

BRANDON WATTS SALMON
1615 Denniston Street
Pittsburgh, Pennsylvania 15217-1457

(412) 874-6982
bsalmon@ece.cmu.edu
<http://www.ece.cmu.edu/~bsalmon>

EDUCATION

Carnegie Mellon University: *Ph.D. candidate in computer engineering* (August 2007)

- Parallel Data Lab, Adviser: Greg Ganger.
- Thesis topic: Storage management in the home.

Carnegie Mellon University: *M.S. in computer engineering* (August 2004)

- Thesis: Challenges in Building a Two-Tiered Learning Architecture for Disk Layout

Stanford University: *B.S. with honors in computer science* (April 2002)

- Senior Project: Backslash, a system to improve web server reliability using a peer-to-peer network as a backing store. Awarded for creativity.
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AWARDS

- Best Paper Award, FAST 2005.
 - Best Student Paper Award, FAST 2004.
 - National Science Foundation Fellowship.
 - CMU Lab for Computer Systems Fellowship.
 - National Merit Scholarship.
 - Henry Newell Scholarship.
 - Electronic Arts Creativity Award.
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RESEARCH EXPERIENCE

Home storage management (Current)

The home digital environment is an area of growth and change in the world of computing. Digital music players, DVDs, cameras and digital video recorders have converted much of the remaining analog media in the home into the digital realm. Managing this burgeoning amount of data and devices will be difficult and time consuming. However, home users should not be expected to spend time dealing with this kind of management. My work focuses on automating the replication and migration of data, so that it will be both reliable and available at devices where it is needed without requiring much user input.

Self-* storage (2003 to Current)

Administration is currently a large part of the total cost of ownership of enterprise storage. The Self-* Storage project focuses on designing storage systems that decrease the need for administrator work in data management. We have built a versatile brick-based storage infrastructure to support automation of various administrative tasks. For example, one planning task is choice of data encoding, which heavily affects performance and reliability. I am building a mechanism to automatically choose an appropriate encoding when an object is first created in the system. I have also researched methods for administrators to specify high-level objectives to the system, to allow the system make mechanism and policy decisions.

Adaptive disk layout optimization

(2002 to 2004)

The way data is laid out on disk has a huge impact on system performance. For this reason, researchers have proposed various heuristics to optimize for particular data access patterns. Each of these heuristics works well for some data, but may be useless or detrimental to other data. As a result, few are used in practice. To enable their safe use for data-specific layout optimization, we proposed a two-tiered system that takes a variety of heuristics and adaptively combines them using simulation and optimization methods to place each piece of data using a correct heuristic. Robustly combining heuristics proved to be difficult, providing us insight into the complexity of even relatively small automation problems, such as this one.

Freeblock scheduling

(2003)

To perform adaptation like layout optimization, a system must be able to efficiently service background tasks. Freeblock scheduling allows a system to perform background disk operations without cost to a foreground workload, even if the disk is currently 100% busy. It obtains this extra bandwidth by scheduling background operations in the rotational latency of the disk, which would otherwise be wasted. I worked specifically on modifying background tasks, such as data migration, to work well with the freeblock system.

Backslash

(Spring 2002)

One common problem web servers face is that of flash crowds, or sudden spikes in workload due to a shift in popularity of Internet data. We proposed a solution called Backslash, which uses a peer-to-peer network to replicate web server data across a set of cooperating web sites. When a flash crowd occurs, this network can be used to offload requests. We built and architected the system as a senior project. The project won an Electronic Arts Creativity Award. Another group member subsequently published a workshop paper on the system.

PUBLICATIONS

- **End-to-end tracing in a cluster based storage system: a feasibility study.** Eno Thereska, Brandon Salmon, John Strunk, Matthew Wachs, Michael Abd-El-Malek, Julio Lopez, Gregory R. Ganger. Proceedings of the Joint International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS'06), Saint-Malo, France. June 26th-30th 2006. (to appear)
- **Ursa Minor: versatile cluster-based storage.** Michael Abd-El-Malek, William V. Courtright, Chuck Cranor, Gregory R. Ganger, James Hendricks, Andrew J. Klosterman, Michael Mesnier, Manish Prasad, Brandon Salmon, Raja R. Sambasivan, Shafeeq Sinnamohideen, John Strunk, Eno Thereska, Matthew Wachs, Jay J. Wylie. Proceedings of the 4th USENIX Conference on File and Storage Technologies (FAST '05), San Francisco, CA. December 13-16 2005. *Best Paper Award.*
- **Challenges in Building a Two-Tiered Learning Architecture for Disk Layout.** Brandon Salmon, Eno Thereska, Craig A.N. Soules, John D. Strunk, Gregory R. Ganger. Carnegie Mellon University Parallel Data Laboratory Technical Report CMU-PDL-04-109. August, 2004.
- **A Framework for Building Unobtrusive Disk Maintenance Applications.** Eno Thereska, Jiri Schindler, John Bucy, Brandon Salmon, Christopher R. Lumb, Gregory R. Ganger. Proceedings of the 3rd USENIX Conference on File and Storage Technologies (FAST '04). San Francisco, CA. March 31, 2004. *Best Student Paper Award.*
- **A Two-Tiered Software Architecture for Automated Tuning of Disk Layouts.** Brandon Salmon, Eno Thereska, Craig A.N. Soules, Gregory R. Ganger. First Workshop on Algorithms and Architectures for Self-Managing Systems. San Diego, CA. June 11, 2003.

TEACHING EXPERIENCE

- **Teaching assistant: distributed systems** (Winter 2005)
Mentored groups in this project-intensive course. Evaluated and refined group objectives and designs to target useful technical problems, coached groups during the development and team-building processes, and evaluated the final projects. Prepared and gave guest lecture.
- **Organized filesystem course** (Fall 2002)
Conceived and led a student-run CMU course analyzing modern file systems. Lectures consisted of student presentations on individual file system characteristics, strengths, weaknesses, and usage. The data was collected into a summary web page.

SELECTED PRESENTATIONS

- Relative fitness models for storage.* JST CREST Advanced Storage System Workshop, San Francisco, CA. December 2005.
- Intelligent Data Placement in a Home Environment. (work in progress)* The 4th USENIX Conference on File and Storage Technologies (FAST '05), San Francisco, CA. December 2005.
- Choosing encoding in a self-* system. (work in progress)* Parallel Data Lab Annual Industry Retreat. Nemacon Woodlands, PA. October 2005
- Challenges in building a two-tiered learning architecture for disk layout.* Parallel Data Lab Annual Industry Retreat. Nemacon Woodlands, PA. October 2004.
- A two-tiered learning architecture for disk layout.* First Workshop on Algorithms and Architectures for Self-Managing Systems. San Diego, CA. June 2003.

PROFESSIONAL EXPERIENCE

- Microsoft research** (Summer 2003)
Sanitized and prepared traces from more than one hundred computers for distribution. Built tools to analyze the file system traces, and select portions of the traces interesting for benchmarking new systems.
- VMware Inc.** (Summers 2001, 2002)
Worked with two other employees to redesign and rewrite the storage back end for the virtual machine monitor. Wrote a design document, defended it to management, and started the implementation of the new code base. Integrated generic SCSI devices into the Windows version of the product, solving a long-standing problem. Managed the transition from one storage format to another in order to make the product compatible with Windows XP.
- Brigham Young University** (1996 to 1998)
Administered a network for Brigham Young University in Provo, Utah. Maintained more than fifty computer kiosks for e-mail and registration. Wrote a new Windows shell to improve security and ease upgrading processes.

INTERNATIONAL EXPERIENCE**Japanese experience**

(1998 to 2000)

Fluent in Japanese language and familiar with Japanese culture, having lived and worked with the people of Japan for more than two years. Served in the community, visited schools, and joined in social gatherings in many homes. Received additional training in Japanese language and culture at Stanford University.