Preface of Special Issue: Future Internet

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Xiulong Liu[1], **Mianxiong Dong**[2], **Xiaobo Zhou**[3]

[1] *Department of Computing, Hong Kong Polytechnic University, Hong Kong*
[2] *Department of Information and Electronic Engineering, Muroran Institute of Technology, Japan*
[3] *School of Computer Science and Technology, Tianjin University, China*

1. INTRODUCTION

With the rapid development of emerging technologies, such as Cloud Computing, Big Data, Internet of Things, Edge Computing, etc., traditional network architecture has gradually exposed defects such as inefficient routing mechanisms, unbalanced resource allocation, and high energy consumption. To this end, a great attention from both academia and industry has been paid to future internet. More and more researchers from all around the world begin to propose and design new architectures, technologies, applications, and algorithms for future internet. This special issue aims to present and discuss advances of current research and development in all aspects of of future internet. In view of this, we selected six papers for this special issue on the basis of their originality, technical quality, and significance. These papers include the following topics:

- Software-Defined Networking
- Data Center Networks
- Content-Centric Networking
- Analysis and Applications
- Cognitive Radio Networks
- Social Networking Services

2. PAPERS IN THE SPECIAL ISSUE

The first paper by Anfeng Liu et al. is entitled “Reliable Differentiated Services Optimization for Network Coding Cooperative Communication System" [1]. In this paper, the authors investigated the differentiated service strategy of network coding cooperative communication system. This study is practically important because different applications require different power consumption for data transmission, and the transmission power should be associated with their reliability needs. In other words, transmission power control is performed in the presence of known reliability. Then, the authors proposed the Reliability-Bounded Transmission Power Control (RTPC) scheme. The RTPC scheme changes the way in which all the applications in the past have been able to maintain the power to be transmitted, but the reliability requirements of different applications will be transmitted with different transmission power. Since the nodes that are far away from the sink node still exist a lot of energy when the network died, they further consider to improve the transmission power of non-hotpots nodes in order to increase the reliability of data transmission. Experimental results show that the RTPC scheme can greatly improve the transmission reliability without affecting the network lifetime.

The second paper by Haisheng Yu et al. is entitled “OpenFlow Based Dynamic Flow Scheduling with Multipath for Data Center Networks" [2]. This paper investigates routing mechanism in Data Center networks, which can significantly affect network performance and latency. Existing Hash-based method, such as ECMP (Equal-Cost Multi-Path), has been widely used in Data Center networks to fulfill the requirement of load balance. However, ECMP statically maps one flow to a path by a hash method, which results in that some paths overloaded while others remain underutilized. Some dynamic flow scheduling schemes choose the most underutilized link as the next hop to better utilize the network bandwidth, while these schemes lacks of utilizing the global state of the network. To achieve high bandwidth utilization and low latency, the authors present a dynamic flow scheduling mechanism based on OpenFlow protocol which enables monitoring the global network information by a

centralized controller. Based on the network statistics gathered by the OpenFlow controller, the routing algorithm chooses the optimal path for each flow. The authors proposed two different routing algorithms for short-lived flows and long-lived flows in Data Center, respectively. They also used pox as OpenFlow controller and mininet as the network emulator to implement the proposed routing algorithms. Extensive experiment results demonstrate that the proposed dynamic flow scheduling algorithms are effective and can achieve high link utilization.

The third paper by Jianji Ren et al. is entitled "PPP: Prefix-based Popularity Prediction for Efficient Content Caching in Content-Centric Networks" [3]. This paper pays focuses on the practically important caching problem for Content-Centric Networking (CCN) architecture. The basic idea of CCN is that, popular content can be cached in some intermediate network devices while being delivered, and the following requests for the cached content can be efficiently handled by the caches. Designing an effective in-network caching mechanism is important for reducing both the traffic load and the delivery delay. In this paper, the authors propose a caching framework of Prefix-based Popularity Prediction (PPP) for efficient caching in CCN. PPP assigns a lifetime (in a cache) to the prefix of a name (of each cached object) based on its access history (or popularity), which is represented as a Prefix-Tree (PT). The evaluation results show that PPP can achieve higher cache hits and less traffic load than traditional caching algorithms (i.e., LRU and LFU). Also, its performance gain increases with users of high mobility.

The fourth paper by Ruiguo Yu is entitled "Analysis and Application of the Spatio-temporal Feature in Wind Power Prediction" [4]. This paper investigates the variance of the spatio-temporal feature, and designs a hybrid machine learning method for wind power prediction. Specifically, the training set is first divided into several groups according to the variance of the input pattern, and then each group is used to train one or more predictors respectively. Multiple machine learning methods, such as the support vector machine regression and the decision tree, are used in the proposed method. Then, all the trained predictors are adopted to make predictions for a sample, and the results generated from these predictors will be combined by an optimized combination method based on the variance. The authors used the NREL dataset to conduct experiments, and the evaluation results show that the proposed method can achieve a better performance than the stage-of-the-art approaches.

The fifth paper by Feng Zhou et al. is entitled "Spectrum Allocation for Cognitive Radio Networks Using the Fireworks Algorithm" [5]. Based on the graph coloring model, the authors took the first step in exploiting fireworks algorithm to solve the spectrum allocation problem for cognitive radio networks, for the purpose of maximizing utility and fairness of spectrum allocation. Two-layer binary coding is adopted for individual fireworks. Specifically, the first layer refers to the coding of cognitive users used to determine channels that can be connected with the user. The second layer refers to the auxiliary coding of channels responsible for addressing mutual interference among multiple cognitive users when they connect with the same channel at the same time. Explosion operator, mutation operator, and the selection operation are designed to allocate the spectrum for the cognitive radio network. Simulation results demonstrate superiority and efficiency of the proposed algorithm in terms of spectrum allocation.

The sixth paper by Yuhui Wang et al. is entitled "Topic Evolution Analysis in Social Networking Services: Taking Sina Weibo as an Example" [6]. Event-related topics in social networking services are always the epitome of heated society issues, therefore determining the significance of analyzing its evolution patterns. In this paper, the authors conducted a comprehensive survey on the tweets about "ransomware" in Sina Weibo, a famous social networking service similar to twitter in China. The keyword corresponds to a global ransomware attack in May 2017, on which our example event-related topics are based. They collected text data from sina Weibo and vectorize each tweets, before using a dynamic topic model to discover the event-related topics. The results of the topic model are explainable enough and help understand the evolution of those topics more thoroughly.

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