

Shashank Khanvilkar

Objective

To obtain a full time position in research and development that offers the opportunity to use my expertise in networking, multimedia and security.

Research Interests

- Design and analysis of next generation network architectures and protocols.
- Selective Encryption techniques for IP-level security.
- Performance issues in securing real-time multimedia data.

Education

PhD in Computer Engineering Expected May'06
ECE, University of Illinois at Chicago GPA: 4.0/4.0
Concentration: Overlay Networks, Multimedia and Security
Advisor: Dr. Ashfaq Khokhar

Masters in Computer Engineering Dec'01
ECE, University of Illinois at Chicago GPA: 4.0/4.0
Concentration: MAC protocols for 3rd generation cellular networks.
Advisors: Dr. Oliver Yu

Bachelor of Engineering in Electronics (Honors) Jul'97
Ramrao Adik Institute of Technology, University of Mumbai, India

Relevant Skills

Languages: C, C++, Java and Perl.
Tools: Opnet, Matlab and NS2.
Platform: Linux, Solaris, Windows.
Other: Security standards (SSH, SSL, Kerberos, IPSec), Networking protocols (TCP, UDP, IP, HTTP, RTP) and audio/video standards (H.323, Vorbis and MPEG Standards).

Research Experience

Multimedia Systems Laboratory Jan'02 to Present
Dr. Ashfaq Khokhar, ECE/CS, University of Illinois at Chicago

Research Focus: Securing multimedia communication over the Internet.

- Engineered a comprehensive study for quantifying performance of Virtual Private Networks for carrying multimedia data. Several VPN solutions (including IPSec, PPTP, Tinc and OpenVPN) were compared in terms of network performance, supported features and operational concerns. This study attributes the security aspects of current generation VPNs as one of the major factors that need enhancements to efficiently carry multimedia data.
- Conceived and developed a flexible, scalable and secure architecture for VPNs, called Flexi-Tunes. This architecture enhances existing security protocols to selectively secure application packets. A Windows/Linux implementation is currently under development for the Chicago Police Department to secure real-time video. Simulations were carried out using C and Opnet.

- Conceptualized and implemented a novel selective encryption scheme for securing MP3 audio, which leverages the internal data structure of MP3 to identify critical portions within the file. It is conjectured that securing these critical portions will make it computationally hard to decode the file. An MP3-Viewer and an MP3-Editor were created in C++ for this purpose.
- Developed an efficient graph algorithm for connecting VPN nodes over the Internet using bandwidth reserved links. Every VPN node only specifies the maximum traffic it can send/receive and the algorithm finds the most optimal way to connect them such that the bandwidth provisioning cost is close to optimal. Simulations were carried out using BRITE and Perl.

Research Focus: Traffic Management in RapidIO devices

- Collaborated with FreeScale Semiconductors to propose a Flow Arbitration Protocol to negotiate limited memory resources required for efficient reassembly of segmented packets in RapidIO compliant devices. Responsibilities included: prototyping the complete 3-layer RapidIO protocol stack along with the proposed protocol in Opnet, evaluating performance and presenting results. This protocol is currently being ratified by the RapidIO Trade Association and is expected to be a part of future specifications.

Networking and Wireless Communication Laboratory

Jan'00 to Dec'01

Dr. Oliver Yu, ECE/CS, University of Illinois at Chicago

Research Focus: QoS issues in 3rd Generation Cellular Networks

- Designed a medium access control protocol (GQ-MAC) for GSM/GPRS cellular network that provides QoS guarantees for multimedia data. GQ-MAC supports bounded channel access delay for delay-sensitive traffic, bounded packet loss probability for loss-sensitive traffic, and dynamic adaptive resource allocation for bursty traffic. Simulations for this protocol were carried out using C and Opnet.
- Developed a novel Admission Control algorithm that uses a multi-level guard channel scheme for admitting calls in a GSM/GPRS network. According to this algorithm, new calls have a higher probability of being dropped as compared to handoff calls. The algorithm is dynamic and is designed to adapt to changing traffic patterns. Matlab was used for simulations.
- Proposed a label switching tree architecture for providing QoS guaranteed mobility over an MPLS-based GPRS backbone. This architecture extends the call admission control to the core of the network. A prototype for this architecture has been developed in Opnet.

Relevant Software Projects

- Developed a library in C++ to manage a durable data-structure (binary Search Tree), which can survive system failure without getting corrupted. [LOC: 1500]
- Implemented Quicksort in C++ that allows multiple processes to concurrently sort an array stored in shared memory. [LOC: 500]
- Designed a Remote network file system in C++. A client can transparently operate on remote files using TCP, without being concerned about their location. Both synchronous/asynchronous calls are supported. [LOC: 1500]
- Implemented the link-state algorithm in C++ that allows multiple clients to exchange routing information and populate routing tables. Clients communicate by passing messages through shared memory [LOC: 800]

Industry Experience

Software Engineer

Patni Computer Systems, Mumbai, India

Aug'97 to Jul'99

Software Consultant

General Electric Aircraft Engines, Cincinnati Ohio

Aug'98 to Feb'99

Two years of professional experience in purchasing system development/maintenance using IBM DB2 and Cobol-CICS. Responsibilities included: adding new features, providing system support and developing user-specific applications. Awarded *Quality Contribution Award* for discovering major bugs in software.

Relevant Teaching Experience

Teaching assistant

ECE, University of Illinois at Chicago

Responsible for conducting labs, helping students with difficult problems, grading programming assignments and proctoring exams for the following courses:

- Object Oriented Programming In Java [*Enrollment: 35, Level: Graduate, Duration: Spr'04*]
- Computer Communication Networks [*65, Graduate + Undergraduate, Fall'03 + Spr'04*]
- Computer Organization and Design [*45, Graduate + Undergraduate, Fall'04 + Spr'05*]
- Introduction to computing [*65, Undergraduate, Fall'04 + Spr'01*]

Professional Service

- Freelance columnist for *Linux For You*, a monthly publication for Linux developers in India.

Publications

Book Chapters/ Journal

1. **S. Khanvilkar**, F. Bashir, D. Schonfeld, and A. Khokhar, "Multimedia Networks and Communication", The Electrical Engineering handbook (ed. by Wai Chen), October 2004.
2. F. Bashir, **S. Khanvilkar**, A. Khokhar and D. Schonfeld, "Multimedia Systems: Content Based Indexing and Retrieval", The Electrical Engineering handbook (ed. by Wai Chen), October 2004.
3. S. I. A. Shah, **S. Khanvilkar** and A. Khokhar, "RapidIO Traffic management and Flow Arbitration Protocol", *accepted by IEEE Communication Magazine, to appear.*
4. **S. Khanvilkar** and A. Khokhar, "Virtual Private Networks: An Overview with performance evaluation", IEEE Communication magazine, vol: 42(10), pp: 146-154, October 2004.
5. O. Yu and **S. Khanvilkar**, "End-to-end Adaptive QoS Provisioning over GPRS Wireless Mobile Network", Mobile Networks and Applications (MONET), vol: 8(3), pp: 255-267, 2003.
6. **S. Khanvilkar** and S. M. Shatz, "Tool integration for flexible simulation of distributed algorithms", Software - Practice and Experience (SPE), vol: 31(14), pp: 1363-1380, 2001.
7. **S. Khanvilkar**, "Dynamic Adaptive guaranteed QoS provisioning over GPRS and UMTS wireless mobile links", M.S Thesis, 2001.

Conferences

8. **S. Khanvilkar** and A. Khokhar, "Selective encryption for MP3", *under preparation.*
9. **S. Khanvilkar** and A. Khokhar, "An efficient heuristic for provisioning Virtual Private Networks in the hose model", *Submitted.*
10. **S. Khanvilkar** and A. Khokhar, "Efficient transmission of MP3 streams over VPN", *submitted to Globecom-2006.*
11. **S. Khanvilkar** and A. Khokhar, "Towards a scalable and flexible architecture for Virtual Private Networks", 4th Intl. Conf. On Networking (ICN), pp: 597-605, April 2005.
12. **S. Khanvilkar** and A. Khokhar, "Experimental evaluations of Open-Source Linux-based VPN solutions", 13th Intl. Conf. on Computer Communication and Networks (ICCCN), pp: 181 – 186, October 2004.
13. O. Yu and **S. Khanvilkar**, "QoS provisioning over GPRS wireless mobile links", Wireless communication and networking conf. (WCNC), vol: 1, pp: 322 - 326, March 2002.
14. O. Yu and **S. Khanvilkar**, "Dynamic adaptive QoS provisioning over GPRS wireless mobile links", Intl. Conf. on Communication (ICC), vol: 2, pp: 1100 – 1104.

Technical Magazine Articles/Reports

15. K. Luruo and **S. Khanvilkar**, "Virtual Network Configuration Tools for User-Mode Linux", Linux for You – Pro, May 2005.

16. K. Luruo and **S. Khanvilkar**, "Virtual networking with User Mode Linux", Linux for You – Pro, March 2005. (*Cover story*)
17. M. Radhakrishnan and **S. Khanvilkar**, "Subversion: Organizing the unorganized", Linux for You – Pro, February 2005.
18. **S. Khanvilkar**, O. C. Daramula and B. Kori, "T-PPM: Trust-based Probabilistic Packet Marking scheme for efficient traceback of IP packets", Computer System Security, Fall 2005.
19. **S. Khanvilkar**, "Guaranteeing memory integrity in secure processors with Dynamic Trees", Advanced Computer Architecture, Spring 2004.
20. **S. Khanvilkar**, "Design and implementation of MPEG encoder/decoder in C", Multimedia Communication System, Spring 2001.

Relevant Coursework

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| ▪ High Speed Cryptography | ▪ Advanced Computer Architectures |
| ▪ Computer and Network Security | ▪ Parallel Programming using MPI |
| ▪ Algorithms | ▪ Algorithms for distributed computing |
| ▪ Computer Networks | ▪ Operating Systems |
| ▪ Network OS Programming (C++) | ▪ Probability and Statistics |
| ▪ Wireless and cellular communication | ▪ Digital Signal Processing |
| ▪ Multimedia communication | |

Professional Membership/Awards

2004 Student Member of IEEE/ACM.

1998 Awarded *Quality Contribution Award* for excellent performance in the PPS-IBM team at Patni Computers Systems.

1994 Certificate of excellence for ranking 5th in first year of engineering.

References

1. Dr. Ashfaq Khokhar (advisor)
Professor, ECE/CS, University of Illinois at Chicago
Email: ashfaq@uic.edu
2. Dr. Syed Ijlal Ali Shah (PhD committee)
Freescale Semiconductors
Email: Syed.Shah@freescale.com
3. Dr. Jason Leigh (PhD committee)
Associate Professor, CS, University of Illinois at Chicago
Director, Electronic Visualization Laboratory, UIC.
Email: spiff@evl.uic.edu
4. Dr. Gyungho Lee (PhD committee)
Professor, ECE, University of Illinois at Chicago
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5. Dr. Sol Shatz
Professor, CS, University of Illinois at Chicago
Associate Dean for Research and Graduate Studies, College of Engineering
Email: shatz@cs.uic.edu