SATELLITE AND SPACE COMMUNICATIONS **SSC**
http://www.comsoc.org/socstr/org/operation/techcom/ssc/index.html

IEEE COMMUNICATIONS SOCIETY

SSC Newsletter **Vol. 20, No. 1, May 2010**

CONTENTS

The Satellite and Space Communications (SSC) Committee is a volunteer group actively involved in advancing satellite and space communication technologies within the IEEE. This committee is approved by the IEEE Communications Society and is governed by the constitution and bylaws of the IEEE as well as the other twenty-three Technical Committees in the Society. The committee belongs to the Technical Committee Clusters of Communication/Signal Processing (C/SP).

SATELLITE & SPACE

- JOIN US -

All conference attendees are welcome to join us in the SSC Committee meeting.

Location: Bartholomew Diaz, Westin Hotel

Date: Tue, May 25, 2010

Time: 12:00pm - 14:00pm

ICC2010 SSC Committee Activities

Symposium on Selected Areas in Communications:
SA-SS: Satellite and Space Communications
Chairs: Laura Pierucci (University of Florence, Italy); Igor Bisio (University of Genoa, Italy)
Tuesday, 25 May 2010
4:15pm - 18:00pm
Location: please check the final program.

Future SSC Meetings

Dec. 2010, Miami, FL, U.S.A.
June 2011, Kyoto, Japan
Dec. 2011, Huston, TX, U.S.A.

HOW TO JOIN SSC COMMITTEE AND MAILING LIST

If you like to join SSC Technical Committee: Please send your name and e-mail address to the SSC Secretary, optionally include your mail address, telephone and fax numbers.
If you like to join SSC Mailing List: Instructions on how to subscribe/unsubscribe are available at http://lists.scnl.dist.unige.it/listinfo/ssc.

SSC COMMITTEE OFFICERS

MESSAGE FROM THE CHAIR

Prof. Takaya Yamazato

Welcome to the twentieth issue of the Satellite and Space Communications newsletter. The goal of the Satellite and Space Communication (SSC) Technical Committee (TC) is to develop, organize and distribute technical information in the area of the satellite and space communications. The engineers and professionals from universities, government and research originations throughout the Globe participate as members and officers of this committee. At the moment, we have about 220 members and the number is growing with respect to previous years. All conference attendees are welcome to attend and those who are attending the SSC TC meeting for the first time will automatically become a member of the TC. Please join us to discuss mutual topics of interest in this important field in communications technology. The meeting agenda and other information about SSC TC activities and operation can be found at the TC web site (http://www.comsoc.org/socstr/techcom/ssc/).

I would like to thank our Vice Chair, Dr. Tarik Taleb, and our Secretary, Dr. Igor Bisio, for editing the SSC newsletter. I would like to thank again to Dr. Igor for SSC web page and membership information updates, and the meeting material preparation.

We will have the officer election and our term will be over at the end of June 2010 and from July the new officers will take place. The SSC TC Officers Selection and Nomination Committee consists of SST TC past-chairs, Prof. Desmond Taylor, Prof. Abbas Jamalipour, Prof. Mario Marchese, Prof. Iwao Sasase, Dr. Ron Smith, and Dr. Satchandi Verma, decided have an electronic election this time. I would like to express my deepest appreciation to our past chairs. They really think of us and they wants us to be more active in ComSoc.

Please read the following email posted by Prof. Mario Marchese on May 12, 2010 1:24:05 AM GMT+08:00 and follow the instruction.

From: Mario Marchese <mario.marchese@unige.it>
Date: May 14, 2010 6:31:25 PM GMT+08:00
To: ssc@scnl.dist.unige.it
Cc: desmond.taylor@canterbury.ac.nz, yamazato@ieee.org
Subject: [SSC] Communication from SSC TC Officers Selection and Nomination Committee

Dear SSC TC Members,

the SSC TC Officers Selection and Nomination Committee is still working.

The decisions of the SSC TC Officers Selection and Nomination Committee are the following:

1) we would officially ask for additional nominations and we would fix the deadline for nominations at Friday, May, 28th. Nominations need to be sent to the SSC TC Officers Selection and Nomination Committee.

2) we would strongly suggest to have a totally electronic vote to allow the participation of a wider number of people. After the deadline, a small committee consisting of previous chairs should design a ballot, email it to the committee membership and then count the votes as they come in. We will allow 3-4 weeks for this and should do it all electronically. Once the counting is complete or the approval (in the case of only one candidate for a position), we will announce to the overall committee that the election is complete, provide the details of the new officers and inform ComSoc of this. Precise guidelines about electronic vote will be sent after May, 28th.

3) Even if the election is slightly postponed, we want also point out that we are hoping to have the new committee executive in place well in advance of Globecom in Miami. Having done this we will be back in business and active as a committee.

4) We need to ensure that the committee shows evidence of activity between the major conferences.

Additionally, about more general aspects, we point out that
5) SSC need to generate visible activity from the Committee on a continual basis and not just at the meetings held at ICC and Globecom. Much of this could be done by email, but it needs to involve persons other than the committee executives. So, see 6)

6) We strongly suggest the creation of an advisory group, to be approved at next Meeting, of about 3/4 people, all of whom should be past chairs and all of whom should be active researchers. In this connection, it would be good if we could identify some one from industry. This group should be charged with identifying hot issues and areas that the committee should focus on and should help in developing these foci. The advisory group should also help the Officers to manage the Committee.

We do hope these suggestions, fruit of a hard work, may be accepted by the SSC TC Chair and Officers.

Best Regards,

Mario Marchese
SSC TC Past-Chair
on behalf of the SSC TC Officers Selection and Nomination Committee
(Past-Chairs: Desmond Taylor, Abbas Jamalipour, Mario Marchese, Iwao Sasase, Ron Smith, Satchandi Verma)

Concerning the technical activities, Dr. Tarik Taleb and Dr. Igor Bisio are also active in the technical activities. Dr. Taleb is Track Chair of Satellite and Space Communications, General Symposium on Selected Areas in Communications, has successfully organized the sessions " SA-SS: Satellite and Space Communications," scheduled on Tuesday, May 25 16:15-18:00. Dr. Bisio chairs the session.

SSC Secretary Dr. Igor Bisio is serving as Symposium Co-Chair of Selected Areas in Communications Symposium of Globecom2010 (5-10 Dec. 2010, Miami, Florida, USA). I will be a TC representative for ICC2011 (5 - 9 June 2011, Kyoto, Japan).

The committee has also been actively promoting satellite communications systems and technology via professional journals, transactions, and magazine publications. Members Dr. Riccardo De Gaudenzi, Dr. Hung Henry Nguyen and Dr. Fotini-Niovi Pavlidou together with SSC Secretary Dr. Igor Bisio and I will sponsor JCN special issue on "Recent Advances in Satellite and Space Communications," expected to publish in December 2010. We received 39 submission and it is a good number.

The field of satellite communications continues to grow rapidly and remains interesting and exciting. I encourage all who are interested in this field to join our committee.

Visit our web site (http://www.comsoc.org/socstr/techcom/ssc/) where you can get information on events and upcoming meetings, and interact with committee officers and members.

Prof. Takaya Yamazato, Chair
Satellite and Space Communications
Technical Committee

SCANNING THE WORLD

Dr. Tarik Taleb

As indicated in a recent China Daily article [1], China is planning to launch 10 Beidou (Compass) navigation satellites by 2012. When the Beidou Navigation Satellite System is completed in 2020 with 35 satellites, it will cover Asia-Pacific region and allow China to be completely independent from the Global Positioning System (GPS).

Having different navigation systems will improve information security and protect users in case one system fails.

In the UK, one of the aims of USO (Universal Service Commitment/Obligation) is to provide good Internet connection to the whole country by 2012. Different solutions, such as improvement of existing telephone lines, new wireless networks, etc., are all under consideration. The satellite Avanti provides broadband Internet access for several thousand European consumers and can also help to achieve the goal.

This year it is planned to launch one more satellite that will provide low cost service to the whole UK and Europe.

[1] Xin Dingding, "China aiming to have its own GPS in place by 2012 -- Experts also urge international cooperation in navigation systems," China Daily, Vol. 30 no. 9273, Jan. 16-17, 2010

Dr. Tarik Taleb, Vice Chair
Satellite and Space Communications
Technical Committee

FORTHCOMING GLOBECOM AND ICC CONFERENCES

MILCOM 2010
October 31-November 03, 2010, San Jose, CA, USA
http://www.milcom.org/
The theme for the MILCOM 2010 conference is "Next Decade of Military Communications". MILCOM is the premier international conference for military communications and attracts a very impressive array of participants with high-level attendance from government, military, industry and academia. MILCOM 2010 gives industry the opportunity to promote communications to all branches of the armed forces, Department of Defense, federal government, and the heads of multi-national forces from around the globe.

In 2010, MILCOM will take place at the San Jose Convention Center in San Jose, California. It's been said that San Jose feels like a "campus." This sensation may be influenced by the proximity of the hotels, restaurants, and attractions including museums and performing arts venues. All are within walking area, and our conference hotel, the Fairmont is practically next door.
The conference is being hosted by Lockheed Martin Corporation and The Aerospace Corporation.

GLOBECOM 2010
December 6-10, 2010, Miami, FL, USA
http://www.ieee-globecom.org/confs/2010
The Premier Telecommunications Event for Industry Professionals and Academics from Companies, Governmental Agencies, and Universities around the World
Themed "MIAMI: Moving Into the Age of Mobile Interactivity," IEEE GLOBECOM 2010 covers the entire range of communications technologies, offering in-depth information on the latest developments in voice, data, image, and multimedia.

COSPONSORING / RELATED CONFERENCES AND WORKSHOPS

ICC 2011
June 5-9, 2011, Kyoto, Japan.
http://www.ieee-icc.org/2011/
The Premier Telecommunications Event for Industry Professionals and Academics from Companies, Governmental Agencies, and Universities around the World.
Themed "Source of Innovation: Back to the Origin," IEEE ICC 2011 covers the entire range of communications technologies, offering in-depth information on the latest developments in voice, data, image, and multimedia.

CONFERENCES CALENDAR

CONFERENCE	DATE & LOCATION	INFORMATION
SPECTS 2010 International Symposium on Performance Evaluation of Computer and Telecommunication Systems	July 11-14, 2010, Ottawa, Canada	http://atc.udg.edu/SPECTS2010/
SPACOMM 2010 The Second International Conference on Advances in Satellite and Space Communications	June 13-19, 2010, Athens, Greece	http://www.iaria.org/conferences2010/SPACOMM10.html
Ka and Broadband Communications Conference	To be defined	http://www.kaconf.org/
WCNC 2011 IEEE Wireless Communications & Networking Conference	March 28-31, 2011 Cancun, Quintana-Roo, Mexico	http://www.ieee-wcnc.org/
PSATS 2011 3nd International Conference on Personal Satellite Services	Feb 17-18, 2011 Malaga, Spain	http://www.psats.eu/
WCSP 2010 International Conference on Wireless Communications and Signal Processing	October 21-23, 2010 Suzhou, China	www.ic-wcsp.org
Array 2010 IEEE International Symposium on Phased Array Systems & Technology	October 12-15, 2010 Boston, MA, USA	www.array2010.org
ICT 2010 17th International Conference on Telecommunications	April 4-7, 2010 Doha, Qatar	www.qu.edu.qa/ict2010
ICSOS 2011 International Conference on Space Optical Systems and Applications	May 2011 Los Angeles, CA, USA	Web Site not yet available

To all SSC members: If your postal address, telephone or fax numbers have changed, please update them with the committee secretary. You can review our current records on our web page at http://www.comsoc.org/~ssc/.

PERSPECTIVE ARTICLE May 2010

Integrated Space-Terrestrial Systems to Provide Group-Oriented Services in Emergency Networks

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***Abstract*— Large scale disasters distributed worldwide have highlighted the importance of creating robust public safety networks able to respond quickly to emergency situations. In the last few years, scientific communities have carried out a massive research activity aimed at the specific design of communications and networking technologies for public safety and security. In this perspective paper a feasible emergency network architecture is designed, where the space and the terrestrial segments are integrated to efficiently provide communication, navigation and monitoring services in the incident area. Possible network architectures and the related application scenarios are described, as well as the main system requirements and the techniques to provide group-oriented services in the identified scenarios.**

***Index Terms*— Emergency Network, Satellite, NAV/COM, UAV, GMES, Group Oriented Services.**

I. INTRODUCTION

Integration of heterogeneous networks represents a research issue shared among the most of public and private research organizations, standardization bodies, and industries. The synergies deriving from the wise integration of space and terrestrial segments are able to overcome most of the limitations, which prevent the full deployment of a world-wide system for pervasive communications, navigation and environment monitoring. Therefore, nowadays, the need of global cooperation among different systems, components and services becomes an important research argument to be investigated. In particular, such an aspect assumes a significant role in environments showing very stringent communications requirements; the case of areas involved in public safety and security scenarios (i.e., human security, natural disasters, emergency situations) could be a typical example.

Indeed, such contexts should be characterized by infrastructures and procedures able to dynamically and efficiently respond to environment changes. Moreover, in an emergency situation the design of a communication system that can be quickly deployed, allowing users (i.e., first aid, civil protection, possible victims, ambulances, and so on) to stay connected, is a must. This perspective paper analyzes the main system requirements and the techniques to provide group-oriented services in an emergency scenario, where the end to end network architecture is characterized by the integration of space and terrestrial segments with the purpose of assuring communication (COM), navigation (NAV) and monitoring [1] services in the incident area.

In fact, in such a context the management of radio resources based on the "group concept" (i.e., first responders and rescue teams groups) allows in an emergency network to efficiently utilize the scarce system resources with a consequent improvement in term of connectivity, capacity and reliability.

The remain part of the paper is organized as follows. Section 2 provides a brief overview of a possible emergency network architecture. Section 3 illustrates the main requirements for group-oriented services. Finally, conclusive remarks are given in Section 4.

II. Integrated System Architecture

This section aims at identifying the end-to-end architecture and the topology of a possible *Emergency Network (EN)*, where the *NAV/COM* system is integrated with the *Global Monitoring for Environment and Security* (GMES) [1] system, allowing to increase the efficiency of the intervention and to better anticipate potential threats.

In the last few years, several research activities have been conducted in this field with the aim to provide communication, navigation and monitoring capabilities in disadvantages areas. For instance, in Europe are being funding several projects, obtaining interesting results in term of innovative architectures and applications. Some of the projects funded are here mentioned: *WISECOM* (Wireless Infrastructure over Satellite for Emergency Communications) [2], *ESS* (Emergency Support System) [3], *EULER* (European software defined radio for wireless in joint security operations) [4], *SAFER* (Services and Applications for Emergency Response) [5], *CHORIST* (Integrating Communications for Enhanced Environmental Risk Management and Citizens Safety) [6], *SECRICOM* (Seamless Communication for Crisis Management) [7], SALICE (Satellite-Assisted Localization and Communication systems for Emergency Services) [8].

On the other hand, in the USA, similar initiatives have been developed by the FEMA (Federal Emergency Management Agency) [9] defining the main requirements to provide secure

and scalable applications in heterogeneous networks when critical conditions are taken into account.

Moreover, several contributions have been recently published also concerning topics related to heterogeneous networks built with seamless satellites and UAV (Unmanned Aerial Vehicle) components [10-12], interoperable gateways [13] and group oriented services [14] in emergency scenarios. A generic *EN* could be split into two component sub-networks, based on their coverage features: *Long-Range Network (LRN)*, utilized for communications toward remote zones, and *Short-Range Network (SRN)*, used to carry out communications within the *Incident Area (IA)*.

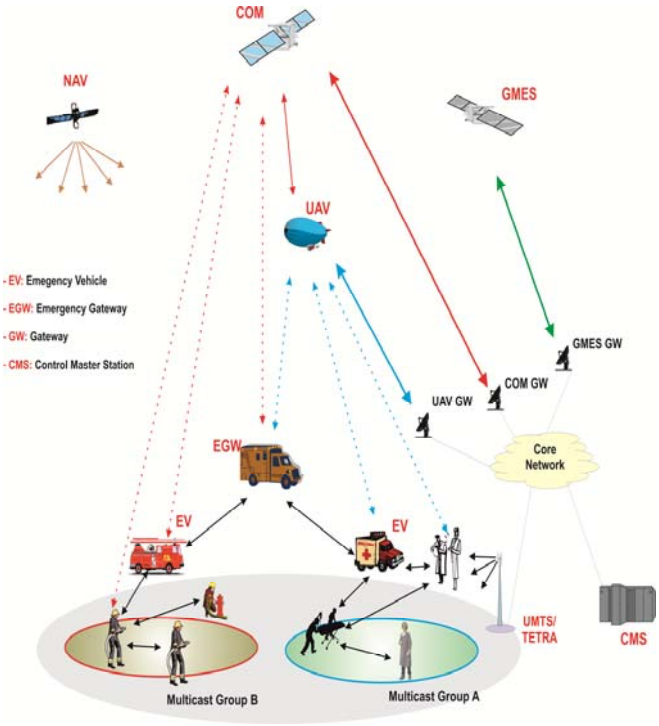

Figure 1. Emergency Network Architecture [8]

The LRN could consist of both a space and a terrestrial segment, while the SRN takes into account only the terrestrial component [11]. As shown in Figure 1, the space segment could comprise: *(i) a Communication* system (e.g., GEO/LEO Satellite, UAV), *(ii)* a *Navigation* system (e.g., GPS, Galileo) and finally *(iii)* an *Environment Monitoring* system (i.e., GMES). The terrestrial segment consists of several mobile/wireless communication systems, such as *WWAN* (e.g., UMTS, TETRA), *WMAN* (e.g., WiMAX), *WLAN* (e.g., WiFi), *WPAN* (e.g., Bluetooth, IEEE 802.15.3, IEEE802.15.4 technologies), or *RFID* (Radio Frequency Identification) useful for indoor localization purposes. These kinds of terrestrial networks are very different in terms of offered data rate and delay, security issues and communication range. This strong heterogeneity poses several problems about the definition of an efficient integration scheme, which allows smart and quick communications between the various system actors. Such a scheme will make users aware of the monitoring place current conditions and will enable them to effectively face emergency situations.

III. Group Oriented Service in the Emergency Network

In order to optimize the coordination among rescue teams in an emergency scenario, the limited radio resources have to be efficiently utilized. In these cases, many groups of first responders may need to be established and to share logistic information of various nature, e.g., dispatching, maps, video of the incident area. Both the number and the distribution of responders belonging to each group may be high. Furthermore, the creation of unusual groups may turn into an intense additional load to the usual traffic of given areas. The employment of Multimedia Broadcast/Multicast Services (MBMS) [15] in the scenarios depicted above can enhance the overall system performance, since multicast emergency transmissions can be delivered to groups of receivers at the same time; thus avoiding data duplications both in the core network and over the air interface [16]. MBMS is the multicast technology developed by the 3rd Generation Partnership Project (3GPP). It is a downlink point-to-multipoint protocol thought for the delivery of multicast and broadcast streams from a single source. Main objectives of MBMS are:

- efficient usage of the radio resources/spectrum (e.g., by delivering data to terminals belonging to the same multicast group, and momentarily present in the same radio cell, over common radio channels);
- provisioning of contents, based on voice, images, video and data, with different bit rate;
- reduction of the impact on existing infrastructures; by this meaning, for instance, the exploitation of already existing common channels and associated protocols.

Notwithstanding, a terrestrial-only MBMS system is not adequate to match the exacting requirements arising in the depicted operational scenarios. An emergency situation implies the presence of different first responder organizations operating at the same time within the same area; each organization gives support to its operators by establishing one or more multicast groups (either for information enhancement on the emergency area or for information exchange among operators); this furnishing an additional traffic load to pre-existing multicast/unicast traffic. In emergency areas where resources are usually scarce, even a small number of multicast groups formed at the same time to deliver differentiated services will find high difficulties in experiencing an acceptable Grade of Service (GoS); furthermore, they will adversely affect the performance of unicast traffic connections due to resource unavailability.

This is why, the integration of space segments into the MBMS architecture deserves a special attention from the scientific and industrial communities. Advantages deriving from the MBMS extension to satellite-terrestrial integrated platforms, known as

Satellite-MBMS (S-MBMS) [17-18], are manifest; they are mainly related to: achievable wider coverage areas, reduction of terrestrial segment overloading, overall cost reduction as a consequence of multicast service delivery to more users in the same (wider) coverage area, augmented possibility of providing services at differentiated (medium and high) bit rates, etc.

In spite of the highlighted advantages, the use of satellites implies severe limitations mainly due to well known features, such as: heterogeneity of the channel quality, unreliability of the satellite channel, long propagation delays in case of geostationary (GEO) satellites and high complexity in case of low-Earth orbit (LEO) satellites (due to mobility).

UAVs are a valid prospective alternative to satellites in supporting MBMS services and applications. As it clearly emerges from the literature [19], nowadays UAV systems are very attractive in the view of assisting terrestrial networks in offering broadband access to multimedia service (both with a broadcast and multicast nature) [20-21].

In previous works [12,14, 22], the impact on MBMS services deriving from the presence of both long range networks (satellite, UAV, cellular network) and short range networks (WLAN, WPAN) has been investigated. It has been shown the capability of the space segment to be either utilized as base stations in the sky or as an overlapping coverage, and it has been demonstrated that the introduction of the space segment can bring many advantages in the management of group oriented services (i.e., MBMS) especially in scenarios regarding the public safety and security.

Nevertheless, in an integrated network, the choice of the best radio resource management (RRM) algorithm to efficiently manage multicast groups should be addressed. It can depend on many factors strictly related to the nature of the groups themselves, for instance: *(i)* the varying *distribution* of multicast users belonging to each group (depending on the specific positioning of the units of responders belonging to a given first-aid force across the territory in emergence); *(ii)* the varying *number* of users joining each group (depending on the specific number of first responders each organization is able to deploy) and, finally, *(iii)* the varying *resources* consumed by each group (i.e., the power consumed to assign multicast channels in the incident area). Therefore, the RRM should implement an adaptive and dynamic algorithm depending to the specific working conditions, in order to find the best policy that optimally assigns multicast groups either to the terrestrial or to the spatial segment.

Moreover, in this research field others open issues have not been yet investigated; among the others it is worth mentioning: *(i)* interoperability among different actors; *(ii)* multicast user mobility, including networks roaming and vertical handovers; *(iii)* users and network cooperation; *(iv)* interference issues when several radio interfaces are used at the same time.

IV. Conclusions

In the envisaged terrestrial-space system for handling emergency situations, the key issue to investigate is the effective and efficient management of information provided from different systems (NAV/COM/GMES) to guarantee the public safety and security. This means that such a system requires highly efficient algorithms to take effective decisions and optimize the connectivity and the overall system performances.

V. Acknowledgement

This work has been supported by Italian Research Program (PRIN 2007) Satellite-Assisted LocalIzation and Communication system for Emergency services (SALICE)", http://lenst.det.unifi.it/salice

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