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Reliable networks design and modeling (foreword)

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This Special Issue contains extended versions of selected papers from 4th International Workshop on Reliable Networks Design and Modeling (RNDM 2012) held in St. Petersburg, Russia on October 3–5, 2012. This event was organized by Gdansk University of Technology (PL) in cooperation with Ghent University (BE), and NTT/Nippon Institute of Technology (JP). The workshop was technically co-sponsored by IFIP TC6 WG 6.10 and by IEEE Region 8.

Similar to previous editions, RNDM 2012 was a forum for discussions between people from academia and industry with special focus on network survivability, i.e., capability of a network to provide the continuous transmission after failures.

After a careful review process, including on average 4.2 completed reviews per each paper, RNDM 2012 papers selected for publication were organized into seven technical sessions, namely: ”Resilience of IP-based Networks”, ”Optical Networks Survivability”, ”Resource Sharing”, ”End-to-end Resilience”, ”Network Reliability Evaluation”, ”Emerging Areas in Reliable Networks Design”, and ”Resilience of Virtual and Overlay Networks”.

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After the event, presented papers were carefully examined again by the Chairs. As a result, authors of eight selected papers were invited to submit the extended versions to this Special Issue. These extended papers were also extensively reviewed. Their final acceptance was conditional upon carefully addressing the reviewers remarks. Each of the papers is briefly introduced below.

The first paper entitled *Future Research Directions in Design of Reliable Communication Systems* by Rak et al. discusses new trends in the design of reliable communication systems with special focus on software failure mitigation, reliability of wireless communications, robust optimization and network design, multilevel and multirealm network resilience, multiple criteria routing approaches in multilayer networks, resilience options of the fixed IP backbone network in the interplay with the optical layer survivability, reliability of cloud computing networks, as well as resiliency of software-defined networks.

In *Quantification of System Survivability*, Trivedi and Xia introduce the notion of survivability focusing on the capability of a system to achieve timely recovery in the face of adverse incidents.

Okamura et al. in *Network Survivability Modeling and Analysis for Power-aware MANETs by Markov Regenerative Processes* present the quantitative network survivability analysis for a power-aware mobile ad hoc network (MANET) based on Markov regenerative processes (MRGPs). In particular, a power-aware MANET model is revisited by using MRGP, and both stationary and transient analysis for the MRGP-based model is presented.

The next paper entitled *On Providing Fast Protection with Remote Loop-Free Alternates—Analyzing and Optimizing Unit Cost Networks* by Csikor and Retvari focuses on providing fast restoration using the concept of remote loop-free alternates (rLFA), which is an extension to the

conventional LFA technique. In particular, their research determines the topological requirements and the protection efficiency of Remote LFA as well as finds optimization methods to tweak the network for 100 % rLFA failure case coverage.

Staessens et al. in *Analysis of Resource Sharing in Transparent Networks* concentrate on reducing the capital expenditures (CapEx) expected from implementing sharing of backup resources in path-protected transparent networks. A nationwide network topology is dimensioned for different protection mechanisms using transparent and opaque architectures. In particular, the authors show that the possible gain for transparent networks strongly depends on the network load.

Multilevel Resilience Analysis of Transportation and Communication Networks by Çetinkaya et al. includes graph-theoretic analysis of physical infrastructures using the spectral properties. Moreover, it proposes a framework to realistically model and analyse robustness of multilevel and multiprovider networks.

Girlich et al. in *On the Resistance of Overlay Networks against Bandwidth Exhaustion Attacks* present metrics to evaluate network topologies in terms of resistance against botnets. In particular, the metrics included in the paper refer to random, greedy, as well as optimally operating attackers.

The last paper entitled *Flow Assignment (FA) and Capacity and Flow Assignment (CFA) Problems for Survivable Overlay Multicasting in Dual Homing Networks* by Kmiecik and Walkowiak focuses on using the overlay multicasting approach for the purpose of safe transmission of critical data. The authors show that additional survivability requirements do not imply a significant increase of the streaming/network cost.

The papers included in this Special Issue were selected in hope that they show the big picture of the best ideas on network reliability presented during RNDM 2012. The editors of this Special Issue would like to express their gratitude to the Editor of Telecommunication Systems journal for his consent to publish RNDM 2012 materials in this Journal, as well as to the reviewers for delivering the detailed reviews.

Jacek Rak holds Ph.D. degree in computer science received with distinction in 2009 from Gdansk University of Technology (GUT), Poland. He is currently an Assistant Professor at the Department of Computer Communications at GUT. His main research areas include: routing, design, and analysis of communication networks with special focus on reliability. He is the author/co-author of over 60 publications, including around 20 publications in journals. Dr. Rak has been involved in many projects related to optimization of reliable computer networks. He has also served as a TPC member of numerous conferences on communications, e.g., IEEE ICC, IEEE GLOBECOM, DRCN, and reviewer of journals, including e.g., IEEE/OSA Trans. on Networking, IEEE Communications Letters, or IEEE Trans. on Multimedia. Between 2012 and 2014, he served as a member of the Editorial Board of Telecommunication Systems (Springer). Dr. Rak is currently the Vice Chair of IFIP TC6 WG 6.10, a senior member of IEEE, Steering Committee Member of NETWORKS and ICUMT conferences, as well as the founder and the General Chair of International Workshop on Reliable Networks Design and Modeling (RNDM).

Mario Pickavet received an M.Sc. and Ph.D. degree in electrical engineering, specialized in telecommunications, from Ghent University in 1996 and 1999, respectively. Since 2000, he is professor at Ghent University where he is teaching courses on discrete mathematics, multimedia networks and network modeling. He is co-leading the research cluster on Network Modeling, Design and Evaluation (NetMoDeL) covering 4 research topics: Fixed internet architectures and optical networks, techno-economic studies, green-ICT and design of network algorithms (DNA). In this context, he is and was involved in several European and national research projects. He has published about 300 international publications, both in journals (IEEE JSAC, IEEE Comm. Mag., Journal of Lightwave Technology, Proc. of the IEEE, JOCN, etc.) and in proceedings of conferences. He is co-author of the book *Network Recovery: Protection and Restoration of Optical, SONET-SDH, IP, and MPLS*.

Hideaki Yoshino received the B.Sc., M.Sc. and D.Sc. degrees in information science from the Tokyo Institute of Technology, Tokyo, Japan, in 1983, 1985 and 2010, respectively. He joined NTT Laboratories in 1985 and has been engaged in communication traffic and service quality research for 27 years. As a visiting scholar, he stayed at the University of Stuttgart, Germany, during 1990–1991. He is currently a professor at the Department of Electrical and Electronics Engineering at Nippon Institute of Technology. Prof. Yoshino was involved in many international conferences related to communication network and quality, e.g., CQRM symposium co-chair of IEEE ICC and GLOBECOM. He is a member of IEEE (and IEEE Communications Society), IEICE Japan, and the Operations Research Society of Japan.