CrossMark

EDITORIAL

Special Issue on Survivable and Resilient Communication Networks and Services

Eytan Modiano[1] · Rudra Dutta[2] · Yi Qian[3]

Communication networks and services play a vital role in our modern lives. This importance is expected to continue to grow in future decades. More and more business, healthcare or government organizations will become increasingly dependent on the communication between their offices and people. Not only does modern society depend on these services in terms of availability but also in terms of proper functioning in all circumstances. These services having stringent requirements with respect to protection of privacy and security. Anonymity (such as e-health) cannot accept, for example, temporary leakage of confidential information by accident whether a result of human error or technical problems. The information and communication network technology itself have also been evolving with tremendous breakthroughs. Users have more and more different types of mobile devices that interconnect them to the Internet. These mobile devices provide incentives to generate novel technology paradigms that enable more flexible provisioning, network virtualization, or improved power efficiency. The robustness and fault tolerance of these novel evolutions is as crucial as ever.

The objective of this special issue is to cover the most recent research with cutting-edge insights, analysis, designs and/or evaluations in the field of the reliability and availability of communication networks and services. The responses to our Call for Papers on this special issue were very good, with a total of 21 manuscripts submitted. During the review process, each paper was assigned to and reviewed by at least three experts in the relevant area, with a rigorous two-round

✉ Yi Qian
  yqian2@unl.edu

[1] Massachusetts Institute of Technology, Cambridge, MA, USA

[2] North Carolina State University, Raleigh, NC, USA

[3] University of Nebraska-Lincoln, Lincoln, NE, USA

⚛ Springer

review process. This special issue will accommodate 12 excellent articles covering various aspects on survivable and resilient communication networks including the following ones: mobile ad hoc networks, wireless mesh, optical, smart grid communication, and software defined networks, to services such as video, data, and routing and IP based services.

The first article, "Constructing Dependable Smart Grid Networks using Network Functions Virtualization" by Niedermeier and Meer, discusses the usage of network function virtualization technologies and constructs a virtual advanced metering infrastructure network to transmit energy-related information in a dependable and cost-effective way.

The second article, "Loop-Free Alternates with Loop Detection for Fast Reroute in Software-Defined Carrier and Data Center Networks" by Braun and Menth, proposes a loop-free alternate to Open Flow-based IP networks for software-defined carrier and data center networks.

The third article, "Effective Risk Assessment in Resilient Communication Networks", Rusek et al. discusses business impact analysis in the context of resilient communication networks. It is based on the total aggregated penalty that may be paid by an operator when the services provided are interrupted due to network failures.

The fourth article, "Traffic Prediction for Reliable and Resilient Video Communications over Multi-Location WMNs", by Rong et al., studies reliable and resilient deployment of video over IP across a multi-location organization, where a number of wireless mesh network clouds are connected by a virtual private network. Particularly, they propose a scheme of an enhanced SIP proxy server that can support an accountable network.

Wang and Doucette present the fifth article, "Dual-Failure Availability Analysis of Span-Restorable Mesh Networks". In this article, the authors propose a new method to calculate network service unavailability. An integer linear programming model framework is also built to qualify the new method and evaluate current and new availability analysis methods.

Hashiguchi et al. present the sixth article, "Cost-Efficient Traffic Aggregation Employing Cross-Layer Shared Protection". In this article, the authors present a multi-layer network design strategy and method that reduce equipment costs by means of both traffic re-aggregation at each layer and protection resource sharing among multiple service traffic at different layers.

The seventh article, "A Virtual Id Routing Protocol for Future Dynamics Networks and Its Implementation Using the SDN Paradigm", by Dumba et al., proposes a new plug-and-play non-IP routing protocol for future dynamics' networks they name VIRO. VIRO decouples routing/forwarding from addressing by introducing a topology-aware, structured virtual id layer to encode the locations of switches and devices in the physical topology. The authors show that VIRO has better scalability than link-state based protocols in terms of routing-table size and control overhead, as well as better mechanisms for failure recovery.

The eighth article, "Cost Comparison of Alternative Architectures for IP-over-Optical Core Networks", Zhang et al. studies alternative architectures to reduce cost of IP-over-Optical Core networks.

Kounev et al. present the ninth article, "Reliable Communication Networks for Smart Grid Transmission Systems". The authors studied the communication reliability requirements for smart grids with a focus on communications in support of wide area situational awareness. They also propose two alternatives for smart grid wide area network design problems.

Zhang and Sterbenz present the tenth article, "Robustness Analysis and Enhancement of MANETs Using Human Mobility Traces". In this article, the authors provide a model to assess the vulnerability of mobile ad hoc networks in face of malicious attacks. They analyzed comprehensive graph-theoretical properties and network performance of the dynamic networks under attacks against the critical nodes using real-world mobility traces.

The eleventh article, "Data Uncertainty in Virtual Network Embedding Robust Optimization and Protection Levels", by Coniglio et al., addresses the Virtual Network Embedding problem that, given a physical substrate network and a collection of virtual networks (VNs), calls for an embedding of the most profitable subset of VNs onto the physical substrate, subject to capacity constraints.

Gardner et al. present the twelfth article, "Determining Geographic Vulnerabilities using a Novel Impact Based Resilience Metric". In this article, the authors studied a new impact-based resilience metric. The new metric uses ideas borrowed from performability to combine network impact with state probability to calculate a new metric called network impact resilience. The authors also present a state space analysis method that analyzes multilayer networks for geographic vulnerabilities.

In closing, we would like to thank all the authors for their excellent contributions. We also thank the reviewers for their dedication in reviewing the papers and providing valuable comments and suggestions for refining the quality of the articles. We appreciate the advice and support of the Editor-in-Chief of the Journal of Network and Systems Management, Dr. Deep Medhi, and the staff of the journal, for their tremendous help in the publication process. Finally, we hope that the readership will find this special issue interesting and informative. We also hope that the readership will stay tuned for new developments in this research area.

Eytan Modiano received his B.S. degree in Electrical Engineering and Computer Science from the University of Connecticut at Storrs in 1986 and his M.S. and Ph.D. degrees, both in Electrical Engineering, from the University of Maryland, College Park, MD, in 1989 and 1992, respectively. Dr, Modiano was a Naval Research Laboratory Fellow between 1987 and 1992 and a National Research Council Post-Doctoral Fellow during 1992–1993. Between 1993 and 1999 he was with the MIT Lincoln Laboratory. Since 1999, Dr. Modiano has been on the faculty at MIT, where he is a Professor in the Department of Aeronautics and Astronautics and the Laboratory for Information and Decision Systems (LIDS). His research is on communication networks and protocols with emphasis on satellite, wireless, and optical networks. He is an Editor-at-Large for the IEEE/ACM Transactions on Networking, and served as Associate Editor for IEEE Transactions on Information Theory and IEEE/ACM Transactions on Networking. He was the Technical Program co-chair for IEEE Wiopt 2006, IEEE INFOCOM 2007, ACM MobiHoc 2007, and DRCN 2015. He is a Fellow of the IEEE and an Associate Fellow of the AIAA, and a member of the IEEE Fellows committee.

Rudra Dutta received a B.E. in Electrical Engineering from Jadavpur University, Calcutta, India, in 1991, an M.E. in Systems Science and Automation from the Indian Institute of Science, Bangalore, India in 1993, and a Ph.D. in Computer Science from North Carolina State University, Raleigh, USA, in 2001.

From 1993 to 1997 Dr. Dutta worked for IBM as a software developer and programmer in various networking related projects. He was employed from 2001 to 2007 as Assistant Professor, from 2007 to 2013 as Associate Professor, and has been employed since 2013 as Professor, in the Department of Computer Science at the North Carolina State University, Raleigh. During the summer of 2005, Dr. Dutta was a visiting researcher at the IBM WebSphere Technology Institute in RTP, NC, USA. His current research interests focus on design and performance optimization of large networking systems, Internet architecture, wireless networks, and network analytics. His research is supported currently by grants from the National Science Foundation, the National Security Agency, and industry, including a recent GENI grant and an FIA grant from NSF. Dr. Dutta has served as a reviewer for many premium journals, on NSF, DoE, ARO, and NSERC (Canada) review panels, as part of the organizing committee of many premium conferences, including Program Co-chair for the Second International Workshop on Traffic Grooming, Program Chair for the Optical Networking Symposium at IEEE Globecom 2008, and General Chair of IEEE ANTS 2010. He serves on the editorial boards of the Elsevier Journal of Optical Switching and Networking, and the Springer Photonic Communication Networks journal. Dr. Dutta also served as guest editor of a special issue on Green Networking and Communications of OSN.

Yi Qian received a Ph.D. degree in Electrical Engineering from Clemson University. Currently, he is a professor in the Department of Electrical and Computer Engineering, University of Nebraska-Lincoln (UNL). Prior to joining UNL, he worked in the telecommunications industry, academia, and the government. Some of his previous professional positions include serving as a senior member of scientific staff and a technical advisor at Nortel Networks, a senior systems engineer and a technical advisor at several start-up companies, an assistant professor at the University of Puerto Rico at Mayaguez, and a senior researcher at the National Institute of Standards and Technology. Dr. Qian's research interests include information assurance and network security, network design, network modeling, simulation and performance analysis for next generation wireless networks, wireless ad-hoc and sensor networks, vehicular networks, smart grid communication networks, broadband satellite networks, optical networks, high-speed networks and the Internet. Dr. Yi Qian is a member of ACM and a senior member of IEEE. He is serving on the editorial board for several international journals and magazines, including serving as the Associate Editor-in-Chief for the IEEE Wireless Communications Magazine. He is a Distinguished Lecturer for IEEE Vehicular Technology Society. He was the Chair of IEEE Communications Society Technical Committee for Communications and Information Security 2014–2015.