SATELLITE AND SPACE COMMUNICATIONS **SSC**

http://committees.comsoc.org/ssc/

IEEE COMMUNICATIONS SOCIETY

SSC Newsletter **Vol. 24, No. 2, December 2014**

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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: Pedernales/Level 1, Hilton Garden Inn
Date: Thursday, 11 December 2014
Time: 12:30-14:00

Future SSC Meetings

June 2015, London, UK
Dec. 2015, San Diego, USA
June 2015, Kuala Lampur, Malaysia

GLOBECOM 2014 SSC Committee Activities:

Symposium on Selected Areas in Communications:

- *Thursday, 11 December 2014 • 14:00-15:45*
  Location: Level 1, Room 402
  SAC-SSC-01: Satellite Networking
  Chair: Giovanni Giambene (University of Siena, Italy)
- *Thursday, 11 December 2014 • 16:15-18:00*
  Location: Level 1, Room 402
  SAC-SSC-02: Space Communications
  Chair: Hiroki Nishiyama (Tohoku University, Japan)

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/.

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MESSAGE FROM THE CHAIR

Prof. Igor Bisio

Since 1962, for the first time in the long history of the Satellite and Space Communications (SSC) Technical Committee (TC) a Chair is confirmed for a second term. As a consequence, again for the first time, the Chair writes the fifth "Message from the Chair" of the TC Newsletter since its launch, 24 years ago.
Indeed, it is my deep belief and awareness that my illustrious Predecessors would have deserved much more than me, the confirmation for a second term: this exceptional event is not due to the abilities of the Chair but it is exclusively due to the critical situation in which our TC is experiencing. As reported in the previous "Message from the Chair", the SSC TC has been finally recertified and, quoting myself, "*It represents a push to continue the effort of the SSC TC Officers and of the members that are cooperating in the many ongoing activities of the committee*". This need for a constant and

continuous activity has been also formalized in several necessary actions, listed in that "Message form the Chair", which required the Chair starting the work to carry it on.
For this reason, despite the concerns related and the exceptionality of a re-election and despite my own doubts about my real capabilities, I accepted – also thanks to the support of distinguished Members of our TC – to continue.
I want to deeply thank all the Members of the TC for their trust and I promise I will do my best to serve the TC in the best way and ensure that our community continues its long history. I want also thank the new Vice-Chair, Dr. Tomaso de Cola, and the new Secretary, Prof. Song Guo, for their availability to be Officers in this intense and complex period.
Concerning the status of the ongoing work, in the following you can find the updates.

Participation to TC Meetings. The SSC TC last meetings have a quite satisfactory number of attendees. In Atlanta during IEEE GLOBECOM 2013, we had around 40 attendees, in Sydney during IEEE ICC 2014, we had 23 attendees. We have to continue to publicize our meeting and to invite members, past and new, to attend.

Operative Policies and Procedures (OP&P). The SSC TC since last year has new OP&Ps. The current version seems satisfactory but we will evaluate during the current term if amendments are needed.

Membership Management. We proposed a two-fold approach: to continue with the acquisition of new members and, more importantly, to involve old and new members in the TC activities (as Symposium Chairs, Guest Editors, etc.). The former activity is proceeding at a slow pace, and we need more incisive action. For what concerns the second part, we deem it is producing adequate results: we nominate new representatives for IEEE ICC/GC and several members are working on interesting and prestigious editorial initiatives.

Extended Cooperation. It consists of strict cooperation with Industries, research institutes, standardization institutes (e.g., CCSDS, ETSI), and space agencies of several countries (NASA, JAXA, ESA). A first step is represented by the nomination of a Standardization Liaison coming from industry.

Review of the Advisory Committee. The new Officers team is evaluating the involvement of new members for those roles.

SSC Website and Mailing List. The Vice-Chair and the Secretary have moved the SSC website on the IEEE ComSoc template (available at http://cms.comsoc.org/eprise/main/SiteGen/TC_SSC/Content/Home.html). Moreover the new mailinglist is almost ready to be used.

Current Journals/Magazines. The two editorial initiatives which have been organized a couple of years ago are the IEEE Communications Magazine (COMMAG) and the IEEE JSAC. The former is closed: Prof. Sacchi and his Guest Editors team have done an excellent work: two issues about satellite and space communications and networking are scheduled in 2015. Around 10 papers will appear in the Magazine. For what concerns the JSAC editorial initiative, in January we will probably receive feedback about the state of the proposal. From this viewpoint, three more initiatives are under development: a possible Special Issue on the IEEE Internet of Things Journal, edited by our Past-Chair Prof. Nei Kato and myself. The *Call for Papers* (CFP) is not entirely dedicated to satellite and space communications and networking topics but contributions from this research area are included in the CFP and are really welcome. Another couple of initiative concerns a possible Special Issue proposal on the IEEE Wireless Communications Magazine and on IEEE Network. In these cases the usual "call for volunteers" will be proposed during the meeting and by using the TC mailinglist.

Conference Activities (ICC/GC and others). In ICC/GC is consolidated the SSC Track. In the recent years the SSC track has been quite successful. The SSC track of IEEE ICC'15, chaired by our Vice-Chair, received around 40 submissions. Concerning other conferences, the SSC TC has endorsed SPECTS2014 and the endorsement for SPECTS2015 and APCC2015 (Asia-Pacific Conference on Communications 2015) has been requested.

Awards and Distinguished Lecturers. The SSC TC works on two kinds of awards: the SSC Awards and the other IEEE/ComSoc Awards. The SSC Award this year has been assigned to illustrious colleagues: Dr. Björn Ottersten, Dr. Symeon Chatzinotas and Dr. Bhavani Shankar of the SIGCOM Research group, the Interdisciplinary Centre for Security, Reliability and Trust, University of Luxembourg.
Concerning the second kind of award, we have to nominate an ad-hoc committee. It will be individuated, hopefully, during the meeting in Austin (IEEE GC'14). Finally, about the Distinguished Lecturers roles, the SSC TC nominated two illustrious colleagues: Prof. Song Guo, the current SSC Secretary, and Prof. Joel Rodrigues, member of our TC.

Standardization Activities. During the meeting in Atlanta (IEEE GC'13), we appointed the Standard Liaison, Dr. Henry Suthon, Principal Senior Engineer at Boeing (h.suthon@ieee.org).

Prof. Igor Bisio, Chair
Satellite and Space Communications TC

SCANNING THE WORLD

Dr. Tomaso de Cola

One of the most important highlights recorded in the second half of year 2014 is certainly the success of Rosetta mission. It essentially consisted in the launch of the Rosetta space probe, performed in 2004, and the landing of the lander Philae on the comet 67P/Churyumov–Gerasimenko (67P). The aim of the mission is to collect information about comet surface composition to see the possible relations with the appearance of water on Earth. Although the landing of the Philae happened only 10 years after the launch with a long journey through the space, Rosetta probe was already able to provide new insights about the characteristics of some asteroids encounter during its route. Finally, it is worth noticing that the communication payload as well as the space link design has been carried much before the launch, at the end of nineties, thus witnessing the huge potentials that new space missions may have with the implementation of more sophisticated communication solutions nowadays available.

From the commercial satellite perspective, notable breakthroughs can be recorded in the framework of maritime and "conventional" broadcast services via satellites. As to the former, renewed interest towards maritime communications via satellite is confirmed by the need for improving AIS services, on the one hand, and the increasing number of vessels that need to be supported during their navigation path. Further to these, additional services are being under investigation to draw the requirements that next generation satellite system should meet. Concerning other commercial services, it is worth mentioning the introduction of new satellite platforms or components able to enable new services, such interactive TV and IoT applications. This is, for instance, the case of *smart-LNB* developed by Eutelsat and providing a system able to easily make use of forward (mostly for TV contents) and return (for signaling and interactive data exchange) links, the latter being implementing a lower data rate channel. This platform can be efficiently used for IoT applications given the small amount of data typically generated by these applications and its bursty nature that is properly handled by advanced channel access and overall physical layer design. Further to this, Gilat has launched new satellite services able to integrate the advantage of satellite broadcasting over the forward link and cellular link availability on the return link. This is expected to give satellite a prominent role in the near future of mobile communications, because of the combinations of two separated technologies which will certainly enable a larger gamma of service for mobile users.

From research perspective, new findings came from the design of satellite payload according to flexible and beam-hopping concepts. The former are actually being adopted in the new family of satellite from Inmarsat (I5 satellite fleet) and allow the dimensioning of the overall satellite network in a dynamic way so as to timely meet the user demands, according to the user traffic demanded within each satellite beam. As such, power and frequency allocation over beams is envisioned to minimize the amount of unmet capacity requests and overall optimize the QoS experience of users. On the other hand, the beam-hopping concept is still under re-definition and essentially consists in illuminating beams according to real traffic demands, so that the capacity allocation is time-driven. Potentials for such an approach are however very much dependent on the payload characteristics.

Finally, cognitive radio strategies are being considered for the future coexistence of satellite and mobile cellular systems (e.g., 5G) for a more efficient use of the spectrum resources through opportunistic access to the instantaneously available frequency channels. The potentials of such application are currently being investigated in the CoRaSat project funded by EU programme and already preliminarily addressed in other ESA-funded initiatives.

Dr. Tomaso de Cola, Vice Chair
Satellite and Space Communications TC

FORTHCOMING GLOBECOM AND ICC CONFERENCES

COSPONSORING / RELATED CONFERENCES AND WORKSHOPS

ICC 2015

June 8-12, 2015, London, UK

http://www.ieee-icc.org/2015/

The IEEE International Conference on Communications (ICC) will be held in London, UK from 8-12 June 2015. Themed "Smart City & Smart World," with its proximity to London's Tech City, the fastest growing technology cluster in Europe, this flagship conference of IEEE Communications Society will feature a comprehensive technical program including twelve Symposia and a number of Tutorials and Workshops. IEEE ICC 2015 will also include an exceptional Industry Forum & Exhibition program including business panels and keynote speakers. We invite you to submit your original technical papers, and industry forum, workshop, and tutorial proposals to this event. Accepted and presented papers will be published in the IEEE ICC 2015 Conference Proceedings and submitted to IEEE Xplore®.

MILCOM 2015
October 26-28 2015, Tampa, FL
http://www.milcom.org/
The MILCOM 2014 - Military Communications Conference is dedicated to military communications networking, services, timing and applications, including:

- *Waveforms and Signal Processing view details*
- *Selected Topics in Communications view details*
- *International Perspectives on Communications*
- *Networking Protocols and Performance view details*
- *Services and Applications view details*
- *Cyber Security and Trusted Computing view details*
- *System Perspectives view details*

The MILCOM 2015 - Military Communications Conference brings together professionals from the industry, academia, and government.

GLOBECOM 2015
December 6-10, 2015, San Diego, CA, USA
http://globecom2015.ieee-globecom.org/
IEEE GLOBECOM is one of two flagship conferences of the IEEE Communications Society, together with IEEE ICC. Each year the conference attracts about 3000 submitted scientific papers. A technical program committee of more than 1,500 experts provides more than 10,000 reviews, and from this a small fraction of the submitted papers are accepted for publication and presentation at the conference. The conference meets once a year in North America and attracts roughly 2000 leading scientists and researchers and industry leaders from all around the world. IEEE GLOBECOM is therefore one of the most significant scientific events of the networking and communications community, a must attend event for scientists and researchers from industry and academia.

CONFERENCES CALENDAR

CONFERENCE	DATE & LOCATION	INFORMATION
SPECTS 2015 International Symposium on Performance Evaluation of Computer and Telecommunication Systems	July 26-29, 2015 Chicago, IL, USA	http://atc.udg.edu/SPECTS2015/
IEEE Aerospace Conference	Mar 7 - 14, 2015 the Yellowstone Conference Center in Big Sky, Montana, USA	http://www.aeroconf.org/
WCNC 2015 IEEE Wireless Communications and Networking Conference	March 9-12, 2015 New Orleans, LA, USA	http://wcnc2015.ieee-wcnc.org/
ICNS Integrated Communications Navigation and Surveillance Conference	April 21-23, 2015, Washington Dulles Airport, VA, USA	http://i-cns.org/
VTC-Spring 2015 IEEE Vehicular Technology Conference	May 11-14, 2015, Glasgow, UK	www.ieeevtc.org/
International Conference on Localization and GNSS	June 22-24, 2015 Gothenburg, Sweden	http://www.icl-gnss.org/2015/index.php
PIMRC 2015 IEEE International Symposium on Personal, Indoor and Mobile Radio Communications	Aug 30-Sept. 2, 2015, Hong Kong, China	http://pimrc2015.eee.hku.hk/index.html
20th Ka and Broadband Communications Navigation and Earth Observation Conference 2015	October 12-14, 2015 Bologna, Italy	http://www.kaconf.org/

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://committees.comsoc.org/ssc/.

Providing a Multi-Hazard Open Platform for Satellite Based Downstream Services: the PHAROS Approach

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INTRODUCTION

Through the coordination and management of the Global Monitoring for the Environment and Security programme (GMES [1], renamed to Copernicus [2] in December 2012) by the European Commission (EC), the foundations for GMES/Copernicus services have been established in the recent years. Significant developments have been achieved in the area of Earth Observation (EO) infrastructure, through the European Space Agency (ESA) and EC contracts for the space segment and through the European Environment Agency (EEA) and/or with Member States contracts for the in-situ sensor segment. Meanwhile, initial versions of the GMES/Copernicus services have been developed within the 7th Framework Programme (FP7) of the European Union, but also with national funding in some European countries [3][4][5][6][7][8][9][10].

As a result, a number of initiatives provide service concepts focusing on rapid mapping based on GMES/Copernicus data and enhanced situational awareness by combining the processed GMES/Copernicus data with modelling to elaborate, for example, forecasts and retrospective assessments for decision making support. Other systems integrate Decision Support Services for specific types of disasters and geographical locations.

In this context, a new EUFP7 project has been recently launched under the SPACE programme 2013: ***PHAROS – Project on a Multi-Hazard Open Platform for Satellite Based Downstream Services.*** PHAROS [11] aims at designing and implementing an innovative multi-hazard open service platform which integrates space-based observation, satellite communications and navigation (Galileo/GNSS) assets to provide sustainable pre-operational services for a wide variety of users in multi-application domains, such as prediction/early detection of emergencies, population alerting, environmental monitoring, crisis management and risk management, targeting several users, such as crisis managers, operators of critical infrastructures, insurance companies and academic/research institutions.

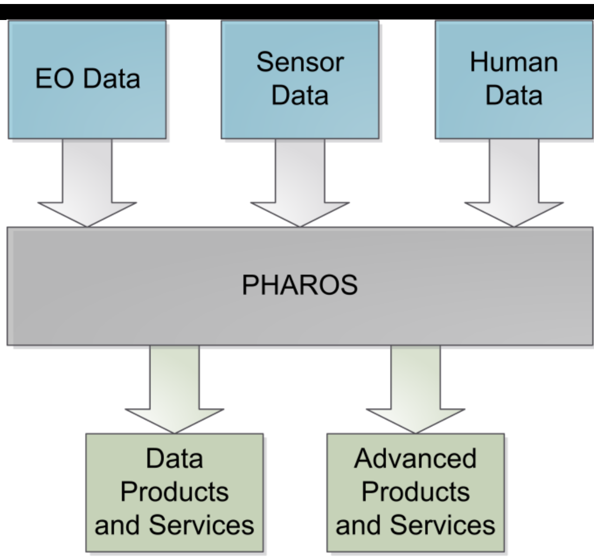
The development of the service platform is widely based on existing developments at the Consortium and will be focused on technology adaptation and transfer. While the service platform is designed to be multi-hazard, the specific developments for the pre-operational system and pilot demonstration will be focused on the forest fire scenario.

APPROACH

PHAROS is conceived as a flexible and scalable modular system providing integrated services through one service platform and exploiting capabilities from GMES/Copernicus, satellite communications and navigation to provide highly efficient tools and enhanced services to the following user profiles:

- Primary users: civil protection and emergency management entities for environmental monitoring, risk assessment as well as detection, monitoring and management of emergency situations, which might be located in a control centre or on the field in case of emergency.
- Secondary users: academic/research institutions, insurance companies, operators of critical infrastructures for environmental monitoring and risk assessment.

On the one hand, the capability of PHAROS to satisfy such different user profiles means an advantage in terms of economies of scale for a sustainable service; on the other hand, this service scalability feature requires a service-centric system design.



Accordingly, the PHAROS approach starts by the conception of the service concept in close cooperation with targeted users and specification alongside with the related business aspects to achieve a sustainable service. This service concept uses the different data inputs available in the system, namely Earth Observation data, sensor data and data provided by first responders in the emergency field (human sensors) in order to provide two main categories of products and services: (1) data products and services and (2) advanced products and services. While the former are intended to provide the user with all available information gathered by the system, processed and presented in a proper way, the latter processes the data to interact with the different modules in order to increase the added value of the gathered information through the complete value chain. These aspects determine the requirements for the system development. Furthermore, the system development strategy will significantly contribute to the overall platform sustainability through the following properties:

- the interoperability and reusability of the sensor infrastructure, services and workflows, as system components are widely based on existing assets owned, provided or operated by project participants, which will be adapted to interoperate through the service platform and generalised to accommodate future developments;
- the evolution from offline situation assessment to the use of online and dynamic tools;
- the evolution from monolithic to distributed and networked systems;
- the capability to grow from single to multi-hazard.

The modular PHAROS system approach is intended to provide flexibility and scalability at two different levels in order to adapt to the different situations and application scenarios that the system shall cover. On one hand, the system must ensure flexibility and scalability in terms of the functionalities that it is able to provide ("functional scalability"), while on the other hand, scalability must allow adapting the system deployment to the different organisational structures, at local, regional, national and international level ("operational scalability"). Regarding "functional scalability", the service platform itself is conceived to accommodate services, independently of the addressed hazard; however, some of the related systems and services are indeed hazard dependent, e.g. EO data and processing, situational assessment or risk modelling. To achieve a true multi-hazard service platform, generic components and workflows have been identified to create the core. The platform will be then populated with hazard specific services and logic in a stepped manner. This approach allows early deployment and operation of PHAROS, being capable of evolving to accommodate further hazard specific features to grow in scope. With regard to the second case, "operational scalability", the system deployment must allow the system to be operated in a wide range of situations, which will vary depending on the different geographical, political and organisational/administrative structures, as well as on the type of hazard, its scope and evolution. Additionally, information sharing and cooperation among the authorities involved in the crisis must be fostered by the use of the PHAROS system.

HERITAGE

Through the service platform, PHAROS integrates Earth observation and in-situ sensor data with know-how and primary services that already exist (as prototype or commercial products) or are under development. On the one hand, PHAROS will further develop relevant know-how for integration in the service platform; on the other hand, relevant already existing primary services will be driven to the relevant level of maturity and integrated into the PHAROS platform to exploit synergies among them and create enhanced services.

The development of the service platform within the project is widely based on existing developments at the Consortium and will be focused on technology adaptation and transfer. While the service platform is designed to be multi-hazard, the specific developments for the pre-operational system and pilot demonstration will be focused on the forest fire scenario. Nevertheless, further features to cover any type of hazard can be integrated in the PHAROS platform through its standard-based interfaces and the proper definition of workflows in the platform.
The PHAROS components based on the heritage in the project Consortium are the following:

The Service Platform

The integrated service platform is based on the GUARDIAN ®service platform by Space Hellas, which incorporates modern software technologies in the field of mediation software. In its core it makes use of a service bus, a workflows engine and a plug-in based architecture, which makes it ideal for integrating different subsystems.

Satellite EO Data Acquisition and Processing

The knowledge in EO data acquisition and processing in the German Remote Sensing Data Center is exploited in PHAROS. Images provided by new, or shortly launched, missions (e.g. FireBird TET-1 / BiROS, NPP VIIRS, Sentinels) will be analysed for inter-comparison with currently available EO data (e.g. MODIS, MSG SEVIRI) to test their capability in providing enhanced monitoring tools to fast detect and accurately locate fire.

Advanced Space Sensors and High-Speed Optical Downlink

The FireBird Mission is a scientific DLR mission for infrared remote sensing to investigate high temperature events, generate fire products and verify new algorithms. The FireBird mission is composed of two satellites: TET-1 (successfully launched) and BiROS (launch planned for 2015). BiROS incorporates advanced algorithms for hot spot detection and several other experiments, including the OSIRIS payload. OSIRIS is a free-space optical link payload capable of transmitting up to 1 Gbps to a (transportable) optical ground station (TOGS) owned by DLR, which allows highly efficient and fast image download.

In-Situ Sensors

The first PHAROS deployment will be focused on the forest fire scenario. Hence, the terrestrial early warning system for forest fires FireWatch® will be integrated in PHAROS as in-situ sensor. FireWatch® uses in-situ optical sensors for smoke detection. An optical sensor incorporates an embedded processor unit for fast image processing and provides an interface for transfer of control and alert data as well as image data to a control centre for further evaluation and action by the responsible operator. FireWatch® will be further enhanced in PHAROS by an energy-efficient satellite uplink based on the S-MIM standard, improving deployment flexibility and resilience.

Energy-Efficient Satellite Uplink

PHAROS will resort to the random access-based protocol of the S-MIM ETSI standard, which ensures effective uplink for sensing applications even in presence of peaks of traffic. Provided that PHAROS shall allow collection of in-situ data with bandwidth requirements that go beyond typical messaging scenarios, e.g. for the transmission of pictures from the FireWatch® system, S-MIM will be adapted to be capable of operating in Ka-band, achieving higher bitrates than its S-band version for the satellite uplink, while preserving delivery reliability.

Data Fusion and Decision Support

The Data Fusion and Decision Support Services (DSS) are based on the DSS developed during the GITEWS Project which currently provides operational support for the Tsunami Early Warning System deployed in Indonesia. The DSS implements data and information fusion methods and algorithms for aggregating, analysing and visualising various sensor data streams as well as corresponding simulation and risk modelling results.

Risk Modelling and Simulation

The risk modelling and simulation subsystem is based on the forest fire simulation capabilities of Tecnosylva's Wildfire Analyst® product, in operational use in several fire agencies in Europe as well as in the USA. Wildfire Analyst® provides real time analysis of forest fire spread and behaviour, as well as the calculation of the evacuation time and the impact analysis during an incident. It provides results in real-time and allows the adjustment of simulations with field observed data as well as EO data. Furthermore it allows the calculation of the fire risk and threat of critical infrastructures based on its simulation capabilities.

Advanced Features to Alert the Population

PHAROS closes the gap between systems for disaster management and alert capability to the population by integrating them, thus allowing the optimisation of decision procedures to accelerate the dissemination of alerts where applicable. PHAROS leverages past developments in the FP6-CHORIST and FP7-Alert4All projects to integrate pre-operational alerting capabilities integrating the Alert4All alerting gateway into the platform, building the interface to a Cell Broadcast Broker and integrating the alert message application.
Further synergies with satellite navigation services are built in the area of alerting. The current developments in the context of the GNSS emergency service can be exploited to disseminate alert messages to the population using EGNOS satellite. This is a very appealing option, given the institutional governance, disregarded from commercial interests, the robustness in front of disasters and the inherent location-based knowledge of receivers to limit the geographical reach of the alert.

Acknowledgement
The research leading to these results has received funding from the European Community's Seventh Framework Programme ([FP7/2007-2013]) under grant agreement n° [606982].

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