OptiBand

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Project title: Optimisation of Bandwidth for IPTV video streaming

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Deliverable Title: Final Plan for the Use and Dissemination of Foreground

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Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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1. Executive Summary

During the past 2,5 years the OptiBand project has been focusing on optimising the used bandwidth of IPTV for the delivery of multiple HD streams over a single ADSL line, while preserving the Quality of Experience (QoE) for the end user. By doing so, OptiBand has made possible viewing of multiple HD channels per household.

OptiBand results have a wide market opportunity and hence carry a substantial exploitation impact to the project partners, thanks to the huge penetration and massive deployment of xDSL as the most popular access technology.

The OptiBand consortium is made of a leading operator, industrial vendors and research entities. Jointly the consortium partners cover the entire IPTV network, and touch on the various technological, operational and business aspects of delivering premium video content over existing installed infrastructure.

The partners' exploitation plans to be carried out over the next five to ten years, following the end of the OptiBand project, are quite robust, as expected in a project which is as much driven by the industrial partners as by the research and educational partners.

This document (deliverable D9.3) is the project's final plan for the use and dissemination of foreground, which additionally lists the dissemination report, and as such it provides a comprehensive summary of the partners' exploitation plans. It further describes the different tools and methods planned for exploitation during the next 5 - 10 years.

A complementary deliverable, D9.2.3 Final plan for the use and dissemination of foreground, separately lists the partners' accomplishments related to dissemination and standardisation activities. It provides an overview of the project's scientific publications and presentations, trade articles, trade event exposure activities, FP7 ICT cluster activities and concertation meetings, as well as its standardisation initiatives.

Industrial partners:

No.	Name	Short Name	Country
1	ORCKIT COMMINICATIONS LTD.	OCL	Israel
3	TELECOM ITALIA S.p.A	TIS	Italy
5	IRDETO B.V.	IRD	Netherlands
12	CORRIGENT SYSTEMS LTD.	CSL	Israel
13	ARTTIC ISRAEL INTERNATIONAL MANAGEMENT SERVICES 2009 LTD	AIL	Israel
14	OPTIBASE TECHNOLOGIES LTD.	OPTEC	Israel
15	THOMSON VIDEO NETWORKS SAS	TVN	France
16	INTEROUD INNOVATION S.L.	INTEROUD	Spain

Research / Academic partners:

No.	Name	Short Name	Country
7	FTW FORSCHUNGSZENTRUM TELEKUMMUNIKATION WIEN GMBH	FTW	Austria
8	FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V	HHI	Germany
9	TEKNOLOGIAN TUTKIMUSKESKUS VTT	VTT	Finland
11	UNIVERSIDADE DA CORUNA	UDC	Spain

2. OptiBand Use and Dissemination of Foreground

This section describes the dissemination measures carried out within this project, and the plan for use and exploitation of the foreground. It is, where appropriate, an update of the initial plan for use and dissemination of foreground, and is consistent with the D9.4 report on societal implications on the use and dissemination of foreground. **Its content may be made available in the public domain** thus demonstrating the added-value and positive impact of the project on the EU.

2.1 Section A (public)

This section presents the scientific dissemination, and the wide spectrum of non-scientific dissemination, carried out by the project partners. Table 2-1 (Table A1) lists the scientific publications relating to foreground, peer-reviewed and published (or in process) from the beginning until after the end of the project.

Table 2-1 A1: List of Scientific (Peer-Reviewed) Publications

Table A1: List of Scientific (Peer-Reviewed) Publications (By order of acceptance)										
#	**Title**	**Main author**	**Title of the periodical or the series**	**Number, date or frequency**	**Publisher**	**Place of publication**	**Year of publication**	**Pages**	**Permanent identifiers[1] (if available)**	**Is/Will open access[2] provided to this publication?**
1	A QoE Evaluation Methodology for HD Video Streaming using Social Networking	B. Gardlo, M. Ries, M. Rupp, R. Jarina (FTW)	ISM2011, in Proc. of 2011 IEEE International Symposium of Multimedia	Annual	IEEE	Dana Point, California	2011	222	**Print ISBN:** 978-1-4577-2015-4; **INSPEC Accession Number:** 12460750; **Digital Object Identifier:** 10.1109/ISM.2011.43	Yes, on OptiBand website

[1] *A permanent identifier should be a persistent link to the published version full text if open access or abstract if article is pay per view) or to the final manuscript accepted for publication (link to article in repository).*

[2] *Open Access is defined as free of charge access for anyone via Internet. Please answer "yes" if the open access to the publication is already established and also if the embargo period for open access is not yet over but you intend to establish open access afterwards.*

Table A1: List of Scientific (Peer-Reviewed) Publications (By order of acceptance)

#	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year of publication	Pages	Permanent identifiers[1] (if available)	Is/Will open access[2] provided to this publication?
2	SOS: The MOS is not enough!	Tobias Hoßfeld, Raimund Schatz, Sebastian Egger (FTW)	Proc. QoMEX 2011: International Workshop on Quality of Multimedia Experience	7-9 September 2011	IEEE	Mechelen, Belgium	2011	131-136	**Print ISBN:** 978-1-4577-1333-0; **INSPEC Accession Number:** 12345973; **Digital Object Identifier:** 10.1109/QoMEX.2011.6065690	Yes, on OptiBand website
3	User-centred Quality Assessment of HD IPTV Services: Results from the FP7 Project OptiBand	Fröhlich, P., Schatz, R. (FTW)	Proceedings of EuroView 2011, Joint ITG and Euro-NF workshop on "Visions of Future Generation Networks"	Annual	Univ. of Würzburg	Würzburg	2011	TBD	N/A	Yes, on OptiBand website
4	QoE Evaluation of High-Definition IPTV Services	Ries, M., Fröhlich, P., Schatz, R. (2011) (FTW)	Proceedings of IEEE Radioelektronika 2011 21st International Conference	Annual	IEEE	Brno, Czech Republic	2012	Not available yet	**Print ISBN:** 978-1-61284-325-4; **INSPEC Accession Number:** 12086525; **Digital Object Identifier:** 10.1109/RADIOELEK.2011.5936485	Yes, on OptiBand website
5	Session-based Watermarking in Live IPTV Environment	Dmitri Jarnikov, Egbert Westerveld, Jeroen Doumen (IRD)	IEEE International Conference on Consumer Electronics (ICCE) 2012	Annual	IEEE	Las Vegas, NV	2011	650	**ISSN:** 2158-3994; **Print ISBN:** 978-1-4577-0230-3; **INSPEC Accession Number:** 12589395; **Digital Object Identifier:** 10.1109/ICCE.2012.6162014	Yes, on OptiBand website

Table A1: List of Scientific (Peer-Reviewed) Publications (By order of acceptance)

#	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year of publication	Pages	Permanent identifiers[1] (if available)	Is/Will open access[2] provided to this publication?
6	DASH-based Approach for Delivery of Automatic Video Summaries	Janne Vehkaperä, Onni Ojutkangas, Mikko Myllyniemi, Seppo Tomperi (VTT)	Proceedings of IWSSIP 2012 conference, April 2012	April 11-13, 2012	IEEE	Vienna Austria	2012	322-325		Yes, on OptiBand website
7	Impact of screening technique on crowdsourcing QoE assessments	Gardlo, B., Ries, M., Hoßfeld, T. (2012) (FTW)	Proceedings of IEEE Radioelektronika 2012 22nd International Conference	April 17, 2012	IEEE	Brno, Czech Republic	2012	Not available yet	**Print ISBN:** 978-80-214-4468-3; **INSPEC Accession Number:** 12770537	Yes, on OptiBand website
8	Microworkers vs. Facebook: The Impact of Crowdsourcing Platform Choice on Experimental Results.	Bruno Gardlo, Michal Ries, Tobias Hoßfeld, Raimund Schatz (FTW)	Proc. QoMEX 2012: International Workshop on Quality of Multimedia Experience	Annual	IEEE	Australia	2012	Not available yet	Not available yet	Yes, on OptiBand website
9	QoE in 10 seconds: are short video clip lengths sufficient for Quality of Experience assessment?	Fröhlich, P., Egger, S., Schatz, R., Mühlegger, M., Masuch, K., Gardlo, B. (FTW)	Proc. QoMEX 2012: International Workshop on Quality of Multimedia Experience	Annual	IEEE	Australia	2012	Not available yet	Not available yet	Yes, on OptiBand website
10	Investigating the Effects of Test Clip Quality Distribution in HD Video Quality-of-Experience Studies	Fröhlich, P., Ries, M., Masuch, K., Schatz, R. (FTW)	Proc. QoMEX 2012: International Workshop on Quality of Multimedia Experience	Annual	IEEE	Australia	2012	Not available yet	Not available yet	Yes, on OptiBand website
11	**Under work:** Extending IPTV environment with Internet TV services	IRD	In process	TBD	TBD	TBD	TBD	TBD	TBD	Yes, on OptiBand website

Besides, HHI has submitted a paper on Adaptive HTTP streaming (related to WP6) to the VCIP 2012 conference. The paper is in a blind review status and therefore information about its title, content, etc. cannot be published until a decision on its acceptance will be made.

Additionally, publications related to possible extensions to the HHI work in the OptiBand project are under consideration. In particular work related to SVC to AVC rewriting to make the video stream output of the PDD decodable for all STB types and work on techniques for increasing robustness against losses in IPTV

systems. This work is being performed by HHI, and although publication commitment is not ensured until the outcome of the research is satisfactory, a couple of publications should be expected. Those publications will likely be finished past the end of the OptiBand project.

Table 2-2 (Table A2) lists all non-scientific dissemination activities (publications, conferences, workshops, web sites/applications, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters). Further details are provided in deliverable D9.2.3 Dissemination Report.

Table 2-2 A2: List of Dissemination Activities

Table A2: List of Dissemination Activities								
No.	**Type of activities[3]**	**Main leader**	**Title**	**Date/s**	**Place/s**	**Type of audience[4]**	**Size of audience**	**Countries addressed**
1	Trade publication	CSL	A Way For Telcos To Move Beyond Bandwidth for IPTV	August 2012	Connect-World	Industry	Wide distribution	Worldwide
2	Annual Conference	FTW	QoMEX 2012, 2011, 2010	September 2012, 2011 and 2010	EU	Scientific & Industry	~ 100-120	EU, USA, Japan
3	Annual Conference	FTW	Radioelektronika 2012, 2011	April 2012 and 2011	Czech Republic	Scientific & Industry	~ 30-100	Central EU
4	Conference	VTT	IWSSIP 2012	April 2012	Vienna	Scientific & Industry	~ 20	EU, USA, China, Japan
5	Conference	UDC	NOSSDAV 2011	June 2011	Vancouver	Scientific & Industry	~ 50	Worldwide
6	Workshop	FTW	EuroView 2011	August 2011	Würzburg, Germany	Scientific & Industry	~ 150	EU, USA

[3] *Types of dissemination activities: publications, conferences, workshops, web, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters, Other.*

[4] *Type of public: Scientific Community (higher education, Research), Industry, Civil Society, Policy makers, Medias ('multiple choices' is possible.)*

Table A2: List of Dissemination Activities

No.	Type of activities[3]	Main leader	Title	Date/s	Place/s	Type of audience[4]	Size of audience	Countries addressed
7	Symposium	FTW	IEEE International Symposium on Multimedia 2011, 5-7, Dana Point,	December 2011	California	Scientific & Industry	~ 30	EU, USA, China, Japan
8	Conference	FTW	COST 2011 TMA	January 2011	Zagreb	Scientific & Industry	~ 30	EU
9	Workshop	HHI	Cisco Adaptive Media Transport Workshop	June 2012	San Jose, California	Industry	~ 50	Worldwide
10	Conference	HHI	INFOCOMM 2012	June 2012	Las Vegas	Industry	~ 200	Worldwide
11	Annual Trade Show & Convention	Various	IBC 2012, 2011 and 2010	September 2012, 2011 and 2010	Amsterdam	Industry	Hundreds	Worldwide
12	Annual Trade Show & Convention	CSL	NAB 2012, 2011 and 2010	April 2012, 2011 and 2010	Las Vegas	Industry	Hundreds	Worldwide
13	Annual Trade Show & Convention	HHI	GSMA 2011	February 2011	Barcelona	Industry	Hundreds	Worldwide
14	Conference	VTT	3rd European Summit on the Future Internet	May-June 2012	Espoo, Finland	Scientific & Industry	200	EU, USA, China, Japan
15	Conference	FTW	Future Network & Mobile Summit 2011	June 2011	Warsaw	Scientific & Industry	~ 50	EU, USA, China, Japan
16	Conference	FTW	Future Internet Assembly (FIA)	May 2011	Budapest	Scientific & Industry	~ 50	EU, USA, China, Japan
17	Annual Conference	Various	NEM Summit 2012 and 2011	Sept. 2011 & Oct. 2010	EU	Scientific & Industry	300	EU and associated
18	Workshop	FTW	ICT 2011 proposers' day	May 2011	Budapest	Scientific & Industry	~ 50	EU and associated

Table A2: List of Dissemination Activities

No.	Type of activities[3]	Main leader	Title	Date/s	Place/s	Type of audience[4]	Size of audience	Countries addressed
20	Meetings	CSL	DG INFSO Cluster and Concertation Meetings	2010 to 2012	EU	Scientific & Industry	~ 20 each	EU and associated
21	Poster	AIL	OptiBand project poster	2010, 2011	Worldwide	Scientific & Industry	A wide distribution electronically; 5 copies printed.	Worldwide
22	Leaflet	AIL	OptiBand project leaflet	2010, 2011	Worldwide	Scientific & Industry	A wide distribution electronically; 600 copies printed.	Worldwide
23	Website	AIL	OptiBand project public website	2010 to 2012	Web	Scientific & Industry	Estimated overall ~ 50K page views, ~ 30K visits and ~100 K hits.	Worldwide

2.1 Section B

This section specifies the exploitable foreground and provides the plans for exploitation. The report marks non-publishable (***confidential***[5]) parts that are expected to be treated as such by the Commission. Information under Section B that is not marked as confidential **may be made available in the public domain,** thus demonstrating the added-value and positive impact of the project on the European Union.

2.1.1 Part B1

The project partners have not generated any applications for patents, trademarks, registered designs, etc.

Table 2-3 B1: List of Applications for Patents, Trademarks, Registered Designs, etc.

B1: List of Applications for Patents, Trademarks, Registered Designs, etc.					
Type of IP Rights[6]:	**Confidential YES/NO**	**Foreseen embargo date dd/mm/yyyy**	**Application reference(s) (e.g. EP123456)**	**Subject or title of application**	**Applicant (s) (as on the application)**
None					

[5] *Not to be confused with the "EU CONFIDENTIAL" classification for some security research projects.*

[6] *The type of IP rights includes: Patents, Trademarks, Registered designs, Utility models, Others.*

2.1.2 Part B2

Table 2-4 B2: List of Exploitable Foreground

Type of Exploitable Foreground[7]	**Description of exploitable foreground**	**Confidential Yes/No**	**Foreseen embargo date dd/mm/yyyy**	**Exploitable product(s) or measure(s)**	**Sector(s) of application**[8] **in *NACE nomenclature***	**Timetable, commercial or any other use**	**Patents or other IPR exploitation (licences)**	**Owner & Other Beneficiary(s) involved**
Commercial exploitation of R&D results	Packet dropping technology	Yes	-	CSL Packet Transport / Carrier Ethernet network solution	J60.2 - Television programming and broadcasting activities; J61 - Telecommunications	2013-2017	-	CSL
General advancement of knowledge	IPR on novel Internet TV technologies	Yes	-	Internet TV products and applications	J60.2 - Television programming and broadcasting activities; J61 - Telecommunications	2013-2017	-	VTT
General advancement of knowledge; Commercial exploitation of R&D results; Exploitation of R&D results via standards	Adaptive Bitrate (ABR) technologies	No	-	-	J60.2 - Television programming and broadcasting activities; J61 - Telecommunications	2013-2017	-	HHI

[7] *A drop down list allows choosing the type of foreground: General advancement of knowledge, Commercial exploitation of R&D results, Exploitation of R&D results via standards, Exploitation of results through EU policies, Exploitation of results through (social) innovation.*

[8] *A drop down list allows choosing the type sector (NACE nomenclature) : http://ec.europa.eu/competition/mergers/cases/index/nace_all.html*

Type of Exploitable Foreground[7]	**Description of exploitable foreground**	**Confidential Yes/No**	**Foreseen embargo date dd/mm/yyyy**	**Exploitable product(s) or measure(s)**	**Sector(s) of application**[8] **in *NACE nomenclature***	**Timetable, commercial or any other use**	**Patents or other IPR exploitation (licences)**	**Owner & Other Beneficiary(s) involved**
Commercial exploitation of R&D results	Synchronised multi-bitrate video encoding and tagging	No	--	Product enhancements	J60.2 - Television programming and broadcasting activities; J61 - Telecommunications	2013-2017	--	IRD
Exploitation of R&D results via standards; Exploitation of results through EU policies; Exploitation of results through (social) innovation	Video distribution and video streaming optimisation innovations	No	-	Enhanced products, services and policies, related in particular to xDSL, IPTV and OTT video distribution offerings	J60.2 - Television programming and broadcasting activities; J61 - Telecommunications	2013-2017	-	TIS
General advancement of knowledge; Exploitation of R&D results via standards	QoE measurement methodology and tools	No	-	New developments of QoE methodologies and project ideas	J60.2 - Television programming and broadcasting activities; J61 - Telecommunications J63.9 - Other information service activities	2013-2022	-	FTW
Commercial exploitation of R&D results	Synchronised multi-bitrate multi-channel video streaming; Live stream tagging of IDR frames.	No	-	Adaptive streaming solutions for IPTV and Enterprise	J60.2 - Television programming and broadcasting activities J63.9 - Other information service activities	2013-2017	-	OPTEC

Type of Exploitable Foreground[7]	**Description of exploitable foreground**	**Confidential Yes/No**	**Foreseen embargo date dd/mm/yyyy**	**Exploitable product(s) or measure(s)**	**Sector(s) of application**[8] **in *NACE nomenclature***	**Timetable, commercial or any other use**	**Patents or other IPR exploitation (licences)**	**Owner & Other Beneficiary(s) involved**
Commercial exploitation of R&D results	A chunking video module elaborated and optimised to handle multiple synchronised encoded streams; IDR frame tagging mechanism for seamless rate-change.	No	-	VS7000 Video Convergent Systems and Encoders for any type of multi-stream synchronised network, whether managed as IPTV or unmanaged with OTT / Web-TV	J60.2 - Television programming and broadcasting activities; J61 - Telecommunications	2013-2017	No	TVN
Commercial exploitation of R&D results	IPTV/OTT Middleware with QoE APIs for video broadcasting head-ends	Yes	-	VoDKATV IPTV/OTT Middleware	J60.2 - Television programming and broadcasting activities;	IPTV/OTT Middleware with QoE APIs for video broadcasting head-ends	Yes	INTEROUD
General advancement of knowledge	Video streaming optimisation scenarios, possibilities and success factors; Quality of experience in video streaming	No	-	Further related collaborative research projects	J60.2 - Television programming and broadcasting activities; J61 - Telecommunications	2013-2017	-	UDC

3. Commercial Exploitation Value

This Chapter explains the OptiBand technologies' commercial exploitation value, in 2 major sub-markets:

- Operators with existing xDSL infrastructure
- Carriers and service providers (such as enterprise and government) benefitting from adaptive streaming in IPTV and OTT (Over-the-top Internet-TV) services

It also highlights the cost advantages of the OptiBand solution vs. alternative technologies to solve the same problems.

3.1 xDSL

The OptiBand solution enables service providers to increase the number of HD streams over an existing DSL network. This section provides a deep cost analysis with regards to the total cost of embedding OptiBand technology in an existing IPTV network based on ADSL2/2+ technology, to achieve this goal. The analysis takes into account not only the added cost for the PDD at the network side and the encoders at the Head-End side, as well as the impact on network capacity, VOD servers required to support this solution, etc.

3.1.1 Network Modelling for the OptiBand solution

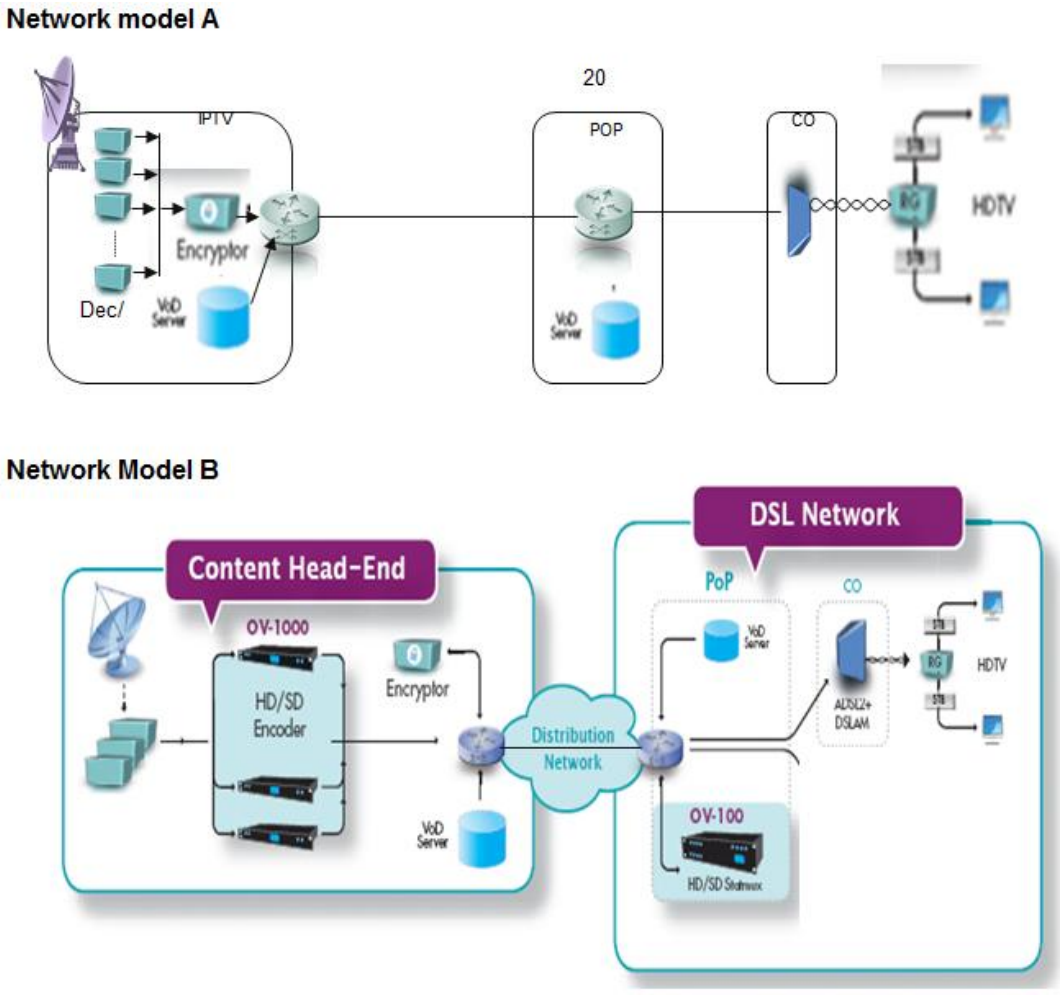

Figure 3-1: Network models

3.1.2 Business case assumptions

Table 3-1 Business Case Assumptions[9]

Content growth trend (2010)	
No. of HD multicast streams	100
No. of SD multicast streams	200
BW per HD stream [Mbps]	7.5
BW per SD stream [Mbps]	2
Encoder redundancy ratio (M/N)	2
Subscribers	
IPTV penetration ratio [%]	20%
Concurrence viewers [%]	50%
IPTV actual concurrence viewers [%]	10%
No. of home-pass per HE	1,000,000
No of IPTV users per HE	100,000
No. of home-pass per POP	50,000
No of IPTV users per HE	5,000
Average No. of users per DSLAM	500
Average No. of IPTV users per DSLAM	50
Average No. of STB per home	2.5
Network architecture	
No. of POPs per HE	20
No of DSLAMs per HE	2,000
No of DSLAMs per POP	100
Average DSL link rate [Mbps]	10
Video BW protection HE->POP (Y=2, N=1)	2
Video BW protection POP->CO (Y=2, N=1)	2
IPTV trends	
Percentage (in average) of TV channels consumed by DSLAM	60%
VoD & TVoD trends (2010)	
Concurrence VoD & TVoD streams [%]	20%
VoD & TVoD streams handled by HE VoD Srv [%]	20%
VoD & TVoD streams handled by POP VoD Srv [%]	80%
VoD & TVoD HD [%]	25%
No. of concurrent streams per VoD & TVoD server	1000
VoD cost per subscriber[USD]	$10
Personalised video statistical multiplexing	
Multiple stream BW consumption factor	2.5
No. of HD/SD streams per PDD	1000
No. of HD streams per Encoder	4
No. SD streams per Encoder	8

[9] *Source: Corrigent Systems Ltd.*

Table 3-2 Cost Assumptions[10]

Network capacity	
Cost of protected Gbps BW in HE->POP network segment [USD]	$5,000
Cost of protected Gbps BW in POP->CO network segment [USD]	$2,500
Equipment cost	
VOD server [USD per IPTV user]	$10
Encoder	$25,000
PDD	$20,000

Table 3-3 Bandwidth Calculations

BW calculations	***Net model A*** [Mbps]	***Net model B*** [Mbps]	***Delta BW***	***Delta Cost***
Multicast HE->POP	1,150	2,875		
Unicast HE->POP	675	1,688		
Total BW HE->POP	**1,825**	**4,563**	**5,475**	**27,375**
Multicast POP->CO	690	0		
Unicast POP->CO	34	500		
Total BW POP->CO	**724**	**500**	**-448**	**-1,119**

3.1.3 Business case results

Table 3-4 OptiBand Solution Added Cost

HE	**Price per Unit**	**Units**	**Total**
Encoder	$25,000	125	$3,125,000
VOD			$400,000
	Cost per user		**$18**
HE->POP	**Price per Unit**	**Units**	**Total**
Network cost			37,500
	Cost per user		**$4**
POP	**Price per Unit**	**Units**	**Total**
VOD	$30,000	4	$120,000
PDD	$20,000	10	$200,000
	Cost per user		**$32**
POP->CO			
Network cost			$1,213
	Cost per user		**$12**
	Total cost per user		**$66**
	PVS total cost per user		**$66**
	FTTH total cost per user		**$1,020**

[10] *Source: Corrigent Systems Ltd.*

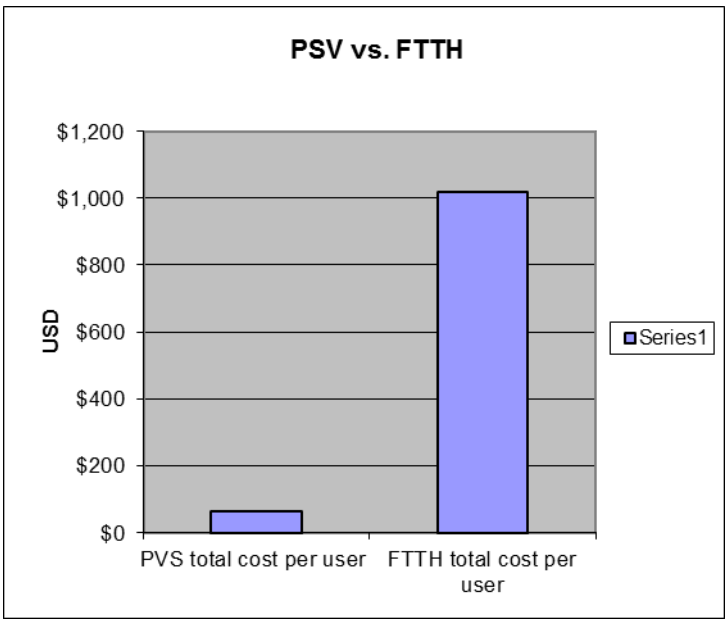

Figure 3-2: Business Case Comparison

3.1.4 Business Case for xDSL OptiBand, in Detail

Table 3-5 Assumptions[11]

No. of HD multicast streams	100
No. of SD multicast streams	200
No. of users per HE	1,000,000
No. of users per POP	50,000
Average No. of users per DSLAM	500
No. of POPs per HE	20
No of DSLAMs per HE	2,000
No of DSLAMs per POP	100
IPTV penetration ratio [%]	20%
Concurrence viewers [%]	100%
Average No. of STB per home	2.5
BW per HD stream [Mbps]	7.5
BW per SD stream [Mbps]	2
Concurrence VoD & TVoD streams [%]	20%
VoD & TVoD streams handled by HE VoD Srv [%]	20%
VoD & TVoD streams handled by POP VoD Srv [%]	80%
VoD & TVoD HD [%]	25%
No. of concurrent streams per VoD & TVoD server	1000
Multiple stream BW consumption factor	2.5
Average DSL link rate [Mbps]	10
Percentage (in average) of TV channels consumed by DSLAM	60%

[11] *Source: Corrigent Systems Ltd.*

VoD cost per subscriber[USD]	10
Streams per PDD	1000
Management cost	10
Encoder redundancy ratio (M/N)	2
Video BW protection HE->POP (Y=2, N=1)	2
Video BW protection POP->CO (Y=2, N=1)	2

Table 3-6 Bandwidth Calculations

BW calculations	***Net model A*** [Mbps]	***Net model B*** [Mbps]	***Delta BW***	***Delta Cost***
Multicast HE->POP	1,150	2,875		
Unicast HE->POP	1,350	3,375		
Total BW HE->POP	**2,500**	**6,250**	**7,500**	**37,500**
Multicast POP->CO	690	0		
Unicast POP->CO	68	1,000		
Total BW POP->CO	**758**	**1,000**	**485**	**1,213**

Table 3-7 Business Case

Cost of protected Gbps BW in HE->POP network segment [USD]	**$5,000**
Cost of protected Gbps BW in POP->CO network segment [USD]	**$2,500**

3.2 IPTV and OTT

As service providers add IPTV and over-the-top (OTT) Internet-TV service alternatives in response to emerging market needs, they will be contented to discover that the OptiBand technologies may be applied (reused) for this type of service migration.

Despite the maturing of the enabling technologies, the deployment of IPTV presents significant technical and financial challenges to those required to successfully provide these services. IPTV represents the convergence of the broadcast and telecommunications worlds.

The mains points for IPTV technical and financial challenges are:

- A need to provide a Set Top box for each end user: An expensive solution;
- A complex service Platform integration;
- A multicast distribution for Live TV with related expensive router infrastructure, Unicast distribution for VoD;
- QoS guaranteed by the telecom operator or enterprise/government service provider, while content protection in the form of forward error-correction (FEC) provided as extra service by the operator.

On the other hand, new OTT technology using Broadband internet with native HTTP protocol also presents numerous technical and financial challenges in order to successfully provide these services.

The mains points for OTT technical and financial challenges are:

- No receiver investment for operator is needed: A light and low cost solution;
- OTT solution relies on existing Broadband infrastructure: A light and low cost solution:
    - Any connected screen can receive video streamed over IP
    - FTTH, ADSL, 3G, 4G, WiFi
- OTT is based on Unicast distribution
    - Same network for DATA and video

The QoS is thus best-effort and depends on available bandwidth with all the known risks on pictures artefacts and prohibitive rebuffering time if no adaptive protocol is implemented.

Content providers are facing an increasing need to deliver content to a rapidly growing number of video capable handheld devices such as Apple's iPad or Google's Android-based systems. Not only do content providers need to provide their content to a large number of different devices but they need to do so with a compelling video experience.

The response of the industry has been so far to build separate distribution systems for IPTV, Internet TV and Mobile 3G networks. Although this approach may appear scalable or flexible, the rapid growth in the number of workflows will soon lead to an unmanageable and costly ecosystem.

Taking a completely different approach, partly based on OptiBand results, the OptiBand IPTV, Internet TV and OTT equipment providers deliver versatile solutions which offer open architectures and enable a simplified workflow as well as the capability to address a large number of delivery formats and easy future service expansion.

The TVN Convergent TV solution, for example, not only simplifies the broadcast distribution architectures by offering scalability, density and upgradability, but also enables smooth workflow evolution, extending the lifespan and removing the need for forklift upgrades. Such solutions are scalable in terms of processing power and therefore future and feature proof.

Furthermore, adding new features such as TV channel branding, mosaic generation, multi-view broadcasting and new codec or streaming formats to reach the latest cool devices becomes a simple operation of seamlessly and automatically rebalancing jobs across such OptiBand-empowered Convergent TV solution.

4. OptiBand Use and Exploitation Plans

This Chapter explains in further detail the exploitable foreground listed in Table 2-4 table, in particular:

- Its purpose
- How the foreground might be exploited, when and by whom
- IPR exploitable measures taken or intended
- Further research necessary, if any
- Potential/expected impact (quantified where possible)

4.1 Commercial

OptiBand partners have in their short to medium term plans a fair amount of activities related to the project's research results and scientific findings. Most of those have been incorporated into partners' business planning; some are discussed jointly by certain partners' executive boards; others are being contemplated and evaluated internally.

Table 4-1 OptiBand Commercial Use and Exploitation Plans

Partner	**Planned Exploitation of Project Results** (Purpose; How the foreground might be exploited; When and by whom; Measures taken or intended; Further research necessary, if any)	**Timetable for Commercial Use**	**Potential/Expected Impact, Market Potential (M €)**
CSL	Promote the use of OptiBand unique packet dropping technology in CSL's Packet Transport / Carrier Ethernet network solution will open new market segment of IPTV aggregation, in which Corrigent plans to increase activity. Most of Corrigent deployments have been so far mainly in Mobile backhauling and Business services. According to market analysts estimates, the residential market segment in general and IPTV in particular are about 20% of the overall market with a yearly estimated market size of $1B and growing.	2013-2017	Aggregate 10 M €
IRD	To extend security product portfolio with solutions that are built using elements developed within the OptiBand project, namely: synchronised multi-bitrate video encoding and tagging.	2013-2017	TBD
	Future product generations	2018-2023	TBD
TIS	Enhanced TIS products, services and policies, related in particular to xDSL, IPTV and OTT video distribution offerings.	2013-2017	TBD
FTW	Potential commercial interest from FTW's industrial partners, such as Telecom Austria and Alcatel Lucent, will be explored.	2013-2022	Growing from 1 to 5 M € yearly total
TVN	Capitalise on the various multi-rate mechanisms developed within OptiBand for the TVN encoders to allow a synchronised multi-stream solution for	2013-2017	Growing from 2 to 10 M € yearly total

Partner	Planned Exploitation of Project Results (Purpose; How the foreground might be exploited; When and by whom; Measures taken or intended; Further research necessary, if any)	Timetable for Commercial Use	Potential/Expected Impact, Market Potential (M €)
	any type of network, whether managed as IPTV or unmanaged with OTT / Web-TV. TVN's exploitable technologies include: • A chunking video module elaborated and optimised to handle multiple synchronised encoded streams. • A special mechanism to tag the IDR frames, developed in order to guarantee seamless switching when changing rates.		
OPTEC	Commercial offering of new-generation synchronised multi-bitrate multi-channel adaptive HD video streaming product lines. The foreground includes technology for multi bitrate multi-channel HD streaming of video. The technology exploits OPTEC background technology for H.264 HD real-time multi-channel video encoding hardware platform at high density (4 channels per board). The foreground is the technology that assures synchronisation of several encoded streams, which can be configured for different bitrates, as well as technology for tagging those streams on IDR boundaries in real-time. Those technology building blocks will be used for adaptive streaming solutions, for streaming video to various end devices, over various networks and under varying conditions. This will be integrated in OPTEC's future video streaming products, implemented on OPTEC's MGW product-line and on other possible future product-lines.	2013-2017	Growing from 2 to10 M € yearly total (potential impact of project results)
UDC	Though not a direct project result, the research is considered as part of the seed ideas for establishing alliances with local companies, and to further continue research in collaboration with the other research partners of the project (VTT, HHI, FTW).	2013-2017	N/A
HHI	Realise advantages of the SVC-based solution in the worldwide IPTV market, through commercial partnerships.	2013-2022	N/A
	Build business partnerships to take advantage of the worldwide market opportunities for HHI's OptiBand IPR building blocks.	2013-2022	N/A
INTEROUD	To include the OptiBand solution as part of its solution portfolio for IPTV markets. To continue research of results application in the OTT field.	2013-2017	Aggregate 1 M €

4.2 Research / Academic

Table 4-2 OptiBand Research / Academic Use and Exploitation Plans

Partner	Planned Use of Project Results	Timetable for Research / Academic Use	Expected Impact
FTW	Increase FTW's reputation as specialist with regard to QoE research; Expand competences in the fields of broadband multimedia and IPTV.	2013-2022	Broadened and deepened know-how portfolio of FTW and its industrial and academic partners.
	Build international research partnerships with the institutions that have been met within the project consortium and through OptiBand-related networking events and meetings.	2013-2017	Experiences gained within the OptiBand project can be applied and further refined.
	Inputs for standardisation, for example in the ITU-T study group 12.	2013-2017	If inputs can be made, more consistent QoE methodology assessments and improvements are possible.
HHI	Further research of the SVC-based solution in the IPTV and OTT Internet-TV domains. The knowledge gained in OptiBand will be used and extended to push SVC-based solutions to allow for an ABR (Adaptive Bitrate) quality of service.	2013-2022	ABR technologies are gaining popularity in recent years and will be very important in the coming years, whether in a managed network as for IPTV (case in point - OptiBand) or in OTT as HTTP streaming.
	Develop new technologies and IPR in Adaptive Bitrate (ABR) Technologies	2013-2017	
	Support the constitution of spin-off companies, and assist with technology transfer between academia and industry in the field	2013-2017	New business opportunities with industry partners will be analysed, and possible spin-off companies will be considered.
VTT	Develop new technologies and IPR of OptiBand's results, to build international research partnerships and to take full advantage of international business opportunities	2013-2022	Patented/licensed IPR and new partnerships and business opportunities for VTT
	The results achieved with the project demonstrator will be utilised in internal multimedia	2013-2015	Technology enhancements to be patented and/or published in scientific conferences/journals

Partner	Planned Use of Project Results	Timetable for Research / Academic Use	Expected Impact
	communication test beds for developing technology that can utilise the enhancements created. Follow on research on Internet TV solutions focusing on adaptive streaming.		
	Support the constitution of spin-off companies, and assist with technology transfer between academia and industry in the field	2013-2020	New business opportunities with industry partners and support for possible new spin-off companies
UDC	Follow-on research in the area of QoE, in which we have already initiated contacts with third-party research bodies through partners of the OptiBand project.	2013-2017	Technology enhancements to be patented and/or published in scientific conferences/journals: Experiences gained within the OptiBand project lead to broadened research lines, increasing the impact of UDC's research group by means of publications in scientific conferences and high impact journals.
	Build international research partnerships	2015-2022	New research opportunities and partnerships, both in academia and with industrial partners, will be pursued.
CSL	Follow-on research	2013-2022	New research opportunities and partnerships
TIS	Follow-on research	2013-2022	New research opportunities and partnerships
OPTEC	Follow-on research in multi-bitrate adaptive streaming technologies and protocols, MPEG-DASH and others	2013-2017	Standards-compliant solution for adaptive video streaming
INTEROUD	Follow-on research in the area of QoE, through partners of the OptiBand project.	2013-2017	Managing multiple sources of QoE information in real time: real time user experience analysis.

5. Exploitation Planning – by Partner

5.1 Industrial Partners

Direct and indirect revenue increases attributable to the OptiBand results, for 2013-2022:

5.1.1 CSL / OCL

CSL's Packet Transport / Carrier Ethernet Solutions Plan

Partner	**CSL**
Time Frame	2013-2017
Planned Exploitation Activity	Integration of OptiBand technology in Corrigent Packet Transport / Carrier Ethernet solutions
Type and Estimated Size of Opportunity for Partner	CSL estimates the aggregate 2013-2017 TAM for Residential aggregation in general with specific focus on IPTV delivery is $1B out of which CSL assume 10M Euro for OptiBand based technology products.
Product Line/s Affected	CM4000
Countries	Worldwide
Expected Commercial Impact	Revenue increase and market share growth attributable to the OptiBand results, for 2013-2017; Joint venture and/or co-marketing/co-sales success with key players in the IPTV distribution industry, is expected to expand the product-line's revenue impact to 10 M €.

5.1.2 TIS

TIS's Video Distribution Products and Services Plan

Partner	**TIS**
Time Frame	2013-2017
Planned Exploitation Activity	Next-generation xDSL, IPTV and OTT video distribution products and services, incorporating OptiBand results
Type and Estimated Size of Opportunity for Partner	TBD
Product Line/s Affected	Products and services for xDSL, IPTV and OTT video distribution offerings
Countries	Worldwide
Expected Commercial Impact	TBD

5.1.3 IRD

IRD's Plan for Extended Security Product Offerings

Partner	**IRD**
Time Frame	2013-2017
Planned Exploitation Activity	Next-generation of security solutions for IPTV and Internet TV product-lines can be built using elements (synchronized multi-bitrate video encoding and tagging) developed within the OptiBand project. The solution will target the market of Internet TV (mainly aiming at adaptive streaming delivery) and IPTV.
Type and Estimated Size of Opportunity for Partner	It is difficult to estimates the aggregate TAM for a specific solution, because a typical security offering includes a large combination of products and services.
Product Line/s Affected	Security Product Offerings
Countries	Worldwide
Expected Commercial Impact	Strengthening the security portfolio of IRD IPTV and Internet TV products.

5.1.4 OPTEC

OPTEC's Next-Generation Video Streaming Products Plan

Partner	**OPTEC**
Time Frame	2013-2017
Planned Exploitation Activity	Next-generation synchronised multi-bitrate multi-channel adaptive HD video streaming products incorporating OptiBand results, with multi-bitrate functionality, targeted for enterprise and IPTV market/s.
Type and Estimated Size of Opportunity for Partner	It is difficult to estimates the aggregate TAM for video streaming as it includes Internet streaming, IPTV, Enterprise streaming and more. Adaptive streaming is a fast growing segment of video streaming in all those sectors.
Product Line/s Affected	Video streaming solution for enterprise and IPTV markets.
Countries	Worldwide
Expected Commercial Impact	OPTEC plans to market adaptive streaming products as of late 2013, and expects to see annual revenues starting at 6 M € in 2013 and growing through the following years. Roughly 10% of those revenues will be attributable to OptiBand results.

5.1.5 TVN

TVN's Multi bit rate Encoding Solutions Plan

Partner	**TVN**
Time Frame	2013-2017
Planned Exploitation Activity	Multi bit rate encoding solutions for any type of video distribution network, including managed IPTV networks and unmanaged OTT and/or Web-TV networks.
Type and Estimated Size of Opportunity for Partner	OTT-video encoding and delivery is an important opportunity for TVN, in order to successfully diversify from its traditional market segments for video broadcast delivery (cable, satellite, terrestrial, etc.). Current market studies on OTT highlight the following: - Strong growth for Multiscreen file + live Head-End market - Roughly estimated to double from 2012 to 2016 to reach to 300M€
Product Line/s Affected	ViBE VS7000
Countries	Worldwide
Expected Commercial Impact	Growing from 2 to 10 M € yearly total

5.1.6 INTEROUD

INTEROUD's IPTV Plan

Partner	**INTEROUD**
Time Frame	2013-2017
Planned Exploitation Activity	By Q1-2013 the IPTV product line will include the project results as a new option for unicast environments with several STB for each household.
Type and Estimated Size of Opportunity for Partner	INTEROUD estimates that this new capabilities will allow them to reach new business opportunities for T2 and T3 Telco companies, which should allow them to grow a 15% in this segment.
Product Line/s Affected	IPTV for Telco solution. Embedded software for media devices
Countries	European, South-American and Middle-East countries
Expected Commercial Impact	Direct impact of 15% growth in the IPTV for Telco segment, and indirect impact in the business development areas for OTT solutions bringing new focus activity for the market.

INTEROUD's Longer-Term Plan

Partner	**INTEROUD**
Time Frame	2018 and Beyond
Planned Exploitation Activity	Closing new distribution agreements with specialized system integrators for each new market
Type and Estimated Size of Opportunity for Partner	N/A
Product Line/s Affected	IPTV/OTT for Telco solution
Countries	Open new markets: North-America and Asia
Expected Commercial Impact	N/A

5.1.7 AIL

As the administrative partner, **AIL** has no exploitation plans per se.

5.2 Research Institute Partners

5.2.1 FTW

FTW's QoE Research Plan

Partner	**FTW**
Time Frame	2013-2017
Planned Exploitation Agenda	Increase FTW's reputation as specialist with regard to QoE research. Expand competences in the fields of broadband multimedia and IPTV. Build international research partnerships with the institutions that have been met within the project consortium and through OptiBand-related networking events and meetings. Inputs for standardisation, such as in the ITU-T study group 12.
Type and Estimated Scope of Opportunity for Partner	Research and Development
Programme/s Affected	FP7 (ICT) and follow-up programmes
Geographic Reach	Worldwide
Expected Exploitation Impacts	Strengthening the know-how portfolio of FTW's academic and industry partners.

FTW's Long-Term Research Plan

Partner	**FTW**
Time Frame	2018 and beyond
Planned Exploitation Agenda	Increase FTW's reputation as specialist with regard to user-centred ICT research. Expand competences to further fields, such as vehicular communications systems and energy-awareness technologies. Build international research partnerships, and continue to contribute inputs for standardisation.
Type and Estimated Scope of Opportunity for Partner	Research and Development
Programme/s Affected	Follow-up programmes of FP7
Geographic Reach	Worldwide
Expected Exploitation Impacts	Strengthening the know-how portfolio of FTW's academic and industry partners.

5.2.2 HHI

HHI's IPTV Research and Contribution to Standardisation Plans

Partner	**HHI**
Time Frame	2013-2017
Planned Exploitation Agenda	Taking into account the knowledge gained during the OptiBand project and considering that DVB plans to develop a new standard for IPTV, HHI is interested in using some of the knowledge acquired and contribute with prevalent inputs to the standardisation process.
Type and Estimated Scope of Opportunity for Partner	Research and contribution to standardisation
Programme/s Affected	Possible future follow-up programmes of FP7 and of other collaboration research frameworks.
Geographic Reach	Worldwide
Expected Exploitation Impacts	New IPR and impact on standards.

HHI's ABR Research and Development Plan

Partner	**HHI**
Time Frame	2013-2017 and beyond
Planned Exploitation Agenda	HHI is planning to continue its research on transport of video in different environments and networks, which need Adaptive Bitrate (ABR) Technology. The knowledge acquired during the project can be used and extended to fit additional scenarios where the resource and available bandwidth is intelligently used to provide HD service of good quality.
Type and Estimated Scope of Opportunity for Partner	Research and Development
Programme/s Affected	Internal and collaboration projects, as well as possible future follow-up programmes of FP7.
Geographic Reach	Worldwide
Expected Exploitation Impacts	New IPR and business opportunities. Furthermore scientific publications related to Internet TV based on ABR technologies are foreseen, which will be strongly correlated with opportunities and support to PhD students to carry out their doctoral works.

5.2.3 VTT

VTT's Technologies and IPR Exploitation Plan

Partner	**VTT**
Time Frame	2013-2017
Planned Exploitation Agenda	VTT will utilize results achieved in the project to develop new technologies and IPR, to build international partnerships and to take full advantage of international business opportunities. The project participation by a research team from the Media Technologies knowledge centre yielded key research topics in multimedia communication to be further pursued by the team. The results developed during the project will increase VTT's IPR property and the most promising results will be considered to be licensed inside or outside the project consortium. Also the results achieved with the project demonstrator will be utilised in internal converging network test beds for developing technology that can utilise the enhancements created in the project. Finally, the results achieved during the project may support the constitution of spin-off companies, and help technological transfer between academy and companies in the field.
Type and Estimated Scope of Opportunity for Partner	New collaboration projects with major players (academic and industry) on the field. Direct contract research projects with select companies focusing on future Internet TV solutions.
Programme/s Affected	Internal and collaboration research projects, business development and contract research projects.
Geographic Reach	Worldwide
Expected Exploitation Impacts	New IPR, business opportunities and revenue. Scientific publications related to multimedia communications and Internet TV.

5.3 Academic Institute Partner

5.3.1 UDC

UDC's Plans in QoE and parallel areas of expertise

Partner	**UDC**
Time Frame	2013-2017
Planned Exploitation Agenda	(a) Disseminate work done within OptiBand to local companies, both as technical content and as experience in partnership at a European project. (b) Follow-on research in the area of QoE, possibly in collaboration with other research partners of the OptiBand projects. (c) Cultivate the international research partnerships that have been established.
Type and Estimated Scope of Opportunity for Partner	Should the scope remain local, UDC estimates that it could generate industrial collaboration with local companies in the proposed time frame, with a budget increase of 60K€. Should opportunities for further research collaboration at an international level appear, UDC participation in another European project would represent an estimated budget assignment of 120K€. In the first case, one PhD student could be supported for a period of two years. In the second case, two PhD students could be supported for a period of two years.
Programme/s Affected	Doctorate programme (research on QoE or related areas, research on parallel areas of expertise).
Geographic Reach	National, European, Worldwide
Expected Exploitation Impacts	Funding of PhD students in the form of salaries, research stays at research partners collaborators facilities, etc.

6. Conclusion

This document provides a comprehensive assessment of the potential business and research exploitation opportunities planned by the OptiBand consortium partners in marketing and sales of products and services based on OptiBand technology and in related further advanced research.

As a project that focused on optimising the used bandwidth of IPTV for the delivery of multiple HD streams over a single ADSL line, while preserving the Quality of Experience (QoE) for the end user, OptiBand now has a wide market potential and a substantial exploitation impact.

The partners' exploitation plans to be carried out over the next five to ten years, following the end of the OptiBand project, are quite robust, as expected in a project which is as much driven by the industrial partners as by the research and educational partners.

