

Stanislav Albright Rost

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EDUCATION

Massachusetts Institute of Technology

2001– PhD candidate in Computer Science.
Advisor: Hari Balakrishnan.

Boston University

1996– Joint BA/MA in Computer Science. (*Summa cum laude*)
2001 Advisors: John Byers, Azer Bestavros.

RESEARCH INTERESTS

Computer networks and distributed systems: content delivery, adaptive overlay networks, peer-to-peer technologies, Internet infrastructure and routing, network measurements and their analysis.

EMPLOYMENT SUMMARY

2001– **Massachusetts Institute of Technology**
Research assistant in the Networks and Mobile Systems group of the Laboratory for Computer Science.

2001– **Maged & Rost P.C., Attorneys at Law**
Technology consultant. Responsibilities include deployment and maintenance of the computing infrastructure, web development and database management.

1997– **Boston University**
1999 Web developer, database administrator for the Electrical and Computer Engineering department. Developed a grant-related, relational database-backed website serving seven universities on a common \$1.2 million Air Force Multidisciplinary Research Initiative on Reduced Target Recognition. The website serves as a central clearinghouse for grant-related information: publications, participants, research summaries, meetings, conference dates and more.

TEACHING EXPERIENCE

Boston University

2001 **Instructor, CS101: Introduction to Computer Science (1 sem.)** Prepared and taught a class of ≈ 80 meeting three hours every week. Created an introductory curriculum spanning history, architectures, applications, databases, web design, the Internet, algorithms, complexity and programming. Supervised a teaching fellow in charge of discussion sections.

2000 **Teaching Fellow, CS555: Computer Networks (2 sem.)** Held office and laboratory hours, answering students' questions. Graded problem sets, tests and projects. Developed course material, including project code and automated grading tools.

AWARDS

- 2001 **NTT Fellowship**, Massachusetts Institute of Technology.
- 2000 **Achievement award recipient**, Boston University.
- 1996–
2000 **Dean’s List honors**, Boston University.
- 1996 **Finalist and the second place winner, project “Infected Program Reconstruction”**
47th International Science and Engineering Fair.
Additional awards: second place winner at local and state science fairs, U.S. Air Force, U.S. Navy, National Taiwan Education Centre science awards.
- Member, Phi Beta Kappa honor society.

PUBLICATIONS

Journal articles

- 2002 “Cyclone Server Architecture: Streamlining Delivery of Popular Content.” Stanislav Rost, John Byers and Azer Bestavros. *Computer Communications (COMCOM): Special Issue on Web Caching and Content Delivery 2002*.

Conference articles

- 2002 “Informed Content Delivery Across Adaptive Overlay Networks.” John Byers, Jeffrey Considine, Michael Mitzenmacher and Stanislav Rost. In Proceedings of *SIGCOMM 2002*.

TALKS

- 2001 “Cyclone Server Architecture: Streamlining Delivery of Popular Content,” Sixth International Workshop on Web Caching and Content Distribution (WCW), Boston, MA, June 2001.
- 2000 —, Web and InterNetworking Group (WING) Workshop, Boston, MA, October 2000.

SKILLS

Languages: C, C++, Java/Swing, Perl/Tk, SQL, Tcl/Tk, Pascal, Matlab, Standard ML.
Development: Client-server, OS kernel and protocols, graphics and vision, databases.

SERVICE AND OTHER ACTIVITIES

Referee for the Computer Communications journal.

- 1998–
2000 **Boston University Competitive Comedy Team**
Actor, script writer. Actor, script writer. Participated in comedy competition conducted among student teams representing colleges and cities. Our team won second place in 1998 national finals (losing to Harvard University), and became the all-American champions in 2000.
- 1997–
1998 **Boston University Computer Graphics Group (BUGG)**
Vice President. Led the development of a game project, “Millennium’s End.” Conducted series of lectures and hands-on workshops educating members about computer programming, computer graphics, computer-aided design methods and the latest industry trends.

RESEARCH SUMMARY

Massachusetts Institute of Technology

2002– **Rate-Aware Splitting of Traffic Aggregates** – Modern networks are increasingly richly connected, providing multiple paths between sources and destinations. Such configurations provide an opportunity for dispersing traffic over multiple paths to decrease congestion. Dispersion involves (1) splitting a time-varying traffic aggregate composed of a number of distinct transport-layer flows of varying rates in proportion to a *relative rate vector* $[f_1, f_2, \dots, f_N]$; and (2) forwarding traffic along the alternate paths. We concentrate on the splitting problem, proposing a number of *dynamic, rate-adaptive* approaches. We also propose a number of novel metrics for the *imbalance* and *flow disruption* of the adaptive approaches, and analyze the performance of our traffic splitting schemes.

Equipped with rate-based traffic splitting, we plan to extend our architecture with traffic measurement feedback and develop a system for load-based routing. One interesting design relies on local adaptation by routers using ECN-like “loss backpressure,” which forces upstream routers to split traffic in attempt to simultaneously re-route its fractions around congested areas, decreasing the rate of the remaining traffic flowing through congested areas.

Boston University

2001–2002 **Informed Content Delivery across Adaptive Overlay Networks** – We study how to optimize throughput of large, multipoint transfers across richly connected overlay networks, focusing on the question of *what* to put in each transmitted packet. We first make the case for transmitting encoded content in this scenario, arguing for the digital fountain approach which enables end-hosts to efficiently reconstitute the original content of size n from a subset of *any* n symbols drawn from a large universe of encoded symbols. Such an approach affords reliability and a substantial degree of application-level flexibility, as it seamlessly accommodates connection migration and parallel transfers while providing resilience to packet loss. However, since the sets of encoded symbols acquired by peers during downloads may overlap substantially, care must be taken to enable them to collaborate effectively. We provide a collection of useful algorithmic tools for efficient estimation, summarization, and approximate reconciliation of sets of symbols between pairs of collaborating peers, all of which keep messaging complexity and computation to a minimum.

Collaborated in all aspects of the project. Co-authored a publication in SIGCOMM 2002.

2000–2002 **OS Support for Scalable Content Delivery** – In serving massive numbers of concurrent requests for the same content, our solution, the Cyclone Server, reduces storage complexity to almost a constant and the rate of disk access to that of a single service thread. To achieve this, it provides for (1) a near-optimal sharing of memory among processes servicing concurrent requests for identical content (2) an almost stateless network stack. Both of these goals are achieved using Tornado Codes, erasure codes which encode n blocks of original content into $k \cdot n$ blocks of the encoding that contain redundancy; receiving any $n + \epsilon$ distinct encoding blocks allows the complete reconstruction of the source data, where ϵ is on the order of $0.03n - 0.06n$. Such codes allow an unbounded number of clients to be services using a single shared sliding buffer.

Collaborated in all aspects of the project. Integrated the shared buffer subsystem into the Linux kernel and modified the TCP stack to perform custom processing for Cyclone-enabled connections. Developed server and client APIs for effortless integration of Cyclone into existing software. Modified Apache and SURGE, a representative web workload generator, to use the Cyclone APIs. Co-authored a workshop paper.

REFERENCES

Prof. Hari Balakrishnan
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Prof. Azer Bestavros, Chair
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Prof. John Byers
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Prof. W. Clem Karl
Boston University Electrical and
Computer Engineering Dept.
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Additional references available upon request.