GLOBAL
Communications
NEWSLETTER

December 2013

First IEEE ICCC International Workshop on Internet of Things (IOT 2013), Xi'an, China

By Yunchuan Sun, IEEE ComSoc Internet of Things Subcommitte; Lingling Zhang, IEEE ComSoc Xi'an Chapter

IEEE/CIC International Conference on Communications in China (ICCC) is a newly incubated international conference series by the IEEE Communications Society (ComSoc) in partnership with the China Institute of Communications (CIC) aiming at realistic globalization by extending ComSoc's reach to the fastest growing regions. ICCC is the flagship conference of the IEEE ComSoc in China, which is held every year in the greater China region.

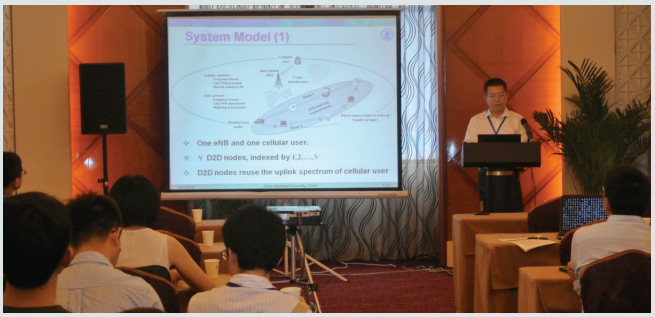
As the second event of this conference series, after the great success of the ICCC 2012 in Beijing, ICCC 2013 was held in Xi'an on August 12-14, 2013. Xi'an is one of the oldest cities in China, with more than 3,100 years of history. Xi'an is one of the Four Great Ancient Capitals of China, having held the position under several of the most important dynasties in Chinese history, including Zhou, Qin, Han, Sui, and Tang. Xi'an is the eastern terminus of the Silk Road and home to the Terra Cotta Warriors and Horses of Emperor Qin Shi Huang.

ICCC 2013 was organized into 7 technical symposia and 4 workshops. The first IEEE ICCC international workshop on Internet of Things (IOT 2013) aims to provide a forum for authors to present early research results on Internet of Things (IOT) that advance the state of the art and practice in Internet of Things (IOT), including theoretical principles, tools, applications, systems infrastructure, and test beds for Internet of Things (IOT). IOT has become the national strategy of China since 2009. European Union started IOT initiative as a Framework Programme 7 project in September 2010. The counterpart of IOT in the United States is Cyber-physical systems (CPS). Many federal agencies have a common stake in CPS research and development.

IOT 2013 was chaired jointly by Prof. Houbing Song and Prof. Ruonan Zhang. Prof. Song serves on the faculty of West Virginia University Institute of Technology and directs both West Virginia Center of Excellence for Cyber-Physical Systems (WVCECPS) and Security and Optimization for Networked Globe Laboratory (SONG Lab). Since 2011 Prof. Song has been the associate editor-in-chief of the blue book series on IOT. Prof. Zhang serves on the faculty of Northwestern Polytechnical University.

Terra cotta warriors and horses.

IOT 2013 Session Chair Prof. Ruonan Zhang.



IOT 2013 Keynote Speaker Prof. Pinyin Ren.

The organizers of IOT 2013 included

General Chairs

Houbing Song, West Virginia Univ. Institute of Technology
Ruonan Zhang, Northwestern Polytechnical University

Steering Committee

Wei Zhao, University of Macau
Nanning Zheng, Xi'an Jiaotong University
Jifeng He, East China Normal University
Xiaojing Wang, National Center of ITS Engineering & Technology
Quansheng Zhang, SATCOM IOT Group
Guangcheng Li, SATCOM IOT Research

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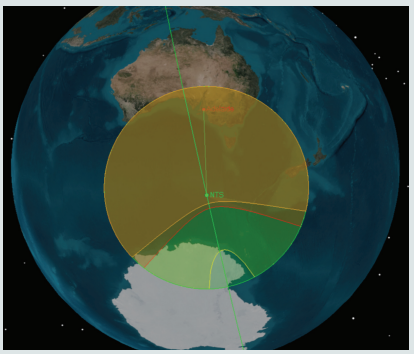
The Global Sensor Network: A Program Led by the Institute for Telecommunications Research at the University of South Australia

By Alex Grant and David Haley, Institute for Telecommunications Research, University of South Australia
Ricky Luppino, Australian Space Research Program

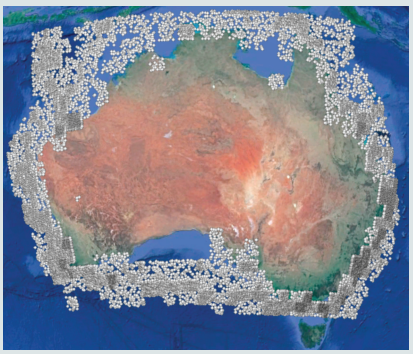
IEEE Communications Society members Dr David Haley and Prof Alex Grant have led an Australian team to produce an innovative new communication system for remote sensing, incorporating a Low Earth Orbit (LEO) microsatellite array.

The Global Sensor Network (GSN) program, developed by the Institute for Telecommunications Research (ITR) at the University of South Australia, has developed novel techniques for highly efficient one and two-way data communication with large numbers of remotely located sensors.

With ITR as lead partner, the success of the GSN was the result of a successful collaboration between research, industry and government sectors. Consortium partners, including COM DEV (Canada), Defence Science and Technology Organisation (DSTO), SAGE Automation, CSIRO and the Australian Institute of Marine Science, contributed over $12M towards the program.



Example Footprint for Satellite Trials (image thanks to COM DEV).



Australian coastline scenario.

Commencing in 2011, the GSN was developed with $5M in support from the Australian federal government's Australian Space Research Program (ASRP).

The GSN system includes new architectures and waveform designs and makes innovative use of software defined radio (SDR) for both ground and space segments. The end result is a cost effective, scalable and flexible system that is able to support very large numbers of users while requiring only a small amount of radio bandwidth.

GSN Applications

A key goal of the GSN is to retrieve sensor data when a very large number of terminals are simultaneously in the satellite field of view. Potential applications are in vessel tracking, asset and livestock tracking, environmental monitoring, and defence.

The system was designed to achieve reliable decoding of more than 100,000 messages from terminals that are simultaneously in the satellite field of view during a single pass.

Key innovations required to deliver this outcome include advanced waveform designs and signal processing techniques that provide highly efficient use of spectrum through reliable multiuser detection.

The system also provides bidirectional communication. This allows users to centrally command remote devices, and upgrade terminals in the field.

Successful Field and Satellite Trials

During April 2013 GSN aircraft trials were performed using DSTO's Defence Experimental Airborne Platform as a satellite surrogate carrying the space grade payload hardware. Using SDR terminals, a sophisticated testbed was built allowing the system performance to be examined with scripted Low Eearth Orbit satellite channel scenarios that were replayed over the air.

On the ground, nine SDR terminals were used as transmitters, each transmitting multiple overlapping packets per time slot, thus emulating the existence of several thousand terminals located around the coastline of Australia (Fig 1). At the final stage of transmission, the signal corresponding to each packet was modified according to a LEO channel model. The transmitted signal included the per-packet LEO channel conditions between each of the emulated terminals and the satellite.

The signals captured at the satellite payload appeared as if they arrived at the payload while it was orbiting in space. The GSN receiver was then given the task of decoding the signal as if it had been captured in orbit. In the Australian coastline scenario during a single 14 minute pass the system successfully detected 39,816 terminals. This result was achieved using only 25 kHz of spectrum.

In another series of aircraft trials, ground terminals were situated in a number of locations around South Australia, each with different environmental conditions. The purpose of this was to verify the performance and robustness of the communications system in different terrain environments.

The results of the trials demonstrated that, despite the demanding environmental conditions, the communications system was able to successfully detect and decode the data from all ground terminals.

GSN satellite trials have been in progress since June 2013. GSN prototype SDR terminals are being used on the ground. For these trials COM DEV has coordinated access to a Low Earth Orbit nanosatellite owned by exactEarth. (Fig.2)

Experiments to date have provided the following outcomes:

- Ability to decode heavily loaded slots consistent with aircraft trial results
- Ability to reliably close the link with small antennas, including a flat antenna smaller than a credit card
- Robustness of waveforms in the presence of interference
- Measured channel path loss characteristics consistent with predictions

Program Outcomes

A key component of the program has been to transfer the fundamental research that enables the system into a working implementation using SDR hardware. Rapid conversion of research outcomes led to a successful bench demonstration with space hardware within 12 months of commencing waveform design. Less than 12 months later the system was aircraft and satellite trial proven.

The project delivered the following outcomes:

- Phase A Study for an Operational Mission
- Complete communications system design

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Telco Tours & Seminars Top ComSoc-SCV Activities: Substantial Progress in ComSoc North American Region

By Alan J Weissberger, ComSoc SCV Chapter Chair Emeritus; Yigang Cai, ComSoc NA Director; USA

This article provides updates from previous IEEE GCN submissions on ComSoc-SCV and NAR activities. Progress reports for both are provided in turn.

ComSoc-SCV is not only the largest ComSoc chapter in the world, but the only active one between Los Angeles, CA and Portland, OR. In 2013 ComSoc-SCV was voted "Best IEEE Chapter in the Santa Clara Valley Section" and "Outstanding Chapter in IEEE Region 6." Our activities include: technical meetings, workshops with other tech non-profits, trips to carrier labs (for seminars and tours), networking socials and an IEEE member email discussion group.

The ComSoc North America Region (NAR) is the largest segment geographical region within all of ComSoc. The NAR is organized into 7 sub-regions (IEEE Region 1-7) and 93 chapters in the US and Canada with total 20,000+ members.

ComSoc-SCV Achievements

ComSoc-SCV technical meetings span mutliple communications technologies and market segments. In 2013, we've covered: Bluetooth, Self Organizing Networks, Trends & Dynamics in the Data Center, WiFi Interworking with Carrier Networks, Fiber Deployments for Broadband Wired and Wireless Access, Wireless Mesh Networks for Sensors and Internet of Things (IoT).

AT&T's Shiyama Clunie presenting "Project Velocity IP" at June 12, 2013 IEEE ComSocSCV meeting in Santa Clara, CA.

Jacob Saperstein describing the mission, purpose and results of AT&T's Palo Alto Foundry at June 12, 2013 IEEE ComSocSCV meeting in Santa Clara, CA.

Note: Texas Instruments graciously provides their auditorium for ComSocSCV technical meetings. Photos courtesy of DJ Cline.

We've also had three very enlightening carrier tours and presentations. There were two "field trips" to Sprint's M2M Innovation Center in Burlingame, CA and a series of AT&T presentations and panel session covering the carrier's Innovation Platform, Palo Alto foundry (where AT&T works with start-ups on proof of concept projects), wireless network infrastructure in CA, and Project Velocity IP (fiber-to-the building, U-Verse and IP DSLAM).

The first trip in March was to attend a series of seminars covering Sprint's Wireless Network Architecture (Network Vision), Fiber optic network backbone network and add/drop points (POPs), Metro Ethernet services offered and planned in the near future.

The second visit to Sprint in late May was a tour of their two research labs, collaboration center showcase, and fiber optic POP. An article summarizing that field trip was published at: http://community.comsoc.org/blogs/alanweissberger/ieee-tour-sprints-m2m-collaboration-center-fiber-optic-pop-burlingame-ca

AT&T's June 12, 2013 set of presentations and lively panel discussion did not disappoint our large, enthusiastic audience of approximately 90 attendees.

•Jacob Saperstein described the mission and purpose of AT&T's Palo Alto Foundry, how it relates to AT&T's Innovation Platform, and its role in the Silicon Valley ecosystem. In addition to its Palo Alto facility, AT&T has Foundry locations in Richardson, TX and Ra'anana, Israel. At these three "Innovation Centers," AT&T teams up with start-ups and leading edge companies to fast-track new apps, devices, software/hardware platforms and other areas of technology innovation.

•Shiyama Clunie presented the highlights and progress of AT&Ts Project Velocity IP- a major effort underway to expand AT&T's wireless and wireline broadband network. Under this plan, AT&T expects to bring fiber to 1 million additional business customer locations, and its wireline IP network is expected to cover 57 million customer locations, by year-end 2015. These locations will have either U-Verse (video, Internet and voice) or U-Verse IP-DSLAM (high speed Internet and voice). AT&T also expects that its 4G LTE wireless network will cover 300 million people nationally by the end of 2014, and 99 percent of customer locations in AT&T's wireline service area are expected to have high-speed Internet access through either IP wireline and/or 4G LTE wireless by year-end 2015.

•Michael Caniglia talked about three aspects of AT&Ts broadband wireless network: Small Cell Evolution, HSPA+ / LTE- 4G Deployment, and the very tricky task of managing additional wireless network capacity to accommodate the exponential growth in mobile data/video traffic and multiple devices. Michael said AT&T has made great progress in its 3G/4G wireless network reliability, coverage and speed- especially in the SF Bay Area. AT&T also provides many WiFi hotspots that its customers can access at no extra charge, as an alternative to 3G/4G access.

A short summary and selected photos of this well attended IEEE - AT&T meeting are published at: http://www.djcline.com/2013/06/12/jun-12-2013-ieee-att/

The Sprint and AT&T presentations (along with many others) are posted on the ComSoc-SCV chapter website: http://comsocscv.org/.

The ComSoc-SCV Chapter also maintains a Linked In Group, Facebook page, Twitter account, and an IEEE member email discussion group that's been going strong since 2006. The latter bi-directional group is open to all IEEE members and features premium content, breaking news &

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TELCO TOURS/*continued from page 3*

analysis, complimentary registration to selected industry events, and spirited discussion of the important tech issues of the day, e.g. high tech snooping to combat terrorism justified or is it an invasion of privacy? There is also a separate unidirectional ComSoc-SCV event notification group open to anyone.

For instructions to join either email group, click on "SUBSCRIBE" at the chapter website given above. There are also logos linking to the ComSoc-SCV Facebook and Linked In pages.

ComSoc NAR Progress Report

The NAR continues to support membership development and growth. Thirteen ComSoc NAR chapters recently elected new chapter chairs (Region 1: Maine, Connecticut, Long Island (NY); Region 2: Columbus, Northern Virginia; Region 3: Florida West Coast; Region 4: Minneapolis-St.Paul, Milwaukee; Region 5: Gainesville; Region 6: Orange County, Buenaventura, Hawaii; Region 7: London, Canada).

NAR launched its first Webinar on March 20, 2013, with over 40 locations participating. Distinguished Lecturer Dr. Steve Bush of IBM Research presented "Ad hoc Nanoscale and Molecular Communication Networks." There was a lot of positive feedback resulting from Steve's talk.

The NAR board/chapter chairs meeting was held in Budapest, Hungary during ICC 2013. 15 board members, chapter chairs and MRC leaders attended the meeting. They discussed NAR membership development, activity management, budget and other work plans during the meeting. The NAR board and local chapters will produce a single ComSoc NAR newsletter.

Various types of social networking are being launched, including ComSoc Chapter and NAR Facebook pages, Chapter Linked In groups and an impressive "Global Network" website (http://www.comsoc.org/globalnetwork). The latter serves as a very convenient on-line, clickable reference for a treasure trove of global ComSoc information. It includes clickable hot links to Facebook pages of several ComSoc chapters all over the world.

The NAR continued its strong DLT/DSP programs in 2013, with a goal of 1/3rd NA ComSoc chapter participation. A total of five DLT/DSP lecture tours are planned for this year. These seminars, from highly knowledgeable subject matter experts, present state of the art research to different geographical areas of the NAR.

Closing Comment:

The co-authors of this article have worked together for five years on DLT programs, ComSoc NAR co-ordination and co-operation. We would encourage other volunteers to work together to progress common goals and shared visions for the greater good of IEEE ComSoc.

IOT 2013/*continued from page 1*

Technical Program Chairs
Qinghe Du, Xi'an Jiaotong University
Jianfeng Ma, Xidian University
Xianghua Yao, Xi'an Jiaotong University

The technical program committee consisted of 50 experts from all over the world, representing different areas within the domain of IOT 2013. IOT 2013 received 45 papers and accepted 17 papers. Papers were submitted from 10 different countries and areas, mainly from China, USA, and Japan. These papers reported advances in all aspects of cyber-physical systems/internet of things, including but not limited to theory, tools, applications, systems, and testbeds. Examples of theoretical advances encompassed by IOT 2013 included but were not limited to control, real-time, hybrid systems, and sensor networks. Similarly, examples of applications included transportation, energy, water, medical, and robotic systems, and other challenges for the twenty-first century.

IOT 2013 also featured a keynote address by Prof. Pinyi Ren, who chairs the Department of Information and Communications Engineering at Xi'an Jiaotong University. His keynote speech was titled "Interference-Aware Routing for Hop-Count Minimization in Wireless D2D Networks."

IOT 2013 was the largest among four workshops in ICCC 2013 and consisted of three sessions, out of eight workshop sessions. IOT 2014 will be held in Shanghai, China as part of ICCC 2014 on August 2014 (http://www.ieee-iccc.org/2014/).

GLOBAL SENSOR NETWORK/*continued from page 2*

- Physical layer technologies delivering high spectral efficiency and simple multiple access
- Demonstrator user terminals
- Concept designs for a sub-$100, credit card sized commodity terminal
- Space-qualified mission-ready payload
- COTS experimental payload
- Complete system validation in real-world operating conditions via aircraft trials and low earth orbit nanosatellite trials
- A strategic portfolio of intellectual property covering all aspects of the system

At the time of writing this article, ITR is pursuing operational demonstration of the GSN system through hosted payload opportunities, and design and manufacture of our low cost small form factor user terminal.

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www.comsoc.org/gcn

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