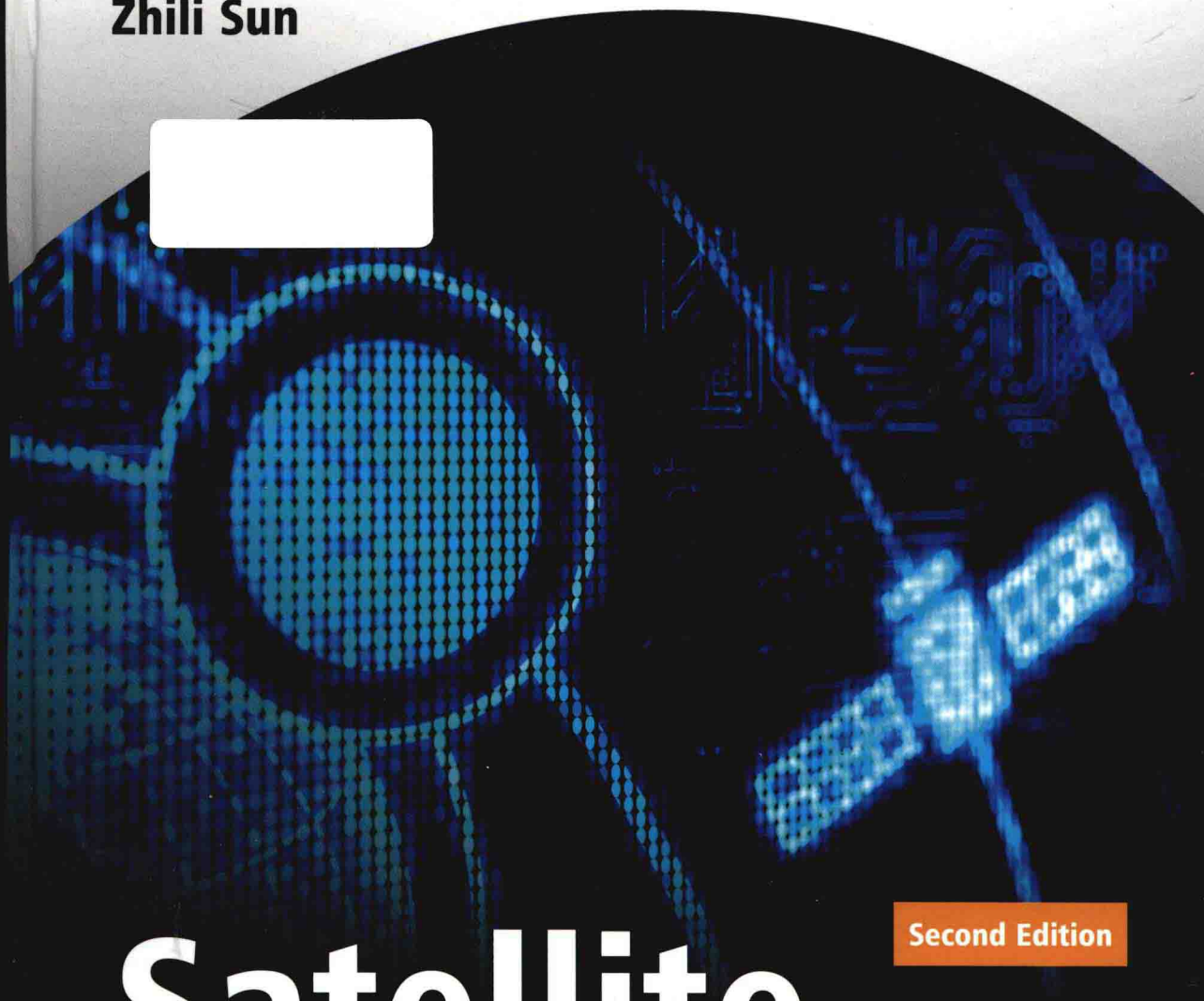
Zhili Sun



Second Edition

Satellite Networking

Principles and Protocols

WILEY

SATELLITE NETWORKING
PRINCIPLES AND PROTOCOLS

SECOND EDITION

Zhili Sun
University of Surrey, UK

WILEY

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SATELLITE NETWORKING

This book is dedicated to the memory of my grandparents and my father

To my mother

To my wife

About the Author

Prof. Zhili Sun (Chair of Communication Networking) is with the Centre for Communication Systems Research (CCSR), University of Surrey. He received a BSc in Mathematics from Nanjing University in 1982 and a PhD in Computer Science from Lancaster University in 1991. He was a Research and Teaching Assistant in Southeast University in China from 1982 to 1985. He worked as a postdoctoral research fellow in Queen Mary University of London from 1989 to 1993. He joined the University of Surrey in 1993. He was principal investigator and technical co-ordinator in many European projects, including the ESPRIT BISANTE project on the evaluation of broadband traffic over satellite using a simulation approach, the VIP-TEN project on Quality of Service (QoS) of IP telephony over satellite, the European Union Fifth and Sixth Framework Programme GEOCAST project on IP Multicast over satellites, the ICE-BERGS project on IP based Multimedia Conference over Satellite, the SatLife project on IP over DVB-S/RCS, the SATSIX project on IPv6 over satellite, the Euro-NGI project on next generation Internet, the RINGRID project on remote instrumentation over GRID computing, the EC-GIN project on EU-China Grid Internetworking, the HCast project for hybrid secure multicast funded by the United Kingdom Electronics and Physical Sciences Research Council, and LKH over satellite funded by the European Space Agency (ESA) and industries. He is a principal investigator in the EU FP7 MONET project on inter-networking between Wireless Mobile Networks and Satellite networks and the UK-China Science Bridge project on beyond 4G networks funded by UKRC, and co-investigator in the multi-layer security funded by EADS Astrium UK. He has supervised over 40 PhDs and 20 postdoctoral research fellows. He has published over 150 papers in international journals and three books as author or co-author. He is also an active contributor to ITU-T and ETSI in QoS and IP multicast over satellite. His areas of interest include IP networking protocols and technologies, satellite communications and networking, Internet and teletraffic engineering, network security, mobile and wireless communications and mobile operating systems.

Preface

There has been a great advance in the area of satellite communications and networks since the publication of the first edition of this book in 2005. Many satellites have been developed dedicated for broadband Internet, broadcasting and broadband communications with large capacity and high quality comparable to terrestrial networks.

Internet and mobile networks have had many new developments which is changing the ways we study, work and live, as well as the ways our business and society operate. It is clear now that all networks are evolving towards an all-IP solution, including telecommunication, mobile, Internet and broadcasting.

It is also clear that satellites still play an important role to complement these networks and support the existing and future services and applications. Satellite networking is a special and important topic, together with other networking technologies in recent years. Due to the nature of satellite links (long propagation delay, relatively high bit error rate and limited bandwidth in comparison with terrestrial links, particularly optical links), it is useful to understand the impact of satellites on standard network protocols and network design as well as their roles and benefits.

Satellite networking has evolved significantly since the first telecommunications satellite, from telephone and broadcast to broadband and Internet networks. The evolution has also been reflected in research and development, including recent studies of onboard processing, onboard switching and onboard IP routing. There is also continuous research in satellite communications and networks, including resource management, security and quality of service, multicast, video conference and broadband satellite access to the Internet.

We have also seen the development of a new generation of standards such as DVB-S2, DVB-RCS2, IPv6 and 4G mobile networks. Satellites should be able to inter-network with these new networks and their services.

There are always many practical constraints to trade-off for an optimal solution, such as cost, complexity, technologies and efficiency of space and ground segments in design, implementation and operation.

Therefore, I have tried to keep these in mind while writing the second edition of this book. Given the large amount of information, fast development of the topic and limited space and my knowledge, it is difficult to include all of them in detail. Hence, I just focus on principles and protocol aspects and update the materials to the best of my knowledge.

In addition to the main texts, I have also tried to update all the references as much as I can to reflect new developments and the publication of new standards.

The book also intends to help readers to understand the seamless integration between satellite and terrestrial networks and to achieve a common understanding of different network protocols and technologies, and the convergence of future network protocols, technologies, services and applications as well as user terminals.

This book covers the following topics:

- Introduction of satellite communications networks, broadband networks, broadcasting and Internet networks.
- Technology development from circuits to packet switching networks.
- Concept protocol reference models and standards, with a focus on satellite-specific issues on networking.
- Internet protocol (IP) over satellites, TCP enhancement over satellites and DVB over satellites (DVB-S/S2 and DVB-RCS/RSC2).
- Introduction to IPv6, the next generation of Internet over satellite and network convergence.

The importance of fundamental concepts and principles for satellite networking and the role satellites will play in future networks can never be overemphasised. Readers who wish to gain further details on some of the relevant topics are directed to the further reading sections at the end of each chapter.

Prof. Zhili Sun
University of Surrey, UK
8 September 2013

Acknowledgements

I would like to take this opportunity to thank my colleagues, research fellows and research students who have worked or who are working with me together on many different projects related to broadband satellite communications and networks, satellite multicast, satellite security and so on. Also thanks to the European Union (EU) framework programmes, European Space agency and UK research council for funding those projects in the areas of broadband satellite communications and networks.

Then, I would like to take this opportunity to thank the publisher for their constant support.

Finally, I would like to thank my mother and my wife for their love and support during the years.

Zhili Sun

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