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Technical Program

Monday, July 8

Tutorial I: Fiber Optics in Datacenter Networks

Abstract:

This tutorial starts with the introduction of the network transformations resulted from the rise of Internet computing applications. We then review the architectural structures of warehouse-scale computers (WSCs) and the fiber optic networking technologies used to scale the performance and deployment of WSC datacenters. This tutorial covers the challenges facing datacenter operators, the need for energy efficient datacenter, and the optical networking technologies required to sustain the growth of Internet computing applications.

Speaker:

Dr. Cedric F. Lam is currently Tech Lead Manager at Google. He manages the Advanced Technology Group of Google Fiber to develop scalable and cost-effective next generation FTTH technologies to fulfill Google's mission of deploying 1 Gb/s access to broadband customer.

Before joining Google, Dr. Lam was Chief System Architect at Opvista which made ultra-high density WDM transport systems. Prior to Opvista, Dr. Lam was Senior Technical Staff Member at AT&T Labs, Broadband Access Research Department.

Dr. Lam has a PhD from UCLA and B. Eng. (First Class Honors) from University of Hong Kong, both in Electrical Engineering. His current interests include broadband access network architectures, technologies, and datacenter networking.

Tutorial II: Software-Defined Networking (SDN)

Abstract:

The rapid growth of heterogeneous services has been driving the demand for new network features, such as flexible routing, agile resource allocation, easy virtualization, good resilience, and strong security. However, the traditional networks have become a hindrance to the adoption of such new features because they are based on aclosed architecture, where the control and data planes are tightly coupled in switches and routers. Consequently, it often incurs high complexity and

modificationsto every switch/router to add even a simple feature. For example, it is well known that shortest path routing is not the best way to meet various application needs including load balancing, QoS requirements, and resource utilization. Nonetheless, it is still the dominant approach in practice because there is no easy way to modify the routers to enable customized routing schemes on a per application basis.

Software defined networking (SDN) paints a promising picture to meet such demands. The essence of SDN is to decouple the control plane from the data plane and perform control in a centralized way. It defines an open control interface so as to facilitate interoperability of devices from different vendors. Based on such open architecture, SDN enables high-level abstraction of the network resources so that the design, development, testing, and deployment of new network features are substantially facilitated. In particular, the network hardware complexity is hidden from developers and operators such that they only need to focus on the control and operation software—which is exactly the design objective of software defined networking.

This tutorial will provide an anatomy of SDN, with the goal of giving the audience some insights from both industry and academic perspectives. We will start by introducing the motivation of the SDN designs, including the demand and the related technologies. We will then proceed to explain the concept and framework of SDN. Specifically, we will give an overview of OpenFlow—the most important specification related to SDN. After that, we will present and analyze a few use cases to demonstrate the application and merits of SDN. Finally, we will introduce the latest research and development and conclude the lecture.

Speaker:

Kang Xi is Industry Associate Professor in the Department of Electrical and Computer Engineering at Polytechnic Institute of New York University (NYU-Poly). His research interests include data center and cloud computing, high-speed networks, network resilience, routing, and network security. He received his BS, MS and Ph.D. from Tsinghua University in 1998, 2000 and 2003, respectively, all in Electrical Engineering. He has four years of experience in the industry working on Ethernet, IP, and SONET network designs. He worked in Osaka University (Osaka, Japan) as a research associate from 2004-2005. He has been with NYU-Poly since 2005. He holds seven US patents (two pending) and received the ICCCN 2010 best paper award for his work on network resilience. His research has been supported by grants from NSF, US Army, NYU Abu Dhabi, and Huawei Technologies. He has been invited to speak at universities, IEEE seminars, Bell Labs, IBM Research Center, and other seminars. He has been teaching fundamental and advanced networking courses at NYU-Poly.

He started teaching a newly designed data center and cloud computing course since 2012 Fall. He was also invited to co-teach a short course on MPLS to an enterprise and received highly positive feedback.

Tutorial III: Software Defined Networks Enabled by Optical Transport and Switching

Abstract:

Software defined networks (SDNs) always assume that optical transport systems are at the service of a centralized controller, so that various feature-rich network applications can be easily executed. This assumption is not valid if optical transceivers cannot open up their bandwidth, or if optical switches/ROADMs cannot provide non-blocking switching and routing. In this talk, we will review the state-of-the-art optical transceivers and optical switch/ROADM architectures which serve as the key enablers for SDN.

Speaker:

Winston I. Way is a Fellow of the IEEE and of the Optical Society of America. He pioneered subcarrier multiplexed optical-fiber systems research at Bellcore, and was a professor at National Chiao-Tung University, Taiwan. He founded OpVista Inc. in 2000, and lead a top engineering team to develop DWDM system products, which were later widely deployed in North American cable TV metro ring networks. He joined NeoPhotonics Corporation in 2009, as the Chief System Architect. His current responsibility is to research and develop next-generation ROADM and line/client100G/400G optical transceivers, all based on photonic integrated circuits. He has published a book on Broadband Hybrid Fiber/Coax Access System Technologies, Academic Press, 1998, over 130 journal and conference papers, and owns 30 US patents. He received his B.S. from National Chiao-Tung University and Ph.D. from the University of Pennsylvania.

Tuesday, July 9

Keynote Speech: Software Defined Computing

Abstract:

Two phenomena are happening simultaneously during the past few years: Enterprises are increasingly aggressive in moving mission critical and performance sensitive applications to the cloud. In addition, many new mobile, social and analytics

applications are directly developed and operated on the cloud. These two phenomenon drove the shift of the value proposition of cloud computing from cost reduction to simultaneous agility and optimization. These requirements (agility and optimization) drove the recent disruptive trend on software defined computing where the entire computing infrastructure - compute, storage and network - are becoming software defined and dynamically programmable.

Software defined computing originated from the compute environment where the computing resources are virtualized and managed as virtual machines. Software defined network (SDN) moves the network control plane away from the switch to the software running on server for improved programmability, efficiency and extensibility. Software define storage, similar to software defined network, separates the control plane from the data plane of a storage and dynamically leverages heterogeneity of storage to respond to changing workload demands. Software defined environment brings together software defined compute, network and storage and unifies the control planes from each individual software defined component. Unified control planes allow rich resource abstractions to enable assembling purpose fit systems and/or providing programmable infrastructures to enable dynamic optimization in response to business requirements.

In this talk, we will discuss the key ingredients of this disruptive trend on software defined computing, and illustrate the potential benefit in the context of mobile, analytics, and managed service environment.

Speaker:

Chung-Sheng Li is currently the director of the Commercial Systems Department, PI for the IBM Research Cloud Initiatives. He has been with IBM T.J. Watson Research Center since May 1990.

His research interests include cloud computing, security and compliance, digital library and multimedia databases, knowledge discovery and data mining, and data center networking. He has authored or coauthored more than 130 journal and conference papers and received the best paper award from IEEE Transactions on Multimedia in 2003. He is both a member of IBM Academy of Technology and a Fellow of the IEEE.

He has initiated and coinitiated several research programs in IBM on fast tunable receiver for all-optical networks, content-based retrieval in the compressed domain for large image/video databases, federated digital libraries, and bio-surveillance.

He received BSEE from National Taiwan University, Taiwan, R.O.C., in 1984, and the MS and Ph.D. degrees in electrical engineering and computer science from the University of California, Berkeley, in 1989 and 1991, respectively.

Technical Session 1: Best Paper Award Nominees

Technical Session 2: Best Student Paper Award Nominees

- King-Tim Ko (City University of Hong Kong, Hong Kong);
- Moshe Zukerman (City University of Hong Kong, Hong Kong)

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   - Hiroaki Harai (National Institute of Information and Communications Technology, Japan)

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   - Ziqian Dong (New York Institute of Technology, USA);

- Roberto Rojas-Cessa (New Jersey Institute of Technology, USA)

Panel: Directions and Challenges of Software-Defined Networking (SDN)

Abstract:

Software-defined networking (SDN), by decoupling control from forwarding, provides a great framework to unleash the potentials of communication networks. SDN is a programmatic way to more effectively integrate applications and IT processes with the network. Vendors, operators, and researchers have seen great opportunities to apply SDN to address a wide variety of networking issues, such as resource access control, routing optimization, security enforcement, traffic engineering, failure recovery, quality of service (QoS) assurance, network debugging, traffic monitoring, and resource allocation. At the same time, SDN is still under active development. Many great challenges need to be addressed to make SDN a mature technology. This panel gathers experts from both industry and academia to discuss the directions and challenges of SDN. We expect to have a highly interactive session among the panelists and the audience to shed lights on the research and development in the exciting area of SDN.

Panelists:

- H. Jonathan Chao (moderator), ECE Department Head of Polytechnic Institute of New York University, USA
- Tzi-cker Chiueh, General Director of the Cloud Computing Center for Mobile Applications (CCMA) at ITRI, Taiwan
- Wu Chou, Head of Huawei Shannon (IT) Lab., USA
- Renato Recio, Fellow & System Networking CTO of IBM, USA
- Zon-yin Shae, ARI, Institute for Information Industry (III), Taiwan

Biographies:

H. Jonathan Chao is Department Head and Professor of Electrical and Computer Engineering at Polytechnic Institute of New York University, Brooklyn, NY, where he joined in January 1992. He has been doing research in the areas of data center network designs, terabit switches/routers, network security, network on chip, and biomedical devices. He holds 45 patents with 11 pending and has published more than 200 journal and conference papers. He has also served as a consultant for various companies, such as Huawei, Lucent, NEC, and Telcordia.

During 2000 - 2001, he was Co-Founder and CTO of Coree Networks, NJ, where he led a team to implement a multi-terabit MPLS (Multi-Protocol Label Switching) switch router with carrier-class reliability. From 1992 to 1999, he taught short courses 3 times a year in the subjects of SONET, ATM, IP, MPLS, switche/router designs, to industry people through UC Berkeley and Oxford University's continuing education programs. From 1985 to 1992, he was a Member of Technical Staff at Telcordia, where he was involved in transport and switching system architecture designs and ASIC implementations, such as the world's first SONET-like Framer chip, ATM Layer chip, Sequencer chip (the first chip handling packet scheduling), and ATM switch chip. From 1977 to 1981, he was a Senior Engineer at Telecommunication Labs of Taiwan performing circuit designs for a digital telephone switching system.

Prof. Chao is a Fellow of the IEEE for his contributions to the architecture and application of VLSI circuits in high-speed packet networks. He received the Telcordia Excellence Award in 1987. He is a co-recipient of the 2001 Best Paper Award from the IEEE Transaction on Circuits and Systems for Video Technology. He coauthored three networking books, Broadband Packet Switching Technologies—A Practical Guide to ATM Switches and IP Routers (New York: Wiley, 2001), Quality of Service Control in High-Speed Networks (New York: Wiley, 2001), and High-Performance Switches and Routers (New York: Wiley, 2007).

Prof. Chao received his B.S. and M.S. degrees in electrical engineering from National Chiao Tung University, Taiwan, and his Ph.D. degree in electrical engineering from Ohio State University.

Dr. Tzi-cker Chiueh is currently the General Director of the Cloud Computing Center for Mobile Applications (CCMA) at ITRI and Professor in the Computer Science Department of Stony Brook University. He received his BSEE from National Taiwan University, MSCS from Stanford University, and Ph.D. in CS from University of California at Berkeley in 1984, 1988, and 1992, respectively.

He received an NSF CAREER award, an NYNEX Excellence in Education Award in 1996, and several best paper awards, including that from the 1999 IEEE Hot Interconnect Symposium, the 25th Annual Computer Security Applications Conference and the 2008 IEEE International Conference on Data Engineering (ICDE). Before joining ITRI, Dr. Chiueh served as the director of Core Research in Symantec Research Labs. Dr. Chiueh has published over 180 technical papers in referred conferences and journals. His current research interest lies in storage systems, wired/wireless networking, and software security.

Dr. Wu Chou is VP, Chief IT Scientist, and Head of Huawei Shannon (IT) Lab,

USA. He is an IEEE Fellow, a renowned expert in the field of IT, computing, networking, Internet/Web, communication, signal processing, speech and natural language processing, unified communication, and IT software.

He has over 20+ years of professional career in leading R&D organizations. Before joining Huawei, he was Director of R&D at Avaya. He graduated from Stanford University in 1990 with four advanced degrees in science and engineering. He joined AT&T Bell Labs after obtaining his Ph.D. degree in electrical engineering and continued his professional career from AT&T Bell Labs to Lucent Bell Labs and Avaya Labs before joining Huawei. In his role at Huawei, he leads the global Huawei Shannon (IT) Lab in its research and innovation in the fast moving IT area. He has extensive experience in cutting-edge technology research, incubating ground breaking products, visionary technical leadership, and agile execution in research and product development.

He is a well known figure in standard bodies and professional societies. He served as an editor for multiple standards at W3C, ECMA, ISO, ETSI, etc. He was an editor of IEEE Transactions on Services Computing (TSC), IEEE TSC Special Issue on Cloud Computing, IEEE Transaction on Audio and Language Processing, and Journal of Web Services Research. He published over 140 journal and conference papers, holds 24 US and international patents with many additional patent applications pending. He received Bell Laboratories President's Gold Award for his achievement in 1997 and Avaya Leadership Award in 2005.

Renato Recio is IBM Fellow & System Networking CTO, specializing in System I/O and Network Architecture, Strategy, and Standards. For the past 15 years, he has played a leadership role in the strategy, architecture and design of future IBM system IO and Networks. He is currently responsible for IBM's System Networking product strategy, which includes the physical system interconnect, network virtualization and Software Defined Networking stack.

He has been a founding engineer and author of several IO and Network industry standards, including: InfiniBand (cluster network), iWARP (Remote Direct Memory Access, RDMA, over TCP/IP), PCI IO Virtualization, Convergence Enhanced Ethernet (CEE), Fibre Channel over CEE and IEEE 802.1Qbg Ethernet Virtual Bridging. More recently he's contributed to the creation of Open Daylight. He also created and chaired IBM’s I/O Technical Community (IOTC), which serves the networking, education, and support needs of over 750 IBM IO and networking professionals. He has received 4 external, professional awards for his contributions to the industry, including a Life Time Achievement Award in recognition for his contributions to Server IO field.

He has filed 200 patents, of which over 140 have already issued. He has published dozens of refereed technical conference (e.g. IEEE and ACM) papers. He created and chaired the IEEE Data Center Converged And Virtual Ethernet Switching (DC CAVES) workshops (see http://www.i-teletraffic.org/itc22/workshops/dc-caves-workshop/).

Dr. Zon-yin Shae is currently the R&D Director of the ARI, Institute for Information Industry (III), Taiwan. Before joining ARI by Dec. 2012, he was a Research Staff Member of IBM Watson Research Center, NY, USA. He received his BSEE and MSEE from National Chiao-Tung University, Taiwan, and Ph.D. in EE from University of Pennsylvania, Philadelphia, USA in 1976, 1978, and 1989, respectively. He joined IBM Watson Research Center since then.

He is announced as a Master Inventor at 2012 by IBM, received IBM Distinguish Accomplishment Awards at 2008, 2010 and 2011, and IEEE SCALE CHALLENGE AWARD-Won First Position at 2011. He has published over 50 technical papers and filed over 50 patents. He engaged actively with the ITU H323, MPEG, and SIP standard activities at 1994-1996, 2002-2003, 2007-2009 respectively. He was a visiting professor of Chiao-Tung University Taiwan 1996-1997. His current research interest lies in cloud computing, parallel distributed processing, application migration to cloud, and SDN.

Technical Session 5: Efficiency and Energy Awareness

Poster Session

- Yan Sun (Queen Mary University of London, UK);
- Chris Phillips (Queen Mary University of London, UK);
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