CONFIDENTIAL

IST R&D. FP6-Priority 2.
SPECIFIC TARGETED RESEARCH PROJECT
Project Deliverable

SUIT Doc Number	SUIT_287
Project Number	IST-4-028042
Project Acronym+Title	SUIT- Scalable, Ultra-fast and Interoperable Interactive Television
Deliverable Nature	Report
Deliverable Number	D0.4
Contractual Delivery Date	January 30th, 2007
Actual Delivery Date	March 15th, 2007
Title of Deliverable	D0.4_Project_Interim_Progress_Report PAR- Project Activity Report
Contributing Workpackage	WP0
Project Starting Date; Duration	01/02/2006; 27 months
Dissemination Level	CO
Project Coordinator Name	Antonio Navarro
Project Coordinator Organisation Name	Instituto de Telecomunicações (IT)
Period covered	1st Feb 2006 – 31st Jan 2007
Revision	2

Abstract

This document is the Periodic Activity Report (PAR) which describes the technical progress of the SUIT project over the last year (Feb 2006-Jan 2007). The PAR is submitted for each reporting period as defined by Article 6 of the contract. It is based on relevant information from Annex I of the contract.

Keyword list: Periodic Reporting, Technical Achievements, Deliverables, Milestones, Meetings, Dissemination.

Periodic Activity Report

D0.4_Project_Interim_Progress_Report

SUIT_287

March, 15th 2007

Table of Contents

PUBLISHABLE EXECUTIVE SUMMARY **5**

SUMMARY DESCRIPTION OF PROJECT OBJECTIVES 5
WORK PERFORMED, CONTRACTORS INVOLVED, ACHIEVED RESULTS AND EXPECTED 5

1 PROJECT OBJECTIVES AND MAJOR ACHIEVEMENTS **10**

1.1 OVERVIEW OF GENERAL PROJECT OBJECTIVES 10
1.2 WORK AND ACHIEVEMENTS IN THE CURRENT PROJECT YEAR 11
1.3 CORRECTIVE ACTIONS 13

2 WORKPACKAGE PROGRESS OF THE PERIOD **16**

2.1 WORKPACKAGE OBJECTIVES 16
2.2 PROGRESS TOWARDS OBJECTIVES 20
2.3 DEVIATIONS FROM THE PROJECT WORK PROGRAMME AND CORRECTIVE ACTIONS 50
2.4 DELIVERABLES LIST 52
2.5 MILESTONES LIST 53

CONSORTIUM MANAGEMENT **54**

2.6 CONSORTIUM MANAGEMENT TASKS 54
2.7 CONTRACTORS 55
2.8 PROJECT TIMETABLE AND STATUS 55
2.9 COORDINATION ACTIVITIES DURING THE PERIOD 57
2.9.1Mailing Lists *57*
2.9.2FTP Server *58*
2.9.3Web Structure *58*
2.9.4Meetings *58*
2.9.5Possible Cooperation *59*

APPENDIX 1 – PLAN FOR USING AND DISSEMINATING THE KNOWLEDGE **60**

ACRONYMS **64**

SUIT- Scalable, Ultra-fast and Interoperable Interactive Television

http://suit.av.it.pt

Participants		Short name	Country
	Instituto de Telecomunicações.	*IT*	Portugal
	IBBT-Interdisciplinair instituut voor BreedBand Technologie Vzw	*IBBT*	Belgium
	URL- Universitat Ramon Llull Fundacio Privada	*URL*	Spain
	R&S-Rohde and Schwarz GmbH and Co Kommanditgesellschaft	*R&S*	Germany
	The University of Surrey	*UniS*	UK
	SA VITEC	*Vitec*	France
	RUNCOM - RUNCOM Technologies Ltd	*RUNCOM*	Israel
	Institut für Rundfunktechnik GmbH	*IRT*	Germany
	Universidad Politécnica de Madrid	*UPM*	Spain
	Wavecom - Soluções Rádio, Lda	*Wavecom*	Portugal

Project Coordinator

Antonio Navarro
Instituto de Telecomunicações - Universidade de Aveiro
Campos Universitário de Santiago
Tel: +351 – 234 377 900
Fax: +351 – 234 796 236
Email: navarro@av.it.pt

Publishable executive summary

Summary description of project objectives

SUIT intends to demonstrate a novel transportation system of TV/video compressed signals over WiMAX and DVB-T/H networks. SUIT will consider an end-to-end chain composed of a playout, last mile networks, and terminals of different computational and display capacities.

Firstly, video contents, either live or pre-recorded will be encoded in a scalable way to be delivered simultaneously to a variety of devices from HD flat displays to handheld devices. Secondly, as the viewer expects that the interactive system responds to a request quickly, SUIT will optimally manage at the playout, the DVB-T/H and WiMAX resources, thereby, the requested content will be delivered as fast as possible through the available TDMA/FDMA slots in both networks. As SUIT is using scalable video contents, the playout system is able to increase, for short time, the bandwidth to support high priority contents, e.g. hyperlinked interactive video contents. Thirdly, scalable multiple descriptions, possibly unbalanced, are delivered through DVB-T/H and WiMAX in order to support high speed mobility.

The basic main objectives are:

1. To include and promote scalable video (SVC), namely advanced scalable video coding technology in broadcasting networks in Europe;
2. To overcome bandwidth fluctuations (QoS) caused by indoor channels and terminals. In SUIT, this is achieved by video scalability as a natural tool for the optimal dynamic adaptation of the video stream to the user preferences and available bandwidth at any instant of time;
3. To enable robust communications for high speed mobile terminals using Multiple Description Coding (MDC);
4. To define adaptive joint source and transmission techniques for optimal network resources allocation so as to take advantage of the source scalability and the last mile wireless channel conditions by transmitting at high source data rates (lower channel code rate) under good network conditions, while reducing source data rates in bad network conditions;
5. To develop and implement Resource Management algorithms at the playout, enabling QoS provisioning and service differentiation for IP-based (DVB-T/H and WiMAX) networks for seamless integration of broadcast, multicast and unicast transmissions.

Work performed, contractors involved, Achieved results and expected

The main achievements are (with reference to the workpackage and contractors involved):

1. A definition of Architecture and Reference Scenarios ->WP1 (**All Partners**).
2. A SVC Codec (software) -> WP3+WP5 (**IT, IBBT, UniS, Vitec, UPM**).
3. A MDC Codec (MDC-1, MDC-2) -> WP3 (**IT, IBBT, UniS, Vitec, UPM**).
4. A Playout system –> WP4 (**IT, IBBT, URL, R&S, IRT**).
5. A Gateway –> WP1+WP3+WP5 (**IT, IBBT, UniS, Vitec, UPM**).

6. A Terminal –> WP1+WP6 (**IT, URL, Vitec, UPM**).

7. A WiMAX+DVB-H Emulator -> WP2 (**IT, UniS, RUNCOM, Wavecom**).

8. WLAN Model -> WP2 (**UPM**).

9. Bit Error Pattern files (WiMAX,DVB-H,WLAN) -> WP2 (**IT, UniS, RUNCOM, UPM, Wavecom**).

10. An End-to-End Demonstrator including some components from above ->WP6 (**IT, UniS, URL, RUNCOM, UPM, Wavecom**).

11. 6 papers, 21 contributions to standardization, 1 workshop, 1 seminar talk ->WP7 (**IT, IBBT, URL, RUNCOM, UPM, Wavecom**).

12. 25 deliverables. Such amounts of deliverables lead us to have a demonstrator in the first year -> All WPs (**All Partners**).

13. SUIT partners have submitted to the ftp around 300 documents, a valuable source of information. ->All WPs (**All Partners**).

Dissemination papers:

IBBT:

- F. Verdicchio, A. Munteanu, A. Gavrilescu, J. Cornelis, and P. Schelkens, "Embedded Multiple-description Coding of Video, " IEEE Transactions on Image Processing, Vol. 15, N.10, pp. 3114-3130, 2006.

URL:

- A. Lopez, G. Fernandez, "Efficient Media Delivery over Mobile Terminals using DVB-H," 10th IEEE Int. Conf. on Consumer Electronics, St. Petersburg, 2006.
- A. Lopez, G. Fernandez, "Efficient IP Encapsulation in a DVB-H Platform," IBC-Amsterdam, 2006.

IT:

- J. Tavares, A. Silva and A. Navarro, 2006, "H.263 Video Codec Performance with a Fast 8x8 Integer IDCT", IEEE ICME 2006, Toronto, Canada.
- Navarro and V. Silva, "Fast Conversion between DCT and Wavelet Transform Coefficients," 3rd International Workshop on Mathematical Techniques and Problems in Telecommunications, Leiria – Portugal, Sept 4-8, 2006.
- B. Gabriel and A. Navarro, "Multi-carrier Optimization for Compressed Video Streaming," IEEE Int. Conf. on Consumer Electronics, Las Vegas, Jan 10-13, 2007.

Standardization contributions:

IT:

1. M. Santos, A. Silva, A. Navarro, "MPEG-4 VLD+IQ+IDCT Implementation on a Virtex-II," ISO/IEC JTC1/WG11 Doc. M13139, April 2006.
2. A. Silva, J. Tavares, A. Navarro, "MPEG-4 Testbed for Video IDCT Specification," ISO/IEC JTC1/WG11 Doc. M13140, April 2006.
3. A. Silva, J. Tavares, A. Navarro, "MPEG-4 Test Results for Video IDCT Specification," ISO/IEC JTC1/WG11 Doc. M13141, April 2006.

4. Arianne T. Hinds, Yuriy A. Reznik, Phoom Sagetong, Honggang Qi, Siwei Ma, Antonio Navarro, “MPEG-4 Test Results for Video IDCT Specification,” ISO/IEC JTC1/WG11 Doc. M13311, April 2006.
5. A. Navarro, “Cross-check of Improved Fixed-Point DCT/IDCT Implementation Scheme with Low Complexity and High Fidelity (M13256),” ISO/IEC JTC1/WG11 Doc. M13376, April 2006.
6. M. Santos, A. Silva, A. Navarro, “H.264 Deblocking Filter Implementation on a Virtex-II,” ISO/IEC JTC1/WG11 Doc. M13620, Jul 2006.
7. A. Navarro, “Crosscheck report on fixed-point DCT/IDCT algorithms,” ISO/IEC JTC1/WG11 Doc. M13701, Jul 2006.
8. Yuriy Reznik, Arianne Hinds and A. Navarro, “On Complexity Criteria and Metrics for MPEG Fixed-Point IDCT Standard,” ISO/IEC JTC1/WG11 Doc. M13703, Jul 2006.
9. A. Navarro, Y. Reznik and A. Silva, “Improved IDCT”, ISO/IEC JTC1/WG11 Doc. M13800, Oct 2006.
10. A. Navarro, Y. Reznik and A. Silva, “Improved IDCT-Replacing M13800”, ISO/IEC JTC1/WG11 Doc. M13803, Oct 2006.
11. A. Navarro, M. Santos, “Hardware implementation of full search H.264 motion estimation”, ISO/IEC JTC1/WG11 Doc. M13989, Oct 2006.
12. A. Navarro, A. Silva, “Performance in MPEG-4 of five submitted integer IDCTs for CD”, ISO/IEC JTC1/WG11 Doc. M13990, Oct 2006.
13. A. Navarro, “Crosschecking an integer 16 bit IDCT (M13791)”, ISO/IEC JTC1/WG11 Doc. M13992, Oct 2006.
14. A. Navarro, “Cross check of proposed additional (CE-stage) IDCT designs”, ISO/IEC JTC1/WG11 Doc. M14003, Oct 2006.
15. A. Navarro, A. Silva and Y. Reznik, “A Correction on Scalable Fixed-Point 8x8 FDCT/IDCT for CD selection”, ISO/IEC JTC1/WG11 Doc. M14078, Jan 2007.
16. A. Navarro, “Cross-checking 9 LLM11-based scaled algorithms from the CE”, ISO/IEC JTC1/WG11 Doc. M14254, Jan 2007.
17. A. Navarro, “Comments on Evaluation Procedure for CD Selection in Hangzhou”, ISO/IEC JTC1/WG11 Doc. M14255, Jan 2007.

RUNCOM:

1. "Deployment scenarios with reuse1", Eli Sofer, Peretz Shkalim,Moti Goldstein, IEEE 802.22 Wireless RAN, June 2006.
2. "OFDMA Single Channel Parameters", Eli Sofer, Ramon Khalona, Wendong HU, IEEE.802.22 Wireless RAN, June 2006.
3. "SuperFrame and PHY Single Channel". Eli Sofer, Doron Ezri, Zion Hadad IEEE802.22 Wireless RAN August 2006.
4. “OFDMA single Channel Harmonization” Eli Sofer, Yossi Segal, doron Ezri, Michael Erlichson, IEEE802.16.22, 11 February 2007.

Exploitation Plans:

Vitec:

- Vitec intends to exploit the SVC Codec and MDC Codec. Demonstrations in technical expositions like IBC and NAB.
- Some Codec results from SUIT can be exported/re-used to Vitec AVC Codecs specially related to High Definition.
- Constant Collaboration with IBBT as IBBT and Vitec jointly collaborate in the design and development of the SUIT MDC Codec.

R&S:

- **Control software for test set-up**
  - It is planned to validate the control software modules that control the test signal generators with potential costumers from the receiver industry. In such a case, the receiver that initiates the handover in a DVB-T/H system is the DUT. Therefore, a receiver manufacturer needs to access QoS relevant information at an internal receiver interface, and integrate the respective control software modules into their testbed control software.

- **Test streams**
  - Test streams are required to provide input signals for the test signal generators of the testbed. These test streams are generated in pairs. They contain at least one service which is identical in both streams but the signalling (PSI/ SI in the respective tables) is different in both streams.
    Such pairs of test streams will be generated for various bit rates in such a way that they can be used with different modulation schemes and different code rates.

- **Wireless Network Emulator**
  A wireless network emulator is required to evaluate video performance over WiMAX and DVB-T/H under multipath channels. The network operators can decide parameters and configurations.

- **To summarise:**
  - Control SW for controlling test signal generators in a HO testbed;
    Decision on product development after validation with potential customers;
    Availability planned for early 2008.

  - Test streams for test signal generators as part of a stream library;
    Availability planned for early 2008

  - Emulator as part of our equipment portfolio. It can be an option of a test equipment
    Availability planned for 2008

RUNCOM:

- Network convergence solutions.
- RUNCOM intends to exploit the receiver dual mode chip.
- Optimize the SUIT demonstrator for mobile video surveillance.
- Playout equipment to assess the receiver dual mode chip functionalities.

Wavecom:

- Wavecom intends to create and exploit a standalone integrated version of the WiMAX/DVB-T/H dual access gateway.

The main expected results are (the overall goal is to achieve all objective mentioned in the technical annex):

- Architecture and reference scenarios refinement -> WP1
- Refinement an integration of a balanced MDC (MDC-2) into the demonstrator -> WP3+WP6

- HO solutions (patent) -> WP1
- SVC Codec (stand alone) -> WP5
- MDC Codec (Multiprocessor) -> WP5
- Playout equipped with intelligent routing –> WP4
- Fast Gateway –> WP5
- Interactive Terminal –> WP6
- Field Trials ->WP6
- Analysis of the extension of the lab demonstrator to a large scale field trial. Gathering feedback from operators and broadcasters -> WP6
- Defining a business model for SUIT platform in the context of those two broadband mobile networks, WiMAX and DVB-T/H -> WP7
- >10 papers, 1 IEEE Conf. organization, MDC Standardization -> WP7

SUIT partners plan to demonstrate SUIT platforms in top expositions like 3GSM, IBC2007, IBC2008 and IST Summit.

SUIT partners will be involved in IEEE ISCE 2008 organization. The intention is to promote a special session on the convergence of mobile broadband networks, especially for broadcasting.

Each partner has provided initial exploitation plan supported by business rational. The elaborated Exploitation Plans will be the subject of a separate D7.1.4 under the title of TIP (Technology Implementation Plans), which will elaborate further the commercial drivers and potential for integration with their existing portfolios of products and services.

Further and updated information about SUIT can be always be achieved from the website suit.av.it.pt

1 Project Objectives and Major Achievements

1.1 Overview of General Project Objectives

Huge changes are taking place in the television world. Passive viewing is ending. Nowadays, television is requiring from the viewer an active participation. Therefore, it is expected that Internet and interactivity will be integrated into television. The DVB-MHP is an example of such convergence. Nevertheless, there are several drawbacks at the lower layers of the OSI reference model. The terrestrial broadcasting network DVB-T is not able to cope with mobility at least at high speed due to inter-carrier interference. Instead of adding a new level of channel coding as followed by DVB-H with the resulting delay increasing, SUIT proposes a different strategy. The main idea is to combine in a fruitful manner DVB-T with the broadband wireless access network IEEE802.16 (IEEE802.20) providing a low round-trip delay and robust communications at high mobile speed, above 150 km/h. In this context of network convergence, broadband networks like DVB-T/H and WiMAX will certainly play an important role, delivering multimedia data namely compressed video to fixed and mobile subscribers.

The main objectives are:

- To include and promote scalable video (SVC), namely advanced scalable video coding technology in broadcasting networks in Europe;
- To overcome bandwidth fluctuations (QoS) caused by indoor channels and terminals. In SUIT, this is achieved by video scalability as a natural tool for the optimal dynamic adaptation of the video stream to the user preferences and available bandwidth at any instant of time;
- To enable robust communications for high speed mobile terminals;
- To define adaptive joint source and transmission techniques for optimal network resources allocation so as to take advantage of the source scalability and the last mile wireless channel conditions by transmitting at high source data rates (lower channel code rate) under good network conditions, while reducing source data rates in bad network conditions;
- To develop and implement Resource Management algorithms at the playout, enabling QoS provisioning and service differentiation for IP-based (DVB-T/H and WiMAX) networks for seamless integration of broadcast, multicast and unicast transmissions;
- To design intelligent multiplexers to support with priorities (QoS) scalable video streams and to accommodate streamed unicast video contents along with broadcasting contents and Internet data;
- To promote fast video-interactivity and to ensure low round-trip delay in broadcasting networks;
- To explore scalable multiple-description coding for error-resilient layered communications over hybrid broadband networks (DVB-T/H+WiMAX);
- To introduce High Definition TV transmission over hybrid broadband networks;
- To contribute to the creation of 4G network, IP-based, running at as high as 100Mbps while mobile and 1Gbps when fixed and support next generation applications such as multimedia services including high definition television to the user terminals anywhere and anytime;

- To identify relevant QoS parameters for HDTV transmission over hybrid networks maintaining a certain QoS level;
- To use rate-distortion-power surfaces to develop a novel power optimized Multiple Description Coding algorithm for scalable video (AVC/H.264 or wavelet based). The use of the rate-distortion-power surfaces in the development of novel Unequal Power Allocation (UPA) to video sub-carriers will reduce co-channel interference, hence enabling an increase in the number of video channels that can be broadcasted. Alternatively, it can enable wider WiMAX cell coverage.

All the objectives mentioned above are away from the state of the art since this is the first project converging WiMAX and DVB-T/H. Besides, SUIT is the first project promoting the introduction of multiple descriptions scalable video coding in broadcasting networks.

1.2 Work and Achievements in the Current Project Year

The research & development work to be carried out in SUIT is divided into eight workpackages. In the following paragraphs, we summarize the main results in each workpackage and make reference to any deliverable, Dx.y, when appropriate. We also mention the expected end results.

WP 0: Project Management. This WP provides overall management of the financial, administrative, technological and operational aspects of the project. It also includes technical monitoring and quality control.

Work performed: MMRs (Man Monthly Report) reception; Agenda organization of eight meetings. Constant technical and administrative monitoring. Writing a Project Handbook (D0.0), QMR-Quarterly Management Reports (D0.1.1, D0.1.2, D0.1.3, D0.1.4), the Quality Assurance Plan (D0.2). Initial version of the project's Web site (M03), a Project Progress Report (D0.4).

Contractors involved: **IT**

Achieved results: QCC group. Eight successful meetings. A web page, ftp and about 10 e-mail reflectors. Around 300 contribution documents submitted to the SUIT ftp. Participation in one concertation meeting.

Expected results: All QMRs, a final project report and a QCC report.

WP 1: Architecture Requirements and Specifications.

This WP specifies the requirements of the end-to-end system to support broadcast and non-broadcasting services over broadband networks DVB-T/H and WiMAX. This workpackage has been crucial in the developments accomplished by other workpackages, since it analyses and defines the overall architecture.

Work performed: Terminal requirements (D1.1); QoS requirements (D1.2); All-IP requirements (D3.1); Fist version of the architecture and reference scenarios (D4.1)

Contractors involved: **IT**, IBBT, URL, R&S, UniS, Vitec, RUNCOM, IRT, UPM, Wavecom

Achieved results: Full discussion and understanding of the overall SUIT architecture; Definition of network scenarios; Definition of service scenarios; Terminals specifications; Specifications of

the playout architecture; QoS specifications; Definition of IP requirements to support scalable MDC over WiMAX and DVB-T/H.

Expected results: Tuning the architecture and service scenarios from feedback results provided by WP4, WP5 and WP6; Possible inclusion of DVB-S2 and DVB-T2 tools.

WP 2: Channel and Systems Simulation.

The main objective of this WP is to model the networks behaviour. Error patterns generated in WP2 will be used to design video algorithms in WP3.

Work performed: Fixed and Mobile Channels specifications (D2.1); DVB-T/H modeling in Simulink (D2.2); WiMAX 16e Modeling in IT++ (D2.3); WLAN Modeling in IT++ (D2.4).

Contractors involved: IT, **UniS**, RUNCOM, IRT, UPM, Wavecom.

Achieved results: Error traces files for WiMAX, DVB-T/H and IEEE802.11g (simulated and real traces). Available in SUIT webpage. A network (WiMAX, DVB-T/H) emulator.

Expected results: Figures for end-to-end capacity of the SUIT convergent proposal of two networks, WiMAX and DVB-T/H; An extra deliverable related to DVB-RCT (D2.6).

WP 3: Robust Scalable Video Communications over Heterogeneous Networks.

This WP targets to design scalable multiple-description video coding approaches. It also deals with the optimal protection of the video contents. WP3 is going to use error traces generated by WP2.

Work performed: Following JVT (Joint Video Team) work; Study, analysis and discussions about JVT evolution. Implementation of two SVC codecs; Implementation of two scalable MDC codecs including extractors (D3.1).

Contractors involved: IT, **IBBT**, UniS, Vitec, IRT, UPM

Achieved results: Two SVC codecs; Two scalable MDC codecs including extractors.

Expected results: Joint source channel coding solutions; Encoding parameters optimization taking into account the entire system (DVB-T/H+WiMAX).

WP 4: Playout, Terminal and Networks Resource Management and Optimisation.

This WP will develop an intelligent playout and multiplexing system for DVB-T/H and WiMAX delivery networks. WP4 must fulfill some requirements defined in WP1.

Work performed: Implementation of RTP (Real Time Protocol) encapsulator and deencapsulator. Implementation of the version of the playout (without any intelligence) (D4.1); Analysis of the protocols required in the context of SUIT (Playout+Gateway+Terminal) (D4.2).

Contractors involved: IT, IBBT, **URL**, R&S, UniS, IRT.

Achieved results: Playout prototype.

Expected results: Protocols (Session and Description) Implementation. Horizontal and vertical handover solutions as defined in WP1. Intelligence (routing) implementation in the playout. Routing capabilities in the gateway.

WP 5: Components for the Test-bed/Field Trials. The main objective of WP5 is to design some components required to setup a testbed in WP6.

Work performed: Specifications and Implementation of gateway (D5.1). Real Time SVC encoder specifications (D5.2). SoC (System on Chip) and FPGA (Field Programmable Gate Array) specifications (D5.3).

Contractors involved: IT, **Vitec**, RUNCOM, IRT, UPM.

Achieved results: First version of the gateway prototype.

Expected results: An innovative SVC+MDC multiprocessor system to encode live HD (High Defnition) video feeds. Design of a dual mode SoC combining 16e and DVB-T/H. Mobility ensured up to 150 km/h. Video over IP in the Up-link.

WP 6: Integration, Performance Evaluation and Validation. This WP evaluates the performance of handover mechanisms, the playout system, the network capacities and the communication QoS in the lab and in the field.

Work performed: Setting up the first demo. Network (IP) aspects configuration. Integration into the Terminal the SVC decoder with the RTP deencapsulator.

Contractors involved: IT, IBBT, URL, R&S, Vitec, RUNCOM, **IRT**, Wavecom.

Achieved results: One demonstrator (Playout+Gateway+Terminal).

Expected results: Testing Metrics; An MHP like application; Integration in the demonstrator new algorithms; Integration and testing of all components from WP5. Testing and analysis of the results.

WP 7: Exploitation and Dissemination. The main objective of this WP is to prepare the Dissemination activities, including the contributions to standardisation, to specify Exploitation plans for the project results namely patent submissions, and the production of the Technology Implementation Plan (TIP) deliverables.

Work performed: Several discussions about exploitation. Organization of an International workshop. 6 papers published and 21 standardization contributions. Participation in MPEG/JVT, IEEE80216e and IEEE802.22 and DVB-T2 meetings. Dissemination Plan (D7.1.1 and D7.1.2).

Contractors involved: IT, IBBT, URL, R&S, UniS, Vitec, **RUNCOM**, IRT, UPM, Wavecom.

Achieved results: 6 papers. A talk in a seminar. Presentation in a Concertation meeting.

Expected results: Organization of a special session in EUSIPCO 2007. Exploiting SUIT products. More than 10 papers. At least 1 patent. Organization of a Special Session on mobile networks convergence . A standardization report and a Technology Implementation Plan.

1.3 Corrective Actions

Although SUIT is composed of 10 partners, most of the achievements were accomplished. However, the following simple technical related problems occurred:

IRT requested to move all MM from activities A2.2 and A2.3 to A2.5. Based on the reasons (working on network planning) presented by IRT, the WP2 Leader, the Project Coordinator and the PB (Project Board) approved this change.

In WP1, UPM worked on activity A1.4 despite not being planned in annex 1. UPM contributed to the definition of the SUIT architecture in D1.4. The total PM spent in this activity during the previous 3 months was 0.3.

In WP3, IBBT requested to the PB, an extension of activities A3.1 and A4.2 for more 6 months. The PB approved this change. See Project Management Report for further details.

2 Workpackage Progress of the Period

SUIT has achieved the main objective for the first period, a demonstrator where a playout was able to route the two video descriptions over two transceivers, WiMAX and DVB-T/H to the gateway and then to the WLAN terminal. If either WiMAX or DVB-T connection is broken, the terminal is still able to render the video. The deviations from the project workprogramme and the lists of deliverables and milestones were grouped together (sections 2.3, 2.4 and 2.5), instead of their division by WP.

2.1 Workpackage objectives

WP1

The main objective of this WP is to specify the requirements of the end-to-end system to support broadcast and non-broadcasting services over broadband networks DVB-T/H and WiMAX. The specific objectives are:

1. To specify the user terminal requirements;
2. To specify a common IP interface to make both networks interoperable with the next generation all-IP network;
3. To specify the maximum round trip delay, suitability for interactive services;
4. To specify the admissible packet error rate over selective/flat and impulsive fading channels for each source layer in function of the S/N and channel codes;
5. To specify the playout sub-system requirements with optimal bandwidth and network (DVB-T/H, WiMAX) selection policies.
6. Identification of broadcasting/multicasting/unicasting services requirements and system requirements
7. To study the overall architecture of the system with strong emphasis on the radio interface, namely physical and link layers of both networks
8. Definition of representative scenarios, to be used by WP2, WP3 and WP4;
9. Identification of user terminals requirements
10. Identification of the QoS requirements
11. Identification of All-IP support requirements
12. Identification of architecture and reference scenarios
13. To produce deliverables D1.1, D1.2, D1.3, D1.4, D1.5.

WP2

The main objective of this WP is to model the behavior of the wireless networks used in the SUIT project. The results will be used to support the work being carried out in WP3. In short, the objectives are:

1. To model the network (WiMAX, DVB-T/H and IEEE 802.11g) behaviour - taking into account the link and physical layer

2. To determine the Network Capacity (and optimal IP packet length)

3. To provide tools for exploration of LDPC and unequal power control schemes in WP3.

4. To produce deliverables D2.1, D2.2, D2.3, D2.4, D2.5, D2.6.

WP3

The main objective of this WP is to design a hybrid scalable multiple description and channel coding system for broadcast and non-broadcasting services over broadband networks DVB-T/H and WiMAX. The specific objectives of WP3 as defined in the original project proposal are listed below:

1. To design scalable multiple-description video coding approaches adaptable to the dynamic network characteristics and the multitude of types of user terminals.

2. To design adaptive joint source and channel coding techniques for optimal network resource allocation so as to take advantage of the source scalability and channel conditions;

3. To optimize the overall rate-distortion performance for given user preferences (in terms of resolution and frame-rate) and network conditions

4. To produce deliverables D3.1, D3.2, D3.3, D3.4, D3.5.

WP4

The main objective is to develop an intelligent playout and multiplexing system for DVB-T/H and WiMAX delivery networks which takes into account the following issues:

1. Minimization of round trip delay in broadcasting networks;

2. Optimal network selection according to DVBT/H/WiMAX network conditions and content;

3. Optimize the bandwidth allocation between broadcasted unicast and multicast services;

4. To support scalable video streams delivered through DVB-T/H/WiMAX networks to terminals;

5. To support interoperability with the local wireless network and devices.

Detailed objectives of WP4 are:

1. Synchronisation between DVB-T and WiMAX networks since related contents of parts of the same content using multiple descriptions may be transmitted by different delivery networks.

2. Implement encapsulation protocols RTP/RTCP and UDP over IP to ensure a right time stamping/time reference and reliable transmission of video streams.

3. Implement MAC/MPE layer in order to accommodate the IP packets into the physical layer (DVB-T/WiMAX).

4. Implement session and service description protocols using MPEG-21-DIA/SDP.

5. Implement session announcement using protocols like SAP,SIP.

6. Implement RTSP (Real Time Streaming Protocol) in the terminal and in the server to support unicasting and to control the video on demand sessions.

7. Implement IP router using intelligent algorithms for optimally delivery of the additional content to the DVB-T/WiMAX networks.

8. The resource manager will have to preserve the QoS namely in terms of transmission of content with a very short latency. The QoS levels as defined in A1.2 will be monitorized to trigger horitzontal (to other cell) and vertical (to other network) handover.

9. The system router/switch will support dynamic bandwidth allocation. The scalable contents will provide a natural implementation of such characteristic.

10. The algorithms will take into account the service differentiation, load of the available networks, content characteristics and user requests and will decide to each user and in real-time which is the best network delivery and configuration.

11. Implement protocols (MPEG21-DIA) to convey return channel information, such as network conditions and terminal capabilities, back to the playout.

12. To produce deliverables D4.1, D4.2, D4.3, D4.4, D4.5, D4.6.

The main objective of WP6 is to setup a testbed and field trials by incorporating, some components form WP5 as well as some other equipment, the results from WP2, WP3 and WP4 and considering several reference scenarios from WP1.

WP5

The main objective of WP5 is to design some components required to setup a testbed in WP6. This WP is composed of three activities, A5.1-Fast Gateway, A5.2-Multiple-descriptive Scalable Video Codec, and A5.3Transceivers on SoC and FPGA.

This WP has three activities composted basically of designing some systems not available in the market nowadays which are required by the playout infrastructure in order to adequately serve scalable contents through both networks to user terminals. A low cost dual mode chip will be designed and placed at the receiver. It will concern the following original components required to set up a test-bed in WP6:

1. A Fast Gateway used for adapting video content to WLAN characteristics;
2. A Multi-Description Scalable Video Codec used for providing living feeds according to robustness principles developed in SUIT;
3. An Electronic Transceiver for transporting WiMAX and DVB-T/H signals.

Concerning the Fast Gateway, it is expected to:

1. Perform conversion of DVB/WiMAX RF signals into a WLAN one for local distribution;
2. Take benefit of multiple incoming descriptions for combining them and recovering from transmission errors;
3. Insure local QoS by transcoding scalable content.

The Multi-Description Scalable Video Codec will tackle the following achievements:

1. Real-time implementation of an SVC codec;
2. Codec extension to provide multiple description outputs;
3. Take in account a large range of video formats up to HDTV.

Transceivers on SoC and FPGA will aim to:

1. Build a dual mode transceiver for interfacing with DVB(-T/H/RCT) + WiMAX networks;
2. Design a dedicated platform for mobility support;
3. Propose a robust support for bi-dir. Solutions.

This WP produces deliverables D5.1, D5.2, D5.3, D5.4, D5.5, D5.6, D5.7, D5.8, D5.9, D5.10, D5.11, D5.12.

WP6

The main objective of WP6 is to setup a testbed and field trials by incorporating, some components form WP5 as well as some other equipment, the results from WP2, WP3 and WP4 and considering several reference scenarios from WP1.

The specific objectives of WP6 as defined in the original project proposal are listed below:

1. Evaluation the performance of handover mechanisms
2. Evaluation the playout system
3. Evaluation the network capacities and QoS
4. To assess the video transmission quality in the up-link through DVB-RCT at high mobile speed
5. Define testing metrics
6. Develop terminal applications (like MHP) for testing and demonstration
7. Develop simple video rendering applications
8. Integration of components from WP5 into the test-bed
9. Evaluating the components from WP5
10. Field trials

11. Test, analyze and optimization of SUIT tools configuration according to different services and terminals. Impact in the whole system. Analysis of results

12. To produce deliverables D6.1, D6.2, D6.3, D6.4, D6.5, D6.6.

WP7

The main objective of this WP is to prepare the Dissemination activities, including the contributions to standardization, to specify Exploitation plans for the project results namely patent submissions, and the production of the Technology Implementation Plan (TIP) deliverables.

The specific objectives of WP6 as defined in the original project proposal are listed below:

1. Dissemination of Results
2. Contributions to Standardization
3. Exploitation Plans
4. Demonstrations at expositions
5. Organization of conferences/special sections
6. Publishing papers
7. To write the Technology Implementation Plan (TIP)
8. To produce deliverables D7.1.x, D7.2, D7.3, D7.4.

2.2 Progress towards objectives

WP0 - *Project management activities*

In this WP there were contributions from the following SUIT partners: **IT**.

The main objective of this WP is to provide overall management of the financial, administrative, technological and operational aspects of the project. It covers all the management activities and provides and maintains the link to the European Commission officers.

The PC (Project Coordinator) is responsible for coordination and management of the project as a whole and will represent the project towards the European Commission. He will obey to the management structure proposed in Fig. 1 of the Handbook (D0.0). This WP ensures the right interdependences of the work performed by all modules represented in that figure. The main duties of the PB are the top-level management of the project including results quality control.

This WP is subdivided into three activities, being: Activity 0.1 Technical Management and Quality Control; Activity 0.2 Administrative and Financial Management; Activity 0.3 Coordination and Concertation.

The tasks accomplished for each activity are:

The **Activity 0.1 Technical Management and Quality Control** has developed the following actions:

IT:

- Elaboration of kick-off meeting agenda.
- Elaboration of the Action Points list.
- Elaboration of the D0.0 - Project Handbook.
- Discussion of main objectives of SUIT in the kick-off meeting.
- Elaboration of the Quality Assurance Plan.
- Reception of the MMReports - February.
- Elaboration of Barcelona intermediate meeting agenda.
- Elaboration of the initial Website version of the project.
- Reception of the MMReports - February/ March.
- Elaboration of Madrid meeting agenda.
- Reception of the MMReports - April.
- Reception of the MMReports - May.
- Reception of the MMReports - June.
- Elaboration of Madrid meeting minutes.
- Elaboration of 1st QMR, D0.1.1
- Contribution and reviewing deliverable D2.1
- Elaboration of Munich meeting agenda and minutes.
- Reception of the MMReports - June/July
- Elaboration of Munich meeting minutes
- Elaboration of 2nd QMR, D0.1.2
- Reviewing deliverable D1.1
- Reception of the MMReports - July and August
- Reception of the MMReports - September and October
- Elaboration of 3rd QMR, D0.1.3
- Reception of the MMReports - October, November, December, January
- Elaboration of Algarve meeting agenda
- Elaboration of Algarve Minutes
- Establishing the QCC members and report request
- Elaboration of Guildford meeting agenda

The **Activity 0.2 Administrative and Financial Management** has developed the following actions:

IT:

- Preparation and hosting of the kick-off meeting held at the Instituto de Telecomunicações, Universidade de Aveiro, Portugal.
- Elaboration of the kick-off meeting minutes.
- Reception of Contract A-forms.
- Elaboration of the mailing lists.
- Elaboration of the SUIT Logo.
- Elaboration of the FTP – File Transfer Protocol.
- Reception of the SUIT partners bank information.
- Reception of the Part I CA signed sheets.
- Transfer of the first project payment, first period.
- Compilation of the CA.
- Drafting the CA Amendment 1
- Transfer of the first project payment to IBBT, UniS and WAVECOM. No payment has been transferred to RUNCOM yet.
- Compilation of the first Quarterly Management Report, D0.1.1
- Reception of the Cost claims report

- Elaboration and delivery of 3rd QMR. D0.1.3 and 4th QMR, D0.1.4
- Elaboration of an internal document to coordinate the work carried out for a demo during the first review – SUIT_146
- Update SUIT ftp

The **Activity 0.3 Coordination and Concertation** has developed the following actions:
IT:

- Definition of all Coordination mechanisms (ftp and mailing lists structures)
- Overall coordination of the Aveiro Meeting
- UniS legal representative updated
- Coordination of the meeting held in Barcelona
- Coordination of Madrid Meeting.
- Delivery D0.1.1 and D2.1 to the Commission.
- Coordination of Munich Meeting.
- Delivery D0.1.1 to the Commission
- Coordination of Munich Meeting
- Participation in the Concertation meeting held in Brussels, EU premises

URL:

- Preparation of presentations for meeting in University of Surrey (6th-8th November 2006)
- Participation in the Concertation meeting held in Guildford, University of Surrey premises

WP1 - *Architecture Requirements and Specifications*

In this WP there were contributions from the following SUIT partners: **IT**, IBBT, URL, R&S, UniS, Vitec, RUNCOM, IRT, UPM, Wavecom.

The main objective of this WP is to model the network behaviour. The models of DVB-T and WiMAX under different channel conditions will be used in this WP (in the second period) to determine the optimal IP packet length and in WP3 and WP4 so as to design optimal scalable contents and resource allocation, respectively. The models will take into account the DVB-T and WiMAX link and physical layer specifications. Other tools like LDPC and power control of multicarriers to cancel inter carrier interference will be explored in the downlink with the goal of increasing the network capacity.

This WP identified some parameters to achieve a packet network based on DVB-T and WiMAX with bit error rate as low as 10^{-11}(quasi-error free) under the interoperability constrains imposed by WP1. Other situations where transmission distortions (low S/N, high Doppler) occur, several error pattern files were generated to facilitate the evaluation of error resilience in multiplex (WP4) and video layers (WP3) in DVB-T and WiMAX type of networks. Furthermore, under poor channel conditions, WP3 will be able to design joint source channel coding solutions. The files are produced by a simulation program assuming several different physical, link and network parameters and Doppler shifts. This WP is organised in four activities:

The WP was subdivided in four activities, being: Activity 1.1: User Terminal Requirements; Activity 1.2: QoS Requirements; Activity 1.3: All-IP Support Requirements; and Activity 1.4: Architecture and Reference Scenarios.

The tasks accomplished for each activity are:

The **Activity 1.1: User Terminal Requirements** has finished.

IT:

- Contribution SUIT_3_WP1_Internal_Report.doc.
- Definition of Reference Scenarios.
- Contribution to SUIT_41.
- Contribution to Deliverable D1.1 mainly on video resolutions and summary of requirements.
- Definition of SUIT terminal requirements.
- Contribution to Deliverable D1.1 mainly on Section 7 - Summing up SUIT Terminals Requirements

IBBT:

- Discussion with other partners about the terminal requirements
- Detailed study of the DVB-T/H technical specifications and available literature.
- Study of the WiMAX technical specifications.
- Study of the business case regarding the broadcast versus the unicast approach.
- IBBT made an internal brainstorming and study of possible scenarios in the context of the two available networks DVB and WiMAX. The result was the definition of a scenario which allows for the possibility to use the WiMAX channel for unicast transmission of the redundant information for DVB-T channel (resilience on demand).
- Discussion regarding the gateway/no-gateway scenarios.
- Discussion regarding the moving and static gateway scenarios.
- Contribution to D1.1
    - Computational capabilities: Entropy decoder complexity , Complexity of MDC versus SDC
    - Common terminal description protocols: MPEG-21 DIA-UED and CC/PP.
- Preparation of the Munich SUIT meeting.
- Study of both “W3C’s composite capability – preference profile” and “MPEG-21 Part 7 Digital Item Adaptation – Usage Environment Description” as terminal description protocols.
- Writing of part 6 of deliverable D1.1 presenting an overview of both studied terminal description protocols as well as an example.

URL:

- Discussion with other partners about terminal requirements.
- Definition and discussion of reference scenarios with other partners.
- Start the compilation of the play-out requirements.
- Definition playout requirements and draft system architecture. The subject was discussed during Madrid meeting and the overall conclusions were the bases of the document SUIT_78_WP4_Madrid_Meeting_Report.doc which elaborates a list of requirements and specification of the playout system.
- Refinement of the architecture. Participation to the elaboration of deliverable D1.1 (terminal requirements).

UniS:

- Elaboration of a presentation about HD cameras for next Madrid Meeting.

VITEC:

- Elaboration of a presentation about HD cameras for Madrid Meeting.
- Presentation about HD cameras and coder interfaces during Madrid Meeting.
- Contribution to SVC decoding computational requirements in deliverable D1.1
- Improvement of contribution in deliverable D1.1

RUNCOM:

- Study of design considerations of DVB-RCT standard and support for Broadcast and intensive multimedia applications.
- Study of design considerations of Mobile WiMAX (IEEE 802.16e) standard and support for Broadcast and intensive multimedia applications.
- Preparing end-to-end schematics of DVB-RCT and WiMAX platforms with the available interfaces supporting SUIT MultiMedia and Broadcasting applications.
- Prepared a document defining interface supporting SUIT multimedia applications (IEEE-802.16e BS Interfaces and Management Architecture), sent on 30th May and resent on 8th June.
- More elaborations on User terminal interfaces for WiMAX and DVB-RCT.
- RUNCOM has generated and sent its contribution on Mobile WiMAX HO (Hand Off).
- Also User Manual has been prepared and sent to partners of WP1 (SUIT_147,148,149).

IRT:

- Preparation work for Interim-Meeting in Barcelona (e.g. travel preparation, study of circulated documents).
- Participation Interim-Meeting in Barcelona.
- Initial work on requirements for SUIT-terminal and IRT's MHP/IPTV platform (e.g. adaptations required for the SUIT-network environment.
- Investigation work on user-terminal-requirements.
- First study on required adaptation work on IRT's MHP/IPTV platform for SUIT.
- Investigations of compatibility issue between IPv6 and IPv4.
- Final work on Deliverable D1.1
- Work on a first Draft version on Architecture Requirements
- Preparation work for Interim-Meeting in Barcelona (e.g. travel preparation, study of circulated documents).
- Work on reference scenarios.
    - Work on user-terminal-requirements.
    - Work on requirements on IRT's MHP/IPTV.
    - Investigations on QoS mechanisms of IPv4 & IPv6.
    - Study of technical related documents for real time streaming.
    - Study of technical related documents for WiMAX.
    - Writing of Deliverable D1.1
    - Work on contribution towards Deliverable D1.1
    - Study of technical related documents for IPTV.
    - Revision of the WiMAX licence application form.
    - Work on a first Draft version on Architecture Requirements, D1.4.

The **Activity 1.2: QoS Requirements** has finished.

IT:

- Contribution to Deliverable D1.2 mainly on its reviewing.

R&S:

- Analysis of requirements for horizontal handover (between DVB-T cells).
- Study of WiMAX related documents.
- Investigation into channel decoding of non-standard-compliant broadcast signals (e.g. LDPC) in the frontend of the test probe.
- Investigation into interfacing external (i.e. non-standard-compliant) channel coding, e.g. LDPC, to the channel coding module of the test signal generator.

- Definition of interface for insertion of new channel coding schemes (eg. LDPC) into test signal generator firmware started.
- Analysis of QoS requirements for HDTV over DVB-T:
- The distribution of HDTV signals over terrestrial networks requires a high quality signal at the terminal to produce a sufficient picture and sound quality for the consumer. The level of the QoS parameters that can guarantee such quality for a high percentage of time were investigated.
- Prioritisation of QoS parameters for evaluation of HO impact:
- The work at R&S in Act 1.2 focused on the selection of a short list of parameters suitable for HO triggering, and the drafting of a concept how the parameters from the short list can be tested in the lab test set-up (e.g. for delays caused by higher layer parameter evaluation).
- The suitability of different QoS parameters (from different layers) for terminal-triggered handover in a broadcasting system is being investigated. The first preliminary results were used to prepare R&S' contribution for deliverable D1.2. A first draft of D1.2 was edited and circulated amongst the partners involved. At a telephone conference on 22 September 2006, the next steps for D1.2 were discussed and a schedule for these steps was agreed.
- The contribution to D1.2 was up-dated with regard to actual measurement values for the parameters listed in the QoS requirements. The contributions from other partners were integrated into D1.2 and the editorial work was started.
- Requirements for terminal triggered horizontal and vertical HO:
    - R&S has worked on the definition of requirements for a test receiver that represents the terminal in the laboratory test set-up. This terminal/test receivers will be capable of initiating horizontal handover between DVB-T/-H signals on different RF frequencies, and a vertical handover between a DVB-T/-H signal and a WiMAX signal.
    - Identification of QoS parameters to establish objective metric for QoS deterioration caused by HO:
    - A theoretical investigation was started to identify those QoS parameters which describe with sufficient accuracy the effect of a vertical or horizontal handover on the integrity of the signal at the different layers. The identified QoS metrics will then be implemented on the test receiver platform.

UniS:

- Preliminary analysis of existing QoS options in the standards to be used (DVB-T, WiMAX, WLAN).
- Analysis of existing QoS options in the standards to be used (DVB-T, WiMAX, WLAN).
- Work on contribution towards deliverable, D1.2.
- Provided a discussion of WiMAX QoS issues in the deliverable for activity 1.2.
- Writing of deliverable WP1.2.

RUNCOM:

- Support for QoS interface requirements were covered by RUNCOM's document, SUIT_98_IEEE-802.16e_BS Interfaces_And_Management_Architecture.
- RUNCOM submitted to the D1.2 its contribution on DVB-RCT QoS
- Discussions with partners on SUIT_125_D1.3_All_IP_Requirements. RUNCOM's tranceivers will act as bridges, no IP address is required.

IRT:

- Investigations on available QoS mechanisms of IPv4 & IPv6.
- Definition and contribution towards D1.2 , in particular chapter on WIFI related QoS requirements

- Discussions about potential impacts for the support of Multicast via WLAN802.11 networks
- Investigations on available QoS mechanisms of IPv4 & IPv6.

The **Activity 1.3 All-IP Support Requirements** has finished.

IT:

- Participation at the WP1,WP3,WP5 meeting at the URL in Barcelona.
- Contribution to SUIT_3_WP1_Internal_Report.doc.
- Specification of the Requirements.
- Definition of Reference Scenarios.
- Contribution to Deliverable D1.3 mainly on Section 8 – DVB-T/H/RCT/802.16/802.11g interoperability issues
- Participation at the WP1,WP3,WP5 meeting at the URL in Barcelona.

URL:

- Discussions about overall system architecture according activity 1.3.All IP-requirements.

UniS:

- Work on contribution towards deliverable, D1.3.
- Work on contribution towards deliverable, D1.2.
- Worked on a draft for D1.3: All-IP requirements, with a focus on WiMAX issues.

RUNCOM:

- Discussions with partners on SUIT_125_D1.3_All_IP_Requirements. RUNCOM's tranceivers will act as bridges, no IP address is required.
- RUNCOM has contributed to D1.3 (All IP Requirements) on the following topics:
- Description of DVB-RCT and Mobile WiMAX networks
- IP traffic over DVB-RCT and Mobile WiMAX systems
- Address resolution definitions.

IRT:

- Contribution towards D1.3 , in particular section on MHP-IPTV scenario

UPM:

- Preliminary analysis of All-IP paradigm within Suit project objectives.
- Participation on the definition of different scenarios.
- Analysis and identification of the All-IP support requirements within Suit project.
- Elaboration of a preliminary draft with the identified requirements
- First proposal of structure and workplan for D1.3 "All-IP requirements".
- Contribution to D1.3 "All-IP requirements" regarding the All-IP concept and Internet Protocol descriptions.
- Contribution to D1.3 "All-IP requirements" with respect to WI-FI networks
- Organization of follow up phone conferences for D1.3.
- Contribution to D1.3 "All-IP requirements" regarding interoperability issues among the wireless networks and edition of the contributions to D1.3 from other partners.
- Final integration of D1.3
- Final integration and conclusion of D1.3.
- Collaboration in the definition of architecture and reference scenarios

WAVECOM:

- All IP requirements for transmission circuits between playout and Base Stations (both WIMAX and DVB)

The **Activity 1.4 Architecture and Reference Scenarios** has developed the following actions:

IT:

- Contribution SUIT_3_WP1_Internal_Report.doc.
- Definition of Reference Scenarios.
- Contribution to SUIT_41_Internal_Presentation.
- Contribution to Playout architecture and interfaces.
- Contribution to Deliverable D1.4 mainly on Sections 2, 3, 4.1 and 4.2. A solution for Handover based on Mega-frame has been proposed by IT
- Contribution to Deliverable D1.4 on Sections 5 and 8.
- D1.4 review

R&S:

- Study of possible scenarios for the demonstrator.
- Study of reference scenarios.
- Participation in WP1 meeting in Barcelona.
- Specification of testsignals for reference scenarios started, especially for handover between systems.
- Specification of signals for horizontal handover:
  Work has started on the specification and development of test signals for horizontal handover between DVB-T/-H cells. Starting point is the DVB-H Implementation Guidelines document (TR 102377). The requirements for the test signals which consist of different MPEG2 Transport Streams and their modulation into a RF channel, were studied. The first step is to define Transport Streams for DVB-H which contain only partly the same services between which a handover is possible. These Transport Streams are then looped seamlessly for implementation on the testbed equipment.
  For the horizontal handover between DVB-T cells the mechanisms applicable for DVB-H are not available. As a result the handover requires the analysis of PSI/SI information in the terminal. The current work focuses on the correct information in the tables of the test signals and their validation.
- Definition of scenario for vertical HO between DVB-T/-H and WiMAX:
  - The definition of such a scenario was started based on the assumption that reception of the DVB-T/-H signal is the typical starting point, and the terminal is then moved out of the DVB-T/-H coverage zone but the service is being continued via WiMAX .
- Review of components suitable for lab test set-up. Instruments and other components (including software tools) are being evaluated and prioritised for incorporation in the testbed.
- Revision of test scenarios for laboratory testbed:
- In the light of the findings in Act. 1.2, the test scenarios were revised and the specification for the test software was amended accordingly.
- For the encapsulation of IP streams in DVB-T, the advantages and draw-backs of realtime and off-line processing are being studied. Emphasis is put on cross-checking and validation of such streams in different test environments and with different equipment, to avoid a closed solution.
- A contribution to D1.4 was drafted describing the components for the test set-up for DVB-T/H → DVB-T/H (horizontal) handover and DVB-T/H → WiMAX (vertical) handover.

VITEC:

- Elaboration of SUIT_14_Preparing_Barcelona_Meeting.
- Contribution to Reference Scenarios.
- Starting to contribute in deliverable D1.4.
- Contribution to deliverable D1.4 (section 3 about Service Scenarios) postponed to D1.5.

RUNCOM:

- Contribution on Network Reference scenario as in[put to D1.4 (Architecture and reference scenarios)
- RUNCOM worked and submitted its contribution on Hand Over for the two platforms (DVB-RCT and WiMAX)
- RUNCOM continued its effort to complete its commitment on HandOver and IP synchronization issues in the two platforms (DVB-RCT and WiMAX). RUNCOM has completed its tasks within Deliverable D1.4.

IRT:

- Initial work on Reference Scenarios.
- Analysis of identified Reference Scenarios and further study.
- Apply for WiMAX licences (deadline was 28th February 2006) at Federal Network Agency.
- Study on potential reference scenarios.
- Work on a first Draft version on Architecture Requirements, D1.4.
- Continued work on Architecture Requirements (Activity 1.4) and identification of open questions
- Writing of Deliverable D1.4
- Collection and integration of contributions from partners into Deliverable 1.4
- Discussion of open questions related to D1.4
- Clarification of remaining questions related to D1.4
- Final editorial work on D1.4

WAVECOM:

- Backbone Network architecture requirements analysis.
- WiMAX and backbone network architecture requirements analysis.
- Analysis of the WiMAX radio regulation scenario.
- Study of a multiband WiMAX transceiver (2.5GHz band and 3.5GHz band) using RUNCOM existing chipset.

All the Activities have contributed to the last deliverable D1.1, D1.2, D1.3 and D1.4.

WP2 - *Channels and Systems Simulation*

In this WP there were contributions from the following SUIT partners: IT, IBBT, URL, R&S, **UniS**, Vitec, RUNCOM, IRT, UPM, Wavecom.

The main objective of this WP was to specify the requirements of a broadcasting/multicasting service over a broadband cellular network on which UMTS advanced/enhanced air interface capabilities should be developed. Therefore, the main efforts within this workpackage were done during the first year. Nevertheless, Activity A1.4 still run after this reporting period.

The WP was subdivided in five activities, being: Activity 2.1: Fixed and Mobile Channels; Activity 2.2: DVB-T Modelling; Activity 2.3: WiMAX Modelling; Activity 2.4: WLAN Modelling and Activity 2.5: Network Capacity.

The tasks accomplished for each activity are:

The **Activity 2.1: Fixed and Mobile Channels** has finished.

IT:

- Contribution to deliverable D2.1 namely on link budget and DVB-T/UHF multipath modelling (COST 207).

UniS:

- Preparation of workplan for WP2, and circulation of the document to partners for comments.
- Analysis of channel models for use in WLAN model.
- Finalisation of channel model to use in WLAN simulations.
- Survey of channel models as preparation for Madrid meeting May 2006.
- Writing of deliverable WP2.1 completed. Coordination and assembly of contributions from UniS, RUNCOM, and IT on channel model for DVB-T, WiMAX and IEEE 802.11g. Editing to make the document look consistent.

RUNCOM:

- Contribution to SUIT _64 on channel modelling :
  - DVB-RCT for fixed environment SUI-5
  - DVB-RCT for Mobile environment COST
  - WiMAX for high mobility ITU-B
- RUNCOM has provided all parameters allowing channel modeling.
  Work has been completed.
- Work continued on channel modelling in 3.5 GHz, which designated as the preferred spectrum for WiMAX operation in Europe
- Contribution was provided on channel modelling in 3.5 GHz

UPM:

- Contribution to channel modelling (WLAN).

The **Activity 2.2: DVB-T Modelling** has developed the following actions:

IT:

- Study of DVB-T modules.
- Starting working with IT++ Software and comparison to Matlab.
- Analysing all DVB-T modules in Matlab/Simulink.
- Implementation of DVB-T modules in Matlab/Simulink.
- Simulink software development and generation of results. Writing up D2.2
- Continuing the implementation of some DVB-T modules in Matlab/Simulink

UniS:

- Material finding and reading of topic on IEEE 802.11g baseband model.
- Setup phone conference & send out details.
- Check progress of consortium member on the task and provide help if necessary.
- Prepare deliverable template for next milestone for WP2.

RUNCOM:

- Study of ITU-R and DVB project documents on Broadband UHF channel modelling including outcome and recommendations of MOTIVATE IST project addressing performance analysis of DVB-T receiver in mobility.
- Study of available literature on Channel Modelling (propagation loss, multi-paths and fading conditions) in the 1.5- 2 GHz band and the possibility of application these models to higher frequency bands and to UHF band.
- Preparing initial document on channel modelling for UHF including some profiles.
- Definition of channels models for fixed and preparation for Mobile DVB-RCT. Definition of channels model for mobile WiMAX. Multipaths profiles were investigated for both fixed and mobile environment.
- Research on LDPC codes – getting the simulation results, comparing them to other companies and comparing them to CC and CTC FEC.
- Have perform simulation, present results and deliverable for DVB-RCT uplink and

downlink

- RUNCOM worked and submitted its contribution to Deliverable D2.2 on DVB-RCT simulation for UpLink and theory (Channel estimation)

IRT:

- Detailed Study of IRT contribution to WP2.
- Reconsideration about IRT contribution towards A2.2 to achieve coherent work

The **Activity 2.3: WiMAX Modelling** has developed the following actions:

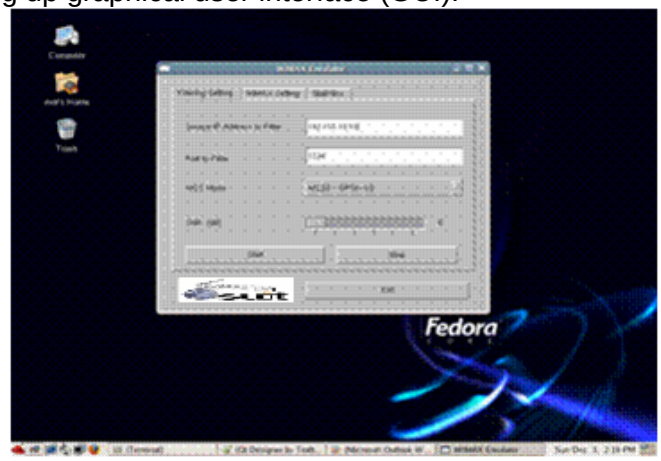
IT:

- Implementation of CTC in IT++ software

UniS:

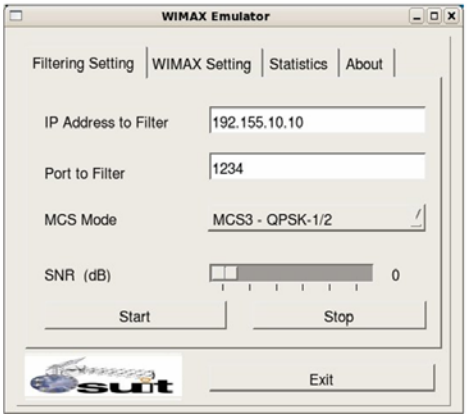
- Material finding and reading of topic on IEEE 802.16e baseband model.
- Software coding & testing for baseband modules of IEEE 802.16e.
- Coding and testing of FUSC & PUSC completed with help from RUNCOM.
- Coding and testing of Interleaver & QAM modem, OFDM transceiver completed.
- Coding and testing of convolution coding and puncturing scheme done.
- Preparation of material for July meeting in Munich:
  - To finalize system parameters for simulation.
  - To define simulation parameters.
  - To define test metric use in simulation.
  - To decide usage of CTC & LDPC.
  - To define and clarify Activity 2.5.
- Software coding & testing for baseband modules of IEEE 802.16e.
  - Coding and testing of FUSC & PUSC completed with help from RUNCOM.
  - Coding and testing of Interleaver & QAM modem, OFDM transceiver completed.
  - Coding and testing of convolution coding and puncturing scheme done.
  - Channel estimation (perfect channel estimation) done.
- Setup phone conference & send out details.
- Check progress of consortium member on the task and provide help if necessary.
- Integration of IEEE802.16e WiMAX modules and simulator calibration using RUNCOM simulator.
- IEEE 802.16e Repetition codec programming & testing.
- IEEE 802.16e trace generation / reading C++ routine coding & testing. Preparing trace generation batch file script in TCL.

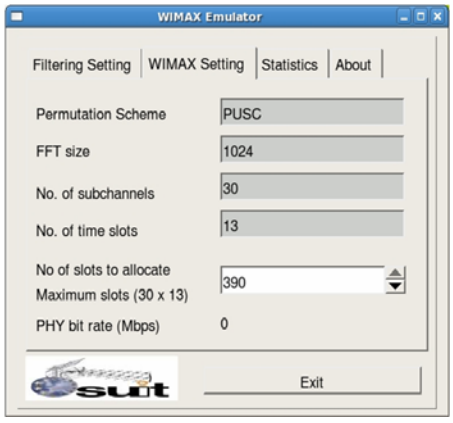
- Provide assistance to Wavecom/IT on IT++ installation.
- Sanity check of IEEE 802.16e software with convolutional coding. Awaiting software from Wavecom on Convolutional Turbo Coding (CTC) for integration
- Prepare deliverable template for next milestone for WP2.
- Collaboration with IT on writing WIMAX software and testing.
- Generation of WIMAX trace.
- Writing of deliverable WP2.3 WIMAX Modeling, integrate input from RUNCOM
- Preparation of Linux based emulator for technical audit.
- Next tasks apply to Activities 2.3 and 2.4
  1. Finish off WLAN & WIMAX deliverable, integrating contributions and unified format. Upload trace & simulator software.
  2. Preparation of Linux based emulator for technical audit.
     - Reading and setting up Linux bridge with packet filtering capability. Filtered packet will be dropped according to error pattern files
     - Setup Linux box as 2 ethernet bridge (using 4 ethernet cards) – Test status okay.
     - Write codes on encapsulation of packet over WIMAX MAC/PHY layer. Interfacing error pattern to the emulator and corrupt packet based on the error pattern.
     - Setting up graphical user interface (GUI).



4. Used emulator performance tests to specify and order a new computer with Intel Pentium 4 CPU and 4 ethernet interfaces for use in the audit.

- Installation of require software library and configuration of new PC. Tested WIMAX emulator for SUIT audit.





The emulation is divided into a two stage process, pre-simulation of error pattern files and a real time packet processing stage (using error pattern files). The pre-simulated error patterns consist of a set of traces for different Signal to Noise Ratios (SNR), and different Modulation and Coding Schemes (MCS). They were generated using the physical layer WIMAX baseband simulator developed in activity 2.3. The packet processing stage utilizes Linux's netfilter capability to capture packets, process the packet (by comparing to error trace), and drop or release the packet again back to the network. As depicted in the figure, the emulator allows the configuration of MCS mode, SNR values, selection of a particular stream (IP & port) and the physical layer bandwidth allocated for transmission.

RUNCOM:

- Providing the vectors for the WiMAX simulations.
- Contribution on LDPC has been delivered for AWGN and ITU-B accompanied with conclusions. RUNCOM has extended the support to simulation work carried out by Surrey
- Continued support for LDPC simulation carried out in Surrey
- RUNCOM submitted its contribution on Mobile WiMAX simulation for Downlink
- RUNCOM worked and submitted its contribution for Deliverable D2.3 on simulation in mobile environment for Mobile WiMAX including all code rated and modulation schemes in three speeds (60, 100 and 150Km/h) in two channel models (AWGN and ITU-A, B)
- RUNCOM continued its work on simulation for the Uplink according to Channel Model ITU-B and the focus was on 16QAM ¾ and 64QAM ½ . Also we added explanation on LDPC including harmonization contribution.

IRT:

- Reconsideration about IRT contribution towards A2.3 to achieve coherent work

WAVECOM:

- Analysis of available air interface models for the 3.5GHz band.
- Investigation of available system models for broadband wireless technologies.
- IT++ start up.
- IT++ evaluation.
- Analysis of convolutional turbo codes to implement the corresponding block for the system simulator.
- Collaborate with IT on implementation of WiMAX software.

The **Activity 2.4: WLAN Modelling** has developed the following actions:

UniS:

- Implementation of channel model to use in WLAN.
- Familiarizing of IT++ signal processing library for future coding of baseband model.
- Preparation of material for July meeting in Munich:
    - To finalize system parameters for simulation
    - To define simulation parameters
    - To define test metric use in simulation
    - To decide usage of CTC & LDPC
    - To define and clarify Activity 2.5
- Software coding & testing for baseband modules of IEEE802.11g completed
    - Simulated AWGN performance
    - Simulated HiperLAN/2 channel A to E performance

- Generation of IEEE 802.11g traces started with the pre-decided parameters started
- IEEE802.11g physical link layer simulation and trace generations.
- Generation of IEEE802.11g traces ongoing.
- Generation of IEEE 802.11g link level simulation curves completed. Preparation of graphs for document
- Writing part of the deliverable for WP2.4
- First draft of WP2.4 written, send to WP2 list to solicit comments
- Prepare deliverable template for next milestone for WP2
- Coding, testing of WLAN 802.11g software in IT++.
- Perform simulation and generate error pattern trace. Software and trace is uploaded to ftp
- Writing of WP2.4, coordinate contribution from UPM.

IRT:

- Detailed study of IRT contribution to WP2.

UPM:

- Preliminary analysis of channel models for use in the transmission model.
- Preliminary work on a test environment for WiFi transmission analysis at the packet level.
- Survey of channel models for IEEE802.11g.
- Software coding & testing for baseband modules of IEEE 802.11g.
- Study of packet analysis tools for wireless transmission.
- Initial set up of test environment: selection of the appropriate WLAN hardware.
- Initial SW developments for packet transmission analysis over WLAN.
- Identification of suitable channel models for WLAN transmission.
- Definition of parameters for the test environment.
- Selection of the most suitable channel models for WLAN transmission.
- Set up of the test environment to gather real data and first round of measurements.
- Development of SW tools to format the obtained data.
- Development of a first version of an algorithm to generate Gilbert-Elliot (GE) models.
- Generation and analysis of preliminary GE models.
- Participation in follow-up conference calls.
- Analysis of the approach based on Hidden Markov Models (HMM) for discrete network modelling.
- Development a preliminary algorithm to generate HMM-based models.
- Generation and analysis of the first discrete models based on HMMs.
- Beginning of data gathering for the different scenarios specified.
- Data gathering for the WLAN modelling task.
- Software development for Gilbert, HMMs and PER-classes discrete WLAN models.
- Measure of the first model statistics for Scenario #1.
- Analysis of the first results for feedback.
- Conclusion of the data collection for three different scenarios.
- Final development and training of the three proposed models.
- Generation of simulated traces for each model.
- Contribution on discrete WLAN modelling for D2.4.
- Conclusions and revision of D2.4.

The **Activity 2.5: Network Capacity** has developed the following actions:

UniS:

- Preparation of WP2.5, solicit input from IRT on Fransy, the frequency planning tools.
- Participated in discussion in project meeting in Algarve, Portugal.
- Prepared minutes and workplan for WP2.5, based on discussions in Algarve SUIT meeting. Sent out workplan for WP2.5.

RUNCOM:

- RUNCOM submitted its contribution on Coverage for Mobile WiMAX and DVB-RCT. Full calculation has been carried out in order to show range and throughput.

IRT:

- Definition and contribution towards D1.2 , in particular chapter on WiFi related QoS requirements.
- Discussions about potential impacts for the support of Multicast via WLAN802.11 networks.
- Preparation of several slides for discussion at Algarve meeting. They depict the work to be planned in A2.5 and provide information about the IRT frequency planning tool FRANSY. It is intended to use a possible scenario (not definition) related to the trial, perform link budget calculation and get the throughput map using the terminal threshold and supported physical layer bit rate. As a result, graphical coverage maps providing the expected data throughput (respectively capacity in units per second) for the area of field-trials (Munich) will be processed. The calculations may be performed iteratively to optimise the transmission system in respect to the envisaged trials.

WP3 - *Robust Scalable Video Communications over Heterogeneous Networks*

In this WP there were contributions from the following SUIT partners: IT, **IBBT**, UniS, Vitec, UPM.

In the last years, digital television has considerably evolved but we are still far away of having a notable change in terms of the concept of 4G. Nowadays, we know excellent multimedia and network algorithms and standards but they were developed separately and therefore do not match each other. This WP targets the following objectives:

1. To design scalable multiple-description video coding approaches adaptable to the dynamic network characteristics and the multitude of types of user terminals.

2. To design adaptive joint source and channel coding techniques for optimal network resource allocation so as to take advantage of the source scalability and channel conditions;

3. To optimise the overall rate-distortion performance for a given user preferences (in terms of resolution and frame-rate) and network conditions.

For the time being, the above task 1 is almost ready and the other tasks, 2 and 3, will have a big effort during from now on.

In WP3, the Shannon's principle of separability was assumed. This WP assumes that transmission distortion will occur and tries to minimise its effect. This WP embraces this problem by proposing and realizing a new joint source and channel coding approach that incorporates (1) the novel concept of scalable multiple description coding of video, (2) joint scalable source and channel coding making use of state-of-the-art scalable source algorithms and rate-controlled channel codes, and unequal error-protection principles optimally matching the protection levels to the error-sensitivity levels associated to each layer in the bitstreams. (3) Other physical layer parameters will be taken into account in the joint design by employing a source dependent power allocation, where we would develop a MDC scheme for WiMAX and

DVB-T that can take advantage of UPA as proposed in WP2. It is thus a form of cross layer optimisation (application and network).

The WP was subdivided in three activities, being: Activity 3.1: Scalable Multiple Description Coding of Video; Activity 3.2: Joint Source and Channel Coding Design and Activity 3.3: Optimisation of the Entire System.

The tasks accomplished for each activity are:

IBBT:

- Preparation of the initial presentation at the Kick-Off Meeting. The related document can be found on the ftp site: SUIT_10_WP3-IBBT.ppt
- First draft of the planning regarding the collaboration between the partners participating in WP3.
- Participation at the Barcelona SUIT meting.
- Assignment of responsibilities for each activities inside the WP3

UniS:

- A loss simulator has been created that will be compatible with the error traces to be produced in Workpackage 2. The loss simulator takes as input an SVC bitstream and an error trace. The simulator then uses the error trace to decide when to drop NALU's. Following some initial tests using UMTS channel models (WLAN etc not available yet), modifications are being made to a recent version of the JSVM software. These modifications are to ensure appropriate results in error prone environments, and are necessary to overcome some deficiencies in current versions of JSVM.

The **Activity 3.1: Scalable Multiple Description Coding of Video** has developed the following actions:

IT:

- Following JVT activities on SVC.
- Study of CBR control strategies on MPEG AVC.
- Reviewing the last developments on SVC from JVT.
- Study of doc JVT-T202
- Following JVT advances. Analyse/study of JVT reports

IBBT:

- Starting from the initial proposed MD coders architectures as given in the SUIT_10_WP3-IBBT related document a redefinition of the third MD coder architecture was proposed in order to meet the resilience on demand scenario.
- Preliminary studies to examine the possibility to incorporate the MD index assignment algorithm into a quality scalable video coder.
- Investigation of FMO tools and additional examination of extended use of FMO.
- It is important to remark that our scientific results on scalable multiple description coding of video have been validated in the context of scalable wavelet-based video coding employing a Spatial-Domain MCTF (Motion-Compensated Temporal Filtering) architecture. These results have been recently accepted for publication in IEEE Transactions on Image Processing. Related paper on the ftp site SUIT_43_TIP-01839-2005_d_col.pdf
- Preparation of the detailed WP3 work plan and task division.
- Preparation of the presentation for the IBBT-VITEC (WP3+WP5) meeting that took place in Brussels 2nd of June.

- Study of the state of the art SVC coder in order to assess the possibility of separating the entropy coding module. This will allow for the inclusion of the MD module at the end of the close loop coding scheme.
- Preparation of the presentation for the IBBT-VITEC meeting. The meeting concluded that:
    - A common software platform will be taken in consideration for the non real time experiments.
    - For the real time implementation the video coder will not provide entropy coding at the end. This will present the advantage that the MD (multiple descriptions) and the EC (entropy coding) can be seen as a post processing modules allowing for flexibility in the development process.
    - The MD coding module will not be included in the close loop architecture allowing for a full flexible implementation.
- Investigation of the SVC system in order to separate the entropy coder from the entire architecture. In this way a MD index assignment matrix can be developed as a separate block and used in between the video coding architecture and the CABAC entropy coder.
- During the Munich meeting it was pointed out by VITEC that in order to achieve real time implementation of the codec all the modules are needed to be optimized including the MD coding block. Consequently alternative IA matrices are investigated in order to reduce the memory allocation.
- Regarding the MD combiner several issues were discussed and a subsequent document was produced in cooperation with VITEC and UPM.
- Futher work was done in order to separate the entropy coder from the entire architecture. This will permit the implementation of severall MD index assignment matrices that can be inserted in the coding scheme.
- Development of the software for the MD coder. A separate C++ class is curently under development. The separation beetween the video coder and the entropy coder enables the insertion of such a MD component block. The class will allow for implementation of different types of MD embedded index assignements. Consequently, the MD coder can be taylored for different networks conditions
- Start of the study of the provisions for redundant slices in the state of the art SVC specification
- Implementation of the Multiple Description Scalar Quantizers into the AVC. The AVC consists in the base layer for the SVC. The side coder and side decoders are already completely functional and bug free
- MDC using redundant slices: generation of two descriptions from single bitstream
- MDC using redundant slices: study of MDC combining and synchronization issues
- Implementation of the Multiple Description Scalar Quantizers into the AVC. The central decoder is functional
- Writing the Deliverable D3.1
- Study and implementation of NAL header parser
- Integration of the MD module in the scalable video coder proposed by VITEC as the SUIT coding platform. The side coders at the level of the base layer are functional. Currently, the work of implementing the MD algorithm at the level of the enhancement layers is pursued.
- Finishing the Deliverable D3.1
- Description of interface between Extractor and playout
- Implementation of Extractor module for the Audit demo
- Study of Vitec encoder & output format

UniS:

- Contribution to writing of deliverable 3.1 in the form of comments and suggestions. Initial evaluation of performance of JSVM and AVC with WLAN and WiMAX models. Full tests to be completed when a wider range of simulations are available
- Development of error corruption tool to drop NAL units from an SVC bitstream. WLAN and WiMAX versions were worked on for testing MDC across different networks.
- Study of MDC schemes to consider their implications for the Unequal Power Allocation scheme. This is particularly relevant for redundant slice based MDC, where the redundant slice may be transmitted with lower power, based on the current channel conditions.
- Further study of MDC schemes to consider their implications for the Unequal Power Allocation scheme. Some work was performed using the JSVM software to try and achieve odd-even frame MDC by changing the prediction structure. Further modifications to the source code will be needed to achieve this.

VITEC:

- Elaboration of SUIT_42 presentation for Barcelona Interim Meeting.
- Preparation of a upcoming meeting between IBBT and Vitec about the implementation of MD techniques in SVC coding technology.
- Common meeting between IBBT and Vitec about the implementation of MD techniques in SVC coding technology.
- Editing of an internal report about the implementation of MD techniques in SVC coding technology, named “SVC Reference Platform Definition”.
- Completion of an internal report about the implementation of MD techniques in SVC coding technology, named “SVC Reference Platform Definition”.
- Starting to contribute to deliverable D3.1.
- Contribution to deliverable D3.1.
- Starting to contribute to deliverable D3.2 (spatial scalability features).
- Contribution to deliverable D3.2 (spatial scalability features).
- Support for interfacing SVC encoder into MDC framework.

The **Activity 3.2: Joint Source and Channel Coding Design** has developed the following actions.

IT:

- Reviewing the last developments in DVB-T2. Attendance DVB-T2 Madrid meeting.

IBBT:

- State of the art study of SVC
- Preparation of the detailed presentation of the MD-SVC block scheme.

UniS:

- Preliminary studies
- To examine potential ways to apply Unequal Power Allocation to SVC (Scalable Video Coding).
- Tests have been conducted to examine the effects of packet losses on perceptual quality when SVC (Scalable Video Coding) is used. For this purpose, a loss simulator, which was donated to JVT by the University of Science and Technology of China and Nokia Corporation, has been used. The simulator simply discards SVC NAL units from the input video bitstreams based on error patterns provided, and outputs the lossy bitstreams. This simulator will also be exploited to test the error effects on SVC streams using error patterns produced in WP2 of this project in the future.
- Experiments are currently being carried out to test the performance of SVC codec using HDTV video inputs. Once an optimal operating point has been determined for such very

high resolution video clips, a number of HDTV encoded video bitstreams will be produced for further testing of the UPA system using the loss simulator.

- Examination of past work at Surrey involving joint optimisation of power, source, and channel coding, for multimedia to determine its suitability for application to SVC. The previous work has some relevance as it was carried out on a scalable 3D mesh. However, the mesh is static, meaning that some adaptation will be needed to get the technique to work with video.
- Investigations have taken place into possible distortion models to allow allocation of power settings amongst the various scalable layers. For example, how can power be best allocated when there are temporal, spatial, and SNR scalable layers.

The **Activity 3.3: Optimisation of the Entire System** has developed the following actions:
UPM:

- Analysis of MD-SVC coding approaches aimed to examining optimized rate control strategies at the gateway.
- Analysis of SVC coding approaches aimed to examining optimized rate control strategies at the gateway.
- Analysis of the implication of D.1.1 “User terminal requirements” regarding the use of scalability coding. Contribution to D.1.1.
- Analysis of an internal report (SUIT_120) from VITEC and IBBT about real-time considerations for the SVC codec. This internal presentation discusses the JVT SVC.
- Analysis and contribution to WP3 workplan.
- Analysis of VITEC report about real-time considerations for the SVC codec.
- Preliminary study of rate control strategies for optimization at the gateway.
- Comments to D3.1.
- Study of rate control strategies for optimization at the gateway.
- Optimization of basic gateway modules.

WP4 - *Playout, Terminal and Networks Resource Management and Optimisation*

In this WP there were contributions from the following SUIT partners: IT, IBBT, **URL**, R&S, UniS, IRT.

The main objective is to develop an intelligent playout and multiplexing system for DVB-T/H and WiMAX delivery networks which takes into account the following issues:

- Minimization of round trip delay in broadcasting networks;
- Optimal network selection according to DVBT/H/WiMAX network conditions and content;
- Optimize the bandwidth allocation between broadcasted unicast and multicast services;
- To support scalable video streams delivered through DVB-T/H/WiMAX networks to terminals;
- To support interoperability with the local wireless network and devices.

This WP will deal with the playout, server and client negotiations and network management. The multi-mode terminal with the capability of rendering scalable contents will be implemented in WP5. WP4 and WP5 will build a complete end-to-end system.

For the time being, this WP has developed a playout with any routing intelligence. The later feature will be developed in the second period. All tests will be done on the demonstrator developed in the first period.

The WP is subdivided into four activities, being: Activity 4.1: Synchronization and Encapsulation; Activity 4.2: Session and Description Protocols; Activity 4.3: QoS Management and Handover; and Activity 4.4: Overall Playout Management, Control and Optimisation.

The tasks accomplished for each activity are:

The **Activity 4.1: Synchronization and Encapsulation** has developed the following actions:
IT:

- Reviewing of RUNCOM's platforms user guides
- Contribution to the definition of the playout equipment and components interfaces (Madrid Meeting).
- Contribution to the discussions about the synchronization of all media with the wall clock
- Analysis and discussion of IP Inserters in SUIT Playout namely on MPE implementation by RUNCOM transceivers.

URL:

- Study of RTP/RTCP protocols especially regarding synchronisation issues and where they will be used.
- Study of the standard for transport of H264 video over RTP, and the standard draft for transport of SVC over RTP
- Search for RTP implementations
- Study and comparison between different existing RTP libraries
- Study of RTCP synchronization
- Study and discussion with VITEC and IBBT about RTP Encapsulation
- Starting definition and implementation of RTCP/RTP C++ library to be used by the extractor module. The Library consists on an extension of the jrtplib-3.6.0, in order to support RTP H264/SVC payload
- Study of RTP encapsulation for H264 SVC/MDC.
- In-depth study of open source library for RTP: JRTPLIB.Possible adaptation for supporting H264/SVC payload
- Study of DVB-T encapsulation (Multi Protocol Encapsulation MPE) RTP/UDP/IP over TS
- Starting definition of deliverable 4.1 "Synchronisation and encapsulation"
- Discussion about functionalities and modules of RUNCOM equipment (BST and CPE)
- Writing of deliverables D.4.1 "Sychronisation and encapsulation" and D.4.2 "Session protocols". The table of contents of these two deliverables has been made and document sections have been assigned to each partner. URL has been working on its sections in the two deliverables.
- Implementation of the RTP Encapsulator:
    - We have agreed with IBBT the kind of information needed to be delivered to the RTP encapsulator.
- Finishing writing deliverable 4.1 "Synchronisation and encapsulation".
- Ongoing development of RTP encapsulator, using Live555 Streaming Media as well as Jrtplib.
- Discussions with IBBT and IRT about signalling in the whole system.
- Initial WP4 presentation to all the SUIT partners. Related document (ftp site): SUIT_9_WP4_Internal_Presentation.ppt.
- Definition of relations of WP4 with other WPs.
- Assignation of a responsible for each activity inside WP4.
- Attendance to the WP3 meeting in order to know what kind of content will be delivered to WP4.
- Internal discussion and study of requirements.

- Definition of the playout architecture modules according the different SUIT reference scenarios and terminals. These modules and interfaces were discussed in Madrid Meeting and were the base for an internal document.
- Study and elaboration of an internal document of GSE (Generic Stream Encapsulation), as proposed by DVB-GBS group for use in DVB-S2 standard. Possible advantages and drawbacks for using it in the playout to send IP over DVB-T, instead of standard MPE.

IRT:

- Work on a written contribution in respect to D4.1 (DVB-IPI encapsulation and adaptation to SUIT)
- Written contribution towards D4.1 (section about DVB-IPI encapsulation and adaptation)
- Contribution to the SUIT Playout architecture: Proposal for integration of IRT's MHP-IPTV (DVB-IPI conform).

The **Activity 4.2: Session and Description Protocols** has developed the following actions:

IBBT:

- State of the art comparison of usage environment description tool: MPEG-21 DIA-UED, CC/PP
- Development of the MPEG-21 Usage Environment Description for SUIT terminal.
- Design of a web service at the playout for registering terminals and receiving and parsing their UED DIA documents.
- Study of MPEG-21 AdaptationQoS tool for use in SUIT; this tool allows mapping available bandwidth to operational parameters for the stream extractor, in a content-dependent, reconfigurable and interoperable manner.
- Study of session and description protocols and standards.
- Writing of Deliverable D4.2.
- Study and implementation of MPEG-21 DIA-UED and AdaptationQoS in the playout.
- Preparation of the initial presentation at the Kick-Off Meeting. The related document can be found on the ftp site: SUIT_65_WP4-IBBT.ppt.
- Investigation of available usage environment description tools and standards.
- State of the art comparison of usage environment description tool (continued): MPEG-21 DIA-UED, CC/PP, and HTTP Headers".

URL:

- Study of classical session management and description protocols (SIP, SDP, RTSP, MPEG21-DIA) and new ones (SDPng).
- Study of different Streaming Servers. RTP, RTSP, SDP protocols studied
- Writing of deliverables D.4.1 "Sychronisation and encapsulation" and D.4.2 "Session protocols". The table of contents of these two deliverables has been made and document sections have been assigned to each partner. URL has been working on its sections in the two deliverables.
- The existing library Live555 has been modified to be adapted to the multiple description extractor:
- Adapted to receive the two descriptions from the extractor, creating our own RTP packets with the necessary information to be delivered to the gateway (inclusion of the timestamp delivered from the extractor).
- Modified to work with two ethernet cards in order to broadcast each description to a different subnet (VLAN).
- Contributions to deliverable 4.2 "Session protocols", about SDP and SDPng.
- Software tests including all playout modules: Encoder, Extractor, RTPEncapsulator and Switch.

- Finished deliverable 4.2 "Session protocols", including URL contributions about finally adopted signalling in SUIT.
- Participation in the general discussion about interfaces and communication between modules.
- Initial WP4 presentation to all the SUIT partners. Related document (ftp site): SUIT_9_WP4_Internal_Presentation.ppt.
- Definition of relations of WP4 with other WPs.
- Assignation of a responsible for each activity inside WP4.
- Attendance to the WP3 meeting in order to know what kind of content will be delivered to WP4.
- Internal discussion and study of requirements.
- Definition of the playout architecture modules according the different SUIT reference scenarios and terminals. These modules and interfaces were discussed in Madrid Meeting and were the base for an internal document.
- Study and elaboration of an internal document of GSE (Generic Stream Encapsulation), as proposed by DVB-GBS group for use in DVB-S2 standard. Possible advantages and drawbacks for using it in the playout to send IP over DVB-T, instead of standard MPE.

IRT:

- Investigations about possible mechanisms for the service announcement, based on DVB-IPI
- Study of service announcement mechanisms for SUIT based on DVB-IPI
- Start of work on a written contribution towards D4.2 (Service Detection& Selection based on DVB-IPI solution)
- Investigation and decisions on protocols as well as the session and service description to be used
- Preparation of a dedicated input towards D4.2 (Service Detection& Selection based on DVB-IPI solution

The **Activity 4.3: QoS Management and Handover** has developed the following actions:
R&S:

- Study of QoS parameters for horizontal handover in DVB-T/-H networks:
  Work has started on the analysis of the most suitable QoS parameters that could trigger a handover in the terminal in DVB-H and DVB-T networks. The pros and cons of physical layer parameters versus link layer parameters for the evaluation of a sufficient QoS level are currently investigated.
- Investigation started of impact of horizontal (between DVB-T/-H cells) and vertical HO (between DVB-T/-H and WiMAX cells) on certain QoS metrics:
  First test were carried out on a reduced test set-up to obtain a first impression of the impact of certain interruptions of streams and certain drop rates for TS packets or IP packets.
- Preliminary tests on HO impact on QoS continued:
- Non-automised tests were conducted to obtain more information on the recovery time of the test receiver in the presence of interrupted DVB-T/-H data streams
- Theoretical calculations and preliminary simulations were carried out to establish suitable waiting periods after a normal handover (horizontal or vertical) before a subsequent handover in the other direction. The investigation focuses on the minimum measurement time required for a reliable statistical value of parameters at protocol layer (typically Layer 2) that are evaluated for triggering a handover
- The investigation into parameters to be used for the triggering of horizontal and vertical HO was ongoing, and the level of acceptable distortions in the case of a handover was

analysed. A special focus was on the comparison of Layer 1 versus Layer 2 or 3 parameters in terms of HO reaction time

- The development of control SW for modulator, channel simulator and test receiver was started. The investigation into parameters to be used for the triggering of horizontal and vertical HO is ongoing. For this purpose, certain test scenarios for HO are developed which represent realistic use cases.
- The development of control SW for modulator, channel simulator and test receiver was continued.
- The development of a user interface for horizontal HO in DVB-T/H systems was started and first tests of the usability were carried out.
- The development of control SW for the modulator and channel simulator is being finalised and verification tests of the user interface and the control SW for horizontal HO tests have started.
- The control SW for the test receiver is still being developed.

IRT:

- Discussions about Handover in WiMAX, in particular in respect to the resulting delay at handover process

The **Activity 4.4: Overall Playout Management, Control and Optimisation** has developed the following actions:

URL:

- First draft of the general architecture for the playout, based on the scheme discussed in Madrid meeting.
- Elaboration of a general scheme of the playout, and the connection between its parts.
- Identification of the building blocks according to used protocols and ISO/OSI layers.
- Assignation of work to partners involved in this workpackage activities.
- Preparation of Munich meeting.
- Initial WP4 presentation to all the SUIT partners. Related document (ftp site): SUIT_9_WP4_Internal_Presentation.ppt.
- Definition of relations of WP4 with other WPs.
- Assignation of a responsible for each activity inside WP4.
- Attendance to the WP3 meeting in order to know what kind of content will be delivered to WP4.
- Internal discussion and study of requirements.
- Definition of the playout architecture modules according the different SUIT reference scenarios and terminals. These modules and interfaces were discussed in Madrid Meeting and were the base for an internal document.
- Study and elaboration of an internal document of GSE (Generic Stream Encapsulation), as proposed by DVB-GBS group for use in DVB-S2 standard. Possible advantages and drawbacks for using it in the playout to send IP over DVB-T, instead of standard MPE.

WP5 - *Components for the Test-bed/Field Trials*

In this WP there were contributions from the following SUIT partners: IT, **Vitec**, RUNCOM, UPM, Wavecom.

The main objective of WP5 is to design some components required to setup a testbed in WP6. This WP is composed of three activities, A5.1-Fast Gateway, A5.2-Multiple-descriptive Scalable Video Codec, and A5.3Transceivers on SoC and FPGA.

This WP has three activities composted basically of designing some systems not available in the market nowadays which are required by the playout infrastructure in order to adequately serve scalable contents through both networks to user terminals. A low cost dual mode chip will be designed and placed at the receiver.

The WP was subdivided into three activities, being: Activity 5.1: Fast Gateway; Activity 5.2: Multi-descriptive Scalable Video Codec; and Activity 5.3: Transceivers on SoCs and FPGAs.

The tasks accomplished for each activity are:

The **Activity 5.1: Fast Gateway** has developed the following activities:
VITEC:

- Elaboration of SUIT_42 presentation for Barcelona Interim Meeting.
- Participation at the WP1, WP3, WP5 meeting at the URL in Barcelona.
- Contribution to the Gateway Architcture and its interfaces towards D5.1- Gateway Specifications

RUNCOM:

- RUNCOM has provided all the basic modules definition for both DVB-RCT and WiMAX.
- RUNCOM has provided more detailed modules definition for both DVB-RCT and WiMAX.
- RUNCOM prepared and delivered its contribution for D5.1 on relevant components (WiMAX and DVB-RCT Tranceivers) of the Gateway.

UPM:

- Preliminary work on the design of the gateway functional architecture.
- First draft of the gateway functional architecture.
- Preliminary analysis of RTP/RTCP protocols and available implementations.
- Contribution to the gateway functional architecture draft to include a proposal of the protocol stack.
- Analysis and update of the gateway functional architecture regarding the use of MD.
- Analysis of the implication of D.1.1 “User terminal requirements” for the WiFi segment
- First analysis of structure and workplan for D5.1 “Gateway specifications”
- Analysis of RFCs and drafts on RTP and AVC/SVC encapsulation within RTP
- Analysis of the RTP encapsulation suggested by URL and its implications in the gateway
- Proposal of structure and workplan for D5.1 “Gateway specifications”
- Analysis of the implications of RTP implementation at the gateway
- Follow up of the discussions on RTP encapsulation
- Analysis of RTP/RTCP libraries
- First proposal for the TOC in D5.1 (Gateway specifications).
- Preliminary approach to gateway software structure.
- Follow up of the discussions on SVC NAL and RTP encapsulation
- Definition of Gateway interfaces.
- Implementation of basic gateway modules: NAL and RTP level synchronization.
- First integration of components.
- Preparation of the SUIT gateway for the Audit.
- Adaptation of the RTP decapsulator as an input to IT.

WAVECOM:

- Investigation of WiMAX technology in terms of: market, equipments, equipment certification and compatibility and also frequency allocation.

- Investigation of IEEE standards supporting WiMAX: IEEE802.16 and IEEE802.16e.

The **Activity 5.2: Multi-descriptive Scalable Video Codec** has developed the following activities:

IT:

- Review D5.2 and suggestions

VITEC:

- Elaboration of SUIT_42 presentation for Barcelona Interim Meeting.
- Participation at the WP1,WP3,WP5 meeting at the URL in Barcelona.
- Real-time SVC encoder specifications: study of the AVC extension applied in SVC coding and its complexity.
- Presentation about the definition of a SUIT SVC Reference Platform during Munich Meeting.
- Real-time SVC encoder specifications: definition of an SVC reference platform for the project
- Starting of the development of an SVC reference platform that will be closed to the real-time SVC encoder/decoder package and will help partners to integrate their own works
- Development of an SVC reference platform that will be closed to the real-time SVC encoder/decoder package and will help partners to integrate their own works.
- First contribution to deliverable D5.1.
- Development of an SVC reference platform that will be closed to the real-time SVC encoder/decoder package.
- Editing a presentation of the SVC reference platform software.
- Deliver to the project, a first release of the SVC reference platform software.
- Editing and contributing to deliverable D5.2 concerning the Real-Time SVC Encoder Specifications.
- Improving the SVC reference platform that will be closed to the real-time SVC encoder/decoder package.
- Starting to study the real-time implementation of the SVC encoder/decoder.

The **Activity 5.3: Transceivers on SoCs and FPGAs** has developed the following activities:

IT:

- Review D5.3 and suggestions

RUNCOM:

- Preparing block diagrams of the mobile User Terminal and the required interfaces supporting SUIT multimedia applications.
- Preparing block diagrams of the DVB-RCT User Terminal and the required interfaces supporting SUIT multimedia applications.
- Preparing block diagram of the Mobile WiMAX User Terminal and the required interfaces supporting SUIT multimedia applications.
- More detailed schematic diagrams of the Mobile WiMAX Base Station and User Terminal were provided to the project. Also detailed schematic diagrams of the DVB-RCT Base Station and User terminal were provided to the project.
- RUNCOM prepared PPT presentation on SoC and FPGA towards presentation during SUIT meeting at Surrey
- RUNCOM prepared and submitted its contribution as part of Deliverable D5.3 (SoC and FPGA specification).
- Improvement was attempted on what has been submitted in December. Additional activity is related to Integrated SoC (System-on-Chip) as a first version, it also included the combiner designed by UPM.

WP6 - *Integration, Performance Evaluation and Validation*

In this WP there were contributions from the following SUIT partners: IT, URL, R&S, RUNCOM, **IRT**, Wavecom.

The main objective of WP6 is to setup a testbed and field trials by incorporating, some components form WP5 as well as some other equipment, the results from WP2, WP3 and WP4 and considering several reference scenarios from WP1. This WP will evaluate the performance of handover mechanisms, the playout system, the network capacities and QoS having as main scenario the provisioning of broadcast/multicast/unicast services over broadband all-IP based cellular networks, in particular DVB-T/H and WiMAX, to heterogeneous terminals ranging from HDTV to handheld units. This WP will also allow us to assess the video transmission quality in the up-link through DVB-RCT at high mobile speed.

Most of the work in this WP will be accomplished in the second period.

The WP is subdivided into four activities, being: Activity 6.1: Testing Metrics; Activity 6.2: MHP Applications and Rendering; Activity 6.3: Integration and Test-bed/Field Trials; and Activity 6.4: Testing and Analysis of Results.

The **Activity 6.1: Testing Metrics** has not developed any actions yet.
R&S:

- On the DVB-T/H test receiver, the implementation of a first set of selected QoS parameters for HO was started. Some problems regarding the control of modulators and test receivers of the HO test set-up were identified and solutions are being worked on.
- On the DVB-T/H test receiver, the implementation of a first set of selected QoS parameters for HO was continued. A compensation for the non-seamless variation of some of the modulator parameters is being worked on.
- The implementation of QoS parameters focused on the parameters relevant for the RF frontend of the DVB-T/H test receiver and is ongoing.

The **Activity 6.2: MHP Applications and Rendering** has developed the following activities:

IRT:

- First investigation work how to adapt IRT's MHP/IPTV receiver to SUIT environment

The **Activity 6.3: Integration and Test-bed/Field Trials** has developed the following actions:
IT:

- Integration of both last mile networks. First experiments towards the first audit. IT wrote a doc describing the SUIT platform to be shown in the first audit (one year period)
- Identification of relevant requirements for a dedicated car to perform the field trials (e.g. power supply (230V), space for measurement equipment, possibility for installation of antennas)
- Arrangement of a car for the field trials (mobility tests)
- Update the demo document –Definition of responsibilities, dates and interfaces between partners work.
- Implementation of sockets module for interfacing PCs (Playout, Gateway, and Terminal) to the IP network
- Integration of both last mile networks. First experiments towards the first audit. IT wrote a doc describing the SUIT platform to be shown in the first audit (one year period).

URL:

- Contribution to the definition of the first audit demo.

RUNCOM:

- RUNCOM prepared two platforma (DVB_RCT and Mobile WiMAX), made preparation for delivering two days seminar to SUIT member scheduled on November at Surrey
- (Integration and Test-bed/Field Trials) RUNCOM prepared and delivered an operational course on DVB-RCT and WiMAX. The DVB-RCT platform was transferred to the coordinator.
- RUNCOM continued its work on DVB-RCT Handoff scheme based on use of two transceivers.
- (Integration and Test-bed/Field Trials) RUNCOM has continued with design and integration of DVB-RCT Handoff.

IRT:

- Initial preparation work for setup testbed (e.g. room for integration, DVB-T demonstration platform, distribution of signals, …)
- Acquisition of time restricted WiMAX transmission licences.
- Initial planning for the setup of the testbed like
    - Organisation and reservation of a dedicated integration-room for system integration
    - Initial investigations about required measurements equipment to perform system integration
    - First investigations about how existing equipment (like IP-Encapsulator, …) will fit project requirements
    - Considerations about needed potential investments (e.g. IP-router)
    - Application for a permit to mount WiMAX antennas on a transmission tower woned by the BR (Bavarian public broadcaster) for the duration of the field trials
    - Planning about how to interconnect the playout with the transmission equipment (e.g. optical link to a power amplifier which might be located close to the transmission tower.
- Discussions about possible solutions for the installation of WiMAX equipment (base stations, amplifiers and antennas) on the transmission tower. The most appropriate candidate for a solution with RUNCOM equipment (no outdoor equipment) is to install the base station at ground (in a container) and feed of the antennas (90 m above ground) using cables with very low attenuations.
- Identification of relevant requirements for a dedicated car to perform the field trials (e.g. power supply (230V), space for measurement equipment, possibility for installation of antennas)
- Arrangement of a car for the field trials (mobility tests)
- Detailed discussions in respect to the envisaged scenarios, in particular the required WiMAX coverage. Identification of issues needed to be solved to the setup field trials. For example, extra power amplifiers have to be deployed in order to perform mobility tests due limited output transmission power of the WiMAX base stations.
- Preparation of a document with information about the WiMAX licence auction (Germany) finished in December 2006.

Wavecom:

- Setup the demonstrator. Network configuration.

The **Activity 6.4: Testing and Analysis of Results** has not developed any actions yet.

WP7 - *Exploitation and Dissemination*

In this WP there were contributions from the following SUIT partners: IT, IBBT, URL, R&S, UniS, Vitec, **RUNCOM**, IRT, UPM, Wavecom.

The main objective of this WP is to prepare the Dissemination activities, including the contributions to standardization, to specify Exploitation plans for the project results namely patent submissions, and the production of the Technology Implementation Plan (TIP) deliverables.

This WP intends to support the preparation of the Dissemination and Exploitation plans. This includes the description of plans for the dissemination of knowledge gained during the work, and the exploitation plans of the results for the consortium as a whole, or for individual participants or group of participants. It should be expressed as much as possible in concrete terms, for instance, the dissemination strategies, the targeted groups and the strategic impact of the project in terms of improvement of competitiveness or creation of market opportunities for the partners. Another deliverable, to be written in the end of the project and based on the former, is the Technology Implementation Plan (TIP). The TIP must describe the participant's actual achievements in dissemination and their plans at that time for the exploitation of their results. Dissemination of the simulation results is made trough the organization of a public workshop on this subject. The conclusions are also to be submitted to publication and presentation as scientific papers.

The WP is subdivided into three activities, being: Activity 7.1: Dissemination of Results; Activity 7.2: Contributions to Standardization; and Activity 7.3: Exploitation Plans.

The tasks accomplished for each activity are:

The **Activity 7.1: Dissemination of Results** has developed the following actions.

IT:
- Attendance at all MPEG meetings, except the one held in Hangzhou.

- IT organized the 3rd International Workshop on Mathematical Techniques and Problems in Telecommunications (http://www.mtpt.it.pt/). Thus, SUIT supported this scientific event. Five tutorials were presented:

1- CROSS-LAYER ISSUES IN WIRELESS NETWORKS, Vincent Poor, Princeton University.
2- ENCRYPTION, Joachim Rosenthal, University of Zurich.
3- MATHEMATICAL NEEDS FOR BEHAVIOURAL MODELLING OF TELECOMMUNICATION CIRCUITS AND SYSTEMS, José Carlos Pedro, Aveiro University.
4- A MULTIOBJECTIVE ROUTING OPTIMISATION FRAMEWORK FOR MULTISERVICE NETWORKS - A HEURISTIC APPROACH, José Craveirinha, University of Coimbra.
5- JOINT SOURCE-CHANNEL TURBO TECHNIQUES FOR WIRELESS MULTIMEDIA COMMUNICATION, Christine Guillemot, IRISA.

- Talk in a Seminar Organized by IT and R&S in Aveiro-Portugal: 70 attendees, mostly from operators and broadcasters.

Papers:
- J. Tavares, A. Silva and A. Navarro, 2006, "H.263 Video Codec Performance with a Fast 8x8 Integer IDCT", IEEE ICME 2006, Toronto, Canada.

- Navarro and V. Silva, "Fast Conversion between DCT and Wavelet Transform Coefficients," 3rd International Workshop on Mathematical Techniques and Problems in Telecommunications, Leiria – Portugal, Sept 4-8, 2006.
- B. Gabriel and A. Navarro, "Multi-carrier Optimization for Compressed Video Streaming," IEEE Int. Conf. on Consumer Electronics, Las Vegas, Jan 10-13, 2007.

IBBT:

Papers:

- F. Verdicchio, A. Munteanu, A. Gavrilescu, J. Cornelis, and P. Schelkens, "Embedded Multiple-description Coding of Video, " IEEE Transactions on Image Processing, Vol. 15, N.10, pp. 3114-3130, 2006.

URL:

- Contribution with articles about DVB-H, MPEG-21 over TS, MPEG-21 over IP, according to a demonstration in IBC 2006.

Papers:

- A. Lopez, G. Fernandez, "Efficient Media Delivery over Mobile Terminals using DVB-H," 10th IEEE Int. Conf. on Consumer Electronics, St. Petersburg, 2006.
- A. Lopez, G. Fernandez, "Efficient IP Encapsulation in a DVB-H Platform," IBC-Amsterdam, 2006.

RUNCOM:

- A template for D7.1.2 was prepared and submitted to SUIT partners

IRT:

- Attendance at the WIMAX World Europe Conference (22nd to 24th May 2006) in Vienna and submission of an abridged report to the Public German Broadcasters and the SUIT Consortium.

UPM:

- Dissemination of results to Spanish companies (Telefónica I+D) and to Spanish Administration authorities (Ministerio de Industria).
- Elaboration of the local SUIT web page.

The **Activity 7.2: Contributions to Standardization** has developed the following actions.

IT:

1. M. Santos, A. Silva, A. Navarro, "MPEG-4 VLD+IQ+IDCT Implementation on a Virtex-II," ISO/IEC JTC1/WG11 Doc. M13139, April 2006.
2. A. Silva, J. Tavares, A. Navarro, "MPEG-4 Testbed for Video IDCT Specification," ISO/IEC JTC1/WG11 Doc. M13140, April 2006.
3. A. Silva, J. Tavares, A. Navarro, "MPEG-4 Test Results for Video IDCT Specification," ISO/IEC JTC1/WG11 Doc. M13141, April 2006.
4. Arianne T. Hinds, Yuriy A. Reznik, Phoom Sagetong, Honggang Qi, Siwei Ma, Antonio Navarro, "MPEG-4 Test Results for Video IDCT Specification," ISO/IEC JTC1/WG11 Doc. M13311, April 2006.
5. A. Navarro, "Cross-check of Improved Fixed-Point DCT/IDCT Implementation Scheme with Low Complexity and High Fidelity (M13256)," ISO/IEC JTC1/WG11 Doc. M13376, April 2006.
6. M. Santos, A. Silva, A. Navarro, "H.264 Deblocking Filter Implementation on a Virtex-II," ISO/IEC JTC1/WG11 Doc. M13620, Jul 2006.
7. A. Navarro, "Crosscheck report on fixed-point DCT/IDCT algorithms," ISO/IEC JTC1/WG11 Doc. M13701, Jul 2006.

8. Yuriy Reznik, Arianne Hinds and A. Navarro, “On Complexity Criteria and Metrics for MPEG Fixed-Point IDCT Standard,” ISO/IEC JTC1/WG11 Doc. M13703, Jul 2006.
9. A. Navarro, Y. Reznik and A. Silva, “Improved IDCT”, ISO/IEC JTC1/WG11 Doc. M13800, Oct 2006.
10. A. Navarro, Y. Reznik and A. Silva, “Improved IDCT-Replacing M13800”, ISO/IEC JTC1/WG11 Doc. M13803, Oct 2006.
11. A. Navarro, M. Santos, “Hardware implementation of full search H.264 motion estimation”, ISO/IEC JTC1/WG11 Doc. M13989, Oct 2006.
12. A. Navarro, A. Silva, “Performance in MPEG-4 of five submitted integer IDCTs for CD”, ISO/IEC JTC1/WG11 Doc. M13990, Oct 2006.
13. A. Navarro, “Crosschecking an integer 16 bit IDCT (M13791)”, ISO/IEC JTC1/WG11 Doc. M13992, Oct 2006.
14. A. Navarro, “Cross check of proposed additional (CE-stage) IDCT designs”, ISO/IEC JTC1/WG11 Doc. M14003, Oct 2006.
15. A. Navarro, A. Silva and Y. Reznik, “A Correction on Scalable Fixed-Point 8x8 FDCT/IDCT for CD selection”, ISO/IEC JTC1/WG11 Doc. M14078, Jan 2007.
16. A. Navarro, “Cross-checking 9 LLM11-based scaled algorithms from the CE”, ISO/IEC JTC1/WG11 Doc. M14254, Jan 2007.
17. A. Navarro, “Comments on Evaluation Procedure for CD Selection in Hangzhou”, ISO/IEC JTC1/WG11 Doc. M14255, Jan 2007.

RUNCOM:

1. "Deployment scenarios with reuse1", Eli Sofer, Peretz Shkalim,Moti Goldstein, IEEE 802.22 Wireless RAN, June 2006.
2. "OFDMA Single Channel Parameters", Eli Sofer, Ramon Khalona, Wendong HU, IEEE.802.22 Wireless RAN, June 2006.
3. "SuperFrame and PHY Single Channel". Eli Sofer, Doron Ezri, Zion Hadad IEEE802.22 Wireless RAN August 2006.
4. “OFDMA single Channel Harmonization” Eli Sofer, Yossi Segal, doron Ezri, Michael Erlichson, IEEE802.16.22, 11 February 2007

The **Activity 7.3: Exploitation Plans** has developed the following actions:

Vitec:

- Vitec intends to exploit the SVC Codec and MDC Codec. Demonstrations in technical expositions like IBC and NAB.
- Some Codec results from SUIT can be exported/re-used to Vitec AVC Codecs specially related to High Definition.
- Constant Collaboration with IBBT as IBBT and Vitec jointly collaborate in the design and development of the SUIT MDC Codec.

R&S:

- **Control software for test set-up**
    - It is planned to validate the control software modules that control the test signal generators with potential costumers from the receiver industry. In such a case, the receiver that initiates the handover in a DVB-T/H system is the DUT. Therefore, a receiver manufacturer needs to access QoS relevant information at an internal receiver interface, and integrate the respective control software modules into their testbed control software.

- **Test streams**

- Test streams are required to provide input signals for the test signal generators of the testbed. These test streams are generated in pairs. They contain at least one service which is identical in both streams but the signalling (PSI/ SI in the respective tables) is different in both streams.
  Such pairs of test streams will be generated for various bit rates in such a way that they can be used with different modulation schemes and different code rates.

- **Wireless Network Emulator**
  A wireless network emulator is required to evaluate video performance over WiMAX and DVB-T/H under multipath channels. The network operators can decide parameters and configurations.

- **To summarise:**
  - Control SW for controlling test signal generators in a HO testbed;
    Decision on product development after validation with potential customers;
    Availability planned for early 2008.

  - Test streams for test signal generators as part of a stream library;
    Availability planned for early 2008

  - Emulator as part of our equipment portfolio. It can be an option of a test equipment
    Availability planned for 2008

RUNCOM:
- Network convergence solutions
- RUNCOM intends to exploit the receiver dual mode chip
- Optimize the SUIT demonstrator for mobile video surveillance
- Playout equipment to assess the receiver dual mode chip functionalities

Wavecom:
- Wavecom intends to create and exploit a standalone integrated version of the WiMAX/DVB-T/H dual access gateway.

2.3 Deviations from the project work programme and corrective actions

Although SUIT is composed of 10 partners, most of the achievements were accomplished. However, the following simple technical related problems occurred:

1. IRT requested to move all MM from activities A2.2 and A2.3 to A2.5. Based on the reasons (working on network planning) presented by IRT, the WP2 Leader, the Project Coordinator and the PB (Project Board) approved this change.

2. In WP1, UPM worked on activity A1.4 despite not being planned in annex 1. UPM contributed to the definition of the SUIT architecture in D1.4. The total PM spent in this activity during the previous 3 months was 0.3.

3. In WP3, IBBT requested to the PB, an extension of activities A3.1 and A4.2 for more 6 months. The PB approved this change. See Project Management Report for further details.

4. Despite some deliverables, namely from WP1, were delivered after the Technical Annex predefined dates. The main reason was a lack of consensus in some critical issues which required a discussion in the following meeting. Therefore, we foresee to deliver all deliverables in planned dates.

5. We have included an extra deliverable, D2.6. This deliverable provided by RUNCOM is a valuable source of information on DVB-RCT. We thank RUNCOM for disseminating this information via SUIT.

2.4 Deliverables List

Del. n.	Deliverable Title	WP	Delivery Date	Actual Date	Leader
D0.0	Project Handbook	WP0	28 Feb	31 Mar	IT
D0.2	Quality Assurance Plan	WP0	30 Mar	3 May	IT
D0.1.1	Quarterly Management Report	WP0	1 May	12 Jun	IT
D0.3	Initial version of the web site	WP0	30 Abr	30 May	IT
D1.1	User Terminal requirements	WP1	30 Jun	11 Sep	IT
D0.1.2	Quarterly Management Report	WP0	30 Jul	26 Sep	IT
D7.1.1	Plan for using and disseminating/exploiting knowledge	WP7	30 Jul	27 Oct	RUNCOM
D1.2	QoS Requirements	WP1	30 Sep	27 Nov	IT
D1.3	All –IP Support Requirements	WP1	30 Sep	16 Oct	IT
D1.4	Architecture and Reference Scenarios	WP1	30 Sep	21 dec	IT
D0.1.3	Quarterly Management Report	WP0	30 Oct	15 Jan	IT
D2.2	DVB – T/H Network Modelling	WP2	30 Nov	15 Jan	UniS
D2.3	WiMAX Network Modelling	WP2	30 Nov	23 Dec	UniS
D2.4	WLAN Network Modelling	WP2	30 Nov	31 Dec	UniS
D5.1	Gateway specifictations	WP5	30 Nov	15 Jan	Vitec
D5.2	Real Time SVC Encoder Specifications	WP5	30 Nov	15 Jan	Vitec
D5.3	Soc + FPGA specifications	WP5	30 Nov	15 Jan	Vitec
D4.1	Synchronization and Encapsulation	WP4	30 Nov	15 Jan	URL
D4.2	Session Protocols	WP4	31 Jan	8 Feb	URL
D0.4	Project Interim Progress Report	WP0	30 Jan	15 Mar	IT
D3.1	Design of scalable multiple-description Video Coder	WP3	30 Sept	15 Nov	IBBT
D3.2	Design of scalable multiple-description Video Coder	WP3	30 Jan	6 Mar	IBBT
D0.1.4	Quarterly Management Report	WP0	30 Jan	6 Mar	IT
D7.1.2	Plan of using and disseminating/exploiting knowledge	WP7	30 Jan	6 Mar	RUNCOM
D2.6	DVB_RCT_up_link simulation	WP2	30 Jan	6 Mar	UniS

2.5 Milestones List

Mil. no.	Milestone name	Planned date	Actual date	Lead Contractor
M0.1.1	Quarterly Management Report	May 2006	June 2006	IT
M0.1.2	Quarterly Management Report	July 2006	September 2006	IT
M0.1.3	Quarterly Management Report	October 2006	January 2006	IT
M0.1.4	Quarterly Management Report	February 2006	March 2006	IT
M0.2	Quality Assurance Plan prepared	March 2006	May 2006	IT
M0.3	Initial Version Project Website	April 2006	May 2006	IT
M0.4.1	SUIT Meeting Aveiro (Kick-off)	February 2006	February 2006	IT
M0.4.2	SUIT Meeting Madrid	May 2006	May 2006	IT
M0.4.3	SUIT Meeting Munich	August 2006	July 2006	IT
M0.4.4	SUIT Meeting Guildford	November 2006	November 2006	IT
M0.4.5	SUIT Meeting Algarve	February 2007	January 2007	IT
M0.5	Project annual progress report prepared	February 2007	March 2007	IT
M1.1	User terminal requirements	June 2006	September 2006	IT
M1.2	QoS specifications	September 2006	November 2006	IT
M1.3	Network/link/physical interface specifications	September 2006	October 2006	IT
M2.1	Radio channel specification	June 2006	June 2006	UniS
M2.2	DVB-T error pattern files	November 2006	January 2007	UniS
M2.3	WiMAX error pattern files	November 2006	December 2006	UniS
M2.4	WLAN error pattern files	November 2006	December 2006	UniS
M3.1	Design of scalable multiple-description Video Coder	February 2007	November 2006	IBBT
M4.1	Session and QoS support protocols Implementation	February 2007	January 2007	URL

Consortium Management

2.6 Consortium management tasks

The Consortium management has been undertaken by WP0. the main objective is to provide overall management of the financial, administrative, technological and operational aspects of the project. It covers all the management activities and provides and maintains the link to the European Commission officers. The specific objectives are:

1. The Project Coordinator (PC) coordinates and manages the project as a whole.
2. The PC represents the project towards the European Commission.
3. The PC obeys to the management structure proposed in Fig. 1 of the Handbook (D0.0).
4. Ensuring the right interdependences of the work performed by all modules.
5. The project board (PB) duties include the top-level management of the project including results quality control.
6. Taking into account the Quality Control Committee reports.
7. Reception of all Monthly Man Reports, Cost Statements and checking their contents (technical issues and resources expenditures).
8. Elaboration of the Quarterly Man Reports and annual reports.
9. Supervising technical issues, keep the work consistent with the SUIT objectives
10. Liaison with the European Commission
11. Managing the ftp, e-mailing lists and updating the SUIT web
12. Participation in the Concertation meetings
13. Elaboration of the following deliverables:

D0.0	Project Handbook (M01)
D0.1.x	Quarterly Management Report (M03, 06, 09, 12, 15, 18, 21, 24, 27)
D0.2	Quality Assurance Plan (M02)
D0.3	Initial version of the project's Web site (M03)
D0.4	Project Interim Progress Report (M12)
D0.5	Project Final Report (M27)

The following figure shows the interrelationships amongst several management bodies. The project management is structured hierarchically and composed by several bodies. The project coordinator (PC) plays a central role in the structure being supported technically by the WP Leaders Board (WPLB) and in terms of Legal, Administrative and Financial issues by a Cabinet specialised in these matters. The project Board (PB) has a representative of each partner and is chaired by the PC. The Quality Control Committee (QCC) provides quality control and reports

directly to the PB. Since the project is organised in WPs, each workpackage has a WP Leader. Due to the size of the project, Activity Leaders are not foreseen. This fact gives more responsibility to the WP Leader.

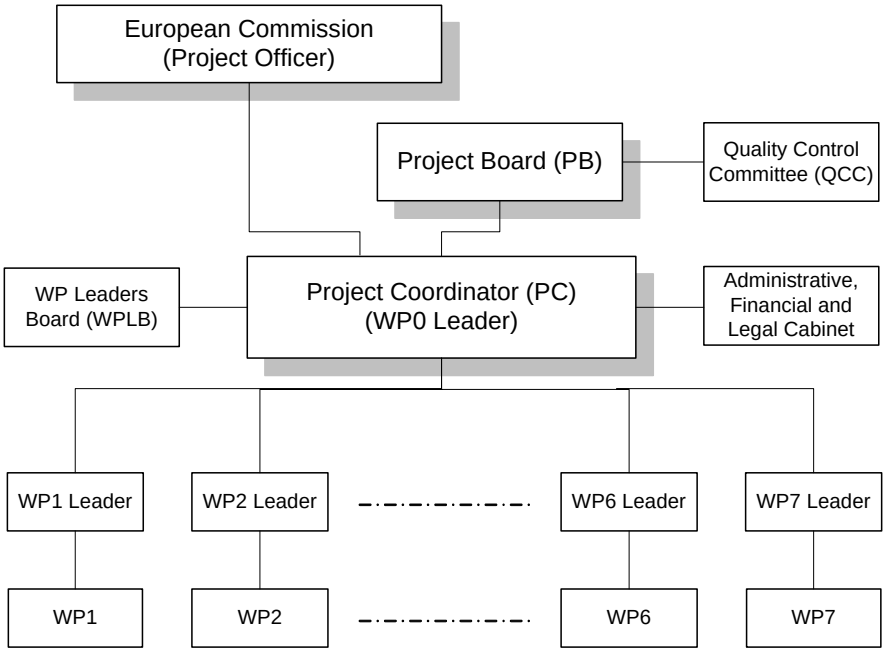


Fig. 1. Hierarchical organisation and structure of the project.

SUIT has created the QCC composed by two external independents members, Gerard Faria (Teamcast) and Michele Ré (Ketikos), and by two internal members, Juergen Lauterjung (R&S) and Julian Cabrera (UPM). The QCC report for the first year has been delivered to the Commission and it points out the delivering delay of some deliverables.

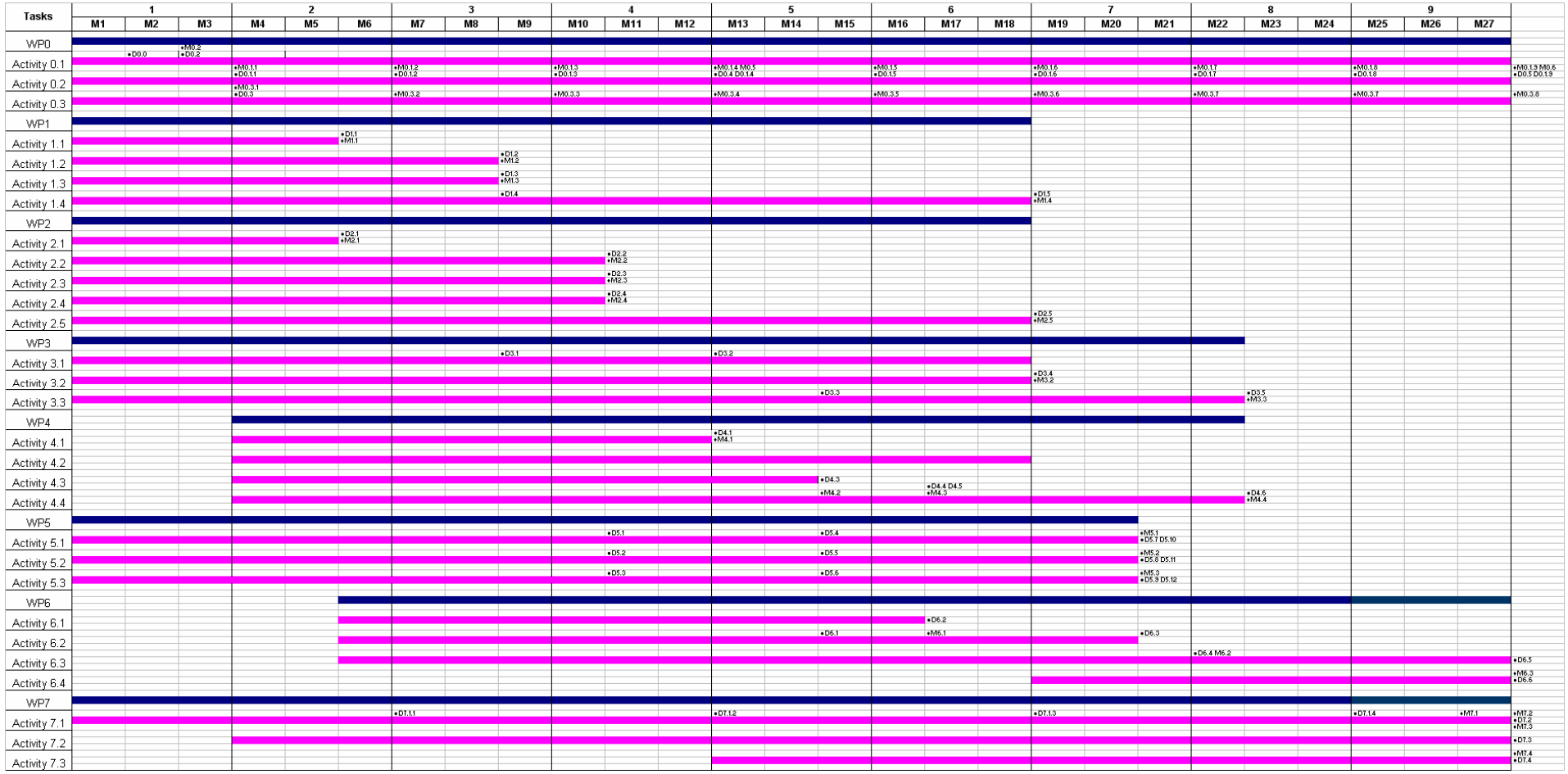
2.7 Contractors

No changes to the consortium took place.

All Contractors have contributed to the project activities.

2.8 Project timetable and status

The following chart shows the current status of the project activities schedule.


Tasks
1
2
3
4
5
6
7
8
9
M1 M2 M3 M4 M5 M6 M7 M8 M9 M10 M11 M12 M13 M14 M15 M16 M17 M18 M19 M20 M21 M22 M23 M24 M25 M26 M27
WP0
Activity 0.1
Activity 0.2
Activity 0.3
WP1
Activity 1.1
Activity 1.2
Activity 1.3
Activity 1.4
WP2
Activity 2.1
Activity 2.2
Activity 2.3
Activity 2.4
Activity 2.5
WP3
Activity 3.1
Activity 3.2
Activity 3.3
WP4
Activity 4.1
Activity 4.2
Activity 4.3
Activity 4.4
WP5
Activity 5.1
Activity 5.2
Activity 5.3
WP6
Activity 6.1
Activity 6.2
Activity 6.3
Activity 6.4
WP7
Activity 7.1
Activity 7.2
Activity 7.3

2.9 Coordination activities during the period

The following activities have been carried out:

The following facilities are provided for this purpose; a Mailing List which is installed for the project as a whole, for the individual WPs and for the management bodies, a version management system, so as to ensure that the history of each official document that must be approved by the PB can be traced, a FTP server and a common website with a restricted access area.

For the guarantee of access to the documents, all partners will use MS – Word as a common text processing tool, and MS – Excel as spreadsheet calculator (Microsoft Office for Windows). Text documents will be distributed in rtf-format to ensure compatibility.

2.9.1 Mailing Lists

The following mailings lists have been created for project purpose:

Quality and Control Committee:

qcc-suit@av.it.pt

All members:

all-suit@av.it.pt

Administrative members:

admall-suit@av.it.pt

This email list only acts as a reflector once the sender is *adm-suit@av.it.pt*. Any reply will be send to *adm-suit@av.it.pt*

Project Board members:

pb-suit@av.it.pt

Work Package Leaders:

wpl-suit@av.it.pt

Technical members:

tech-suit@av.it.pt

Work Package members:

wp1-suit@av.it.pt

wp2-suit@av.it.pt

wp3-suit@av.it.pt

wp4-suit@av.it.pt

wp5-suit@av.it.pt

wp6-suit@av.it.pt

wp7-suit@av.it.pt

As well as the following email addresses:

PC email:

navarro@av.it.pt

Administrative support:

adm-suit@av.it.pt

2.9.2 FTP Server

For the purpose of the project, a FTP server has been created at ftp-suit.av.it.pt, every project partner has a password to access this server. The FTP contains the following folders:

Deliverables

Templates

Meetings

MMR

Temp

Templates

WP0

WP1

WP2

WP3

WP4

WP5

WP6

WP7

Templates for official documents are available at the Templates folder.

The partners deliver their reports in the *temp* directory from which it will be removed into the respective folder so they are accessible for appreciation by the other partners, though respecting the dissemination level of each report (*see table 7.6 page 36/80 and further of the Project Contract*).

After the first period, SUIT ftp has 300 documents which shows a performance of almost 1 document uploaded every day.

2.9.3 Web Structure

The Web page is available at suit.av.it.pt (or any other provided by the Commission). The Web site is created, managed and maintained by the prime contractor (IT) and will give access to drafts and finished papers as well as to other official documents. The Web site also allows providing publicly accessible information, hence fostering dissemination of results. Some project results, like error pattern files are available on the web for downloading.

2.9.4 Meetings

There was planned one overall meeting every three months. The structure of the meetings are two full days of working. The meetings will start at 2 pm on the first meeting day and finish at 12 pm at the last meeting day. We can also have intermediate meeting, usually of shorter duration than an overall meeting.

There have been managed the following seven meetings:

- Preparing and hosting Kick-of meeting, Aveiro, Portugal, February 2006
- Technical meeting Barcelona, Spain, March 2006
- SUIT Consortium meeting, Madrid, Spain, May 2006
- SUIT Consortium meeting, Munich, Germany, July 2006
- SUIT Concertation meeting, EU Premises, Belgium, October 2006
- SUIT Consortium meeting, Guildford, UK, November 2006
- SUIT Consortium meeting, Algarve, Portugal, January 2007

During this report period, there were three audio conferences.

2.9.5 Possible Cooperation

The PC has attended one Concertation meeting and foresees to reach the following collaborations with the below mentioned projects. The PC made a presentation which can be downloaded from the Commission web page.

Projects	Topic
Astrals, C-Mobile, Enthrone	Field Trials (Core Network)
Astrals, VISNETII, Enthrone	SVC Standardization
Enthrone	Cross-layer optimization
Samba	Applications

Appendix 1 – Plan for using and disseminating the knowledge

Section 1 - Exploitable knowledge and its Use

Overview table

Exploitable Knowledge (description)	**Exploitable product(s) or measure(s)**	**Sector(s)** of application	Timetable for commercial use	Patents or other IPR protection	**Owner** & Other Partner(s) involved
1.HD SVC Encoder	*Real time video encoder*	*1. Multimedia 2. Telecommunications*	*2008*		***Partic. Vitec (owner)*** *Partic. IBBT*
2.HD MDC Encoder	*real time video encoder*	*1. Multimedia 2. Telecommunications*	2008		***Partic. Vitec (owner)*** *Partic. IBBT*
3.Control software for test set-up	software	*1. Multimedia 2. Telecommunications*	2008		***Partic. R&S (owner)***
4.Test streams	streams	*1. Multimedia 2. Telecommunications*	2008		***Partic. R&S (owner)***
5.Wireless Network Emulator	emulator	*1. Multimedia 2. Telecommunications*	2008		***Partic. R&S (owner)*** *Partic. UniS Partic. IT*
6. dual mode chip	VLSI Chip	*1. Electronics 2. Telecommunications*	2008		***Partic. RUNCOM (owner)***
7. Convergent solution	SUIT all chain telecom solution	*1. Multimedia 2. Telecommunications*	2008		***Partic. RUNCOM (owner)*** *Partic. All*
8. Gateway	Gateway to the WLAN	*1. Multimedia 2. Telecommunications*	2008 2009		***Partic. Wavecom (owner)*** *Partic. UPM Partic. IT*

Exploitation Plans:

Vitec:

- Vitec intends to exploit the SVC Codec and MDC Codec. Demonstrations in technical expositions like IBC and NAB.
- Some Codec results from SUIT can be exported/re-used to Vitec AVC Codecs specially related to High Definition.
- Constant Collaboration with IBBT as IBBT and Vitec jointly collaborate in the design and development of the SUIT MDC Codec.

R&S:

- **Control software for test set-up**
  - It is planned to validate the control software modules that control the test signal generators with potential costumers from the receiver industry. In such a case, the receiver that initiates the handover in a DVB-T/H system is the DUT. Therefore, a receiver manufacturer needs to access QoS relevant information at an internal receiver interface, and integrate the respective control software modules into their testbed control software.

- **Test streams**
  - Test streams are required to provide input signals for the test signal generators of the testbed. These test streams are generated in pairs. They contain at least one service which is identical in both streams but the signalling (PSI/ SI in the respective tables) is different in both streams.
    Such pairs of test streams will be generated for various bit rates in such a way that they can be used with different modulation schemes and different code rates.

- **Wireless Network Emulator**
  A wireless network emulator is required to evaluate video performance over WiMAX and DVB-T/H under multipath channels. The network operators can decide parameters and configurations.

- **To summarise:**
  - Control SW for controlling test signal generators in a HO testbed;
    Decision on product development after validation with potential customers;
    Availability planned for early 2008.

  - Test streams for test signal generators as part of a stream library;
    Availability planned for early 2008

  - Emulator as part of our equipment portfolio. It can be an option of a test equipment
    Availability planned for 2008

RUNCOM:

- Network convergence solutions.
- RUNCOM intends to exploit the receiver dual mode chip.
- Optimize the SUIT demonstrator for mobile video surveillance.
- Playout equipment to assess the receiver dual mode chip functionalities.

Wavecom:

- Wavecom intends to create and exploit a standalone integrated version of the WiMAX/DVB-T/H dual access gateway.

Section 2 – Dissemination of knowledge

Overview table

Planned/actual Dates	**Type**	**Type of audience**	**Countries Addressed**	**Size of audience**	**Partner responsible /involved**
During and after the project	Seminars/Workshops	Research	All	small	All
During the project	Internal Seminars	Research	All	small	All
During and after the project	Press Conferences	General Public	All	large	RUNCOM
During the project	Demonstrations	Operators/ Broadcasters	All	small	IT
End of project	Project Workshop/Special session	Public	All	medium	All
During and after the project	Publications	Research	All	large	All
During the project	Contributions to Standardization Bodies	Research	All	large	All
Done (updated during the project)	Project web-site	General public / Consortium members	All	large	IT
During the project	Posters	General public	All	medium	All
Done	Leaflets	General public	All	large	RUNCOM
During the project	PowerPoint Presentation	Research	All	medium	RUNCOM

Project Workshop
A special session in IEEE ISCE will take place in spring 2008 in order to present and discuss the main project results.

Project Web-Site
The project web page is hosted at http://suit.av.it.pt since March 2006 and contains a public and a private area. The first displays information about the project that all can access, and the second contains restricted information for the consortium. The page has constantly been updated during the project.

Contributions to Standardization Bodies
One of the project's objectives is to submit contributions to MPEG, DVB, IETF and IEEE technical groups or other standardization bodies. This should be done throughout the project.

Journal Publications and Conferences

The references of the journal publications and conferences can be found in section 2- WP7 of this document. Besides of already published paper, SUIT has also a plan for dissemination of results publishable in conferences and journals (see Plan of dissemination deliverable, D7.1.2)

Acronyms

All-IP	= All-Internet Protocol
AVC	= Advanced Video Communication
AWGN	= Additive White Gaussian Noise
CA	= Consortium Agreement
CC/PP	= Composite Capabilities/Preferences Profile
COST	= European Co-operation in the Field of Scientific and Technical Research
CTC	= Convolutional Turbo Coding
C++	= C Language ++
Dx.y	= Deliverable
DVB-T	= Digital Video Broadcasting-Terrestrial
DVB-T/H	= DVB-T/Handheld
DVB-RCT	= DVB- Return Channel Terrestrial
FEC	= Forward Error Correction
FMO	= Flexible Macroblock Ordering
FPGA	= Field Programmable Gate Array
FTP	= File Transfer Protocol
HD	= High Definition
HDTV	= High Definition Television
HO	= Hand_Over
IBBT	= Interdisciplinair Instituut voor Breedband Technologie Vzw
IEEE	= Institute of Electrical and Electronics Engineers
IRT	= Insitiut für Rundfunktechnik GmbH
IT	= Instituto de Telecomunicações
IT++	= Information Theory in C++
ITU	= International Telecommunications Union
ITU-R	= International Telecommunication Union Radiocommunication Sector
JVT	= Joint Video Team
LDPC	= Low Density Parity Check
Mx.y	= Milestone
MCTF	= Motion-Compensated Temporal Filtering
MD	= Multiple Description
MDC	= Multiple Description Coding
MD-SVC	= Multiple Description-Scalable Video Coding
MHP/IPTV	= Multimedia Home Platform/ Internet Protocol Television
MMR	= Monthly Management Reports
MPE	= Multi Protocol Encapsulation
MPEG21-DIA	= Moving Picture Experts Group 21 Digital Item Adaptation
MPEG-21 DIA-UED	= Moving Picture Experts Group 21 Digital Item Adaptation – Usage Environment Description
MPEG AVC	= MPEG Advanced Video Coding
MPTP	= Mathematical Techniques and Problems in Telecommunications
OFDM	= Orthogonal Frequency Division Multiplexing
PB	= Project Board
QAM	= Quadrature Amplitude Modulation
QoS	= Quality of Service
RF	= Radio Frequency
RFC	= Request For Comments
R&S	= Rohde & Schwartz
RTP/RTCP	= Real-time Transport Protocol/ RTP Control Protocol
RTSP	= Real Time Streaming Protocol
RUNCOM	= RUNCOM Technologies Ltd
SDC	= Single Description Coding

SDP	= Session Description Protocol
SDPng	= Session Description Protocol (New Generation)
SIP	= Session Initiation Protocol
SoC	= System on Chip
SVC	= Scalable Video Coding
TCL	= Tool Command Language
TIP	= Technology Implementation Plan
UDP	= User Datagram Protocol
UHF	= Ultra High Frequency
UPA	= Unequal Power Allocation
UPM	= Universidad Politécnica de Madrid
UniS	= The University of Surrey
URL	= Universitat Ramon Llull Fundacio Privada
VITEC	= SA VITEC
WAVECOM	= WAVECOM - Soluções Rádio, Lda
WiFi	= Wireless Fidelity
WiMAX	= Worldwide Interoperability for Microwave Access
WLAN	= Wireless Local Area Network
WP	= Workpackage
W3C	= World Wide Web Consortium