SATELLITE AND SPACE COMMUNICATIONS SSC
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SSC Newsletter **Vol. 17, No. 1, June 2007**

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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: **Leven Room at the SECC/Convention Center.**

Date: **Tuesday 26, June 2007**

Time: **12:30-14:00**

Future SSC Meetings

Nov. 2007 Washington, D.C., USA
May 2008, Beijing, China.
Dec. 2008, New Orleans, U.S.A
Jun. 2009, Dresden, Germany
Nov.-Dec. 2009, Honolulu, U.S.A
May 2010, Capetown, South Africa

ICC 2007 SSC Committee Activities

CQR1 : QoS in Satellite and Broadcasting Networks, Monday, 25 June, 14:00-15:40, Dochart1

WCS13 : Satellite Comms, Tuesday, 26 June, 9:00-10:40, Argyl1

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://cassius.ee.usyd.edu.au/mailman/listinfo/ssc.

SSC COMMITTEE OFFICERS

CHAIR
Prof. Mario Marchese
Department of Communications, Computer and System Science
University of Genoa
Via Opera Pia 13,
16145, Genova (Italy)
Tel. +39-010-3536571 (Office)
Tel: +39-010-3532806 (Lab)
Fax: +39-010-3532154
e-mail: mario.marchese@unige.it

PAST CHAIR
Prof. Abbas Jamalipour
School of Electrical & Information Engineering
University of Sydney
Sydney NSW 2006, Australia
Tel: +61 2 9351 2843
Fax: +61 2 9351 3847
Email: a.jamalipour@ieee.org
http://www.ee.usyd.edu.au/~abbas

VICE CHAIR / EDITOR
Prof. Takaya Yamazato
Department of Electrical Engineering and Computer Science
Nagoya University
Nagoya, 464-8603, Japan
Tel: +81-52-789-2743
Fax: +81-52-789-3173
E-mail: yamazato@ieee.org

COMMITTEE HISTORIAN
Mr. Louis Pollack
c/o Pollack Associates
15321 Delphinium Lane
Rockville, MD, USA 20853
Tel: +1 301 929 1295

SECRETARY
Dr. Tarik Taleb
Graduate School of Information Sciences
Tohoku University
Sendai, Japan 980-8579
Tel/Fax: +81-22-795-5856
Email: talebtarik@ieee.org
http://www.aiet.ecei.tohoku.ac.jp/~taleb

COMMITTEE ADVISOR
Dr. Desmond P. Taylor
Dept. of Electrical & Electronic Engineering
University of Canterbury
Private Bag 4800
Christchurch, New Zealand
Tel: +64 3 364 2213
Fax: +64 3 364 2761
Email: taylor@elec.canterbury.ac.nz

MESSAGE FROM THE CHAIR

Mario Marchese

The first duty of my role in this period has been the recertification process. Last December I received a message as Chair of the Satellite and Space Communications Technical Committee from Prof. Sergio Benedetto, Vice President - Technical Activities. He announced me that the ComSoc BoG, upon recommendation of the Recertification Committee, had positively evaluated the overall activity of our Committee and approved its recertification up to year 2009. Together with this very positive message, he sent some suggestions to further improve our activity. In short: 1. A problem that ComSoc Award Committee has been continuously facing is the lack of good candidates proposed for the various IEEE and ComSoc Awards. We should consider that these awards are an important aspect of our society life, and serve the purposes of recognizing deserving candidates as well as of giving them highly valued elements to grow in their career. Thus, we are warmly encouraged to also consider this an important Committee duty, and to timely respond to the solicitations of the Award Committee Chair. 2. A second problem concerns the fact that Technical Committees are not very active in proposing successful candidates to positions of distinguished lecturers, senior member and fellow. We are invited to enhance the activity of our Committee in this respect, perhaps in a more organized and structured way, by assuming these as Committee tasks, rather than leaving them to the individual members initiatives. 3. Traditionally, ComSoc has not been heavily involved in standardization processes, and, more generally, to related fora. This is becoming more and more important, and the constitution of a Director of Standards also recognized that. We are invited to consider two possible actions: gather information on the participation of TC members to standardization activities, and consider structured participation (see the Standards web site accessible from ComSoc web site to this purpose); insert news on your TC web site, and a link to the abovementioned Standard web site

and other related web sites. 4. As a last point, Sergio suggested to consider carefully the present Charter of your TC, and revise it with the aim of: avoiding as much as possible the overlaps with other TC Charters; mentioning explicitly all the TC scopes, including those that go beyond the scientific activities, such as proposing deserving members for awards, senior or fellow promotion, contribution to standards, etc.

I worked immediately to match this last important request and, together with Past-Chair Abbas Jamalipour, Vice-Chair Takaya Yamazato and Secretary Tarik Taleb, proposed our new Charter, recently approved by BoG and published on our web site. The text of the new Charter is: "*The Committee facilitates technical interchange in the field of satellite and space communications. It explores the evolution of new satellite and space-based systems and the application of new and emerging technologies, at all layers of the network protocol suite. The Committee maintains a keen interest in the development and maintenance of standards in this area and facilitates nomination of suitable candidates for IEEE awards, distinguished lecturer program, and IEEE Fellow elevation among its members.*

Specific technologies of current interest include: Satellite Air interfaces, Advanced Modulation/Demodulation and On-board Signal Processing; Advanced and Active Antennas; Architectures, Protocols and Applications for Satellites; Satellite IP; Integration with Terrestrial and Wireless Networks; LEO/MEO/GEO and HAPs Communications; Deep Space Communications; Broadcasting and High-definition television (HDTV); Advanced Global Navigation Satellite Systems; Integration of Communication and Navigation Systems; Satellite Network Control and Management."

My last comment is related to our activity within ICC and Globecom. Unfortunately, due to the limited number of papers submitted to our Symposium at GC'06, we could not get a new chance to organize our own Symposium. Nevertheless we will co-chair the Wireless Networking Symposium at GC'07, we will co-chair, having a specific track, the Symposium of Selected Areas in Communications (the General Symposium) both at ICC'08 and at GC'08, and, according to the new "standardized" symposium list proposed by GITC, we should co-chair two Symposia starting from ICC'09: Wireless Communications and Wireless Networking. I have analyzed the proposal in detail and I appreciate it very much. The role of satellite communications is fully considered. SSC TC appears both in Wireless Communications and in Wireless Networks. It is the precise identification of what satellite communication is now and it is conformant with our new Charter. I think the proposal is close to our dream: our own symposium. I am conscious that numbers do not allow it and I think the proposal is the best we can have for now.

Prof. Mario Marchese, Chair
Satellite and Space Communications
Technical Committee

SCANNING THE WORLD

Takaya Yamazato

Let me start with the follow-up of ETS-VIII. It was launched on December 18, 2006. On Dec. 25, it started to deploy the receiving antenna of its large deployable antenna reflector (LDR) and the sending antenna on Dec. 26. Both these antennas were confirmed to be successfully deployed through telemetry data and images from onboard cameras. Unfortunately, on February 2, the National Institute of Information and Communications Technology (NICT) and the Japan Aerospace Exploration Agency (JAXA) have announced that an abnormal status was detected when power was turned on the Low Noise Amplifier (LNA, designed by NICT). NICT and JAXA are now investigating the cause. They recently announced that if only 4 out of 32 LNAs are broken, a communication experiment using the small mobile terminal, with the expected gain loss in 1dB. However, there is a possibility of that all of Lanes are damaged.

25th AIAA International Communication Satellite Systems Conference (ICSSC2007) was held in Seoul, Korea, from 10 to 13 April 2007. The conference started with the colloquium on Satellite Broadcasting Services for Mobile Users. In two days' technical sessions, 162 papers were presented. At the award luncheon, the AIAA aerospace Communication Award was presented to Dr. Robert Briskman, Co-founder and Technical Executive of Sirius Satellite Radio Inc. Next ICSSC will be held in San Diego on 9-12 June 2008.

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

FORTHCOMING GLOBECOM AND ICC CONFERENCES

GLOBECOM 2007
November 26-30, 2007, Washington DC, USA
http://www.ieee-globecom.org/2007/
The theme of the IEEE GLOBECOM 2007 conference is "Innovate ● Educate ● Accelerate", which exemplifies the accomplishments that we are hoping achieve during this special Globecom Anniversary Conference. The technical program will consist of the General Symposium, 9 Technical Symposia, Tutorials and Workshops, Telecom Business Forums, Design and Developers and a Student Program

ICC 2008
May 19-23, 2008, Beijing, China.
http://www.ieee-icc.org/2008/
The 2008 IEEE International Conference on Communications (ICC 2008) will be held in Beijing, China, from 19-23 May, in the year of the Beijing Olympic Games, with the theme "Communications: Faster-Higher-Stronger".

COSPONSORING / RELATED CONFERENCES AND WORKSHOPS

IWSSC 2007 - 2nd Int. Workshop on Satellite and Space Communications
September 13 – 14, 2007, Salzburg, Austria
http://iwssc2007.sbg.ac.at/
The objective of this workshop is to provide a forum for researchers and technologists to present new ideas and contributions in the form of technical papers, panel discussions and tutorials of ideas in the field of satellite communications. It is intended to bring together various satellite communication systems developers to discuss the current status, technical challenges, standards, fundamental issues, and future services and applications.

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MILCOM 2007
October 29 – 31, 2007, Orlando, Florida, USA
http://www.milcom.org/
MILCOM 2007 is soliciting both unclassified and classified papers (up to DoD Secret) relevant to communications and information processing system technologies and capabilities that address the 21st century challenges of National Defense, Homeland Security, Disaster Response and Interoperability as summarized above. Industry, academic and government organizations from both the US and countries around the globe are invited and encouraged to participate.

CONFERENCES CALENDAR

CONFERENCE	DATE & LOCATION	INFORMATION
16th IST Mobile & Wireless Communications Summit	1 -5 July 2007 Budapest, Hungary	http://www.mobilesummit2007.org/
SPECTS 2007 International Symposium on Performance Evaluation of Computer and Telecommunication Systems	July 16-18, 2007 San Diego, California (USA)	http://eia.udg.es/SPECTS2007/ (the site is not working though)
IWSTI 2007 INTERNATIONAL WORKSHOP ON SATELLITE/TERRESTRIAL INTERWORKING	14 August 2007 Vancouver, British Columbia	To be held jointly with the Fourth International Conference on Heterogeneous Networking for Quality, Reliability, Security and Robustness (QShine 2007) http://www.qshine.org/
SatNEX Third International Summer School on Satellite Communications	August 27-31, 2007 Pisa, Italy	www.satnex.org
CAMAD 2007 12th International Workshop on Computer Aided Modeling and Design of Communication Links and Networks	7 September, 2007 Athens, Greece	http://www.pimrc2007.org/econf2/saved/CAMAD_2007_CFP.pdf Part of the 18th IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC 2007) 3-7 September, 2007
IWSSC 2007 International Workshop on Satellite and Space Communications 2007	13 ~ 14 September 2007 Salzburg, Austria	http://iwssc2007.sbg.ac.at/
TELSIKS 2007 International Conference on Telecommunications in Modern Satellite, Cable and Broadcasting Services	September 26-28, 2007 Serbia, Nis	http://www.telsiks.org.yu/
WRECOM 2007 Wireless Rural and Emergency Communications Conference	October 1-2, 2007 Rome, Italy	http://www.wrecom.org/home.html
ICTTA 2008 International Conference on Information & Communication Technologies: From Theory to Applications	April 9th, 2008 Damascus, Syria	URL: not available yet See this URL of a workshop that will be held jointly with the conference http://www.nr.no/~abie/scs2.pdf
ISSSTA 2008 International Symposium on Spread Spectrum Techniques and Applications	25 ~ 28 August, 2008 Bologna, Italy	URL: http://www.isssta2008.org/ (not working at the present time) Check here http://www.comsoc.org/confs/calendar/2008/confdate.html

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/.

Satellite Backbones for Supporting Large Scale Terrestrial Networks and the Internet

Evangelos Papapetrou[1], Niovi Pavlidou[2]

[1]Department of Computer Science, University of Ioannina, 45110, Ioannina, Greece, Email: epap@cs.uoi.gr

[2]Department of Electrical & Computer Engineering, Aristotle University of Thessaloniki, 541241, Thessaloniki, Greece, Email: niovi@auth.gr

Introduction

Communication satellites have been used for various purposes over the last years. However, using satellites competitively to terrestrial infrastructures, like in the case of LEO systems that provided telephony services, has declined due to the rapid development of cost-effective terrestrial networking technologies. Another, more realistic, approach has been to explore the synergy of satellite and terrestrial systems [1]. Such proposals include the use of satellites for providing "last mile" connectivity to the Internet [2], extending the coverage of terrestrial networks in areas that infrastructure deployment is not possible [1] and for interconnecting terrestrial networks of different technologies [1],[3],[4] in order to form a large scale unified network. The last proposal seams to be the most attractive one, especially in the context of all IP-based networks [3],[4] and their integration with the Internet.

Although the role of satellites in building a world-wide network is very important, until now it involves only the interconnection of terrestrial infrastructures. However, the challenge for the satellite community lies in redefining and extending this role. To this end, *an appealing concept is to use satellites for supporting the management of large scale terrestrial networks*. Unfortunately, developing flexible large scale and if possible world-wide networks, has been proved to be not an easy task. Real life experience indicates that *flexibility* and *network size* are contradicting network properties. Internet provides an appropriate example; The lack of flexibility in managing the Internet has led several attempts of evolution to partial or total failure. For example, the attempt of migrating to IPv6 has never been completed due to the cost of upgrading existing infrastructure in such a large scale. To overcome the problems involved in managing the core network, two approaches have seen the light of the day. The first one is to avoid network-wide solutions and therefore implement any required upgrades only to parts of the network. For example this is the approach of DiffServ [5] architecture for providing QoS in the Internet. However, the downside of this approach lies in that the performance of the network is guaranteed only within the affected network areas and there is no guarantee when other parts of the network are included in the communication. Another popular approach has been to bypass the problem related to the inflexibility of core network infrastructure by pushing functionality to end users where any upgrade procedure becomes more flexible and depends on the user's will. Examples of this approach are newly developed transport protocols such as Stream Control Transmission Protocol (SCTP) [6], RTP, etc and the advent of overlay networks. In this way core routers, that are unable to understand the new protocols, are bypassed. Obviously, such solutions depend on specific applications, since the implementation exists at the user side. However, the major drawback of this approach is that its performance depends on the capabilities of the underlying existing infrastructure. For instance, using an overlay network to support an advanced protocol for VoIP communication (such an example is Skype) makes possible the quick and easy deployment of the new protocol over the users of the Internet but will never guarantee the performance of the network.

It becomes clear that *the capacity of a network for transforming and evolving the provided services, relies on the ability to efficiently manage and even upgrade its core infrastructure*. This has been exactly the problem of the Internet. The rapid development of a plethora of diverse applications has created the need for innovative communication services that can not be provided by the core network due to its size, its chaotic structure, the lack of centralized management and the cost of infrastructure replacement. *Satellites may provide an efficient and cost effective solution to this problem by forming a flexible backbone network for providing interconnection to core elements of terrestrial networks*. The concept of using backbone networks in order to overcome network inflexibility is well-known in the Internet. An example is Content Distribution Networks (CDNs) [7] with the most representative examples being that of the Akamai and the Amazon networks. However, these networks run rather independently from the Internet and are used only for providing communication services to specific users. On the other hand a backbone network for managing terrestrial networks should provide connectivity to large parts of the terrestrial infrastructure. Clearly, satellites emerge as the most

appropriate solution due to their immanent characteristics.

Reference Scenarios

The lack of scalability and flexibility and their implications are well-known in the Internet and other large scale terrestrial networks. However, in order to emphasize on the suitability of satellites, it is useful to identify specific reference scenarios where the presence of a backbone network could be of assistance. By identifying such scenarios, the scientific community could explore in detail the impact of a satellite backbone network to existing technologies. A major area of interest is the development of IP technologies for providing QoS such as IntServ [8] and DiffServ [5]. While IntServ architecture suffers scalability issues, the performance of DiffServ is subject to the deployment of appropriate routers across the Internet. Both architectures could benefit when implemented to a small size and flexible satellite backbone. Another interesting case is related to the recent trend for data-centric communications that evolves in the Internet in the form of p2p applications [9]. Such applications suffer scalability issues related to the flood-based mechanisms for locating data. Satellites could affect the design of such applications and reduce scalability problems by providing fully meshed connectivity to a large number of peers. Furthermore, recently there is an increasing popularity of overlay networks (or overlays) in the Internet. Overlays are used to support a variety of services such as file sharing, grid computing, telephony, etc and are implemented by using TCP connections. The major issue regarding overlays is that there are constructed independently of the underlying network. This leads to severe overheads since one overlay connection may break down to several actual network connections. This problem is known as lack of network-awareness [10]. The simple structure and the limited size of a satellite backbone could significantly decrease the effects of network-unawareness. Finally, an important field of research is related to the impact of using a backbone network in the design of new transport protocols or the evolution of existing ones. For example, SCTP implements the architecture of multihoming for improving reliability and supporting required signalling. This architecture could greatly benefit from the existence of a secondary, less complex, route through the satellite backbone.

Objectives of Future Research

Besides determining specific reference scenarios for validating the advantages of using satellite backbones, some objectives should be set for future research in this field, in order to increase its added value. Such objectives are:

- *Definition and proposal of efficient networking protocols*: the advantage of using a small size backbone network allows researchers to shed new light on well-known networking concepts. Special emphasis should be laid on producing fully upgradeable architectures that could support QoS communications.
- *Determination of flexible mechanisms for the management of the backbone network*: taking into account the rate of introduction of new services in the Internet, it is clear that the key characteristic of a network must be its flexibility.
- *Evaluation of the impact of satellite backbones on the performance of existing services developed over the Internet*: supporting and improving the performance of already implemented applications and protocols is a necessity for the success of satellite backbones.
- *Innovative communication schemes/paradigms*: take advantage of the special backbone characteristics in order to develop new communication schemes between the users of the Internet. This involves the evolution of current schemes such as p2p applications, multicast communications, etc, as well as proposing innovative communication paradigms.

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A vision on standardisation role in future Mobile Satellite Systems

N. Chuberre/ETSI TC SES S-UMTS chairman, A. Bolea-Alamanac/ESA[1], L. Combelles/Thales Alenia Space, G. Corazza/ISI[2] chairman, B. Evans/CCSR director[3], P. Glennon/ Inmarsat, R. Goodings/ETSI TC SES GMR chairman, Ho-Jin Lee/ETRI[4], B. Martin/Thales Alenia Space, A. Vanelli-Coralli/CNIT[5] –University of Bologna

Corresponding author details: N. Chuberre, Thales Alenia Space, 26 av. JF Champollion, F-31037 Toulouse Cedex 1, Phone: +33534356497, fax: +33534356169, E-mail: nicolas.chuberre@thalesaleniaspace.com

Introduction

The satellite industry now has proven large deployable antenna technology and high power platform for geo-stationary satellites allowing closure of link budget to handheld devices. Thanks to these technology breakthroughs, several mobile satellite systems have been successfully deployed and are generating revenues by addressing profitable markets.

This paper gives a brief status on the Mobile Satellite System (MSS) industry context and how standardization is considered for future systems. It then gives an overview of the objectives of the Satellite Universal Mobile Telecommunication System (S-UMTS) standardisation working group within the Technical Committee for Satellite Earth Stations & systems (TC SES) of the European Telecommunication Standard Institute (ETSI), covering 3G and beyond 3G MSSs.

Section 1 : Mobile Satellite Systems context

It is known that Satellite systems offer limited capacity in terms of number of subscribers that can be served with personalized data streams per km2, due to intrinsic on board power & beam aperture constraints.

However they can complement terrestrial mobile systems with cost effective & dependable wide coverage and/or broadcast capability.

Several 2nd generation MSS systems offering voice & data services have been developed and deployed.

- Regional MSS based on Geostationary satellites: Thuraya & Asia Cellular Satellite (AceS). They respectively use GMR-1 & 2 radio interfaces standardized at ETSI by the "Geostationary Mobile Radio" working group within TC SES. GMR radio interfaces have been derived from the GSM standards.
- Worldwide MSS based on Low Earth Orbit satellite constellation: Iridium & Globalstar. Iridium uses a proprietary TDMA radio interface. Globalstar is based on IS-95 CDMA with proprietary adaptation for operation in LEO environments.

More recently, in 2004, Inmarsat launched a third generation MSS offering voice and data services with data rate up to 492 kbit/s called Broadband Global Area Network (BGAN) and using a TDMA based radio interface.

Each of these systems address about several hundred thousand institutional or high end professional subscribers, mostly interested in the service dependability and less concerned by cost aspects. Thanks to high Average Revenue Per User (ARPU), these systems provide sufficient revenue to justify both extending coverage with new satellites and renewal of existing satellites as they come to the end of life, with new spacecrafts featuring increased capacity.

Separately, several satellite mobile broadcast systems addressing vehicular and handset terminals have been launched since 2001. These include XM radio and Sirius radio in North America offering digital radio programs and SDMB in Korea offering TV, radio, and datacast services to about 12 Millions subscribers using TDMA or CDMA proprietary radio interfaces.

Unlike terrestrial mobile systems, no worldwide standards have been defined since each system promoter

[1] European Space Agency
[2] Integral Satcom Initiative technology platform included in the seventh Framework Programme (FP7) of the European Commission, see URL www.isi-initiative.eu.org
[3] Centre for Communication Systems Research, University of Surrey
4 Electronics and Telecommunication Research Institute, Director Global Wireless Technology Research Group (Korea)
[5] CNIT - Consorzio Nazionale Interuniversitario per le Telecomunicazioni

needed to maximize its specific system performance and consequently design optimized radio interfaces for their particular regulatory constraints and space segment characteristics.

Section 2 : Towards standardization of Mobile Satellite Systems ?

There are however several good reasons to standardize Mobile Satellite Systems:

- Enlarge the industry stakeholders and especially terminal and/or chipset vendors;
- Enlarge the service offer with 3rd party service provider, beyond satellite and terrestrial network operators;
- Share the development cost and risks between different stakeholders;
- Lower terminal costs by increasing the volume with global roaming between systems.

Moreover, selecting an existing standardized radio interface can reduce the overall time to market which is usually a major drawback of new MSSs and also allows to benefit from state-of-the-art radio interface technologies maximising spectrum usage efficiency.

Consequently, standardization of MSS is becoming more important when defining new systems and services.

There are several on going projects which can be classified as Beyond 3G systems. These include ICO, TerreStar, and MSV in North America, and the joint effort of SES and Eutelsat in Europe for which satellites are currently under development. These systems may be hybrid in terms of service offering, such as broadcast & interactive services, but also in terms of infrastructure, with a combination of space and terrestrial components. They have all considered the use of one or several standardized radio interfaces adapted to the satellite context. ICO has selected the DVB's satellite to handheld standard, SH, for mobile broadcast services.

Section 3: Role of the ETSI S-UMTS working group

Initial objective: When defining the 3rd generation mobile system also known as Universal Mobile Telecommunication System, the initial vision was to define a system offering high data rate interactive services anywhere and anytime to handset terminals. The global coverage would be achieved with a terrestrial and a satellite component complementing each other. In that perspective, ITU reserved worldwide a spectrum for MSSs in the 2 GHz frequency band directly adjacent to the IMT2000 spectrum allocated to terrestrial mobile systems.

The ETSI's objective was to implement this vision but the standardization activity of the 3rd generation Mobile system was transferred to 3GPP which abandoned the definition of the satellite component.

At the initiative of a group of industrialists and operators, and with the support of the European Commission and the European Space Agency, ETSI TC-SES, responsible for all aspects relative to satellite communications, has created in May 1998 a working group named SUMTS/IMT2000 to define the Satellite component of the Universal Mobile Telecommunication System (S-UMTS) and of the International Mobile Telecommunications (IMT-2000).

Achievements: A great deal of work has been undertaken to define a satellite radio interface derived from the 3GPP WCDMA radio interface with adaptations in terms of new configurations and/or new features. The main achievement lies in the demonstration that the terrestrial WCDMA radio interface can be used over satellite with a few identified adaptations. The work has also demonstrated that a Multimedia Broadcast/Multicast Service (MBMS) over a WCDMA carrier broadcasted by a Geostationary satellite can provide interesting data cast performance, and that OFDM can also be operated as a more efficient satellite radio interface.

Related work includes the definition of a harmonized standard for systems operating in the IMT2000 frequency band allocated to Mobile Satellite Services. This will ensure co-existence of multiple MSSs operating in this band and also co-existence between T-UMTS and MSS systems operating in adjacent bands.

New objectives: In view of the overall MSS context, the scope of working group SATELLITE UMTS™/IMT2000 was revised at the end of last year to develop worldwide satellite Standards, not only for 3G, but also for "beyond 3G" MSSs operating in any Mobile Satellite Service frequency bands below 6 GHz, typically. This includes the Satellite component of UMTS and of IMT-2000 & IMT-Advanced, and is also expected to include standardisation of the new system mentioned above, BGAN

The working group will focus on the following topics

- Heterogeneous satellite/terrestrial infrastructure offering broadcast and interactive services.
- Radio interface harmonization between terrestrial and space segment as well as with existing standards
- Intra and inter system coexistence studies
- Interoperability of MSS with terrestrial mobile systems
- Fixed and mobile convergence at service layer
- Inter-working with Global Navigation Satellite Systems for the delivery of location based services and optimized radio resource management

- Feasibility study on the integration of satellite enabling features in terrestrial mobile handset terminals

Conclusion

The SUMTS working group invites all industry stakeholders to contribute to these topics and implement the vision of ubiquitous access to telecommunication services, and harmonisation and cooperation between terrestrial & satellite mobile systems, for 3G and beyond 3G Mobile Satellite Systems.