartcard interface by the STB manufacture. Putting an extra effort into collaboration with the STB manufacture to develop a support for smartcard interface resulted in a delay of the integration. To mitigate the risk to the integration test and the live test, two alternatives have been proposed and implemented by the consortia:

1. using a third-party STB with integrated IRD security component, but without INTEROUD middleware

2. adding a component (descrambler) that can be placed before the STB, so a scrambled MPEG-2 TS is decrypted by the descrambler and is passed to the STB as a clear MPEG-2 TS.

Both alternatives allow testing the CAS system, the PDD performance as well as verifying that the solution that has been developed by the OptiBand consortia is transparent to any standard-compliant conditional access system.

3.5.1 Encryption components at the head-end

Figure 14 shows components of the encryption system as they are installed in the TI laboratory. The equipment consists of IRD IPTV Scrambler, IRD KeyServer, and IRD KMS. Specifically to support descrambling of content before it reaches a STB, IRD IPTV Scrambler is equipment with a descrambler board.

Figure 14: Encryption components: IRD IPTV Scrambler, IRD KeyServer, and IRD KMS

3.5.2 Using a (third-party) STB

Figure 15 provides a detailed diagram of the system that relies on STBs to handle descrambling. The content comes from the multiplexers described above and, once scrambled, is transmitted to a STB over a delivery network. The delivery network typically contains a number of network devices (e.g. routers, DSLAMs); it may also contain the PDD. All these devices, however, are transparent to the conditional access system, and therefore are not shown on Figure 15.

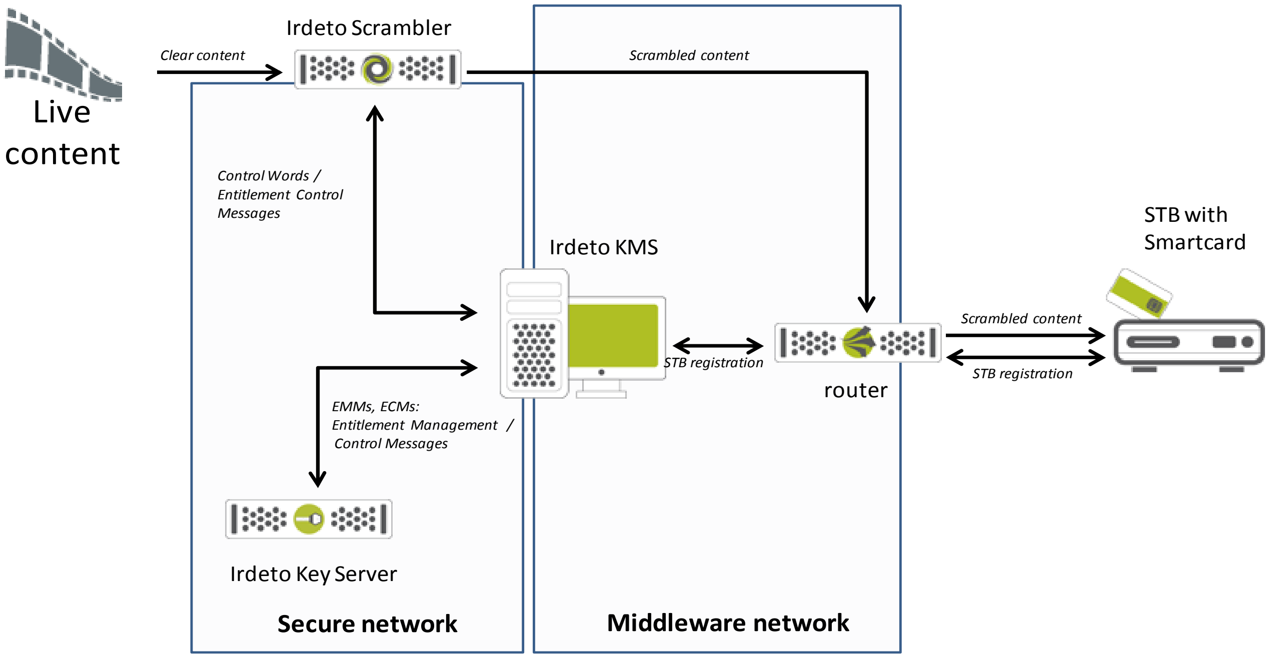


Figure 15: Description of the encryption configuration for the STB-based descrambling

Figure 17 demonstrates the test setup that uses a third-party STB integrated with IRD security (a DVB-over-IP STB by Altech UEC, model DID4614). The STB on the right side is the test box that is capable of displaying encrypted and unencrypted content, while the STB on the left is the 'reference' box that is capable of displaying only un-encrypted content.

Figure 16: Test setup – IRD-enabled STB

Figure 17: Test setup – IRD-enabled STB

3.5.3 Using a descrambler

Figure 18 provides a detailed diagram of the system that relies on the standalone descrambler to handle decrypting of content. The content comes from the multiplexers described above and, once scrambled, is transmitted to a STB over a delivery network. Prior to arrival to a STB, the content passes through a descrambler that decrypts it and forwards to the final destination.

The initial setup of the security component is similar to the one discussed in the previous section. The major difference is that since there is only one input and output board for the IRD IPTV Scrambler and it should be used for scrambling and descrambling, we need to loop and merge two IP flows while at the same time keep the IGMP management intact.

For the descrambler-based solution, no security-related communication from the STB is required.

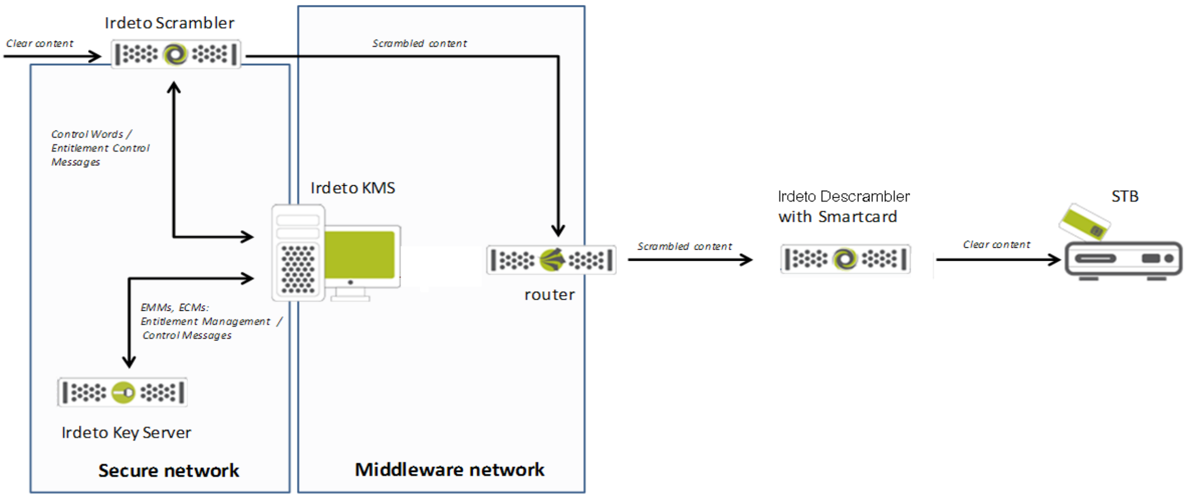


Figure 18: Description of the encryption configuration for the descrambler-based descrambling

4. Test cases to check their correct operation

Head-End (Live Encoder)

The live encoder have been supplied with live sources, coming from PC equipped with HDSDI interface and uncompressed HD content; the encoders have been configured with the correct encoding parameters and instructed to output the encoded stream on a pre-defined IP multicast group; the correctness of the output stream has been verified with VLC program running on a PC on the same network of the encoders.

Middleware

The middleware is a client-server software that connects end users to the video head-end. The middleware at the server side contains information of the multicast channels and the middleware at the client (STB) exchanges information with the middleware at the server for service discovery.

The middleware installation was carried out by INTEROUD, who remotely installed the software on one of the servers provided by TI. INTEROUD also tested remotely the correct operation of the middleware, checking the correctness of the middleware answers to the requests done by the STB.

Live Channels

The correctness of the received live channels has been tested connecting a PC to the hub of the STB (see Fig. 10) and verifying with Wireshark (see Fig. 12) that the live stream had the expected bandwidth and with VLC that the content could be displayed correctly

PDD

The PDD behaviour was tested activating one STB at a time on a specific ADSL line and checking with Wireshark (Fig. 12) that the stream with the correct bandwidth is delivered by the PDD to the STB, according to ADSL line characteristics and number of active STBs. At the same time it was checked the TV sets connected to the STBs would display the expected channel without artefacts.

STB

For every STB the following behaviour have been tested: correct network initialization and connection at the middleware, correct channel selection, correct execution of the selected test suite as further described in chapter 6.

DISPLAY and TRACING

For Display and Tracing we used the free tools VLC and Wireshark

4.1 ADSL Lines Checks

This activity has been performed to ensure that the IPTV service of the project OptiBand would get the best possible quality available on the ADSL lines used for testing.

The configuration of the ADSL lines used for the project OptiBand is the same used for Telecom Italia residential customers.

After installation of these lines were performed all the standard checks carried out after the installation of a standard ADSL line of TI, these checks also provide an indication on the errors found on the lines.

These tests showed that the error rate is within normal values (limits) used for normal commercial ADSL lines.

4.1.1 Measurements and error of the ADSL lines in the OptiBand network for audio/video traffic

After the standard checks TiS also performed additional checks on these lines using a program developed by TiS.

- The purpose of the activity has been monitoring the loss of IP packets, in terms of burst and interval (between a loss and the subsequent loss) on a HD stream
- The measurements were carried out at the user terminal (a PC), thus including both errors on the ADSL line and errors on the Home Network
- The PC has a minimal Linux operating system and TI-developed software that monitors the IP packet loss of a dedicated multicast IPTV streams.
- The stream is generated by a specialized server (DVStore), installed on the Head End network, that is sending a multicast video stream with special markers, enabling the downstream PC to detect IP packet loss.

- The test were divided into:

  Without PDD
  - Check ADSL lines in the laboratory. These lines are totally similar to those used for the Live Test
  - Checks ADSL lines in the TILab User Experience Lab

  With the PDD
  - Check ADSL lines in the laboratory. These lines are totally similar to those used for the Live Test
  - Checks ADSL lines in the TILab User Experience Lab

Characteristics of the measurement campaign

- The check was at IP level and not at the physical level (we are interested in IP packet loss, not noise pulses)
- We checked the full path from the user terminal (including the home network) to the head end (included) and not only the access network
- We used specialized PC client, because we could not use the STB for this measurement

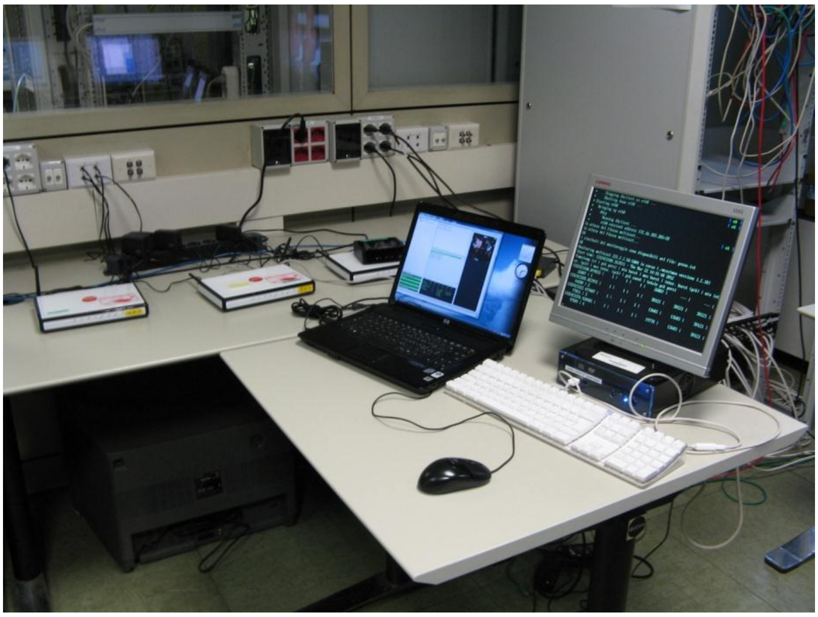


Figure 19: Validation ADSL lines TI set-up

Figure 19 show the PC used for the ADSL checks. On the Mini PC run the software developed in TI that checks the loss of the IP packets

Conclusion

All the ADSL lines configured for the OptiBand project were tested and also in this case the lines show a good quality.

Each line was tested for an hour and at the end of the check we registered a couple of IP packet loss events for every ADSL line; this packet loss rate was considered acceptable for the live tests, as it does not interfere with the QoE testing.

4.2 Encryption Validation

Since the beginning of the project, it was agreed between all the partners that the encryption doesn't have to be part of the Live Test; but we report in this chapter the effort made by IRDETO that despite being aware of the above reported has pursued an activity of developing of the components of encryption to verify the behaviour of the encryption components in the OptiBand network.

4.2.1 Test of the encryption components

The test environment for the encryption is based on the use of the descrambler in front of the STBs. The setup works in the following way. After the test streams are encoded and multiplexed at the head-end, they are sent through the scrambler to produce encrypted streams, then to the PDD that passes through the streams with the bit-rates selected individually for each STB, while dropping the packets that belongs to the other streams. After the PDD, the streams o through the descrambler equipped with the IRD CAM and IRD Smartcard. The descrambler decrypts the content and sends the streams to the STBs. The general view is shown in Figure 20.

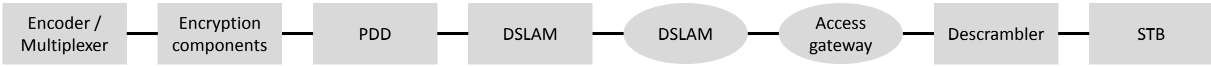


Figure 20 General view of the test setup (square elements are the ones specific to the OptiBand project)

One of the challenges in deploying the setup discussed above is that the descrambler is a unidirectional network device (i.e. it allows only traffic from the input network interface to the output interface). Moreover, the device can only receive multicast UDP streams. Such behaviour disallows any communication between the STB and the head-end. To address the challenge, IRD and TI introduced an additional network device – the traffic filtering bridge (Figure 21). The device acts as a typical network bridge with a single exception – it allows blocking multicast traffic on a pre-defined IP range. As a result, all UDP-multicast from the head-end to the STB goes via the descrambler, while the rest of the network traffic goes via the traffic filtering bridge.

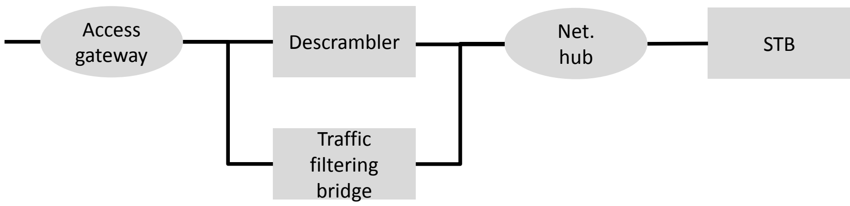


Figure 21 A customize test setup for traffic filtering

We hypothesize that the changes to the system behaviour that are brought by the encryption component:

a) does not influence the other components of the system and as a result do not produce any artefacts during play-out of video streams
b) may decrease QoE due to, potentially, longer zapping time. The possible outcomes of using encryption can be split into three categories:
   1) Visual/audible artefacts are present when encryption is on.
   2) No visual/audible artefacts are present and no increase in zapping time.
   3) No visual/audible artefacts are present, but zapping time is increased

compared to using no encryption.

Outcome 1 would imply that the OptiBand solution does not work in-line with the project objectives, since artefacts mean the PDD and encryption are not mutually transparent.

Outcome 2 would imply that the OptiBand solution meets the objective of being transparent to a standard IPTV encryption system. The absence of the additional zapping delay indicates that the descrambler already passes through the service the user navigates to (e.g. another STB in the network has been accessing the service). This is a specific case for the test setup that is only possible when the device performing video decoding (i.e. STB) is decoupled from the device performing the descrambling (i.e. descrambler)

Outcome 3 would imply that the OptiBand solution meets the objective of being transparent to a standard IPTV encryption system. The increased zapping time, however, is a key element in validating solution’s QoE. In the case of outcome 3, we would want to assess the influence of the longer zapping time on QoE.

4.2.2 Scenarios

Based on the hypothesis above, we designed the test scenarios.

Scenario 1. Visual artefacts after zapping

For the scenario, we use three services (i.e. channels) and one STB connected to the main TV.

Step 1. All channels are in clear. The test STB is used to zap through channels in a random pattern. The play-out on the main TV is recorded (test_s1_clear.mpg)

Step 2. Two channels are in clear and one channel is encrypted. The test STB is used to zap through channels in a random pattern. The play-out on the main TV is recorded (test_s1_scr1.mpg)

Step 3. Three channels are encrypted and one channel is in clear. The test STB is used to zap through channels in a random pattern. The play-out on the main TV is recorded (test_s1_scr3.mpg)

Scenario 2. Zapping time to the pre-processed encrypted channel

For the scenario, we use three services (i.e. channels) and two STBs – one (STB1) connected to the main TV and one (STB2) connected to the auxiliary TV.

Step 1. Two channels are in clear and one channel is encrypted. STB2 is subscribed to the encrypted channel. STB1 is used to zap through unencrypted channels in a random pattern. The play-out on the main TV is recorded (test_s2_clear.mpg)

Step 2. Two channels are in clear and one channel is encrypted. STB2 is subscribed to the encrypted channel. STB1 is used to zap through channels in a random pattern. The play-out on the main TV is recorded (test_s2_scr.mpg)

Scenario 3. Zapping time

For the scenario, we use three services (i.e. channels) and one STB connected to the main TV. In this scenario we want to check if the zapping time increases when changing to a scrambled channel.

Step 1. Two channels are in clear and one channel is encrypted. The STB is used to zap through unencrypted channels in a random pattern. The play-out on the main TV is recorded (test_s3a_clear.mpg)

5. Plan the selection of the end users

A selection of users from a stable TiS panel of users will be invited to the trial, they are characterised by different and complementary profiles, in terms of attitude towards new technologies and socio-demographic features.

The evaluation campaign is planned under the supervision of professional ergonomists certified by CREE (Centre for Registration of European Ergonomists). These Ergonomists are Telecom Italia personnel from TI LAB (Turin).

5.1 Designing the Test Phases

We will conduct a pilot phase (involving about 3 colleagues) in which we'll:

- check the maximum number of sequence to evaluate in a single session
- check the pause time between the sequences
- Check the correct distance of the monitor
- Check the specific questionnaire

Regarding the user profile we suggest to consider:

- Age (20-30, 31-40, 41-50, >50)
- Gender
- Visualization of content
- Visualization the video on PC

Each participant to the test will receive:

- Briefing about scopes and operability of the evaluation
- The tasks
- After each sequence it will be asked the filling of the questionnaire post-task
- At the end of the test it will requested the filling of final questionnaire

5.2 Plan how to organize live tests with the end user

The Live Test will be conducted in a near home environment, a room with furniture and TV placed according to the typical layout of a TV set in a residential apartment, high end computers to drive them, audio equipment and software to record user experience scores. Figure show the typical rooms of the lab which will be adapted for QoE test.

Test Environment : TILab User Experience Lab

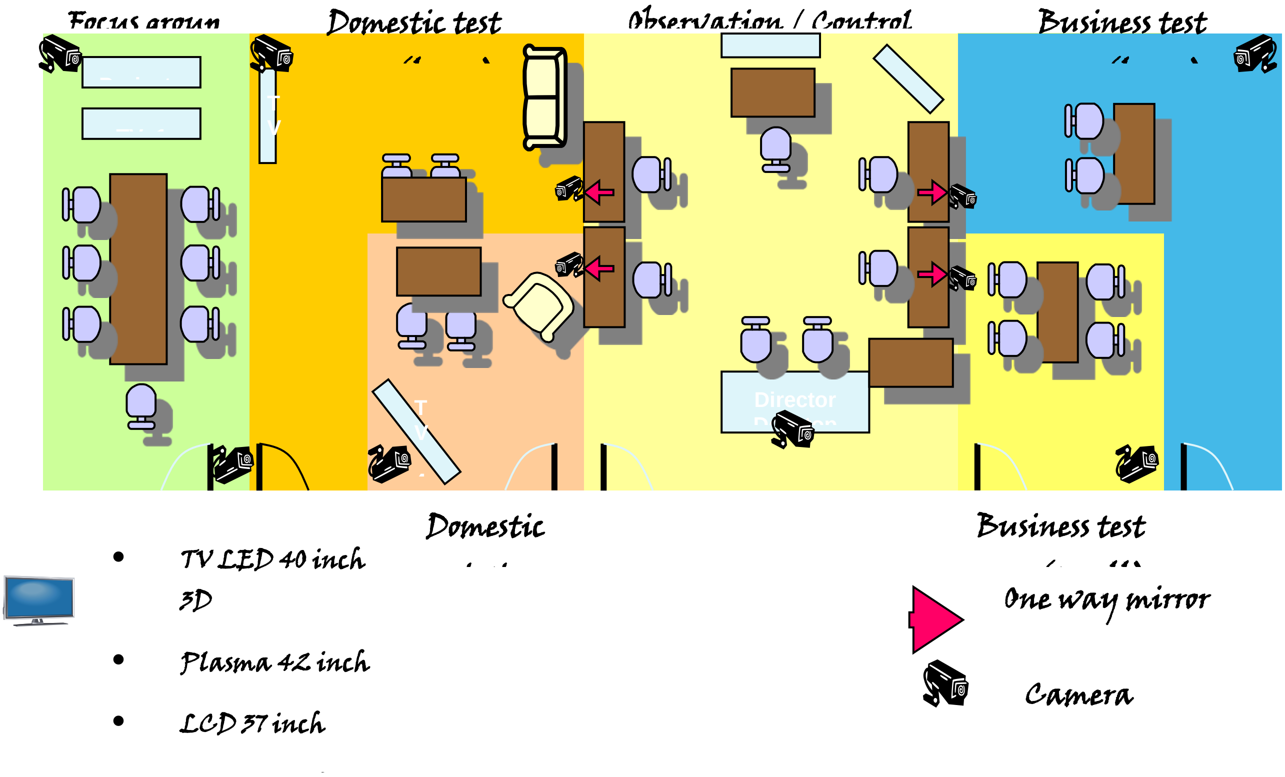


Figure 22 TILab User Experience Lab

5.2.1 Where the tests will be carried out

Figure 23 Domestic Test Room

6. Defining the Live Test

6.1 Focus of interest

In the following, the main variables that we focus on in the OptiBand QoE research are described, in order to understand their impact on QoE in real world conditions. The variety of test conditions is explained in the following, namely the evaluated use cases which consider different zapping patterns.

The OptiBand live test is designed to answer the following research questions:

- What is the QoE (the relative difference) of a video being shown to a user within a household, in the following scenarios:
    - When no further TV is switched on and the whole bandwidth is available (SOTA, 8M)
    - When no further TV is switched on and restricted bandwidth is available (7M for the application layer), using the OptiBand data dropping method
    - When one further TV is switched on (i.e. zapped according to a specific pattern), resulting in a transition of quality (on average for both TV sets 10M for the application layer)
    - When two further TVs are switched on, resulting in 15M on the application layer.
- Do the degraded sequences of the above sequences reach the quality thresholds (absolute QoE)?
- What is the impact of the content type (soccer, action, documentary)?
- What is the correlation between acceptability and quality rating?
- What is the impact of the changing pattern?

Following technical criteria should be followed:
- Identification of setups where the use of the packet dropping algorithm is useful/required/effective …
- Classification of the quality of the ADSL lines
    - “ADSL2+” profiles:
        - High bitrate profile
            - Good ADSL2+ link aligns at 18 mbps
            - Bad ADSL2+ link aligns at 12 mbps
        - Low bitrate profile
            - ADSL2+ link aligns at 7 mbps
- Enlargement of the offer of the IPTV commercial service
- Compliance with the requirements stated in the technical annex

6.2 Technical background

One of the main influence factors of QoE is the extent to which bandwidth reduction related to the live video streams performed, but also the various settings and selected parameters are very important.

To cover the most relevant implementation possibilities, we systematically evaluate packet dropping within different use cases. The evaluations were made for the following two 1080i multirate packet dropping scenarios with

- external mux
- internal mux

For the 1080i scenario, two partners, OPT and TVN.

6.3 Item for specifying the use cases for live tests

- ADSL link alignment (total available bitrate)
  - Weight of the protocols' stack overheads:

PROTOCOLS	PACKET LENGHT	OVERHEAD	OVERHEAD %
TS	1316		
UDP	1324	8	0,6
IP	1344	20	1,6
ETH	1358	14	1,1
RFC1483 LLC	1368	10	0,8
AAL5	1392	24	1,9
ATM	1537	145	11,3

Table 3: ADSL link alignment

- Example of calculation of the overheads
  - Mux_bitrate = video + audio + psi = 15000000 + 384000 +30000 = 15414000 bps
  - Payload of any ip packet = 1316 bytes
  - Total overhead (%) = 16,8 %
    - Physical layer bitrate = mux_bitrate * 1,168 ≅ 18 mbps
    - It means that the ADSL2+ link alignment must be at 18 mbps
- Household environment (number of STB/TV set)
- Audio/video parameters
  - SOTA for HD video is 7 mbps → drop of 33% means 4.7 mbps
  - SOTA for mux is ≤8 mbps (depends on audio, psi tables, subtitles, stuffing, …) → drop of 33% of video means ≤ 5.7 mbps
  - Audio bitrate up to 384 kbps per channel
  - No subtitles
- According to following look up table (LUT) the PDA will switch the bandwidth level (BL):

Look up table for multi-stream AVC				
level	BL (Mbps)	Soccer (MOS)	Action (MOS)	Documentary (MOS)
L	8.00	4.1	4.3	4.2
L1	6.50	4.02	4.14	4.08
L2	4.95	3.98	4.07	4.025

Table 4: LUT

- Patterns of household bandwidth sharing (e.g., how often do users zap, how many TV sets are for how long time used in parallel, etc.)
- User preferences (priorities between content types)

6.4 Use cases for live tests

In this section we try to make clearer the use cases reported in deliverable D1.1. Three use cases are specified; they cover typical households with three different ADSL2+ links as classified in the above described criteria.

The household is supposed to have a number of TV sets such that the available bandwidth is stressed.

The third “use case” is not reported in the Deliverable D1.1 but we consider it could add value to the project. For instance, currently in Italy IPTV is not offered for ADSL links which align at most at 7Mbps; we consider then this use case for the opportunity of expanding the commercial IPTV.

6.4.1 Content classes

The most important rationale for content class definition was to use genres that viewers could be realistically expected to watch in a typical HD IPTV consumption situation. To support this motivation, Telecom Italia performed own market research and the available popularity ratings were investigated. The results of this survey reflect the sport, film and documentary genre dominance within the available HD channels in Europe. Finally in WP8, we add documentary in order to cover the whole range of most challenging content classes.

Therefore, we selected the following content classes for focused investigation in OptiBand QoE research (WP2):

- Action movie (CC1)
- Soccer (CC2)
- Documentary (CC3)

For these three content classes HD resolution provides the most significant benefit from the point of view of perceived quality. Action movie, soccer and documentary classes with different levels of detail, complexity of structures, and movements.

Figure 24: Snapshots of Soccer (left), Action movie (middle) and documentary sequences.

Note that in the Live Test (WP8) a third content type will be introduced: ‘documentary’.

6.4.2 Use Case

Use Case 0:

- Sequence with constant bitrate at SOTA Level (L)
- No zapping
- This scenario should be tested for the quality rating tests and for all CCs (3 +3)
- ADSL link alignment on the application layer at 15Mbps

Use Case 1:

- The user is connected to the platform through an ADSL2+ line. The ADSL2+ link is supposed to align at 18 Mbps. The available downstream bandwidth at the application layer is then 15 Mbps.
- The considered household has 3 active devices, connected to a single AG.
- The household has 3 TV set: one of them is full HD with a monitor larger than 40”. The other TV sets are a smaller LCD TV set HD ready at 32”
- The household is watching a combination of HD channels. The live test must involve moments when:
    - Only one TV set (that is only one STB) is running. No dropping will be required in this case.
    - Two and three TV sets are running simultaneously. Some dropping is required to get the two HD channels together.
    - All the three TV sets are running simultaneously. Heavy dropping is required to get all the three HD channels together.

- Each encoded content will be composed of:
    - The video elementary stream encoded at 8 Mbps for each channel.
    - The audio elementary stream (audio channel encoded AC3 at 128 Kbps each).
    - No subtitles.
- The HD channels will be sport (preferably soccer) and or movies/documentary. The user profile will state whether sports have priority over movies or vice versa. The requirement about the perceived quality will be higher for the content type which has higher priority (1st TV-set).
- Dropping information from the original stream in the way established by the algorithm doesn’t significantly lower the perceived quality of the played audio and video.
- The Zapping times of the second and third TV sets are selected in order to test all potential transition combination between 3 TV sets and 3 CC.
- The zapping of all three TV sets should be performed according to patterns in Tables 3, 4, 5.

Fast zapping:

- Transitions: 8
- The minimal zapping period was set at 15 second in order to evaluate transition smoothens in case of rapid channel switching at the TV set num. 2 and 3.
- This zapping pattern cause low variance of DSL line payload.
- Two zapping requirements are allowed simultaneously, in order to evaluate system robustness.
- For acceptability tests are valid only the first 2 minutes of the pattern.
- On the 2nd and 3rd TV-set the zapping channel between the content is always the same independently of the channel streaming on the 1st TV-set

Zapping time sec.	15	30	45	60	75	90	105	120
1st TV set	TV set under QoE test for CC1, CC2, CC3							
2nd TV set	CC1	CC1	CC1					
				CC2	CC2	CC2		
							CC3	CC3
3rd TV set	CC1			CC1			CC1	
		CC2			CC2			CC2
			CC3			CC3		

Table 5: FAST zapping pattern for all CCs with active 3 TV sets

Slow zapping:

- Transitions: 2
- The minimal zapping period was set at 60 second in order to evaluate transition smoothens in case of slow channel switching.
- On the 2nd and 3rd TV-set the zapping channel between the content is always the same independently of the channel streaming on the 1st TV-set

Zapping time	15	30	45	60	75	90	105	120
1st TV set	TV set under QoE test for CC1, CC2, CC3							
2nd TV set	CC1	CC1	CC1	CC1	CC1	CC1		
							CC2	CC2
3rd TV set								
	CC2	CC2	CC2					
				CC3	CC3	CC3	CC3	CC3

Table 6: SLOW zapping pattern with 3 active TV sets for all CCs

- This scenario should be tested quality rating tests for all CCs (3)
- This zapping pattern cause low variance of DSL line payload. This lead to limited variance of allocated bandwidth for single TV set.
- No more than one zapping requirement at ones is allowed, in order to avoid network impairments due to multiple zapping requirements.

Zapping time	15	30	45	60	75	90	105	120
1st TV set	TV set under QoE test for CC1, CC2, CC3							
2nd TV set	CC1	CC1	CC1	X	X	X	X	X
				X	X	X	X	X
				X	X	X	X	X
3rd TV set				X	X	X		
	CC2	CC2	CC2	X	X	X		
				X	X	CC3	CC3	CC3

Table 7: SLOW zapping pattern with 1 active TV set under QoE test and connecting and disconnecting 2 TV sets (for all CCs)

- This scenario should be tested quality rating tests for all CCs (3)
- The DSL line payload varies significantly, due to connecting and disconnecting the one or two TV sets. This allows evaluating QoE at all BL.
- No more than one zapping requirement at ones is allowed, in order to avoid network impairments due to multiple zapping requirements.
- On the 2nd and 3rd TV-set the zapping channel between the content is always the same independently of the channel streaming on the 1st TV-set

Use Case 2:

- The user is connected to the platform through an ADSL2+ line. The ADSL2+ link is supposed to align at 12 Mbps. The available downstream bandwidth at the application layer is then 10 Mbps.
- The considered household has 2 active devices, connected to a single AG.
- The household has 2 TV set: one of them is full HD with a monitor larger than 40”. The other TV set are a smaller LCD TV set HD ready at 32”

- The household is watching a combination of HD channels. The live test must involve moments when:
  - Only one TV set (that is only one STB) is running. No dropping will be required in this case.
  - All the two TV sets are running simultaneously. Heavy dropping is required to get all the two HD channels together.

- Each encoded content will be composed of:
  - The video elementary stream encoded at 8 Mbps for each channel.
  - The audio elementary stream (audio channel encoded AC3 at 128 Kbps each).
  - No subtitles.

- The HD channels will be sport (preferably soccer) and or movies/documentary. The user profile will state whether sports have priority over movies or vice versa. The requirement about the perceived quality will be higher for the content type which has higher priority.
- Dropping information from the original stream in the way established by the algorithm doesn't significantly lower the perceived quality of the played audio and video.
- The Zapping times of the second TV sets are selected in order to test all potential transition combination between two TV sets.
- The zapping of the TV set should be performed according to the patterns in Tables 6, 7, 8.

Fast zapping:

- Transitions: 8
- The minimal zapping period was set at 15 second in order to evaluate transition smoothens in case of rapid channel switching
- This zapping pattern provide constant payload of DSL line.

Zapping time	15	30	45	60	75	90	105	120
1st TV set	TV set under QoE test for CC1, CC2, CC3							
2nd TV set	CC1			CC1			CC1	
		CC2			CC2			CC2
			CC3			CC3		

Table 8: FAST zapping scenario for all CCs with active 2 TV sets

- This zapping pattern low variance of DSL line payload. This lead to limited variance of allocated bandwidth for single TV set.

Slow zapping:

- Transitions: 2
- The minimal zapping period was set at 15 second in order to evaluate transition smoothens in case of slow channel switching

Zapping time	15	30	45	60	75	90	105	120
1st TV set	TV set under QoE test for CC1, CC2, CC3							
2nd TV set	CC1	CC1	CC1					
				CC2	CC2	CC2		
							CC3	CC3

Table 9: SLOW zapping pattern with 1 active TV set under QoE test and 1 TV sets

- This scenario should be tested quality rating tests for all CCs (3)
- This zapping pattern cause low variance of DSL line payload. This lead to limited variance of allocated bandwidth for single TV set.

Zapping time	15	30	45	60	75	90	105	120
1st TV set	TV set under QoE test for CC1, CC2, CC3							
2nd TV set	CC1	CC1	CC1	X	X	X		
				X	X	X		
				X	X	CC3	CC3	CC3

Table 10: SLOW zapping pattern with 1 active TV set under QoE test and connecting and disconnecting 1 TV sets (for all CCs)

- This scenario should be tested quality rating tests for all CCs (3)
- The DSL line payload varies significantly, due to connecting and disconnecting TV set. This allows evaluating smoothness of transitions in whole scale of dedicated BL.

Use Case 3:

- The user is connected to the platform through an ADSL2+ line. The ADSL2+ link is supposed to align at 7 Mbps. The available downstream bandwidth at the application layer is then 6 Mbps.
- The considered household has 1 active device, connected to a single AG.
- The household has 1 TV set: it is a full HD set with a monitor larger than 40”.
- The household is watching an HD channel. Some dropping is required to get that channel.
- The encoded content will be composed of:
  - The video elementary stream encoded at 8 Mbps for each channel.
  - The audio elementary stream (audio channel encoded AC3 at 128 Kbps each).
  - No subtitles.
- The HD channel will be sport (preferably soccer) and movies. The user profile will state whether sports have priority over movies or vice versa. The requirement about the perceived quality will be higher for the content type which has higher priority.
- Dropping information from the original stream in the way established by the algorithm doesn’t significantly lower the perceived quality of the played audio and video
- This scenario should be tested separately for acceptability tests and quality rating tests for all CCs (3 +3)

6.4.3 How the Use Case Tests will be prepared?

- The live encoders will be running in parallel during the tests.
- Use ADSL lines, DSLAM and PDD.
- Define in advance a model for packet dropping approach.
- 9 tests are required (3 contents x 3 use cases).

SOTA for HD video 8Mbps --- SOTA-16% --- SOTA-33%Mbps • **Soccer & Action & Documentary** • **SOTA video 8Mbps - SOTA-xx%=6.5Mbps - SOTA-xx%=4.95Mbps**						
Physical Layer Bitrate	**Application Layer Bitrate**	**N. STB**	**STB1**	**STB2**	**STB3**	**STB**
18Mbps	15Mbps	3	8Mbps 8Mbps 4.95Mbps	--- Mbps6.5 Mbps4.95	--- --- Mbps4.95	1 2 3
12Mbps	10Mbps	2	8Mbps 4.95Mbps	--- 4.95Mbps		1 2
8Mbps	7Mbps	1	6.5Mbps	---	---	1

Table 11: ADSL lines settings and Used STB

6.5 Live Tests Methodology

6.5.1 Quality rating test

- Sample size: 18 participants (one test round)
- Quality rating tests will be performed according to ITU-R Recommendation BT.500
- MOS scale: 1 to 5 (5 grades)
- Acceptability: simple binary answer [yes/no]
- The target is to check that packet dropping up to 33% keeps an acceptable QoE
- Content:
    - 3 popular content classes (soccer, action movie and documentary, in consistence with the contents used in WP2)
        - 1080i:
            - TVN: documentary
            - OPTEC: Action and soccer
- Content / tests will be audio-visual.
- Use cases:
    - Use case 0: Sequence with constant bitrate at SOTA bandwidth (8 mbps)
    - Use cases 1 and 2: Video sequences with changing operation points according to real-world household bandwidth sharing patterns
        - 2 patterns for slow zapping (one of the slow zapping uses disconnecting scenario)
        - 1 pattern for fast zapping
    - Use case 3: Sequence with constant bitrate. The ADSL2+ link is supposed to align at 7 Mbps.
- Sequence length: 2 minutes
- Tracking of test conduction, data gathering
    - Test conduction needs to be filmed
        - Video recording of test subject
    - Reliable Wireshark log files are necessary should be obtained.
    - Wireshark log files data analysis can be done in collaboration between FTW and TiS

6.6 Test duration overview

Quality rating test	Use Case 0	Fast zapping (Use Case 1 & 2)	Slow Zapping #1 (Use Case 1 & 2)	Slow Zapping #2 (Use Case 1 & 2)	Use Case 3
OPT	2 (CC1 + CC2)	4 (CC1 + CC2)	4 (CC1 + CC2)	4 (CC1 + CC2)	2 (CC1 - + CC2)
TVN	1 (CC3)	2 (CC3)	2 (CC3)	2 (CC3)	1 (CC3)
Total Tests	3	6	6	6	3

Table 12: Quality rating test overview

Number of quality rating test: 24

Estimated resources for 30 participants

Questionnaire: MOS scale: 1 to 5 (5 grades) --- Acceptability: simple binary answer [yes/no]

6.7 Phase 1

The goal of this phase is to evaluate the QoE that users see when the bandwidth assigned for channels remains constant the whole time, either being able to provide the 8 Mbps for the SOTA or a lower available bandwidth for Case 0 and case 3 respectively. This section describes the subjective tests planned to be executed at Telecom Italia Lab about **Use Case 0** and **Use Case 3.** The final target of these tests is to evaluate video quality, subjectively perceived.

This task is planned under Quality of Experience (QoE) modelling activity led by OptiBand Project.

6.7.1 Use Case 0

Content Classes	Use Case 0 SOTA Level
Action Movie (CC1)	CC1
Soccer (CC2)	CC2
Documentary (CC3)	CC3

Table 13: Use Case 0 --- Content Classes Definition

6.7.2 Use Case 3

Content Classes	Use Case 3 (ADSL 7M)
Action Movie (CC1)	CC1
Soccer (CC2)	CC2
Documentary (CC3)	CC3

Table 14: Use Case 3 --- Content Classes Definition

User 1	User 2	User 3	User 4	User 5	User 6	User 7	User 8	User 9
Uc3: 7mb	Uc3: 7mb	Uc3: 7mb	Uc0: 15mb	Uc0: 15mb	Uc0: 15mb	Uc3: 7mb	Uc3: 7mb	Uc3: 7mb
1) Action	1) Soccer	1) Docum.	1) Action	1) Soccer	1) Soccer	1) Action	1) Soccer	1) Docum.
2) Soccer	2) Docum.	2) Action	2) Soccer	2) Docum.	2) Docum.	2) Soccer	2) Docum.	2) Action
3) Docum.	3) Action	3) Soccer	3) Docum.	3) Action	3) Action	3) Docum.	3) Action	3) Soccer
Uc0: 15mb	Uc0: 15mb	Uc0: 15mb	Uc3: 7mb	Uc3: 7mb	Uc3: 7mb	Uc0: 15mb	Uc0: 15mb	Uc0: 15mb
4) Action	4) Soccer	4) Docum.	4) Action	4) Soccer	4) Docum.	4) Action	4) Soccer	4) Docum.
5) Soccer	5) Docum.	5) Action	5) Soccer	5) Docum.	5) Action	5) Soccer	5) Docum.	5) Action
5) Docum.	6) Action	6) Soccer	5) Docum.	6) Action	6) Soccer	5) Docum.	6) Action	6) Soccer
User 10	User 11	User 12	User 13	User 14	User 15	User 16	User 17	User 18
Uc0: 15mb	Uc0: 15mb	Uc0: 15mb	Uc3: 7mb	Uc3: 7mb	Uc3: 7mb	Uc0: 15mb	Uc0: 15mb	Uc0: 15mb
1) Action	1) Soccer	1) Soccer	1) Action	1) Soccer	1) Docum.	1) Action	1) Soccer	1) Soccer
2) Soccer	2) Docum.	2) Docum.	2) Soccer	2) Docum.	2) Action	2) Soccer	2) Docum.	2) Docum.
3) Docum.	3) Action	3) Action	3) Docum.	3) Action	3) Soccer	3) Docum.	3) Action	3) Action
Uc3: 7mb	Uc3: 7mb	Uc3: 7mb	Uc0: 15mb	Uc0: 15mb	Uc0: 15mb	Uc3: 7mb	Uc3: 7mb	Uc3: 7mb
4) Action	4) Soccer	4) Docum.	4) Action	4) Soccer	4) Docum.	4) Action	4) Soccer	4) Docum.
5) Soccer	5) Docum.	5) Action	5) Soccer	5) Docum.	5) Action	5) Soccer	5) Docum.	5) Action
5) Docum.	6) Action	6) Soccer	5) Docum.	6) Action	6) Soccer	5) Docum.	6) Action	6) Soccer

Table 15: Phase1, Use Case0 and Use case3 - USERs view order definition

Test duration for each user 1.30 min. – we do not expect the random order but we respect the policy of changing the toggling of vision

User:

Sq1= CC1 (Action Movie) + CC2 (Soccer) + CC3+ (Documentary) → **Tot. 3 CCs x 1.3 min. = 4.5 min.**

User1: Use Case 0 + Use Case 3 → TOT. 2 x 4.5 = 9 min.

Phase1: Use Case 0 & 3

Users to be involved in the testing 18

In the use cases 0 & 3 we have decided to adopt the within-subjects method. In this experimental design all participants are exposed to every condition.

To maintain an high interest, we propose to provide movies with a duration of 1,5 minutes.

In our experience 1,5 minutes is enough to give to evaluate the overall quality.

6.8 Phase 2

The goal of this phase is to evaluate the QoE that users see when the bandwidth assigned for channels varies with the time due to different switching patterns of the users, for a low zapping scenario and a fast zapping scenario, Case 1 and case 2 respectively. The document describes the subjective tests planned to be executed at Telecom Italia Lab about **Use Case 1** and **Use Case 2.**
The final target of these tests is to evaluate:

1) video quality, subjectively perceived

2) acceptability quality, subjectively perceived

This task is planned under Quality of Experience (QoE) modelling activity led by OptiBand Project.

6.8.1 Use Case 1

- The user is connected to the platform through an ADSL2+ line. The ADSL2+ link is supposed to align at 18 Mbps. The available downstream bandwidth at the application layer is then 15 Mbps.
- The considered household has 3 active devices, connected to a single AG.

6.8.2 Use Case 2

- The user is connected to the platform through an ADSL2+ line. The ADSL2+ link is supposed to align at 12 Mbps. The available downstream bandwidth at the application layer is then 10 Mbps.
- The considered household has 2 active devices, connected to a single AG.

Quality rating test	Fast Zapping (Use Case 1 & 2)	Slow Zapping #1 (Use Case 1 & 2)	Slow Zapping #2 (Use Case 1 & 2)
OPT	4 (CC1 + CC2)	4 (CC1 + CC2)	4 (CC1 + CC2)
TVN	2 (CC3)	2 (CC3)	2 (CC3)
Total Tests	6	6	6

Table 16: Quality rating test overview --- Use Case 1 & 2

Content Classes	Use Case 1 & 2
Action Movie (CC1)	UC1 – UC2
Soccer (CC2)	UC1 – UC2
Documentary (CC3)	UC1 – UC2

Table 17: Use Case 1 & 2 --- Content Classes Definition

User1	User2	User3	User4	User5	User6	User7	User8	User9
Uc1 3 STB 15 mb	Uc1 3 STB 15 mb	Uc1 3 STB 15 mb	Uc2 2 STB 12 mb	Uc2 2 STB 12 mb	Uc2 2 STB 12 mb	Uc1 3 STB 15 mb	Uc1 3 STB 15 mb	Uc1 3 STB 15 mb
Video Action	Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum
Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Slow Zapping1	Slow Zapping2	Fast Zapping
Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping2	Fast Zapping	Slow Zapping1
Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Fast Zapping	Slow Zapping1	Slow Zapping2
Uc2 2 STB 12 Mb	Uc2 2 STB 12 Mb	Uc2 2 STB 12 Mb	Uc1 3 STB 15 Mb	Uc1 3 STB 15 Mb	Uc1 3 STB 15 Mb	Uc2 2 STB 12 Mb	Uc2 2 STB 12 Mb	Uc2 2 STB 12 Mb
Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum	Video Action
Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Slow Zapping1	Slow Zapping2	Fast Zapping
Slow Zapping1	Slow Zapping2	Fast Zap ping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping2	Fast Zapping	Slow Zapping1
Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Fast Zapping	Slow Zapping1	Slow Zapping2
Video Action	Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum
Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Slow Zapping1	Slow Zapping2	Fast Zapping
Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping2	Fast Zapping	Slow Zapping1
Slow Zapping2	Fast Zapping2	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Fast Zapping	Slow Zapping1	Slow Zapping2
Uc1 3 STB 15 Mb	Uc1 3 STB 15 Mb	Uc1 3 STB 15 Mb	Uc2 2 STB 12 Mb	Uc2 2 STB 12 Mb	Uc2 2 STB 12 Mb	Uc1 3 STB 15 Mb	Uc1 3 STB 15 Mb	Uc1 3 STB 15 Mb
Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum	Video Action
Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Slow Zapping1	Slow Zapping2	Fast Zapping
Slow Zapping1	Slow Zapping2	Fast Zap ping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping2	Fast Zapping	Slow Zapping1
Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Fast Zapping	Slow Zapping1	Slow Zapping2

Table 18: Phase2, Use Case1 and Use case2 - USERs view order definition 1/2

User10	User11	User12	User13	User14	User15	User16	User17	User18
Uc2 2 STB 12 mb	Uc2 2 STB 12 Mb	Uc2 2 STB 12 Mb	Uc1 3 STB 15 mb	Uc1 3 STB 15 mb	Uc1 3 STB 15 mb	Uc2 2 STB 12 mb	Uc2 2 STB 12 Mb	Uc2 2 STB 12 Mb
Video Action	Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum
Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1
Slow Zapping2	Fast Zapping	Slow Zapping1	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2
Fast Zapping	Slow Zapping1	Slow Zapping2	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping
Uc1 3 STB 15 Mb	Uc1 3 STB 15 Mb	Uc1 3 STB 15 Mb	Uc2 2 STB 12 Mb	Uc2 2 STB 12 Mb	Uc2 2 STB 12 Mb	Uc1 3 STB 15 Mb	Uc1 3 STB 15 Mb	Uc1 3 STB 15 Mb
Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum	Video Action
Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1
Slow Zapping2	Fast Zapping	Slow Zapping1	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2
Fast Zapping	Slow Zapping1	Slow Zapping2	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping
Video Action	Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum
Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1
Slow Zapping2	Fast Zapping	Slow Zapping1	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2
Fast Zapping	Slow Zapping1	Slow Zapping2	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping
Uc2 2 STB 12 Mb	Uc2 2 STB 12 Mb	Uc2 2 STB 12 Mb	Uc1 3 STB 15 Mb	Uc1 3 STB 15 Mb	Uc1 3 STB 15 Mb	Uc2 2 STB 12 Mb	Uc2 2 STB 12 Mb	Uc2 2 STB 12 Mb
Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum	Video Action	Video Soccer	Video Docum	Video Action
Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1
Slow Zapping2	Fast Zapping	Slow Zapping1	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2
Fast Zapping	Slow Zapping1	Slow Zapping2	Slow Zapping1	Slow Zapping2	Fast Zapping	Slow Zapping1	Slow Zapping2	Fast Zapping

Table 19: Phase2, Use Case1 and Use case2 - USERs view order definition 2/2

User:

Sq1= CC1 (Action Movie) + CC2 (Soccer) + CC3+ (Documentary) → Tot. 6min.

Use Case 1 Fast Zapping → TOT. 3 x 2min.=6 min.
Slow Zapping 1 → TOT. 3 x 2min.=6 min.
Slow Zapping 2 → TOT. 3 x 2min.=6 min.

Use Case 1 → TOTAL TIME: 6 x 3 = 18 min.
Use Case 2 → TOTAL TIME: 6 x 3 = 18 min.

Phase2: Use Case 1 & 2

Users to be involved in the testing 30

For the use cases 1 & 2 we have decide to apply the between-subjects method. The combination of the variables: movie content, use case and different levels of zapping produce a very high number of combinations.

We divide the sample in three different groups: the first evaluate the cc1 + cc2, the second cc2+cc3 and the third cc1+cc3.

In this experimental design each user test and evaluate twelve different combinations (maximum number of combination to provide during a single test)

According to the combinations number we decide to have movie 2 minutes long

6.9 Total Time

6.9.1 Users:

Use Case 0 →TOTAL TIME 3 x 1.3min. = 4.5 min.

Use Case 1 → TOTAL TIME: 6 x 3min. = 18 min.

Use Case 2 → TOTAL TIME: 6 x 3min. = 18 min.

Use Case 3 → TOTAL TIME 3 x 1.3 = 4.5 min.

TOTAL TIME for USER = (Time Test) 45 min. + (Questionnaires Time) 20min.

N. of users involved in the Live Tests. 30

Needed time for recruiting users: 5gg five days

6.10 Timetable for each of the live test steps

- Duration = 6 months (January 2012 – July 2012)
- T8.1 Preparation of the Live Test Plan (M25 – M27): in progress; some delay due the heavy involvement in supporting the integration; probably non closed at the end of march
- T8.2 Live Test Execution (M27 – M30): planned to be carried out in June/July with the following details
- Other activities:
  - Setup of the room where the tests will be done
  - Selection of involved people: 2 weeks
  - Actual run of the tests for live 1~3 week

7. Responsibility and allocation of work for each partner

Work package number	8	**Start date or starting event:**					M25
Work package title	**Live Test**						
Activity type	DEM						
Participant number	3	4	5	6	7	8	11	12
Participant short name	**TIS**	TVN	IRD	INTEROUD	FTW	HHI	UDC	CSL
Person-months per participant	12	1.5	6	2	6	4	3	9
	TOTAL PERSON-MONTHS: 43,5							

Table 20: Work Package 8 List of the Participant Partners and Person-Months per Participant

The above table shows the time allocation that the partners have in this wok package. The roles of each partners is described below:

- TIS, WP8 Leader and responsible for overall test execution; supervised the execution of the live tests on the test-bed provided by WP7
- TVN, contributes with encoding technology; this part was developed, integrated and tested in WP7 and used for live tests
- IRD, contributes with encryption technology; this part was developed, integrated and tested, but not included in the live tests
- INTEROUD and UDC, contribute with STB management software for automating the tests and communicating with the PDD
- FTW, contributes to the test suite definition
- HHI, contributes with VoD technology; this part was developed, integrated and tested in WP7, but not included in the live tests
- CSL, contributed with PDD technology; this part was developed, integrated and tested in WP7 and used for live tests. During Live Test preparation some troubles were indicated with the video performance, which were not indicated at the integration phase. Code changes were required at the PDD and onsite support was performed.