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Preface

Over the last three decades, there have been a number of significant technological developments in intelligent network technologies. The most important step in the development of intelligent networks was the agreement of the Regional Bell Operating Companies (RBOCs) and Bellcore to work on the advanced intelligent network (AIN) project.

Today's ultra-scale intelligent networks (modern clusters, cognitive networks, clouds and mobile clouds, federated clusters and modern wireless technologies) enable the aggregation and transmission of huge amount of data generated by geographically-distributed users. In the Big Data era, such data can be incomplete and the whole process of data analytics is dynamic and complex.

The concept of the support the data intensive analytics process by advanced intelligent networks and various scale today's network technologies makes a positive impact on the development of new efficient data, information and network systems. This issue contains ten research papers reporting the recent results on models, solutions, and techniques from such a wide research area, ranging from conceptual and theoretical developments to advanced technologies and innovative applications and tools.

In the first four papers the authors present interesting examples of efficient energy-effective and data resilient approaches in modern intelligent networks. Esmaeilifard and Rahbar developed a novel energy-efficient data transmission model in cellular networks. They considered a realistic scenario in a country area and defined the high capacity energy efficient protocol for the optimization of required output power for network traffic and data transmission between the base station and a mobile user. Although the traffic and number of users can be rather low in such environments, the network access problem and big distance from the base station are the main reasons of high energy consumption in the network and low mobile resource reliability (the batteries can drain very quickly). The presented approach is a simple example of the power management support in wide area cellular networks.

A rapid grow of various public utility services based on the new developments in ICT sector can be observed over the last decades. Intelligent network technologies play a crucial role in supporting the management, monitoring and control of such services. However, the ultra-scale of those networks and a huge volume of different service offered for the user make the service management and control problems very complex and challenging. Therefore,

there is a need to make those processes independent from the system and network administrators. In the second paper, Nayaka and Biradar survey the recent network technologies useful in automation of the management and control of water, electricity and gas supply processes. They compare the efficiencies of networks set on the provide a comprehensive network analysis based on communication protocols, topologies, network, hardware, and applications used for automated management of public utility services. As the conclusion from the provided analysis, the authors propose a prototype of a new wireless sensor network topology, where the sensor nodes on two data fusion and aggregation layers are its main components.

The automation of data transmission and traffic in modern networks is an important example of energy optimization method in network management process. Kutin in the third paper addresses the problem of energy-aware data transmission using the wavelets and signal decomposition methods. The author analyzes the signals properties generated by classical modulation methods and spline modulation and defines a novel wavelet coefficients transmission model. The effective reduction of energy used for data transmission and, more general, data migration in heterogeneous large-scale networks such as grids and Infrastructure-as-a-Service (IaaS) layer in cloud systems, remains one of the most important issue in data and tasks allocation processes in such environments. Konovalov and Razumchik try to solve resource allocation problem in a simple 2-servers scenario, where the considered jobs have fixed sizes and the objective is the minimization of mean job sojourn time in the system. The optimal allocation policy in this system is of threshold type with one threshold i.e. if upon arrival of the job the amount of unfinished work at faster server (plus total work in its queue) minus the amount of unfinished work at slower server (plus total work in its queue) exceed the threshold value, job is allocated to slow server. The authors propose a scalable fast iterative non-simulation algorithm for the approximation of the policy parameter (threshold), which has been verified in comprehensive experimental analysis.

Many processes in modern ultra-scale and small-scale networks, as well as the prediction of network reliability and performance, can be defined and estimated by using well-known probabilistic models. In the next four papers, few interesting examples of the application of mathematical models can be found.

Islam *et al*. focus on cognitive radio network with two types of users: primary user (PU) and secondary user (SU). They used 2-dimensional Markov Chain model for traffic analytics and prediction. In the next paper, Krok presents the simulation and prediction of the time series. The author compares the efficiency of two types of Artificial Neural Networks trained by Kalman filter support method and Bayesian-based method. A simple theoretical study of the prediction model and efficiency of both training methods is provided.

Although the OpenStack standard seems to be well explored and exploited in cloud computing, Grzonka analyzed in details the features and performance of the OpenStack cloud in the case of complex data processing and analytics. The prediction of the system performance and cloud resource reliability remain still challenging tasks, mainly because of complex memory management frameworks in OpenStack libraries.

The paper of Grzonka shows indirectly the limitation of today's network systems in the case of massive and Big Data processing. One of the main reasons of low network reliability is, besides the data volume, the data dynamics. Therefore, there is a need of development of simple and scalable data distribution model with the dynamic factor. Krok in the eight paper, analyze Gaussian distribution model for defining the experimental data in complex global optimization tasks. The author used genetic algorithms for estimation of the Gaussian process parameters. Gaussian-based data modeling accuracy was compared with neural networks model learned by Kalman filter method. The results of the performed experiments shows that Gaussian processes can be efficient in simulation and prediction of concrete hysteresis loops in cycling experimental data loading.

The last part of the issue includes two papers with interesting practical example of application large scale networks in e-commerce (Suchacka *et al*.) and historical analysis of analog telephone systems (Patil).

I believe that all papers presented in this issue ought to serve as a reference for students, researchers, and practitioners interested or currently working in the evolving and interdisciplinary areas of energy-aware intelligent networks of various types and scale, where traffic management and data processing and analytics are the crucial issues. I hope that the readers will find there new inspirations for their further research.

I am grateful to all the contributors of this issue. I thank the authors for their time and efforts in the presentation of their recent research results. I also would like to express my sincere thanks to the reviewers, who have helped us to ensure the quality of this publication. My special thanks go to the journal Editors, Managers and Publishers for their great support throughout the entire publication process.

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