TECHNOLOGIES AND APPLICATIONS OF FUTURE SATELLITE NETWORKING


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The second part of the Feature Topic "Satellite Communications and Networking: Emerging Techniques and New Applications," published in this issue of *IEEE Communications Magazine*, presents the overflow from the first part published in the March issue. In the first part, the accent was on a renewed vision of satellite communications and networking that we claim as "Space 2.0" [1] in order to mark a clear discontinuity with the "Space 1.0" era, begun in 1945 with A.C. Clarke's article "Extra Terrestrial Relays." The contributions published in the first part mainly focused on techniques that will characterize future satellite networking, such as exploitation of higher frequency bands, cognitive spectrum utilization, delay- and disruption-tolerant networks (DTNs), software-defined networking (SDN), and network virtualization. In the remaining part of the Feature Topic, we aim at shifting the emphasis to the application aspects without losing sight of technological investigation.

Indeed, one of the basic questions that arises among the social and business communities is "How can we exploit the cost efficiency, resilience, and ubiquity naturally provided by satellite networking to design new services for the emerging mass market of the next decades?" We believe that the five articles published in this issue can contribute an answer to this question.

The first article of the issue, "Challenges for Efficient and Seamless Space-Terrestrial Heterogeneous Networks," by J. P. Choi and C. Joo, analyzes the main challenges that should be solved in order to realize seamless space-terrestrial heterogeneous networks. The final aim is to provide multi-purpose readily available platforms for both commercial and no-profit services.

The second article, "Design Challenges in Contact Plans for Disruption-Tolerant Satellite Networks," by J. Fraire and J. Finochietto investigates one of the most critical aspects of DTN architectures: the provision of reliable and efficient contact plan design.

The third article, "Emergency Satellite Communications: Research and Standardization Activities," by T. Pecorella, L. S. Ronga, F. Chiti, S. Jayousi, and L. Franck, considers in detail the coordinated endeavors carried on at various levels (academic, industrial, international standardization bodies, national space agencies, governmental institutions, etc.) targeted at realizing a global infrastructure for emergency communications. In such a framework, satellite communications plays a key role.

The fourth article, "Alerting over Satellite Navigation Systems: Lessons Learned and Future Challenges," by T. De Cola and C. Pàrraga Niebla, proposes a very interesting application of satellite navigation systems (i.e., the deployment of public alerting messages in case of danger for citizens). Global navigation services can profitably support the efficient dissemination of alerting messages. In the article, the challenges and constraints characterizing this safety-critical service coexisting with the regular geolocalization service are carefully analyzed.

The last article, "Flexible Heterogeneous Satellite-Based Architecture for Enhanced Quality of Life Applications," by E. Del Re, S. Morosi, L. S. Ronga, S. Jayousi, and A. Martinelli, analyzes the synergistic use of communication, positioning, and monitoring techniques, provided by meshed terrestrial-satellite heterogeneous network architectures, to satisfy specific requirements coming from everyday life: e-Health and well-being, public safety, and mobility.

At the conclusion of this Feature Topic, the Guest Editors wish to thank the anonymous reviewers for their commitment in sending their timely and always valuable comments, the editorial staff of *IEEE Communications Magazine* and IEEE ComSoc for their continuous assistance, and, last but not least, all of the contributors. We received a large number of high-quality submissions, covering all aspects of satellite communications and networking. In our opinion, this is clear proof that, 70 years after the

publication of Dr. Clarke's visionary contribution, satellite communication remains a field of increasing interest for advanced research and novel technology development.

REFERENCES

[1] C. Sacchi *et al.*, "Towards the Space 2.0 Era," Guest Editorial, *IEEE Commun. Mag.*, Part 1, Feature Topic on Satellite Communications and Networking: Emerging Techniques and New Applications, Mar. 2015.

BIOGRAPHIES

CLAUDIO SACCHI [SM] (sacchi@disi.unitn.it) obtained his Laurea degree in electronic engineering and Ph.D. in space science and engineering from the University of Genoa, Italy, in 1992 and 2003, respectively. Since August 2002 he has held a permanent position as an assistant professor on the Faculty of Engineering at the University of Trento. He is currently affiliated with the Department of Information Engineering and Computer Science at the University of Trento. He is the author and co-author of more than 80 contributions published in international journals, edited books, international conference proceedings, and so on.

KUL BHASIN [SM] is a senior space communications architect at NASA Glenn Research Center in Cleveland, Ohio. He has led a number of NASA-wide architecture teams who design space communication systems and ground networks. Currently, he is leading and designing NASA's next-generation space-based communications satellite architecture, as well as designing a network service portal system. Prior to that he held the position of system engineering and formulation manager for space communications projects at NASA GRC. He is an associate fellow of AIAA and a Fellow of the Society of International Optical Engineers (SPIE).

NAOTO KADOWAKI [M] received a B.S. in communications engineering, a Master's degree in information engineering, and a Ph. D. from the University of Tohoku, Sendai, Japan, in 1982, 1984, and 2010, respectively. From July 2004 to December 2006 he was the managing director of the Strategic Planning Department at NICT and director general of the Wireless Network Research Institute at NICT from July 2008 to June 2013. He is currently senior executive director and executive director of the Strategic Planning Department at NICT. He is a member of AIAA and IEICE of Japan.

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