Recent Research Progress on Elastic Optical Networks, Software-Defined Networking, and Cloud Computing

Zuqing Zhu*
School of Information Science and Technology
University of Science and Technology of China, Hefei, China
*Email: {zqzhu}@ieee.org

***Abstract*—In this technical report, we provide a brief review on our recent research progress in different areas related to large-scale networking and computing. Specifically, we discuss our research efforts mainly in three areas, 1) elastic optical networks (EONs), 2) software-defined networking (SDN), and 3) cloud computing. The related papers are reviewed.**

***Index Terms*—Elastic optical networks (EONs), Software-defined networking (SDN), Cloud computing.**

I. Introduction

Since the inception of our research group in Year 2011, we have conducted research on different areas related to large-scale networking and computing. Specifically, our research efforts can be summarized on three topics: 1) elastic optical networks (EONs), 2) software-defined networking (SDN), and 3) cloud computing. The rest of the report is organized as follows. Section II discusses our research efforts on EONs, the research progress on SDN is described in Section III. We talk about cloud computing and other miscellaneous research topics in Sections IV and V, respectively. Finally, Section VI summarizes the report.

II. Elastic Optical Networks (EONs)

For EONs, we first studied the based routing, modulation and spectrum assignment algorithms for unicast lightpaths [1–8]. Then, the effect of spectrum fragmentation and how to use defragmentation to improve network performance is addressed in [9–20]. Next, we focused on the multicast provisioning in EONs [21–27]. Together with multicast, we also investigated the service provisioning schemes for anycast, network virtualization, advance reservation, and other data-oriented applications [28–36]. It is also known that protection and restoration are very important topics in optical networks. Hence, we designed a few protection schemes for EONs [37–42]. Finally, we leveraged the idea of software-defined networking and implemented the algorithms discussed above in SD-EON testbeds [43–61].

III. Software-Defined Networking (SDN)

In our initial work, we addressed SVC streaming with centralized network control [62–64]. Next, we tried to leverage OpenFlow to realized agile IP-forwarding interchanging for flexible traffic engineering [65–67]. Finally, we focused on the protocol-oblivious forwarding (POF) technology and investigated OpenFlow 2.0 [68].

IV. Cloud Computing

We started to work on cloud computing in the direction of network virtualization [69–71]. Then, we considered the problem of coordinated data backup in inter-datacenter networks [72, 73] and profit-driven scheduling of inter-datacenter data transfers [74, 75]. Besides these topics, we also investigated green data-center in [76], optical network based cloud computing in [77], and application-related cloud computing in [78].

V. Miscellaneous Topics

A. Green Optical Networks

We have studied green optical networks or energy-efficient optical networks in two aspects. First of all, we considered to use mixed regenerator placement to realize energy-efficient translucent optical networks [79–90]. Secondly, we also studied how to achieve energy-efficient scheduling in hybrid fiber coaxial (HFC) networks that support DOCSIS 3.0 standard [91–98].

B. Optical Signal Processing

In the area of optical signal processing, we have studied how to use signal pre-distortion to enhance the performance of all-optical clock recovery [99, 100]. Meanwhile, we also considered the crosstalk due to optical de-multiplexing in subcarrier multiplexed systems [101–103].

VI. Conclusion

From 2011 to 2015, we totally published 47 journal papers and 58 conference papers.

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