

Ajay Mahimkar

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Research Interests

- My research interests span several areas of systems and networks, including network design & management, security, intrusion detection, and diagnosis.

Education

- Ph.D. in Computer Sciences (expected 2009)
University of Texas at Austin, TX, USA.
Advisors: Yin Zhang and Jennifer Yates
Thesis Topic: Large-Scale Network Diagnostics
- M.S.E. in Electrical & Computer Engineering (08/03 - 12/05)
University of Texas at Austin, TX, USA.
Advisors: Harrick M. Vin, Yin Zhang and Vitaly Shmatikov
Thesis: DYNAMO: DYnamic Network-based Attack Mitigation Operations
- B.E. in Computer Science (06/98 - 05/02)
University of Mumbai, India.
Advisor: R. K. Shyamasundar
Thesis: Design and Implementation of Software Defined Radio

Relevant Publications

1. Ajay Mahimkar, Ashwin Lall, Jia Wang, Jim Xu, Jennifer Yates and Qi Zhao, "SYNERGY: Detecting and Diagnosing Correlated Network Anomalies", *under review*.
2. Ajay Mahimkar, Jennifer Yates, Yin Zhang, Aman Shaikh, Jia Wang, Zihui Ge and Cheng Tien Ee, "Troubleshooting Chronic Conditions in Large IP Networks", *Proc. 4th ACM International Conference on emerging Networking EXperiments and Technologies (CoNEXT)*, December 2008.
3. Ajay Mahimkar, Jasraj Dange, Vitaly Shmatikov, Harrick Vin and Yin Zhang, "dFence: Transparent Network-based Denial of Service Mitigation", *Proc. 4th USENIX Symposium on Networked Systems Design and Implementation (NSDI)*, April 2007.
4. Ravi Kokku, Upendra Shevade, Nishit Shah, Ajay Mahimkar, Taewon Cho and Harrick Vin, "Processor Scheduler for Multi-Service Routers", *Proc. 27th IEEE Real-time Systems Symposium (RTSS)*, December 2006.
5. Ajay Mahimkar and Vitaly Shmatikov, "Game-Based Analysis of Denial-of-Service Prevention Protocols", *Proc. 18th IEEE Computer Security Foundations Workshop (CSFW)*, June 2005.

Research and Work Experience

- Summer Intern, AT&T Labs - Research, Florham Park, NJ (Summer 2006 and 2007)
Advisors : Jennifer Yates and Aman Shaikh

1. Scalable and Automated Network Diagnosis

- We design a new framework for network diagnosis that can scalably analyze network-wide statistical event correlations. The core components include a flexible infrastructure for correlation testing as well as tools for subsequent analysis of resulting correlation patterns and automatic drill-down for surprising correlations.
 - Above our core infrastructure, we have prototyped three exciting applications: (i) troubleshooting known network events, (ii) discovering undesirable modes of network operation that may be flying under the operation team’s radar, yet potentially impacting customers, and (iii) detecting changes in event relationships.
 - We use real network data from an operational tier-1 ISP backbone to illustrate the applications and their value. Our prototype system revealed interesting correlation patterns.
- Graduate Research Assistant, Computer Sciences, UT-Austin (Nov’03 - May’06)
 Advisor : Harrick M. Vin
 Co-advisors: Yin Zhang and Vitaly Shmatikov
 1. **Network-based Denial of Service Defense System** (Jan’05 - May’06)
 - We design a novel network-based defense system for mitigating denial of service (DoS) attacks. The key contribution of the system is complete transparency to the existing Internet infrastructure with no software modifications at either routers or end hosts. The special-purpose middlebox devices are dynamically introduced into the data path for hosts under attack. By intercepting both directions of IP traffic and applying stateful policies, the middleboxes effectively mitigate a broad range of spoofed as well as unspoofed attacks. We evaluate the implementation using a prototype testbed of Intel IXP network processors.
 2. **Adaptive Scheduling in Hyper-Threading enabled processors** (Aug’05 - Dec’05)
 - We design and implement a new scheduler for HT-enabled processors that takes into account the application behavior while making its allocation decisions. Application behavior is built and maintained using a performance monitor tool, o-profile. We modify the Linux kernel (2.6.14) to incorporate our scheduler. Comparative evaluation with Linux scheduler (with o-profile) shows benefits of the order of 5-10 % improvement.
 3. **Resource Allocation in packet-processing systems** (Nov’03 - Aug’05)
 - We design a novel adaptive scheduler for allocating processor resources to services in packet-processing systems (such as routers). My contributions include the design and implementation of different services (SYN flood detection, port scan detection) using Shangri-La framework and the new scheduler on Intel IXP network processor, and demonstrating the adaptation of resources based on traffic conditions.
 4. **Game-based Analysis of DoS Prevention Protocols** (Aug’04 - Dec’04)
 - We demonstrate how game-based formal methods can be used to verify availability-related security properties of network protocols. We specify the protocols as alternating transition systems, state their security properties in alternating-time temporal logic and verify them using MOCHA model checker.
 - Research Assistant, Tata Institute of Fundamental Research, Mumbai, India, (Jul’02 - Jul’03)
 Advisor : R. K. Shyamasundar
 Funding : Government of India
 1. **Solving the Hidden Terminal Problem in Wireless Networks**
 - We design a new distributed topology control and code assignment algorithm that eliminates direct and hidden terminal interference. Analytically, we prove that the condensed topology preserves network connectivity and has an upper bound of six on the node degree.

- Project Intern, Tata Institute of Fundamental Research, Mumbai, India, (Jun'01 - Jun'02)
Advisor: R. K. Shyamasundar

1. Design and Evaluation of Multi-mode, Multi-band Software Defined Radio

- We design and implement a multi-mode, multi-band software defined radio on a general-purpose processor. The system components are communication for two modes GSM and CDMA, mode identification, mode switching, and AES cryptography algorithm. We simulate and evaluate the system using Matlab and Java on a general-purpose processor.

Grants and Awards

- Travel Grant for NSDI (2006, 2007, 2008)
- Tata Doctoral Fellowship (2003-2005) and Undergraduate Scholarship (1999-2002)
- Certificate Awards from University for securing 1st rank during 2nd & 3rd years.

Presentations

1. “Troubleshooting Chronic Conditions in Large IP Networks”, AT&T Labs 2008 University Collaborations Symposium, NJ.
2. “Network-Wide Information Correlation and Exploration (NICE): Framework, Applications and Experience”, AT&T Labs 2007 University Collaborations Symposium, NJ.
3. “dFence: Transparent Network-based Denial of Service Mitigation”, NSDI 2007, Cambridge, MA.
4. “Transparent Network-based DoS Mitigation”, Poster, EdgeNet 2006, Microsoft Research, WA.
5. “Game-Based Analysis of Denial-of-Service Prevention Protocols”, Paper, IEEE CSFW, 2005, France.
6. “Trace Generation for High bandwidth network links”, Presentation, 2003, Intel Labs, Portland, OR.

Professional Activities

- Reviewer for DSN (2006), CCS (2006), Infocom (2006), ICDCS (2006), ACM SAC Track on Computer Security (2006), WWW Security, Privacy and Ethics track (2006), CSFW (2006), ACNS (2006)

Computer Skills

- *Languages* : C, C++, Java, Perl, Matlab
- *Operating Systems* : Linux, UNIX, Windows
- *Networking* : TCP/IP, Socket Programming, Intel IXP Network Processors

References

Prof. Harrick M. Vin
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