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Guest Editorial

Satellite Network Protocols

Satellites have been playing a significant role in global communications over the past few decades. The increasing demand for multi-mode broadcasting, high-speed Internet access, maritime navigation and mobile communications drives the need for developing new network infrastructures including terrestrial and satellite hybrids. There is a definite need to understand the current network protocols performance and their impact due to various Satellite link characteristics such as, latency and link errors.

For both geostationary (GEO) and non-geostationary (NGSO), such as LEO or MEO networks, many technical challenges have to be addressed. One of the key challenges is to devise end-to-end protocol solutions providing the user Quality-of-Service (QoS) levels across IP-based satellite networks. The unique characteristics of satellite links, such as asymmetry, link impairments and user mobility, pose significant challenges in designing physical level, link level and transport layer protocols for broadband satellite networks. These issues include, bandwidth allocation, congestion control mechanisms, packet scheduling for achieving guaranteed quality-of-service (QoS), transport layer protocol performance and efficient routing algorithms. Recently there has been considerable research carried on Space Internet architectures as well.

This special issue on Satellite Network Protocols of Space Communications an International Journal, brings together some of the best papers of the Ninth Ka-Band Conference. All of the papers were reviewed by experts in the appropriate areas.

The first article, "Satellite and Next Generation Networks: Proposal for QoS Architectures", by Stephane Combes, Oliver Alphand, Pascal Berthou and Thierry Gayraud proposes Next Generation Network (NGN) Quality of Service (QoS) architecture. This paper defines NGN overall architecture, showing the coupling between application/session layers and Network/transport layers to achieve end-to-end QoS support. Detailed architectures proposed by two recent research projects, IST Satellite Broadband Multimedia System for IPv6 (SATIP6) and ESA Integrated Resources and QoS Management in DVB-RCS networks (QoS for RCS), are presented. A "QoS assured" architecture proposed in the frame of QoS for RCS and "QoS enabled" architecture proposed in the frame of SATIP6 are presented.

The second paper, "Improving HTTP Performance in a Mobile Satellite-Terrestrial Network", by Giovanni Ciccarese, Mario De Blasi, Andrea Palmieri, Luigi Patrono and Giuseppe Tomasicchio, describes simulation models for mobile users accessing Web service and compares two approaches to improve TCP performance and TCP-based application-level protocols performance in a mobile satellite-terrestrial integrated network. The authors discuss the TCP Reno in a reliable data link protocol and TCP Reno with the SACK option and an unreliable data link protocol on the satellite channel. The simulation results have shown that in suburban and rural environments recovering wireless losses at link layer can improve HTTP performance more than using an enhanced version of TCP.

The third article, "Performance Enhancement of MPEG-4 DVB-RCS in Two Way Satellite Environments", by Nam-Kyung Lee, Soo-Hoan Chae, Ho-Jin Lee and Deock-Gil Oh, describes a cooperative system of MPEG-4 and DVB-data carousel that uses descriptors. MPEG-4 clients can receive the data of DVB-data carousel, with the greater flexibility in representation of information inherent in MPEG-4. Further performance enhancement is achieved through use of a PEP (Performance Enhancing Proxy) server. This paper presents experimental results showing significant improvement in data throughput.

The fourth paper, "Interworking of Connection Oriented GEO Satellite Networks with Multicast Source Discovery Protocol", by L. Secondiani and G. Losquadro, describes the IP ConferEncing with Broadband multimedia over Geostationary Satellites (ICEBERGS) project of provisioning IP-based multiparty videoconference services through a communication infrastructure where Next Generation Satellite Systems (NGSS) are fully integrated with the Internet.

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The ICEBERGS scenario assumed a seamless interoperation of a Connection Oriented (CO) GEO satellite network with Internet multicast domains. The authors describe the main features of the interworking function defined between signaling protocols of the Internet multicast domains and the signaling protocol of the satellite network.

Next the fifth paper, "Variable Size Packets (VSP) for transport of IP Datagrams over satellite links: Physical and Access Layer Optimization", by A.-L. Philippot, M.-L. Boucheret, K. Leconte, C. Morlet, C. Bazile, and J. Yu, presents an approach called Variable Size Packets (VSP) for satellite access lower layers. The VSP solution aims at optimizing the transport of packets issued from network layers with highly variable sizes. The authors recall the VSP concept, insisting on its impact at the physical and access layers and present an efficient coding and modulation scheme for the VSP solution, resources allocation constraints and packet sizes and slot sizes definition strategies.

Following that, the sixth article, "A Congestion Control Algorithm for the Deep Space Internet", by Luigi A. Grieco and Saverio Mascolo, proposes a new rate based congestion control algorithm that significantly improves the utilization of planetary links with respect to classic TCP congestion control. The authors present Ns-2 based simulation results showing that the proposed algorithm provided significant goodput improvements with respect to New Reno, Reno Sack, Reno Fack, Vegas and Westwood + TCP in the presence of RTTs larger than 1 s and smaller than 2000 s and packet loss probability ranging from 0.0001 to 0.01.

The seventh paper, "Teletraffic Analysis of Integrated Satellite-Terrestrial Cellular Networks with DS/CDMA Access Method", by Gennaro Boggia, Pietro Camarda and Alessandro Tettei, presents two level hierarchical cellular communication networks and analyzed, integrating Low Earth Orbit (LEO) satellite and terrestrial layers, exploiting in both layers the DS/CDMA access method. The authors presented analytical results to evaluate the main system performance in terms of new call blocking probability and forces termination probability, for two classes of users.

The eighth article, "Improved Algorithms for Internet Routing in Low Earth Orbit Satellite Networks", by Mauro De Sanctis, Ernestina Cianca and Marina Ruggieri, proposed enhanced algorithms for two of the three basic steps in Low Earth Orbit (LEO) satellite network routing: the *downlink* routing and the *inter-satellite links* (ISLs) routing. The author's referred to polar/near-polar constellations and to connectionless routing protocols based on the Internet Protocol (IP), a downlink routing procedure and an ISL routing algorithm. The proposed algorithms are evaluated in terms of system performance and computational burden and showed a significant improvement in end-to-end delay and the overall LEO network efficiency.

In closing, we would like to appreciate all the authors for their excellent contributions, along with their patience and understanding for the delay due to various reasons, to this special issue. Special appreciation to Mr. Bill Brandon for his contributions in the initial review process of this Special Issue. We wish to appreciate Professor Michel Bousquet, Chief Editor and Kim Willems, Publication Manger, for their support in the publication process. We hope that the readership will find this issue interesting and valuable in their satellite network research and systems deployment.

S.L. Kota