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Guest Editorial

Introduction to the special section on Network Measurement for Software-defined and Information-centric Networking

Background

New technologies such as the Internet of Things (IoT) and cloud computing, and developments such as Information-Centric Networking (ICN) have attracted significant interest in the research community in recent years. By supporting routing by name, ICN achieves location independence and enables a series of valuable features such as in-network caching, multicast and mobility support. Such features are particularly desirable for applications related to the delivery of content to both fixed and mobile users. Indeed, following efforts on peer-to-peer content distribution and Content Delivery Networks (CDNs), research on ICN has been largely motivated by the proliferation of content-centric applications on the Internet. In addition, by binding names to the content/information itself, ICN also supports inherent security features rather than relying on a posteriori patches.

While most ICN studies are related to Internet applications, more recent studies have begun to advocate adoption of the ICN networking paradigm to address security and resilience concerns in the context of smart grids, focusing mostly on power grid monitoring and home energy management applications. We argue that the ICN paradigm can be further leveraged to support and facilitate communications in emerging smart electric vehicle charging applications. Following advances in several key technologies, such as power electronics, energy storage and embedded software, reliable electric vehicles are beginning to penetrate the transportation landscape. With sustainability in mind, some governments already provide incentives for the use of more environmentally friendly electric vehicles. For instance, the United Kingdom government offers a Plug-in Car Grant of up to £5000, while the U.S. federal government provides tax credits up to $75,00 to electric vehicle buyers.

In this context, the grid-to-vehicle (G2V) charging application environment, in which a series of different autonomous, administrative entities/actors such as electric vehicles (EVs), distribution system operators (DSOs), energy providers (EPs), and charging station operators (CSOs) need to share and exchange information in a complex application environment, has started to expand. Often, the same information must be exchanged by multiple entities at different time-scales and granularities, resulting in a complicated flow of information. In addition, information may require different levels of security and privacy clearances (e.g., for charging and billing purposes). Moreover, communications in this domain also impact critical operations related to the stability of the power grid.

Papers in this special section

Software-defined networking paradigm faces many challenges, including reliability, resiliency, scalability, and availability. These challenges can be tackled by carefully selecting placements within the network. However, the evaluation of all placements is only practical for small networks. In '***An Adaptive Heuristic for Multi-Objective Controller Placement in Software-Defined Networks***', a fast and efficient adaptation of evolutionary algorithms is presented to solve large-scale multi-objective controller placement problems. The presented algorithm requires reasonable memory resource and enjoys a greedy heuristic to generate a high-quality initial population, smart mechanisms to encourage the diversification and intensification, and a new fast Pareto finder. Moreover, a new variant of the problem is developed in which the capacities of controllers and loads of switches are added as constraints. A new constraint handling technique is applied to adapt our algorithm to solve the new problem. Finally, the results on several topologies from Internet Topology Zoo revealed that our presented algorithms outperformed some other efficient algorithms from the literature.

With the rapid advancement of the social network, the total interpersonal relationships among people constitute a social network in real life and the human is the node in this network. Against this background, '***A Novel Social Network Measurement and Perception Pattern Based on a Multi-Agent and Convolutional Neural Network***' proposes a novel social network search and perception pattern based on a multi-agent and convolutional neural network. Our research can be regarded as a parallel integration of

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the multi-agent and CNN. In the CNN part, we adopt prior knowledge that differs from the ordinary convolution neural network and the convolution neural network unique neuron receptive field structure. In the multi-agent part, we combine the characteristics of individual and general-community agents; the establishment and revision of its faith intention is the result of internal thought conditions and interaction with external factors. We apply the proposed model to a social network search, and perception and connection awareness analysis, respectively. The experimental result proves that the proposed method achieves a satisfactory performance.

The market performance prediction of domestic motion picture is an important problem that is worthy of study. In '***Complex Network Measurement and Optimization of Chinese Domestic Movies with Internet of Things Technology***', by incorporating Chinese fine-grained semantic features, we proposed a method of community detection and genetic optimization especially for Chinese domestic films. These semantic features, also named as gene elements, are used to construct a movie complex network. Through leveraging the advantages of both the whole network and the internal community, four unique communities are revealed for successful Chinese movies. And then, the Genetic Algorithm (GA) with a proposed novel fitness function is used to obtain the optimal cluster of gene elements. For the other operations in GA (i.e. initialization, selection, crossover and mutation), the parameters are also be optimized by a distinctive evaluation method. Finally, the experiments on the data of Chinese motion pictures in 2016 demonstrate the efficacy and accuracy of the overall system.

Several Software Defined Networking (SDN) based architectures have been proposed for wireless networks. Among them, the proposal of Reconfigurable Base Station (RBS) programmable with different Radio Access Technologies (RATs) dynamically by an SDN controller has the potential to improve mobility. This improvement can be achieved by dynamically converting expensive inter-RAT mobility procedures into efficient intra-RAT ones by deploying RBSs along with traditional base stations. This conversion requires development of algorithms for optimal RAT selection in RBSs by the SDN controller, to increase the proportion of intra-RAT mobility procedures in the network. '***Radio Access Technology Selection in SDN controlled Reconfigurable Base Station***' proposes three novel algorithms using parameters such as mobility procedure counts and execution time of each procedure. Simulation results compare these algorithms and suggest their applicability under various deployment scenarios and User Equipment (UE) mobility patterns. Also, the algorithm based on mobility procedure counts with preference only to incoming UEs in a cell, performs better in most scenarios.

Wireless Sensor Networks (WSNs) are commonly used information technologies of modern networking and computing platforms. Today's network computing applications are faced with a high demand of powerful network functionalities. Functional network reach is central to customer satisfaction such as in mobile networks and cloud computing environments. However, efficient management of WSNs remains a challenge, due to problems supplemental to them. Recent technology shift proposes Software Defined Networking (SDN) for improving computing networks. '***Software Defined Wireless Sensor Networks Application Opportunities for Efficient Network Management: A Survey***' highlights application challenges faced by WSNs for monitored environments and those faced by the proposed approaches, as well as opportunities that can be realized on applications of WSNs using SDN. We also highlight Implementation considerations by focusing on critical aspects that should not be disregarded when attempting to improve network functionalities. We then propose a strategy for Software Defined Wireless Sensor Network (SDWSN) as an effort for application improvement in monitored environments.

In traditional IEEE 802.11 protocols, the RSSI is usually taken as the criterion for AP selection, by which the AP with the greatest signal strength may be heavily burdened. In '***A Novel AP Selection Scheme in Software Defined Networking Enabled WLAN***', A SDN-based AP selection scheme called TPR is proposed. Through centralized control from SDN controller which has a full view of the network, our TPR enables AP selection more reasonable and efficient. In addition, the OpenFlow protocol embedded in the AP firmware is revised to efficiently collect the measurement data for AP selection. Besides, since the data processing task is shifted to the SDN controller, the burden of each STA is greatly alleviated thus resulting in fewer energy consumption and overheads at STAs. Experimental results demonstrate the ability of our TPR to increase the throughput of the WLAN system in multi-AP scenario and to reduce the number of handoffs among different APs.

Technologies such as Internet of Things allow small devices to offer web-based services in an open and dynamic networking environments on a massive scale. End users or service consumers face a hard decision over which service to choose among the available ones, as security holds a key in the decision making process. In '***Measuring Web Service Security in the Era of Internet of Things***' a base linguistic evaluation set is designed, based on which all the other fuzzy term sets that used for describing security attributes are uniformed and integrated for calculating an overall security value of the services. This work, to the best of our knowledge, is the first practical solution to offer direct comparisons and rankings of network services based on multiple security attributes such as confidentiality, availability, privacy and accountability. We analysed four major cloud service platforms to illustrate the proposed approach.

'***Soft Frequency Reuse-based Optimization Algorithm for Energy Efficiency of Multi-cell Networks***' studies the optimization problem of energy efficiency in multi-cell networks with multiple users such as 5G networks. However, the spectrum allocation and inter-cell interference in multi-cell networks are an important challenge. To the end, the Soft Frequency Reuse (SFR) technology is used to build a SFR-cellular network. We take the global energy efficiency of networks as the objective function of the optimal problem to obtain the maximum energy efficiency. Unfortunately, the objective function is a non-concave function. This is significantly difficult to directly solve the problem. Therefore, we utilize the integer relaxation, fractional program, successive convex approximation, Lagrange duality, Karush-Kuhn-Tucker conditions, and subgradient iteration to transform the objective function into a concave function. In such a case, we can solve the problem with the convex optimization method. Finally, based on SFR, we propose