

## **XU Ke**



Professor

Department of Computer Science & Technology  
Tsinghua University, Beijing, China  
Joined Department : 2001

**Email** xuke@tsinghua.edu.cn

**Phone** +86 10 62603056

**Fax** +86 10 62603064

### **Education Background**

Bachelor's degree in Computer Science & Technology, Tsinghua University, Beijing, China, 1996;

Master's degree in Computer Architecture, Tsinghua University, Beijing, China, 1998;

Ph.D. in Computer Architecture, Tsinghua University, Beijing, China, 2001

### **Work Experience**

Lecturer in Computer Networks, Department of Computer Science & Technology, Tsinghua University, Aug. 2001 – Dec. 2004;

Associate professor in Computer Networks, Department of Computer Science & Technology, Tsinghua University, Jan. 2005 – Dec. 2009;

Professor in Computer Networks, Department of Computer Science & Technology, Tsinghua University, Jan. 2010 – now

### **Research and Teaching Profile**

Xu Ke has been engaged in teaching and scientific research on Computer Network Architecture and Large-scale Distributed Systems like P2P systems since was awarded Ph.D. and became a faculty member at Tsinghua University in 2001. Now he is working as a professor and Ph.D. candidate supervisor at Department of Computer Science & Technology, Tsinghua University, a part-time graduate student supervisor at School of Software and Microelectronics, Peking University, and a joint Ph.D. candidate supervisor at Shandong University. He is an editorial member of *Computer Applications and Software(in Chinese)*, *China Science Paper(in Chinese)* and *Networking Science* by Springer, a guest editor of the *Special Issue on Network Virtualization of IEEE Network*, a senior member of IEEE and a TPC member of many international academic conferences, such as IEEE GLOBECOM, IEEE ICCCN, IEEE ISCC, etc. Prof. Xu is also a senior member of China Computer Federation and a member of its Academic Work Committee, Internet Special Committee and Services Computing Special Committee.

Xu Ke has directed as P.I. many national projects, including four Natural Science Foundation of China projects, one National Science and Technology Major Project – *New Generation Broadband Wireless Mobile Communication Network*, one major project of the national “863 Plan”, three CNGI projects by the State Development and Reform Commission, as well as many international cooperation projects. Prof. Xu was selected into the Nova Program of Science and Technology by Beijing City in 2007, and into the New Century Excellent Talents Support Program by Ministry of Education in 2008. He won the Young Scientist Award by China Computer Federation in 2011, and the Talent Award by China Venture Investment Corporation Software Engineering in 2012. His research on *IPv6 Core Router* helped win National Science and Technology Progress Award (second class) in 2005.

Among papers Prof. Xu has published since 2007, 14 papers have been indexed by SCI and 72 papers by EI. Meanwhile, 20 patents of his have been granted.

His major research achievements are as follows:

### **1. Research on the Scalable and Reconfigurable High-performance Routing and Switching Technology**

This research presents a BGP implementing model based on the scalable routing and switching System, which has a higher speedup ratio compared with that of the previous proposals.

It proposes the function module division and system development method at three levels – sub-component, component and macro-component – based on the characteristic of routing and switching software. Compared with other methods, this one raises the code reuse proportion and efficiently reduces the routing system development cost. From this research, six patents of invention have been granted.

The scalable and reconfigurable high-performance router software platform has better compatibility, and provides developing and testing tools with higher performance efficiency compared with Cisco IOS system and MIT Click platform, respectively. The result helped win the Science and Technology of Electronic Information Award by the Chinese Institute of Electronics (first class) in 2012.

This software platform has been applied to routers of Bitway Networking Technology Co., Ltd., and adopted by network operators, such as CERNET2, China Telecom, and China Mobile, realizing desirable economic and social achievements. Many communication companies have also adopted this software when developing products or testing performance, including H3C, Ruijie Networks and Maipu Communication Technology Co., Ltd. Practical application by these companies shows “the application of this platform greatly improves development efficiency and accelerates research progress.”

### **2. Research on P2P Network Traffic Classification & Management and Live Streaming Technology**

This research proposes a new P2P network traffic estimation model, which possesses higher estimation accuracy than the recently proposed gravity and independent connection model. A P2P network traffic classification method is proposed based on P2P networks' transmission behavior. This method has a simpler approach to classification with a higher success rate than the best result of previous classification methods proposed based on the Bayes' Theorem. The paper has been cited for ten times since it was published in *Computer Communications*. A cache replacement algorithm based on P2P network live streaming media is proposed; it has higher cache efficiency than the previous representative cache method based on segments.

A node selection and a transmission scheduling method based on P2P network live streaming media are proposed, solving the problem that the traditional random selection method can hardly guarantee the transmission quality of streaming media and being granted two patents of invention. Based on this achievement, Prof. Xu's group and PPLive cooperated to develop and implement the cross-platform P2P video accelerator, PPVA. According to the measurement and statistics of the PPVA website (<http://www.ppacc.com/index.html>), there have been 280 million times of downloading this software, which supports thousands of video web sites invisibly with more than 10 million on-line users downloading videos every day, effectively saving the network broad-band of video web sites and network operators.

### **3. Research on Internet Traffic Management**

Network multipath traffic management and optimal traffic engineering are studied based on Network Utility Maximization (NUM) theory, which leads to the multipath traffic management method based on the logarithmic barrier method. The multipath traffic management method can realize theory optimization and convergence assurance simultaneously that the previous representatives, including TRUMP, can't achieve.

A new load balancing in proportion method based on traffic engineering is proposed, getting a new conclusion that the optimal routing in load balancing in proportion is the routing with the shortest M/M/1 queuing delay. Based on this conclusion, the optimal traffic engineering can be realized through routing protocols designed to find the shortest path, such as OSPF, in network engineering.

In addition to his research, Prof. Xu has also gained remarkable achievements in teaching.

To manage the situation of lacking Chinese teaching materials for graduate computer network courses, Prof. Xu worked as the editor-in-chief of the textbook *Advanced Computer Network—Architecture, Protocol Mechanism, Algorithm Design and Router Technology* (Mechanical Industry Press, 1st edition in 2003, 2nd edition in 2009). This book won the Excellent Teaching Material Award of Tsinghua University (first-class) in 2008, and has been used as a textbook by more than 20 universities in China, including Peking University, Fudan University, Beijing University of Posts and Communications, etc.

He also participated in the design of computer network course syllabus and proposed with other colleagues a multi-level teaching ideology of "emphasizing fundamentals for undergraduates, ability for master candidates and innovation for doctoral candidates, promoting teaching with research, and all-along practice". The teaching materials for undergraduates, master and doctoral candidates are closely interconnected with their respective emphases. Prof. Xu won the Teaching Achievement Award of Tsinghua University (first class) with other designers by the Multi-level Teaching Exploration of Computer Networks Course in 2008.

The course – *Advanced Computer Networks* – instructed by Prof. Xu won the title of Excellent Graduate Course of Tsinghua University in 2010. Prof. Xu won the Excellent Teaching Award for Young Teachers of Tsinghua University in 2011.

## **Representative Publications**

### **JOURNAL AND MAGAZINE PUBLICATIONS**

[1] Haiyang Wang, Feng Wang, Jiangchuan Liu, Chuang Lin, Ke Xu, and Chonggang Wang, "Accelerating Peer-to-Peer File Sharing with Social Relations," *IEEE Journal on Selected areas in Communications*, to be appeared

[2] XU Ke, Hongying Liu, Jiangchuan Liu, Jixiu Zhang, "LBMP: A Logarithm-Barrier-based Multipath Protocol for Internet Traffic Management," *IEEE Transactions on Parallel and Distributed Systems* 22(3):476-488 2011

[3] LI Dan, WU Jianping, LIU Jiangchuan, CUI Yong, XU Ke, "Defending Against Distance Cheating in Link-Weighted Application-Layer Multicast," *IEEE/ACM Transactions on Networking* 19(5):1448-1457, 2011

[4] XU Ke, Ming Zhang, Jiangchuan Liu, Zhijing Qin, Mingjiang Ye, "Proxy Caching for Peer-to-Peer Live Streaming," *Computer Networks* 54(7):1229-1241 2010

[5] LIU Jiangchuan, WANG Haiyang, XU Ke, "Understanding Peer Distribution in the Global Internet," *IEEE Network* July/August 2010

[6] XU Ke, Ming Zhang, Mingjiang Ye, Dah Ming Chiu, Jianping Wu, "Identify P2P Traffic by Inspecting Data Transfer Behavior," *Computer Communications* 33(10):1141-1150 2010

[7] XU Ke, Mingwei Xu, Qi Li, Song Lin, "Analysis and Case Study on Multi-dimensional Scalability of the Internet Architecture," *Science in China Series F: Information Sciences* 51(11):1661-1680 2008

[8] XU Ke, Huan He, "BGP parallel computing model based on the iteration tree," *The Journal of China, Universities of Posts and Telecommunications* 15(Suppl.): 1-8 2008

[9] MA Zhen, Ke Xu, Jiangchuan Liu, Haiyang Wang, "Measurement, modeling and enhancement of BitTorrent-based VoD system," *Computer Networks* 56:1103-1117 2012

- [10] HE Huan, Ke Xu, Ying Liu, "Internet resource pricing models, mechanisms, and methods," *Networking Science* 1 (1-4) :48-66 2012
- [11] HUANG Yan, Ke Xu, Haitao Li, Yang Cao, Xin Yao, "Large-scale P2PVOD system: Focusing on clients," *SCIENCE CHINA-INFORMATION SCIENCES* 54(8):1677-1690 2011
- [12] LI Suogang, Ke Xu, Ying Liu, Jianping Wu, "Edge Overlay Multicast to Support Comparable Multi-class Services," *Journal of High Speed Networks* 17(1):13-36 2008
- [13] LIU Chunyu, Ke Xu, "Framework for End-to-End Optimal Traffic Control Law Based on Overlay Mesh," *Journal of Communications and Networks* 9(4): 428-437 2007
- [14] CUI Yong, Ke Xu, Jianping Wu, Linjian Song, "CBroadcast: an Application Layer Multicast Mechanism based on Combination of Central Control and Self-organization," *International Journal of Ad Hoc and Ubiquitous Computing* 2(4):232-238 2007
- [15] WU Jianping, Ke Xu, "Next-generation Internet Architecture," *Journal of Computer Science and Technology* 21 (5): 723-731 2006

#### **CONFERENCE PUBLICATIONS**

- [1] XU Ke, Hongying Liu, Jiangchuan Liu, Meng Shen, "One More Weight is Enough: Toward the Optimal Traffic Engineering with OSPF," *IEEE ICDCS* 2011
- [2] XU Ke, Meng Shen, Mingjiang Ye, "A Model Approach to Estimate Peer-to-Peer Traffic Matrices," *IEEE INFOCOM* 2011
- [3] XU Ke, Haitao Li, Jiangchuan Liu, Wei Zhu, Wenyu Wang, "PPVA: A Universal and Transparent Peer-to-Peer Accelerator for Interactive Online Video Sharing," *IEEE IWQoS* 2010
- [4] Haiyang Wang, Jiangchuan Liu, Bo Chen, Ke Xu, Zhen Ma, "On Tracker Selection for Peer-to-Peer Traffic Locality," *IEEE P2P* 2010
- [5] XU Ke, Xiaowei Ma Chunyu Liu, "A Hash Tree Based Authentication Scheme in SIP Applications," *IEEE ICC* 2008
- [6] XU Ke, Minpeng Qi, Haitao Li, Peng Yang, Hui Deng, "A Novel Interfacing Solution to Make IKEv2 Work in MIPv6 Environment," *IEEE ICC* 2008
- [7] XU Ke, Yahui Yang, Tao Chen, "Improving BitTorrent Network's Performance via Deploying Helpers," *IEEE/IFIP International Conference on Embedded and Ubiquitous Computing* 2008
- [8] XU Ke, Jiangchuang Liu, Lizheng Fu, Chunyu Liu, "On the Stability of Application-layer Multicast Tree," *ISCIS 2006, LNCS4263* 2006
- [9] MA Zhen, Ke Xu, Yifeng Zhong, "Exploring the Policy Selection of P2P VoD System-A Simulation based Research," *IEEE/ACM IWQoS* 2012

[10] LI Haitao, Ke Xu, James Seng, Po Hu, "Towards health of replication in large-scale P2P-VoD systems," *IEEE IPCCC* 2009

### **BOOKS**

[1] XU Ke, Yifeng Zhong, Huan He, *Internet Resource Pricing Models*. Springer, 2013 (to be published)