Editorial: Simulation Tools and Techniques for Communications and Networking

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Editorial:

Simulation technology appears with the development of computer. Simulation tools are the application of theory, based on the existing theoretical and mathematical knowledge. The study and utilization of simulation tools and techniques for communications and networking is necessary, considering the rapid expansion of network size and capacity. The 5th generation wireless systems (in short 5G) was proposed aiming to provide infinite networking capability to mobile users. Different from 4G, 5G is much more than increased maximum throughput. It aim to involve and benefit from many current technical advances including massive dense networks, interference and mobility management, Internet of Things (IoT), pervasive and social computing, mobile ad hoc networks (MANET), cognitive radio, World Wide Wireless Web (WWWW), cloud computing, IPv6, and so on. How can simulation techniques and tools be used to explore the architecture and performance of 5G and next-generation communication networks? How can novel method stimulate our innovation for the next generation of mobile networks and applications? These problems are fiery in both industry and academia, with great fervor all over the world. This special issue focuses on a broad range of research challenges in the field of simulation, modelling and analysis, addressing current and future trends in simulation techniques,

models, practices and software. It is dedicated to fostering interdisciplinary collaborative research in these areas and across a wide spectrum of application domains.

This special issue features twenty selected papers with high quality. The first article, “An AI-based Adaptive Cognitive Modeling and Measurement Method of Network Traffic for EIS”, proposed an AI-based lightweight adaptive measurement method (ALAMM) for SDN to reduce the traffic measurement overheads and improve the measurement accuracy. The artificial intelligent algorithm was utilized to model and predict the flow traffic in the enterprise information system.

The second article titled “A Blockchain-based Security Traffic Measurement Approach to Software Defined Networking” presented the motivation for introducing blockchain technology into the network measurement framework to ensure the security and consistency of the statistics. Authors modeled the network traffic as an ARIMA model and forecast the network traffic with the coarse-grained measurement of flows.

As an important part of the future network, the satellite communication network gets more attention. In the next article with the title “A Dynamic Resource Scheduling Scheme in Edge Computing Satellite Networks”, the authors studied the resource division strategy in edge computing satellite (ECS) network to improve service efficiency. The advanced K-means algorithm (AKG) and breadth-first-search-based spanning tree algorithm (BFST) are provided to realize ECS resource division and inter-satellite link (ISL) construction respectively.

The fourth article titled “DSWIPT Scheme for Cooperative Transmission in Downlink NOMA System” proposed a dynamic simultaneous wireless information and power transfer cooperative NOMA (DSWIPT NOMA) scheme to reduce the throughput performance gap between the cell-center user and cell-edge user in a two-user downlink non-orthogonal multiple access (NOMA) system.

The development of quantum physics give more attention to quantum information computing and processing. The fifth article, “A Quantum Key Distribution Protocol Based on the

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EPR Pairs and its Simulation” proposed a novel quantum key distribution protocol based on the entanglement and dense coding. The trade-off between the information and the disturbance is calculated under the intercept-measure-resend attack and the entanglement-measure attack to verify the security of the proposed method.

The application of machine learning algorithm in vehicle networks greatly promotes the construction of smart city. The sixth article, “Efficient Traffic Sign Recognition Using Cross-Connected Convolution Neural Networks Under Compressive Sensing Domain”, modified traditional convolutional neural networks (CNN) and proposed a novel algorithm based on compressive sensing domain and cross-connected convolution neural networks (CCNN) for traffic sign recognition. The proposed scheme significantly improved the recognition accuracy.

The point target detection technology is advancing rapidly, especially in the field of military monitoring and the application. In the next article with the title “Adaptive Morphological Contrast Enhancement Based on Quantum Genetic Algorithm for Point Target Detection”, the authors proposed a novel method based on quantum genetic algorithm to optimize and obtain structural element, which is used as morphological filter for small target detection in original infrared images.

The eighth article titled “MTAPS: Indoor Localization Algorithm Based on Multiple Times AP Selection” introduced main indoor localization technologies in the multi access points (AP) scenario. In order to reduce the complexity of localization computation, authors proposed a novel indoor positioning method MTAPS to improve the localization performance with an efficient AP selection algorithm.

Computer-aided drug design (CADD) steps up the process of protein-ligand docking and opens up prospects of drug design as a basis. The ninth article, “A Novel Firework Algorithm for the Protein-Ligand Docking on the AutoDock” proposed an improved fireworks algorithm to solve the protein-ligand docking problem more effectively, which utilized the position updating information of fireworks to avoid premature convergence of the algorithm.

The machine learning algorithm is considered as a promising solution for link planning in the time-varying space-air-ground integrated networks. In the next article with the title “An Adaboost Based Link Planning Scheme in Space-air-ground Integrated Networks”, the authors utilized the ARMA model and Adaboost algorithm to predict the traffic flow and classify the networks nodes to adaptively select the optimal data transmission links in space-air-ground integrated networks.

The network traffic prediction has a great impact on network management. The eleventh article, “A New Network Traffic Prediction Approach in Software Defined Networks”, proposed a network traffic prediction method based on short time Fourier transform (STFT) and traffic

modeling. The network traffic dataset is decomposed into high-frequency components and low-frequency components to reduce the prediction errors.

The twelfth article titled “Spectral Efficiency Analysis for Massive MIMO System under QoS Constraint: An Effective Capacity Perspective” presented the motivation for obtaining maximum spectral efficiency (SE) in massive multiple-input multiple-output (MIMO) systems. By adopting the effective capacity (EC) theory of wireless channels, authors associated the delay violation probability with the transmission rate fluctuations to build a continuous function to obtain the maximum SE.

A vehicular voice cloud service has unique advantages that can help drivers reduce their operational reliance on vehicular equipment and increase driving safety. In the next article with the title “A QoE Test System for Vehicular Voice Cloud Service”, the authors designed a lightweight vehicular voice cloud evaluation system, which can send voice information to the voice cloud server according to user habits and capture packets to analyze the key indicators. The system tried to avoid complex communication and language processing to provide strong objective evaluation results.

The fourteenth article titled “A New Traffic Prediction Algorithm to Software Defined Networking” proposed a lightweight traffic prediction algorithm for SDN applications. Compared with traditional traffic measurements, authors utilized the time-correlation theory and regressive algorithm to model the traffic flow in SDN.

With the rapid development of 5G network, Space Information Networks (SIN) is increasingly applied to life and production. The fifteenth article, “A Prediction Approach to Origin-Destination Traffic in Space Information Networks” studied the 3-dimensional space information networks based on SDN (SINS) network architecture. Authors proposed an improved hidden Markov model to predict the change trend of origin-destination traffic (ODT) in SINS.

The sixteenth article titled “Investigating the Strategy on Path Planning on Aircraft Evacuation Process Using Discrete Event Simulation” applied a discrete event simulation (DES) model to investigate passengers’ evacuation paths for aircraft evacuation under emergency. Authors investigated the effect of different path planning strategies on total evacuation time. Results suggested that a flight attendant directed approach yielded significantly more efficiency than passenger random exit choosing and switching exits.

In previous studies, the modulus-based synchronous multisplitting iteration methods was constructed by an equivalent reformulation of the linear complementarity problem into a system of fixed-point equations. In the next article with the title “Relaxed Modulus-Based Synchronous Multisplitting Multi-Parameter Methods for Linear Complementarity Problems”, the authors studied relaxed modulus-based synchronous multisplitting multi-parameter methods for linear

complementarity problems. The convergence results of the proposed methods was given under weaker conditions.

The eighteenth article titled “Weaker Convergence of Global Relaxed Multisplitting USAOR Methods for An H-matrix” further analyzed global relaxed parallel multisplitting USAOR (GUSAOR) method and obtain the weaker convergence results. Compared to previous studies, the proposed method had wider convergence domain when the system matrix is an H-matrix.

Network emulation is an essential method to test network architecture, protocol and application. The nineteenth article, “Network Emulation as a Service (NEaaS): Towards A Cloud-based Network Emulation Platform” designed and implemented an innovative cloud-based network emulation platform for large network emulation. The proposed platform can significantly outperform legacy network emulators regarding to scalability, agility, and extensibility with much lower costs.

The last article titled “A Hybrid Virtualization Approach to Emulate Heterogeneous Network Nodes” focused on mitigating the emulation incompatibility problem caused by node heterogeneity in heterogeneous network emulation. The authors proposed a hybrid virtualization approach concurrently utilizing multiple virtualization technologies like KVM, QEMU, and Docker to emulate heterogeneously architected nodes. The elaborated hybrid virtualization approach can effectively dispose of the emulation incompatibility problem with affordable performance degradations.

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