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Wireless Infrastructure over Satellite for Emergency COMmunications

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Thematic Priority: Information Society Technologies (IST)

WISECOM PUBLISHABLE FINAL ACTIVITY REPORT

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General

Document Info

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Table of Contents

Related Documents

Applicable Documents

Documents and Deliverables delivered during the whole is project duration:

[D1.1-1] "Survey of Use Cases", WISECOM Deliverable 1.1-1, November 2006.

[D1.2-1] "User and System Requirements for Emergency Telecommunication Services", WISECOM Deliverable 1.2-1, January 2007.

[D1.3-1] "Business Model Evaluation Report (draft)", WISECOM Deliverable D1.3-1, September 2008.

[D1.3-2] "Business Model Evaluation Report (final)", WISECOM Deliverable D1.3-2, August 2008.

[D2.1-1] "Terrestrial and Satellite Systems for Emergency Situations: State of the Art", WISECOM Deliverable 2.1-1, January 2007.

[D2.2-1] "WISECOM Overall System Architecture", Deliverable 2.2-1, June 2007.

[D2.3-1] "Regulatory and licensing dossier for emergency situation telecom infrastructures", WISECOM Deliverable 2.3-1, January 2007.

[D2.4-1] "WISECOM Target System Report", WISECOM Deliverable D2.4-1, August 2007.

[D3.1-1] "Demonstrator requirements and specification", WISECOM Deliverable D3.1-1, December 2007.

[D3.1-2] "Procurement and validation plan for the WISECOM Demonstrator", WISECOM Deliverable D3.1-2, September 2007.

[D3.2-1] "WISECOM Demonstrator Development Report", WISECOM Deliverable D3.2-1, March 2008.

[D3.2-2] "Demonstrator User Manual", WISECOM Deliverable D3.2-2, August 2008.

[D3.3-1] "Demonstrator Integration Report", WISECOM Deliverable D3.3-1, August 2008.

[D4.1-1] "Trial and Demonstrator Time Plan", WISECOM Deliverable D4.1-1, August 2007.

[D4.1-2] "Validation Test Procedures and Forms", WISECOM Deliverable D4.1-2, August 2007.

[D4.2-1] "Trial Result Analysis Report", WISECOM Deliverable D4.2-1, August 2008.

[D5.2-1] "Results for Trials Execution for All the Hybrid Configurations", WISECOM Deliverable D5.2-1, August 2008.

[D6-1] "Final Dissemination Report", WISECOM Deliverable D6-1, August 2008.

Reference Documents

Project publications and other relevant documents:

[1] H. Skinnemoen, S. Kopland-Hansen, A. Jahn, and M. Berioli, “Satellite based infrastructure for emergency communications,” in Proceedings 25th AIAA International Communications Satellite Systems Conference (ICSSC 2007), Seoul, Korea, April 2007, paper AIAA 2007-3152.

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[3] M. Berioli, N. Courville, and M. Werner, “Emergency communications over satellite: the wisecom approach,” in Proceedings 16th IST Mobile and Wireless Communications Summit 2007, Budapest, Hungary, July 2007.

[4] M. Berioli, N. Courville, and M. Werner, “Integrating satellite and terrestrial technologies for emergency communications: the WISECOM project,” in Proceedings of the International Conference on Heterogeneous Networking for Quality, Reliability, Security and Robustness (Qshine 2007), Vancouver, British Columbia, August 2007.

[5] Eriza Hafid Fazli, Dimitri Tassetto, Hillar Tork, Jaak Laineste, Markus Werner, “Location Based Services (LBS) for Satellite Based Emergency Communications”, in Proceedings of the 1st IEEE Conference on Wireless Rural and Emergency Communications (WRECOM 2007), Rome, Italy, 30 September – 2 October 2007, to appear.

[6] E. Fazli, M. Werner, N. Courville, M. Berioli, V. Boussemart, “Development of Integrated and Transportable Communication Terminal Using GSM and WiFi over Satellite for Emergency Communications“, 26th AIAA International Communications Satellite Systems Conference (ICSSC 2008), San Diego, CA, 10-12 June 2008.

[7] E. Fazli, M. Werner, N. Courville, M. Berioli, V. Boussemart, “Integrated GSM-WiFi Backhauling over Satellite: Flexible Solution for Emergency Communications”, IEEE 67th Vehicular Technology Conference (VTC2008-Spring), Marina Bay, Singapore, 11-14 May 2008.

[8] D. Tassetto, E. Fazli, M. Werner, “A Novel Hybrid Algorithm for Passive Localization of Victims in Emergency Situations”, 4th Advanced Satellite Mobile Systems Conference (ASMS 2008), Bologna, Italy, 26-28 August 2008.

[9] Emergesat Web Site: http://www.emergesat.org

[10] TRACKS (Transportable station for Communication network by Satellite): ESA Web site: http://telecom.esa.int/telecom/www/object/index.cfm?fobjectid=11473

Acronyms and Abbreviations

ANS	AnsuR
ASTR	Astrium SAS
BGAN	Broadband Global Area Network
BTS	Base Transceiver Station (GSM)
DLR	German Aerospace Center
DVB-RCS	Digital Video Broadcasting Return Channel Satellite
FP6	6th Framework Programme
LBS	Location-Based Services
OCHA	Office for Coordination of Humanitarian Affairs
PM	Progress Meeting
PPDR	Public Protection and Disaster Relief
PSCE	Public Safety Communications Europe
RUL	Reach-U Ltd.
SatNEx	Satellite Network of Excellence
SFZ	Steinbeis Foundation Center
TAS	Thales Alenia Space
TETRA	Terrestrial Trunked RAdio
TGS	TriaGnoSys
TSF	Telecom Sans Frontiers
WP	Work Package
UMTS	Universal Mobile Telecommunications System
UN	United Nations

Introduction

The present report is an expanded executive summary of the WISECOM project, cumulating the project activities and results over the full project duration. It is meant to be broadly comprehensible to an interested general reader, but not excluding technical details.

It can be used for direct publication by the Commission, if this can be useful to disseminate the project results.

1 Project Execution

1.1 Project Overview and Main Objectives

Disasters are often combined with the destruction of the local telecommunication infrastructure and may also happen where such infrastructures did not exist beforehand. This causes severe problems to the rescue operations during which first line telecommunication services are of paramount importance for assistance to victims or co-ordination of the rescue work. In these cases, only satellite systems are able to provide almost ubiquitously a backhaul connection to the intact network infrastructure.

Nowadays, satellite phones are extensively used in the first hours after the disaster. More complex and bulky technologies (see for instance [9] or [10]) can be transported to the disaster scene during the following hours or days, to restore local telecommunications for voice and data services using the most common telecommunication standards (GSM/UMTS, WLAN, WiMAX, TETRA) and a satellite backhauling link for the connection to the remote public networks: These solutions are already available on the market and enable victims and members of rescue teams to use their own, well-known terminals. So there is clearly a gap to be filled: the need of a system which is immediately deployable (like the satellite phones), but which enables advanced services (like for instance [9] or [10]).

The WISECOM project aims at defining the reference architecture of a complete target emergency telecommunication solution, also called WISECOM system, to replace the traditional use of satellite phones and of heavy and cumbersome devices. A prototype, the WISECOM demonstrator, representative of the critical features of this WISECOM system is then developed, tested, and validated in the project.

Thus WISECOM project can be split in two main phases; the first one aims at the in-depth analysis and design of the reference architecture of the WISECOM system, together with the definition of a suitably general business model, whereas the second one is focused on the development and test of a WISECOM demonstrator, validating the key features of the previously defined WISECOM system.

1.2 Work performed and results achieved

Relying upon the wide experience of its members, the WISECOM team has initially investigated topics ranging from the classical management of a disaster situation [D1.1-1, D2.1-1] to licensing and regulatory issues for emergency telecommunications [D2.3-1]. This has made the WISECOM team aware of the necessity of having a lightweight, robust, easily deployable and operable telecommunication system restoring quickly and transparently a local coverage with the most common wireless communication standards, so that highly stressed victims and members of rescue teams can use their own well-known, personal telecommunication devices to access the provided telecommunication services.

Based upon these preliminary studies, an important part of the initial work has been focused on the definition of a reference architecture for the WISECOM system, which was specified from the highest level to the most detailed one [D1.2-1, D2.2-1, D2.4-

1]. The definition of the reference architecture for the WISECOM system, illustrated in Figure 1, has been initiated by the expression of a wide set of requirements (user, service and system requirements) that should be fulfilled by the WISECOM system.

The architecture is based on a modular approach where several access and transport solutions can be supported. Two main segments are defined in WISECOM:

- the On-Disaster Site Segment encompassing the User-terminal Domain, the Local Access Domain, the WISECOM Client Domain and the group of network elements responsible for the access to the transport domain from the disaster area (satellite terminals, wireless terminals, etc…).,
- the Disaster-Safe Segment consisting of the group of network elements responsible for the access and control of the transport domain, the WISECOM Server / Operator Domain, the Public Networks Domain and the Home Networks Domain.

The interface between the two segments is provided by the Transport Domain. Nevertheless, part of the network elements of the Transport Domain is located in the On-Disaster Site Segment whereas another part is located in the Disaster-Safe Segment.

In the On-Disaster Site Segment, the WAT (WISECOM Access Terminal, see Figure 1) has been identified as the critical device for emergency telecommunication. The WAT is the devices which will be carried to the place of the disaster, and so it should be light and small as a suitcase, resistant to shock, water, humidity, dust, heating, etc… The telecommunication applications, provided by the WISECOM system, should range from classical voice services to the transfer of data and Location Based Services (LBS); they have been extensively described in this first project period.

The analysis of the WISECOM system has been organized and divided into the following seven configurations and tasks; each of them was designed and specified in details by the indicated responsible partner(s):

1. Disaster-safe segment for all configurations (DLR),
2. GSM over BGAN configuration (TGS);
3. Wi-Fi over BGAN configuration (DLR);
4. GSM over DVB-RCS configuration (ANS);
5. Wi-Fi / WiMAX over DVB-RCS configuration (ASTR);
6. Tetra over DVB-RCS configuration (TAS);
7. Location-Based Services (RUL).

The WISECOM architectural and functional description as displayed in Figure 1 and the interfacing to external networks also go hand in hand with the WISECOM business context. For this reason in this analysis the different organisations involved in the crisis management, their roles and their relationships have been carefully considered, and especially, the complexity of their relationships and the hurdles reducing the efficiency of their common work have been identified. The schematic representation of the role model and of the relationship between the different operators involved in the WISECOM system, and in general when restoring

telecommunication after a disaster, is presented in Figure 2 (see also [D1.3-1, D1.3-2]).

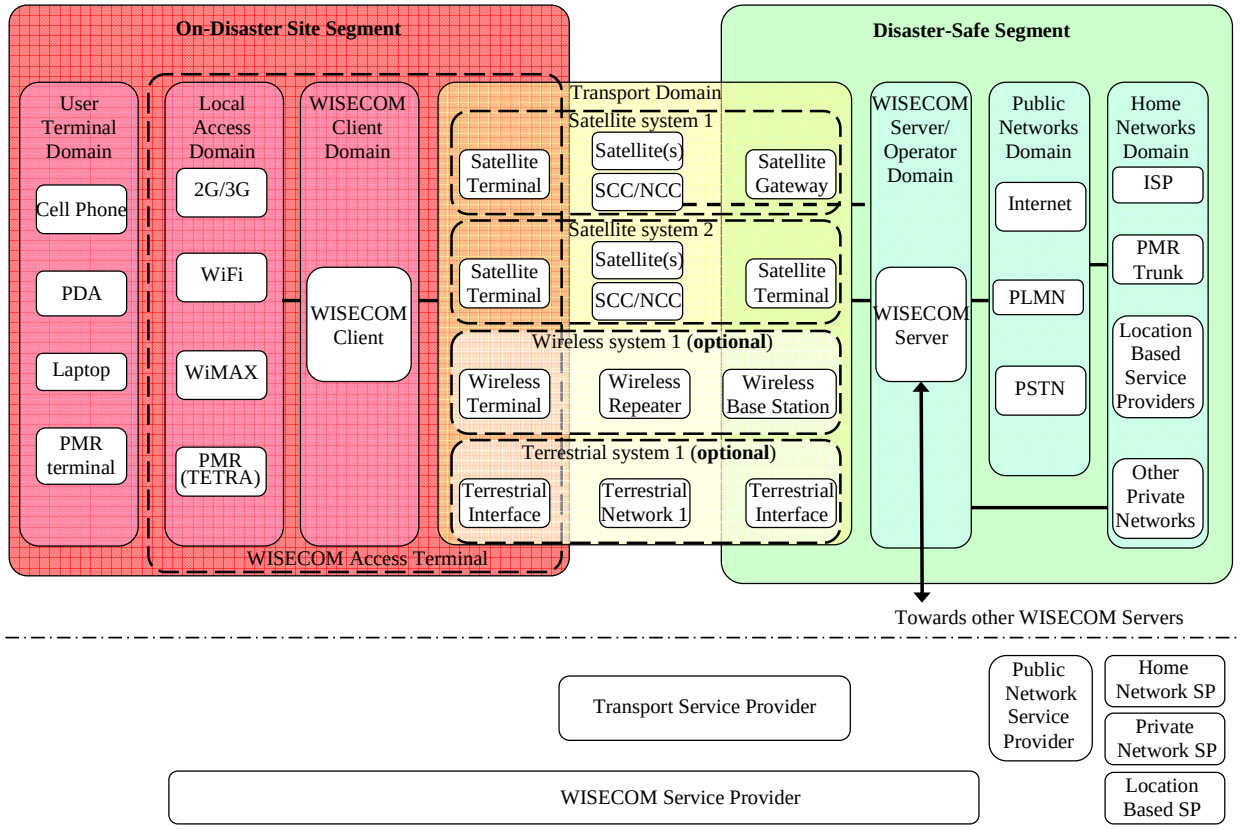

Figure 1 WISECOM functional architecture.

The WISECOM demonstrator, representative of the critical features of this WISECOM system, was then developed in the second part of the project, and used in a realistic drill with real rescue organizations in the final project demonstration. First a main programme of the final WISECOM demonstration has been defined, together with the main features of the WISECOM system that should be demonstrated [D3.1-1, D3.1-2]. Based on this analysis, working plans, procurement plans, time schedules and test plans for the different hybrid configurations have been proposed [D4.1-1, D4.1-2] and will be used as guidelines for the work performed in the setting up and testing of the WISECOM demonstrator and for the organization of the associated demonstration.

Two demonstrators were developed for the two WAT versions:

- the light and small one based on BGAN satellite terminal, which can be deployed by non-expert people within minutes (Figure 3(a));
- the more advanced one, based on DVB-RSC, which is bigger and has longer deploying times, and for this reason is meant for longer after-disaster recovery phases (Figure 3(b)).

For both WAT demonstrators, different devices (GSM pico-cells, WiFi base stations, GSM capable user terminals, BGAN terminals, DVB-RCS terminals, etc…) have been procured, set up and tested by different partners, software modules have been developed and integrated, and hardware parts prepared to build the final WATs

[D3.2-1]. The software and hardware integration between all these devices and modules was described in detail in [D3.3-1].

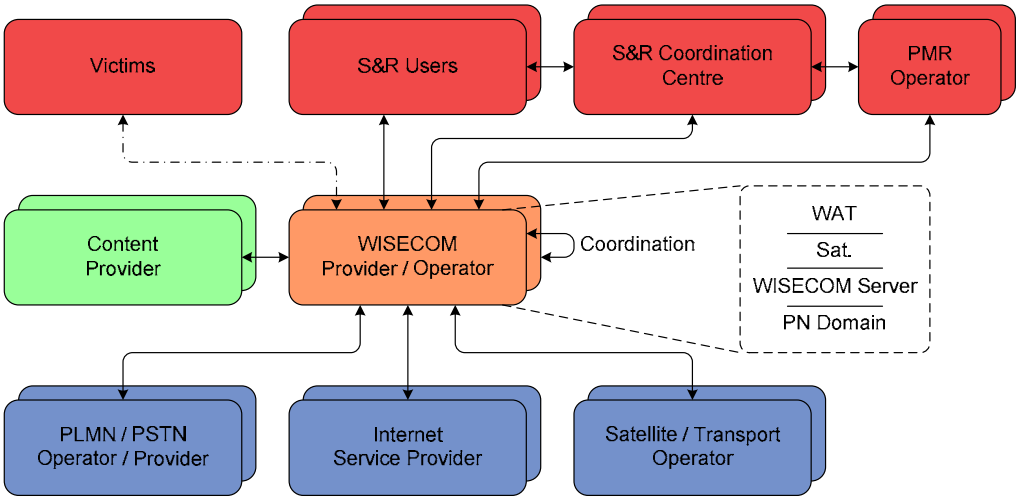

Figure 2 Schematic Representation of the Role Model and of the Relationship between the Different Players involved in the WISECOM System.

The partners have also performed a careful analysis of all demonstrator modules and tests of the overall system prototypes (the BGAN and the DVB-RCS one). The results were reported in [D4.2-1]. A “Demonstrator User Manual” was also prepared [D3.2-2].

The final WISECOM demonstration took place on May 28th 2008 at DLR premises (Oberpfaffenhofen, Germany), see Figure 4. It was a big event, involving many people and external parties (fire brigades, regional civil protection authorities, press, etc.), so the technical as well as the organizational preparation of the event constituted a big effort. The collaboration with real rescue workers who were able to operate the WAT was very valuable for the project to get useful feedback on the characteristics of the system.

(a) (b)

Figure 3 WISECOM Access Terminals: BGAN-based (a), DVB-RCS-based (b)

Simultaneously, the WISECOM team has been very active in the dissemination activity, producing 5 conference papers, planning further papers with focused technical contents in high-level international journals and conferences, organizing an own workshop within the IST Mobile Summit 2007, performing the Integral Satcom Initiative (ISI) endorsement of the project, and actively participating to several public safety fora (in particular the ETSI SatEC and the PSCE Forum, where WISECOM project manager, Matteo Berioli, is also chairing the satellite working group).

Figure 4 WISECOM Final Demonstration

1.3 Conclusion

Looking at the current reality of emergency communications it is easy to conclude that satellites are a fundamental element which has to be considered in this area, but their integration with terrestrial technologies is needed. The WISECOM project proposes a solution which includes the existing state of the art, which is easily to be upgraded with new upcoming technologies, and which, at the same time, is general enough to accommodate the complex business interactions between rescue teams and different service providers. This target WISECOM system was specified in details during this first phase of the project, and it was validated, in its key and critical aspects, in the second part of the project. The development of the WISECOM demonstrator, which was used by real rescue workers in a drill at DLR premises in May 2008, and the feedback of rescue organizations involved in the final project event, showed the big value of the WISECOM solution.

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1.4 Acknowledgments

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The WISECOM project team would also like to express sincere thanks to the following external companies:

- Pitney Bowes Mapinfo (www.mapinfo.com) for providing free licences for use of the MapX and MapX Mobile software during the course of WISECOM,

which formed an essential basis for the LBS application developed within WISECOM;

- MCP (Maritime Communication Partner AS, www.mcp.com), for providing the GSM microcell used in the GSM over DVB-RCS experiment;
- The GSM provider 1st Mobile, for the support in the GSM over BGAN experiment;
- The regional district of civil protection LRA Starnberg and the Bavarian Red Cross, for the support in the final demonstration.

2 Dissemination and use

NOTE: The following text is directly taken from the "Publishable Results" section of the WISECOM Final Plan for Using and Disseminating the Knowledge.

2.1 Publishable Results

The publishable results produced by WISECOM mainly deal with the overall system architecture, the system requirements definition, the business and role model, and the WISECOM demonstrator with all the results of the tests and trials performed with the system. These results were already published in the papers mentioned at the beginning of this document [1-8] as well as in the trials result report [D5.2-1, D4.2-1].