

Hang Zhao

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RESEARCH INTERESTS	My research interests span cloud security, anomaly detection, mobile ad hoc network (MANET) security and policy enforcement. I am also interested in other system and network security topics.	
EDUCATION	Doctor of Philosophy in Computer Science Graduate School of Arts and Sciences, Columbia University • Thesis advisor: Professor Steven Bellovin	Oct 2012
	Master of Science in Computer Science Fu Foundation School of Engineering and Applied Science, Columbia University	Feb 2008
	Bachelor of Computing with Honors School of Computing, National University of Singapore	Feb 2005
RESEARCH EXPERIENCE	Postdoctoral Research Scientist <i>Intrusion Detection Systems Lab, Columbia University</i> Researched on anomaly detection in distributed systems, like the cloud computing environments. <ul style="list-style-type: none">• Led the project on distributed monitoring and cross-checking (DMCC) as the core of the Meerkats project for mission-oriented resilient clouds (MRC) funded by DARPA;• Designed and investigated alerts correlation approaches to implement defense in depth and breadth for detection of sophisticated multi-stage attacks using anomaly detection techniques and machine learning methods;• Supervised graduate students to develop an automated web-based security testing framework (open source) for data traffic generation, sensor testing, and graphic results representation;• Led the collaboration and integration of DMCC with other Meerkats components to demonstrate the concept of moving target defense in the cloud.	Sept 2012 – May 2015
	Graduate Research Assistant <i>Columbia University</i> Researched on scalable security policy enforcement in distributed systems. <ul style="list-style-type: none">• Proposed a generic algebra framework for security policy composition, analysis and delegation with a concrete instantiation in firewall policies;• Developed and evaluated a distributed routing-based firewall mechanism for high efficiency and reduced transmission overhead, especially for MANETs;• Proposed and implemented a distributed refinement solution for access control policy in compliance with high level security and business goals;• Proposed and investigated a privacy-enhanced access control mechanism for outsourced data sharing in the cloud environments.	Sept 2006 – May 2012
	Research Intern <i>IBM T.J. Watson Research Center</i> With the Policy Lifecycle Technologies group, designed and implemented a centralized policy refinement scheme for network services. This work was published in IFIP/IEEE IM'11.	May 2010 – Aug 2010
	Research Intern <i>IBM T.J. Watson Research Center</i> With the Policy Lifecycle Technologies group, developed a policy algebra for analysis and integration of Ponder policies. This work was published in IEEE POLICY'08.	Jun 2007 – Aug 2007
	Undergraduate Research Assistant <i>National University of Singapore</i> With the Communication and Internet Research Lab, developed and evaluated a TCP-Friendly Rate Control support mechanism for enhanced security and performance. This work was published in IEEE LCN'04.	Jan 2004 – Dec 2004

Nathaniel Boggs, **Hang Zhao**, Senyao Du, Salvatore Stolfo. Synthetic Data Generation and Defense in Depth Measurement of Web Applications. In *Proceedings of International Symposium on Research in Attacks, Intrusions and Defenses (RAID'14)*, Sept 2014.

Mariana Raykova, **Hang Zhao** and Steven M. Bellovin. Privacy Enhanced Access Control for Outsourced Data Sharing. In *Proceedings of Financial Cryptography and Data Security (FC'12)*, February 2012.

Hang Zhao, Jorge Lobo, Arnab Roy and Steven M. Bellovin. Policy Refinement of Network Services for MANETs. In *Proceedings of IFIP/IEEE International Symposium on Integrated Network Management (IM'11)*, May 2011.

Hang Zhao and Steven M. Bellovin. High performance firewalls in MANETs. In *Proceedings of the 6th International Conference on Mobile Ad-hoc and Sensor Networks (MSN'10)*, December 2010.

Hang Zhao, Maritza Johnson, Chi-Kin Chau and Steven M. Bellovin. Source prefix filtering in ROFL. In *Proceedings of the Annual Conference of ITA (ACITA'09)*. A version is available as Technical Report CUCS-33-09, Department of Computer Science, Columbia University, July 2009.

Hang Zhao, Chi-Kin Chau, and Steven M. Bellovin. ROFL: Routing as the firewall layer. In *Proceedings of the New Security Paradigms Workshop (NSPW'08)*, September 2008. A version is available as Technical Report CUCS-026-08, Department of Computer Science, Columbia University, July 2008.

Hang Zhao, Jorge Lobo, and Steven M. Bellovin. An algebra for integration and analysis of Ponder2 policies. In *Proceedings of the 9th IEEE International Symposium on Policies for Distributed Systems and Networks (POLICY'08)*, June 2008.

Hang Zhao and Steven M. Bellovin. Policy algebra for hybrid firewalls. In *Proceedings of the Annual Conference of ITA (ACITA'07)*. A version is available as Technical Report CUCS-017-07, Department of Computer Science, Columbia University, March 2007.

Rui Zhang, **Hang Zhao**, and Miguel A. Labrador. A scalable and energy efficient sink location service for large-scale wireless sensor networks. In *Ad Hoc and Sensor Wireless Networks Journal*, Vol. 4, No. 4, pp. 289-320, 2007.

Rui Zhang, **Hang Zhao**, and Miguel A. Labrador. A grid-based sink location service for large-scale wireless sensor networks. In *Proceedings of the ACM International Wireless Communications and Mobile Computing Conference*, Vancouver, Canada, July 2006.

Rui Zhang, **Hang Zhao**, and Miguel A. Labrador. The anchor location service (ALS) protocol for large-scale wireless sensor networks (invited paper). In *Proceedings of the CREATE-NET InterSense*, Nice, France, May 2006.

Venkatesh Obanaik, **Hang Zhao**, and Akkihebbal L. Ananda. Decoupling loss differentiation and loss recovery to ensure security and performance. In *Proceedings of the IEEE Conference on Local Computer Networks (LCN'04)*, Tampa, FL, 2004.

Columbia University

Course Instructor

- COMS W4187 Security Architecture and Engineering, Fall 2012.

Teaching Assistant and CVN Course Manager

- COMS W4187 Security Architecture and Engineering, Fall 2007, 2008, 2010.

College of William and Mary

Teaching Assistant and Lab Instructor

- CS131 Concepts of Computer Science, Spring 2005.
- CS141 Introduction to Computer Science Using Java, Fall 2005.
- CS312 Principles of Programming Languages, Spring 2006.

National University of Singapore

Teaching Assistant and Lab Instructor

- CS2105 Computer Networks, Fall 2004.

PROFESSIONAL
ACTIVITIES

Journal Reviewer

- Computers & Security
- IEEE Security & Privacy
- IEEE Transactions on Wireless Communications
- IEEE Transactions on Parallel and Distributed Systems
- IEEE Transactions on Dependable and Secure Computing
- ACM Transactions on Internet Technology
- ACM Transactions on Information and System Security

Conference Reviewer

- Annual Conference of the International Technology Alliance (ACITA 2008)
- Information Security Conference (ISC 2012)
- ACM Conference on Computer and Communications Security (ACM CCS 2013)
- ACM Conference on Computer and Communications Security (ACM CCS 2014)
- International Conference on Distributed Computing and Networks (ICDCN 2014)

Program Committee Member

- International Workshop on Access Control Policies, Models and Mechanisms (ACPM-2014)
- International Symposium on Women in Computing and Informatics (WCI-2014)
- Recent & Emerging Trends in Computer & Computational Sciences (RETCOMP-2015)
- IEEE International Conference on Communications (ICC 2015)

Editorial Board

- International Journal of Computer Science and Telecommunications (IJCST)

SKILLS

Languages: C/C++, Java, Python, R, HTML/XML

Simulation Tools: NS-2, MatLab, Weka.

Operating Systems: Windows, UNIX (Linux, OS X).

HONORS AND
AWARDS

Columbia University Computer Science Service Award 2007, 2008, 2009

Undergraduate Scholarship, awarded by the Ministry of Education of Singapore, 2001 – 2005

REFEREES

Prof. Steven Bellovin

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