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Special Issue on Integration of IoT with Future Internet

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The Internet of Things (IoT) is the terminology used for uniquely identifiable objects (or, things) and their virtual representations in an Internet-like structure. The idea of IoT considers same ubiquitous environment as that is for ubiquitous or pervasive computing. Basic difference between pervasive computing and IoT is that when the same setting is seen from the conceptual angle, it is termed pervasive environment but when seen from the angle of identifiable objects taking part in the system, it is called IoT, an Internet-like network of networks. IoT is often considered to be an integrated part of Future Internet. However, the conceptual definitions of these two, separate them in various ways. While IoT is clearly defined by this time, Future Internet is still standing as a cloudy term. Future Internet refers to a wide variety of research issues related to the idea of some kind of huge network of networks that can connect numerous networking devices around the globe. The objective is to get an Internet-like establishment but not in the way we have it today. Some new visions and ideas are sought for. If simply a relatively faster and larger Internet with new devices and technologies is brought forward at the end, it could end up just as an extension of the current Internet that we have. As the basic vision behind Future Internet is that it is not the Internet that we have seen so far, it may have a new way of operating, it may have a new method of connecting devices, and there might be even complete *clean-slate* approach of developing it. As the full operational definition is not yet finalized, there are numerous research issues that can be worked on. The objective of this special issue was to collate different thoughts of the researchers and practitioners on the relevant topics. Given current status, it could be said that any enhanced technology addressing database issues, security issues, networking issues, communications issues, artificial intelligence issues, software engineering related issues, and so on can be considered as the wide work space. However, we thought about getting some specific contributions on actual integration of IoT concept with Future Internet.

Though there were other submissions with high quality, because of the restrictions of the number of papers in one special issue, finally we have been able to accept 5 papers, all of which have come from top level conferences: NSS/IDCS 2012, IEEE IoT-CN 2012 , and IoT 2012. All these papers have been extended and revised by more than 30% considering the idea, texts, figures, and references alongside taking care of the review comments provided from the conferences. Each paper has gone through an editorial checking to ensure the standard set by the Journal of Internet Technology.

Let us talk about the papers a bit to understand how these papers have contributed in the area of focus of this special issue:

Cheng, G. and Wu, H., in their work, "***A NetFlow v9 Measurement System with Network Performance Function***" design a NetFlow v9 measurement system (N9MS) that converts IPv6 packet headers into the Net-Flow v9 flow records and monitors the link performance with these flow records. NetFlow can be employed for accounting, anomaly detection, and network

monitoring, and can bring new data source for network management. The authors discuss various aspects of it alongside providing detailed experimental analysis results. For their experiments, they test and analyze N9MS in a 10Gbps backbone link between Nanjing site and the CNGI-CERNET2 backbone. The observations presented in this paper could help understand the operational principles of the Future Internet and part of it may also help understand faster communications among various nodes in IoT scenario.

Hjorth, T.S. et al. present an interesting work entitled, "***User-friendly Establishment of Trust in Distributed Home Automation Networks***". The authors talk about various issues for establishing trust in future home automation networks. They define the concept of *Trusted Domain*, which establishes and maintains secure cryptographic relationships between Internet-capable devices. They present the issues of using short session keys for various applications like Pidgin, PGPfone; talk about pairing methods that work when the devices are in physical proximity, home network with smartphones, laptops, and home automation devices connected by IP, and related implementation issues. This work is a good contribution to this special issue focusing on the main theme.

In the work, "***A Valley-Free Shortest Path Algorithm and Its Application in Detecting Critical Links among Autonomous Systems***", Peng et al. study the shortest path problems under the *no-valley-and-prefer-customer* routing policies in the Internet. *Valley-free* property is basically an indicator that universal best practices are not being preserved in the propagation of routes. As the authors describe, the *prefer-customer* guideline requires ISPs (Internet Service Providers) to assign higher preference to routes learned from customers than those from peers and providers in BGP (Border Gateway Protocol) routing decision process. The *valley-free* (or *no-valley*) guideline requires no c2p (customer-to-provider) connection is followed after traversing one p2c (provider-to-customer) or p2p (peer-to-peer) connection. Such a constraint leads to the so-called *valley-free* routing model. The authors describe the problems using graph theory terms and analyze the problem theoretically. Based on the theoretical analysis, they present the design of a *valley-free* Dijkstra algorithm with consideration of both the *valley-free* policy and the *prefer-customer* policy. Then they apply the algorithm to solve the critical Autonomous Systems (AS) link detection problem. A genetic algorithm is also designed to find the optimal critical link set, whose removal will lead to maximal degradation of network performance. Though theoretical, the work is a good addition to this special issue.

Wei, et al. in their work, "***BSU: A Biased Seed Unchoking algorithm for P2P Systems***" propose a biased seed unchoking (BSU) algorithm in the environment where there are many free-riding peers in the system. BSU's designation details are given and its performance is evaluated in both homogeneous and heterogeneous environment scenarios. The evaluation results show that BSU can improve the performance of the system. Moreover, the authors show that the benefit of BSU algorithm is more prominent as the ratio of free riders of all peers in the system increases. Besides this, a random seed scheduling (RSS) algorithm is presented to further boost the delivery efficiency. The evaluation results also confirm that RSS algorithm achieves better performance than currently adopted seed scheduling algorithm of BitTorrent. This work could be beneficial when IoT structure includes various types of devices which would communicate in a p2p fashion.

Finally, Zhuang, Z. and Kwok, S. talk about optimization issues associated with Content Delivery Network (CDN) in their paper, "***Optimizing Streaming Server Selection for CDN-delivered Live Streaming***". As Content Delivery Networks (CDNs) are increasingly being employed to facilitate the delivery of live streaming, the work carries significance that such mechanism could help faster live streaming via IoT entities in the Future Internet. By definition, a Content Delivery Network (CDN) is a large distributed system of servers deployed in multiple data centers in the Internet. The main objective of a CDN is to serve contents to end-users with high availability and high performance. CDNs basically serve a large fraction of the Internet content today, including web objects (e.g., text, graphics, URLs, and scripts), downloadable objects (e.g., audio/video files, software, documents), applications (e.g., e-commerce, portals, e-learning), live streaming media, on-demand streaming media, and social networks. Hence, this work could guide the practitioners to find optimal streaming solution if CDN becomes a part of integration with IoT (the entities of which would also transfer bulk of information and contents) in Future Internet.

Considering the target and the outcome, the Special Issue has become a success. While we hope that the papers in this issue would be very beneficial for the researchers working on the relevant fields, we would like to express our sympathy to those authors who also submitted good quality papers but because of the given limitations, we could not finally accept their works. We would like to thank all the editors, authors, and reviewers involved in the entire process to make it happen. Especially, we are thankful to the Editor-in-Chief, Professor Han-Chieh Chao who approved the special issue and has guided us throughout the process.

Best Wishes,
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