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Areas of Interest

Networked systems design and analysis, data center networking (DCN), network security, network applications, and networking support for Operating Systems and Cloud Computing

Education

Institute of Communications Engineering, Nanjing	Communications and Information Systems	Ph.D. (2000)
Institute of Communications Engineering, Nanjing	Communication and Electronic Systems	M.S. (1997)
Institute of Communications Engineering, Nanjing	Communications Engineering	B.S. (1993)

Employment History

Microsoft Research Asia, Beijing (July 2007 – present): Lead Researcher

Institute of Communications Engineering, Nanjing (Dec 2004 - Jun 2007): Associate Professor

Microsoft Research Asia, Beijing (Jan 2002 - Dec 2004): Associate Researcher, Researcher

Institute of Communications Engineering, Nanjing (Jul 2000 - Dec 2001): Lecturer

Research Funding (Primary Investigator)

- China High-speed Information Network Differentiated Service 863-300-02-04-99 (1999-2001)
- NSFC Young Science Funding Award, No. 60503049 (2005-2008)

Research Experience

Data Center Networking (2007-present)

<http://research.microsoft.com/en-us/projects/msradcn/default.aspx>.

I have been leading the Data Center Networking (DCN) project. The goal of the DCN project is to design scalable network architecture for mega data centers that scale to one million servers. We need to achieve high network capacity, low cost, and good application support at the same time. We take a modular approach by using containers as our build blocks and design novel network structures for intra-container and inter-container interconnections. We achieve high network capacity by taking a server-centric design in which servers with

multiple network ports actively decide how to route and forward packets for various traffic patterns. We achieve low cost by using low-end, commodity switches.

We are one of the first and leading research groups in data center networking. Our two data center networking papers are the first few pioneer papers that published in ACM SIGCOMM 2008 and 2009, the leading conference in networking. We also have publications in top networking conferences IEEE Infocom 2009 and ACM SIGCOMM CoNext 2009.

Packet Scheduling (1998-2007)

I led the packet scheduling project. Packet scheduler is an indispensable part to enable a multi-service support Internet. It is a grand challenge to design an $O(1)$ time complexity packet scheduler that provides bounded end-to-end delay. The goal of the project is to design the ideal packet scheduler that: (1) has $O(1)$ time complexity to decide the next packet to be scheduled; (2) provides bounded end-to-end delay guarantee; (3) provides fairness among competing flows. Before our research, packet schedulers with guaranteed delay bound have at least $O(\log N)$ time complexity, where N is the number of active flows in the scheduler. In our study we showed that we can achieve bounded delay and $O(1)$ time complexity at the same time. And we also have designed a series of algorithms that have different delay bound and time complexity tradeoffs.

This project is a long journey which lasted for near 10 years. We finally achieved $O(1)$ time complexity and bounded delay at the same time. The results we got are published in the leading networking conferences ACM SIGCOMM 2001, IEEE Infocom 2007 and IEEE Infocom 2008, and primary journal IEEE/ACM trans. Networking. Our SIGCOMM paper is the first paper that accepted to SIGCOMM by a researcher from China. This project was supported in part by China High Tech Research and Development Project 863-300-02-04-99.

Network Security (2003-2007)

There are several sub-projects.

I was one of the main contributors to the Shield project during 2003-2004. Shield is a vulnerability-driven end-host firewall where network traffic is "patched" according to known software defects. Such a data-driven "patch" is much easier to test for and to deploy than software patches, and can effectively protect the critical time window between vulnerability disclosures and patch application where 90% of the attacks take place today. The research along this line published one ACM SIGCOMM paper and an NDSS paper.

I led the smart-phone security project. We studied the security issues brought by smart-phones. Smart-phones are fully programmable devices, and they bring new threats when they are compromised by worms or viruses. We identified the new smart-phone attacks and defined the defense framework. The result was published as an ACM SIGCOMM HotNets position paper.

I led the networked end-hosts anomaly detection project. The traditional virus and malware detection is signature-based hence cannot detect new malwares. In this project, we designed a new detection method based on the observable behaviors of software. Specifically, we leveraged the causality relationship between user input and network events for anomaly detection. This project was supported by the NSFC funding No. 60503049.

Mobility Management (2002-2004)

I lead the mobility management project. One of the challenges faced by the existing Mobile IP solutions is that they need to add new network components or functionalities into the existing network infrastructure. We overcame this obstacle by designing an end-system-based mobility protocol without adding new components into the existing infrastructure. Our solution uses a direct end-to-end protocol to maintain existing network connections and leverages peer-to-peer network to map DNS names to IP addresses and to handle the simultaneous

movement cases. Based on this end-system-based mobility management scheme, we have designed a seamless roaming solution that enables mobile users seamlessly handover among different wireless networks such as Wireless LAN and Wireless WAN.

The publications include two IEEE JSAC papers and one IEEE Communications Magazine paper.

Professional Activity

Program committee member:

- [ACM SIGCOMM 2010](#)
- [IEEE Infocom 2010](#)
- [ACM Mobicom MICNET 2009 Workshop](#)
- [ACM CoNEXT 2009 Student Workshop](#)
- [SBAC-PAD 2009](#)
- [IEEE Infocom 2009](#)
- [QoSIm 2009](#)
- [Securecomm 2008](#)
- [IEEE Globecom 2008](#)
- [QoSIm 2008](#)
- [IEEE Infocom 2006](#)
- [IEEE BroadNets 2006](#)
- [IEEE BroadNets 2005](#)
- [IEEE BroadNets 2004](#)

Panelist for:

- ACM Mobicom 2009 Panel “[Network Science: Hype or Reality](#)”

Reviewer for:

- NSFC proposal reviewer 2006, 2007, 2008, 2009
- IEEE/ACM trans. Networking, Elsevier Computer Networks, IEEE trans. Communications, IEEE JSAC, IEEE Journal on Wireless Communications, IEEE Communications letters, IEEE trans. Vehicular Technology, ACM SIGCOMM Computer Communication Review

Publication

1. **Chuanxiong Guo**, Guohan Lu, Dan Li, Xuan Zhang, Haitao Wu, Yunfeng Shi, Chen Tian, Yongguang Zhang, and Songwu Lu, BCube: A High Performance, Server-centric Network Architecture for Modular Data Centers, in ACM SIGCOMM 2009.
2. Suk-Bok Lee, Sai-Wang Tam, Ioannis Pefkianakis, Songwu Lu, M. Frank Chang, **Chuanxiong Guo**, Glenn Reinman, Chunyi Peng, Mishali Naik, Lixia Zhang, and Jason Cong, A Scalable Micro Wireless Interconnect Structure for CMPs, in ACM Mobicom 2009.
3. Haitao Wu, Guohan Lu, Dan Li, **Chuanxiong Guo**, Yongguang Zhang, MDCube: A High Performance Network Structure for Modular Data Center Interconnection, in ACM CoNEXT 2009.
4. Dan Li, **Chuanxiong Guo**, Haitao Wu, Kun Tan, Yongguang Zhang, and Songwu Lu, FiConn: Using Backup Port for Server Interconnection in Data Centers, in IEEE Infocom, 2009.

5. **Chuanxiong Guo**, Yunxin Liu, Wenchao Shen, Helen Wang, Qing Yu, and Yongguang Zhang, Mining the Web and the Internet for Accurate IP Address Geolocations, in IEEE Infocom mini conference, IEEE Communications Society, April 2009
6. Chen Tian, Danfeng Zhang, Guohan Lu, Yunfeng Shi, **Chuanxiong Guo**, and Yongguang Zhang, A Windows Support Framework for the NetFPGA 2 Platform, in Stanford NetFPGA Developers Workshop 2009.
7. **Chuanxiong Guo**, Haitao Wu, Kun Tan, Lei Shi, Yongguang Zhang, and Songwu Lu, DCell: A Scalable and Fault-Tolerant Network Structure for Data Centers, in ACM SIGCOMM 2008.
8. **Chuanxiong Guo**, Improved Smoothed Round Robin Schedulers for High-Speed Packet Networks, in IEEE Infocom 2008.
9. **Chuanxiong Guo**, G-3: An $O(1)$ Time Complexity Packet Scheduler That Provides Bounded End-to-End Delay, in IEEE Infocom 2007.
10. Nikita Borisov, David J. Brumley, Helen J. Wang, John Dunagan, Pallavi Joshi, and **Chuanxiong Guo**, Generic Application-Level Protocol Analyzer and its Language, in Network & Distributed System Security Symposium (NDSS), Internet Society, 2007.
11. Chen Chen, **Chuanxiong Guo**, Yunxin Liu, Helen J. Wang, Qing Yu, Yongguang Zhang, Mining the Web for IP Address Geolocations, no. MSR-TR-2007-139, October 2007.
12. Juan Chen, **Chuanxiong Guo**, Fast and Efficient Memory Management for Non-FIFO Routers, in Chinacom 2006 (invited paper).
13. Juan Chen, **Chuanxiong Guo**, Online Detection and Prevention of Phishing Attacks, in Chinacom 2006 (invited paper).
14. **Chuanxiong Guo**, Haitao Wu, Kun Tan, Qian Zhang, Jingmin Song, Junfeng Zhou, Christian Huitema, and Wenwu Zhu, End-system based Mobility Support in IPv6, in IEEE Journal on Selected Areas of Communications (JSAC), vol. 23, no. 11, pp. 2104-2117, November 2005.
15. Nikita Borisov, David Brumley, Helen J. Wang, and **Chuanxiong Guo**, Generic Application-Level Protocol Analyzer and its Language, no. MSR-TR-2005-133, February 2005.
16. **Chuanxiong Guo**, Wenwu Zhu, Zhensheng Zhang, and Zhi-Li Zhang, Utilizing the Diversities and Invariants of the Internet to Support Multi-Services, in ACM SIGCOMM Asia Workshop 2005.
17. Helen J. Wang, **Chuanxiong Guo**, Daniel R. Simon, and Alf Zugenmaier, Shield: Vulnerability-Driven Network Filters for Preventing Known Vulnerability Exploits, in ACM SIGCOMM 2004.
18. **Chuanxiong Guo**, Helen J. Wang, and Wenwu Zhu, Smartphone attacks and defenses, in ACM SIGCOMM HotNets, 2004.
19. **Chuanxiong Guo**, Zihua Guo, Qian Zhang, and Wenwu Zhu, A Seamless and Proactive End-to-End Mobility Solution for Roaming across Heterogeneous Wireless Networks, IEEE Journal on Selected Areas of Communications (JSAC), vol. 22, no. 5, pp. 834-848, 2004.
20. **Chuanxiong Guo**, SRR: An $O(1)$ Time Complexity Packet Scheduler for Flows in Multi-Service Packet Networks, IEEE/ACM trans. Networking, vol. 12, no. 6, pp. 1144-1155, Dec. 2004.
21. **Chuanxiong Guo**, Wenwu Zhu, Zhensheng Zhang, and Zhi-Li Zhang, Utilizing the Diversities and Invariants of the Internet to Support Multi-Services, no. MSR-TR-2004-46, May 2004.
22. **Chuanxiong Guo**, Haitao Wu, Kun Tan, Qian Zhang, Wenwu Zhu, and Christian Huitema, End-to-End Mobility Support in IPv6 Using Peer-to-Peer Technologies, no. MSR-TR-2004-29, March 2004.
23. Qian Zhang, **Chuanxiong Guo**, Zihua Guo, and Wenwu Zhu, Efficient Mobility Management for Vertical Handoff between WWAN and WLAN, in IEEE Communications Magazine, vol. 41, no. 11, pp. 102-108, November 2003.

24. **Chuanxiong Guo**, SRR: An $O(1)$ Time Complexity Packet Scheduler for Flows in Multi-Service Packet Networks, in ACM SIGCOMM 2001.
25. **Chuanxiong Guo** and Shaoren Zheng, Analysis and Evaluation of the TCP/IP Protocol Stack of Linux, in ICCT 2000.
26. **Chuanxiong Guo** and Shaoren Zheng, Analysis of the IP Layer Queuing of the Linux TCP/IP Protocol, Chinese Journal of Computers, August, 2001. (Written in Chinese)
27. **Chuanxiong Guo** and Shaoren Zheng, A Continuous Audio Stream Transmission Algorithm on the Internet, Journal of China Institute of Communications, vol. 20, no. 3, 1999. (in Chinese)
28. **Chuanxiong Guo**, Juan Chen, and Shaoren Zheng, Study of the Virtual Machine-based SCF Architecture of the Intelligent Network, Journal of China Institute of Communications, vol. 20, no. 7, 1999. (in Chinese)
29. Shaoren Zheng, **Chuanxiong Guo**, and Zhaolong Su, Computation of the Blocking Probability of a Switch Network, Journal of China Institute of Communications, vol. 18, no. 7, 1997. (in Chinese)