David G. Andersen

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Education

MASSACHUSETTS INSTITUTE OF TECHNOLOGY — Cambridge, MA

S.M. in Computer Science, 2001
Ph.D. candidate in Computer Science. (Expected summer 2004)
Advisor: Hari Balakrishnan
Minor in Computational Biology

UNIVERSITY OF UTAH — Salt Lake City, UT

Bachelor of Science in Computer Science. *Cum Laude*, 1998
Bachelor of Science in Biology. *Cum Laude*, 1998

Research Interests

Computer systems in the networked environment.

Professional Experience

1999– **Research Assistant** — MIT

Research assistant at the Laboratory for Computer Science (LCS / CSAIL). Worked in cooperation with the University of Utah on the RON+Emulab testbed. Major projects at MIT include Resilient Overlay Networks, Resilient Access Networks, Mayday, and the Congestion Manager. A summary of my research activities at MIT and elsewhere begins on page 4.

Summer 2001 **Summer Intern** — Compaq SRC

Summer internship working on the Secure Network Attached Disks project.

1997-1999 **Research Assistant / Research Associate** — University of Utah

One year as an undergraduate and one year as a staff research associate in the Flux research group at the University of Utah.

1996-1997 **Research Assistant** — Department of Biology, University of Utah

Undergraduate research assistantship in the Wayne Potts Laboratory in the Department of Biology.

1995-1997 **Co-founder and CTO, ArosNet, Inc.**

Acted in a directorial and technical capacity over technical operations: network design and topology planning, software development, consulting projects, and short-term research. During my three years with the company, ArosNet grew from its inception to become the third largest ISP in Utah.

1995-2003 **Consultant** — *IJNT, Inc., Sypherance Technologies, Ascensus, others*.

Provided network design, security, and intellectual property consulting services.

1993-1995 **Systems Administrator, The Lower Lights**

Implemented and managed database systems and medium-scale dialin analog modem banks.

Teaching Experience

2001 — Teaching Assistant, MIT course 6.829, Computer Networks.
Assisted with homework / quiz design and grading, some lectures, office hours. Designed and coordinated the group project for undergraduate students.

2001-2003 — UROP / Undergraduate Thesis supervisor, MIT.
Co-supervised one undergraduate thesis and two undergraduate research assistants in the Congestion Manager and RON projects.

1997 — Teaching Assistant, University of Utah course CS508, Computer Networks.
Assisted with Homework / quiz design and grading, held weekly office hours.

2001-2003 — Lecturer and organizer, MIT Winter Mountaineering class.
Organized curriculum and lectures, presented some lectures.

Refereed Publications

[1] David G. Andersen, Alex C. Snoeren, and Hari Balakrishnan. Best-path vs. multi-path overlay routing. In *Proc. Internet Measurement Conference*, October 2003.

[2] Nick Feamster, David Andersen, Hari Balakrishnan, and M. Frans Kaashoek. Measuring the effects of Internet path faults on reactive routing. In *Proc. ACM SIGMETRICS*, San Diego, CA, June 2003.

[3] Marcos K. Aguilera, Minwen Ji, Mark Lillibridge, John MacCormick, Erwin Oertli, David G. Andersen, Mike Burrows, Timothy Mann, and Chandramohan Thekkath. Block-Level Security for Network-Attached Disks. In *Proc. 2nd USENIX Conference on File and Storage Technologies (FAST)*, March 2003.

[4] David G. Andersen. Mayday: Distributed Filtering for Internet Services. In *Proc. USENIX Symposium on Internet Technologies and Systems (USITS)*, March 2003.

[5] David G. Andersen, Nick Feamster, Steve Bauer, and Hari Balakrishnan. Topology Inference from BGP Routing Dynamics. In *Proc. Internet Measurement Workshop*, Marseille, France, November 2002.

[6] David G. Andersen, Hari Balakrishnan, M. Frans Kaashoek, and Robert Morris. Resilient Overlay Networks. In *Proc. 18th ACM SOSP*, pages 131–145, Banff, Canada, October 2001.

[7] David G. Andersen, Hari Balakrishnan, M. Frans Kaashoek, and Robert Morris. The Case for Resilient Overlay Networks. In *Proceedings of the 8th Workshop on Hot Topics in Operating Systems (HOTOS-VIII) (Best Student Paper Award)*, May 2001.

[8] Alex Snoeren, David Andersen, and Hari Balakrishnan. Fine-Grained Failover Using Connection Migration. In *Proc. USENIX Symposium on Internet Technologies and Systems (USITS)*, September 2001.

[9] David Andersen, Deepak Bansal, Dorothy Curtis, Srinivasan Seshan, and Hari Balakrishnan. System Support for Bandwidth Management and Content Adaptation in Internet Applications. In *Proc. of the Fourth Symposium on Operating Systems Design and Implementation*, October 2000.

[10] Ray Spencer, Stephen Smalley, Peter Loscocco, Mike Hibler, David Andersen, and Jay Lepreau. The Flask Security Architecture: System Support for Diverse Security Policies. In *Proc. of the Eighth USENIX Security Symposium*, August 1999.

Other Articles

[11] David G. Andersen, Hari Balakrishnan, M. Frans Kaashoek, and Robert Morris. Experience with an Evolving Overlay Network Testbed. *Computer Communication Review*, 33(3):13–19, July 2003.

Pending and Submitted Publications

[12] David G. Andersen, Hari Balakrishnan, and Frans Kaashoek. Grassroots Reliability with Resilient Access Networks. To be submitted, February, 2004.

Patents

“Method and system for securing block-based storage with capability data.” Marcos K. Aguilera, Minwen Ji, Mark Lillibridge, John MacCormick, Oerwin Oertli, Dave Andersen, Mike Burrows, Tim Mann, Chandu Thekkath. Pending, filed in May 2003.

Selected Honors and Awards

2002–2004	Microsoft Research Graduate Fellowship
2001	Best Student Paper, 8th IEEE Workshop on Hot Topics in Operating Systems
2001	MIT Joseph Levin award for best MasterWorks oral presentation
1999	MIT Vinton Hayes Fellowship (graduate)
1998	University of Utah Graduating Student Leadership Award
1993	Member, Phi Kappa Phi and Golden Key academic honor societies
1993–1997	University of Utah Honors at Entrance Scholarship
1993	National Merit Scholar

Service and Other Activities

	Reviewer for OSDI, SOSP, SIGCOMM, CCR, HotOS, ToN, Infocom, HotNets.
1999–2003	Secretary, board member, and rock climbing instructor for the MIT Outing Club.
1999–2000	Secretary, Utah Regional Exchange Point
1997–1998	Chair, University of Utah Undergraduate CS Advisory Committe
1995-1996	EMT Volunteer, University of Utah Medical Center emergency room.

Research - Network Resilience and Performance

1999– **Resilient Overlay Networks** MIT

My dissertation research investigates host-based techniques that improve the end-to-end fault resilience of communication on the Internet. Wide-area reachability suffers two weaknesses. First, inter-provider routing with BGP can be fragile and suffers from a longer time-to-repair than does intra-provider routing. Second, clients' access links are a common single point of failure impacting end-to-end reachability. The Resilient Overlay Networks (RON) and Resilient Access Networks (RAN) projects address these two points of failure.

RON is a framework that creates dynamic overlay networks between participating hosts or applications. The overlay networks use a combination of active probing and passive measurements to find more reliable and better performing routes by sending packets through the other participating nodes in the overlay. A set of Internet-based experiments in 2001 showed that RON can avoid up to half of the failures that interrupt communication, and can offer significant latency improvements for poorly-performing paths.

RAN uses a combination of overlay techniques and multiple local Internet connections to improve clients' connectivity to Internet hosts. RAN improves the reliability of hosts' communication not only with each other, but also to external hosts, and incorporates techniques that address some of the scalability concerns of RON. The RAN system is currently implemented in a Web proxy system running and being evaluated at MIT, the University of Utah, and two private companies.

1999–2000 **Congestion Manager** MIT

The Congestion Manager provides a unified congestion controller for ensembles of TCP and UDP flows that eliminates adverse interactions and extends the benefits of congestion control to non-TCP applications. To help evaluate the CM, I co-implemented a congestion-controlled version of `vat`, an internet audio tool, which used the Congestion Manager to behave in a TCP-friendly manner with low overhead. I helped design and implement the kernel to user API for the CM, and performed extensive performance measurements of the CM for both in-kernel and userspace applications.

1998– **Emulab + RON Testbed** University of Utah / MIT

Systems and networking researchers frequently use home-grown testbeds to evaluate prototypes and perform Internet measurements. To reduce the burden of creating these testbeds and to help provide a framework with better experimental repeatability, I played a part in the conception and design of a large-scale network testbed, Emulab, and a portion of its management databases, algorithms, and software. At MIT, I deployed and currently manage a 36-node distributed Internet testbed which is integrated with Emulab. I have been helping to transition the lessons learned from this testbed into the emerging Planetlab testbed.

Research - Network Security

2003 **Mayday: Distributed Filtering for Internet Services** MIT

Mayday presents an incrementally deployable Denial of Service *prevention* service that acts primarily as an overlay service, minimizing the network changes required for its deployment. Unlike tactics such as spoofing prevention, Mayday provides immediate protection to its deployers instead of requiring upgrades on the part of third parties. Mayday generalizes earlier work on Secure Overlay Services by separating overlay routing from filtering and by providing a larger set of choices for each, allowing the implementer to choose a high-performance deployment such as proximity routing, or a slower system that can withstand more capable attackers.

As part of the evaluation of Mayday and earlier work, I developed several practical attacks, two of them novel, that are effective against filtering-based systems like Mayday and SOS.

Summer 2001 **Secure Network Attached Disks** Compaq SRC

Traditional disk architectures interpose a fileserver between clients and disks to provide access control. *Network Attached Disk* efforts aim to place the disks directly on the network, eliminating the bottleneck presented by the file server. The capability-based approach we examined permits the disks to export a familiar block-based interface; compared to earlier NAD efforts, this eliminates disk layout changes and simplifies the on-disk implementation. I created a filesystem simulator for our proposed architecture and created a benchmark suite from measurements of SRC's fileserver traffic to drive the simulator.

1997-1999 **Flask: A secure microkernel** University of Utah

Users' requirements for operating systems vary considerably, from the MLS policies favored in military applications, to RBAC-like policies more common in large enterprises, to type enforcement policies favored for providing least privilege to local processes. The Flask security architecture provides fine-grained access rights and permits for their revocation to permit a single OS implementation to support a wide range of security policies. As an undergraduate, and continuing as research staff, I implemented and benchmarked parts of the Flask architecture, improved the reliability of the underlying Fluke microkernel, and implemented several of the example applications used in its evaluation.

References

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