

# Amy Babay

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## Education

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**Doctor of Philosophy** in Computer Science  
*Johns Hopkins University*

**September 2018**  
*Baltimore, MD*

Thesis: *Timely, Reliable, and Cost-Effective Internet Transport Service using Structured Overlay Networks*

**Master of Science in Engineering** in Computer Science  
*Johns Hopkins University*

**May 2014**  
*Baltimore, MD*

Thesis: *The Accelerated Ring Protocol: Ordered Multicast for Modern Data Centers*

**Bachelor of Arts** in Cognitive Science, minor in Classics  
*Johns Hopkins University*

**May 2012**  
*Baltimore, MD*

GPA: 4.00. Phi Beta Kappa, University Honors, Departmental Honors, Dean's List

## Honors and Awards

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- **Professor Joel Dean Excellence in Teaching Award** **May 2018**  
*Johns Hopkins University Computer Science Department*  
For "outstanding teaching contributions to the department"
- **Finalist for Graduate Teaching Assistant Award** **March 2018**  
*Johns Hopkins University Whiting School of Engineering*
- **Best Paper Award** **June 2017**  
*IEEE International Conference on Distributed Computing Systems (ICDCS 2017)*  
For *Timely, Reliable, and Cost-Effective Internet Transport Service using Dissemination Graphs*, selected out of 531 submissions
- **Special Service Award** **May 2015**  
*Johns Hopkins University Computer Science Department*  
For "outstanding work to benefit the department, Johns Hopkins University, and the community"
- **Excellence in Cognitive Science Award** **May 2012**  
*Johns Hopkins University Cognitive Science Department*  
Awarded annually to a graduating Cognitive Science major for academic excellence and outstanding accomplishment in research

## Experience

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### Partner

*Spread Concepts LLC*

**July 2018-Present**

*Savage, MD*

Bridging the gap and creating cross-fertilization between academic research and technologies and the commercial world.

### Research Assistant

*Johns Hopkins University Distributed Systems and Networks Lab*

**September 2014-July 2018**

*Baltimore, MD*

*PhD research:* Developing protocols to support a new generation of Internet services, using structured overlay networks. This work included a timely and highly reliable Internet transport service for interactive applications with demanding latency constraints (e.g. remote manipulation, remote robotic surgery, collaborative virtual reality) as well as an intrusion-tolerant network service for monitoring and control of high-value infrastructure ([www.spines.org](http://www.spines.org)).

Building dependable infrastructure systems that maintain correct operation and predictable performance, even in the presence of sophisticated attacks and compromises. This work developed the first intrusion-tolerant SCADA system for the power grid that is resilient to both system-level compromises and network attacks ([www.dsn.jhu.edu/spire](http://www.dsn.jhu.edu/spire)).

### Software Engineer

*LTN Global Communications*

**May 2014-August 2014**

*Savage, MD*

*Access-control system:* Played an important role in the design and implementation of a system for maintaining access-control rules for a global-scale multicast flow transport and delivery service. Code base was written in C using the TLS and DTLS protocols in OpenSSL.

*Log collection and processing:* Wrote Python scripts to automatically organize, compress, and collect logs from remote appliances across the globe.

### Research Assistant

*Johns Hopkins University Distributed Systems and Networks Lab*

**June 2012-April 2014**

*Baltimore, MD*

*MSE research, accelerated ring protocol:* Designed and implemented a new reliable, ordered multicast protocol based on a logical token ring, improving throughput on 1-gigabit and 10-gigabit local area networks by 30-50% and reducing latency by 20-35%. Implemented the protocol in the open-source Spread toolkit, where it was adopted as the default ordering protocol for data center environments ([www.spread.org](http://www.spread.org)).

## Publications and Products

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### Released Software

- **Spines overlay network platform**, co-creator

Yair Amir, Claudiu Danilov, John Schultz, Daniel Obenshain, Thomas Tantillo, and Amy Babay. First release February 2003, latest release November 2018 (creator since version 5.3, March 2018). A framework for deploying innovative networks to provide services not available on the native Internet and improve performance for existing services ([www.spines.org](http://www.spines.org)).

- **Spire intrusion-tolerant SCADA system for the power grid**, co-creator

Yair Amir, Trevor Aron, Amy Babay, and Thomas Tantillo. First release May 2017, latest release November 2018 (creator since version 1.0, May 2017). An intrusion-tolerant SCADA system with performance guarantees under attack. Successfully withstood a red-team attack conducted by Sandia National Laboratories at Pacific Northwest National Laboratory from March 27 to April 7, 2017. Demonstrated in a test-deployment at the Hawaiian Electric Company from January 22 to February 1, 2018. ([www.dsn.jhu.edu/spire](http://www.dsn.jhu.edu/spire)).

- **Prime intrusion-tolerant replication engine**, co-creator

Yair Amir, Jonathan Kirsch, John Lane, Marco Platania, Amy Babay, and Thomas Tantillo. First release June 2010, latest release November 2018 (creator since version 3.0, May 2017). An intrusion-tolerant replication engine. Implements the first Byzantine-fault-tolerant replication protocol with performance guarantees under attack. ([www.dsn.jhu.edu/prime](http://www.dsn.jhu.edu/prime)).

- **Spread toolkit**, major contributor

Yair Amir, Michal Miskin-Amir, Jonathan Stanton, and John Schultz. First release October 1997, latest release May 2018 (major contributor since version 4.4.0, May 2014). Group Communication toolkit providing reliable, high performance, resilient messaging for local and wide-area networks. ([www.spread.org](http://www.spread.org)).

## Journal Papers

- Amy Babay, Emily Wagner, Michael Dinitz, and Yair Amir, “Timely, Reliable, and Cost-Effective Internet Transport Service using Structured Overlay Networks” (in preparation).

## Refereed Conference Papers

- Amy Babay, John Schultz, Thomas Tantillo, Samuel Beckley, Eamon Jordan, Kevin Ruddell, Kevin Jordan, and Yair Amir, “Deploying Intrusion-Tolerant SCADA for the Power Grid” in *Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN)*, Portland, OR, June 2019. (Accepted).
- Amy Babay, Michael Dinitz, and Zeyu Zhang, “Characterizing Demand Graphs for (Fixed-Parameter) Shallow-Light Steiner Network” in *Proceedings of the 38<sup>th</sup> IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS)*, Ahmedabad, India, December 2018, pp. 33:1-33:22.
- Amy Babay\*, Thomas Tantillo\*, Trevor Aron, Marco Platania, and Yair Amir, “Network-Attack-Resilient Intrusion-Tolerant SCADA for the Power Grid” in *Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN)*, Luxembourg City, Luxembourg, June 2018, pp. 255-266.
- Amy Babay, Emily Wagner, Michael Dinitz, and Yair Amir, “Timely, Reliable, and Cost-Effective Internet Transport Service using Dissemination Graphs” in *Proceedings of the 37<sup>th</sup> IEEE*

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\* Equal contribution

*International Conference on Distributed Computing Systems (ICDCS)*, Atlanta, GA, June 2017, pp. 1-12. **Best paper.**

- Daniel Obenshain\*, Thomas Tantillo\*, Amy Babay, John Schultz, Andrew Newell, Md. Endadul Hoque, Yair Amir, and Cristina Nita-Rotaru, “Practical Intrusion-Tolerant Networks” in *Proceedings of the 36<sup>th</sup> IEEE International Conference on Distributed Computing Systems (ICDCS)*, Nara, Japan, June 2016, pp. 45-56.
- Amy Babay and Yair Amir, “Fast Total Ordering for Modern Data Centers” in *Proceedings of the 36<sup>th</sup> IEEE International Conference on Distributed Computing Systems (ICDCS)*, Nara, Japan, June 2016, pp. 669-679.

### **Invited Papers**

- Amy Babay, John Schultz, Thomas Tantillo, and Yair Amir, “Toward an Intrusion-Tolerant Power Grid: Challenges and Opportunities” in *Proceedings of the 38<sup>th</sup> IEEE International Conference on Distributed Computing Systems (ICDCS)*, Vienna, Austria, July 2018, pp. 1321-1326. (Vision Track).
- Amy Babay, Claudiu Danilov, John Lane, Michal Miskin-Amir, Daniel Obenshain, John Schultz, Jonathan Stanton, Thomas Tantillo, and Yair Amir, “Structured Overlay Networks for a New Generation of Internet Services” in *Proceedings of the 37<sup>th</sup> IEEE International Conference on Distributed Computing Systems (ICDCS)*, Atlanta, GA, June 2017, pp. 1771-1779. (Vision Track).

### **Posters and Student Forum Papers**

- Amy Babay, Emily Wagner, Michael Dinitz, and Yair Amir, “Timely, Reliable, and Cost-Effective Internet Transport Service using Dissemination Graphs”, *N2Women Workshop*, New York, NY, October 2016. (Poster).
- Amy Babay, “Timely, Reliable, and Cost-effective Transport Service Using Dissemination Graphs” in *IEEE/IFIP International Conference Dependable Systems and Networks (DSN)*, Rio de Janeiro, Brazil, June 2015. (Student Forum).
- Amy Babay and Yair Amir, “Fast Total Ordering for Modern Data Centers” in *Proceedings of the 35<sup>th</sup> IEEE International Conference on Distributed Computing Systems (ICDCS)*, Columbus, OH, June 2015, pp. 762-763. (Extended Abstract and Poster).

### **Patent Applications**

- Yair Amir, Amy Babay, and Thomas Tantillo, “Systems and Methods for Cloud-Based Control and Data Acquisition with Abstract State,” International Patent Application PCT/US18/15451, filed January 2018.
- Yair Amir, Amy Babay, and Thomas Tantillo, “Network-Attack-Resilient Intrusion-Tolerant SCADA Architecture,” International Patent Application PCT/US17/38565, filed June 2017.

## Mentoring

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- Edmund (Ned) Duhaime. MSE May 2017. Co-advised with Yair Amir. Study: “Seamless Overlays for Application Use.”
- Emily Wagner. MSE December 2016. Co-advised with Yair Amir. Project: “The Playback Network Simulator: Overlay Performance Simulations with Captured Data.”

## Teaching

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- **Co-Instructor**, Software for Resilient Communities **Spring 2018**  
*Johns Hopkins University*  
Co-taught and designed the new project-based undergraduate course. Students work in small teams to design and develop useful open-source software products that support our communities.
- **Co-Instructor**, Intermediate Programming (C/C++) **Fall 2017, Fall 2015, Spring 2014, Fall 2013**  
*Johns Hopkins University*  
Co-taught all aspects of the 60 – 90 student undergraduate course (divided into 30-student sections), including lectures, assignments, tests and grading. Worked with a team of course and teaching assistants to provide a hands-on interactive experience for students.
- **Special help**, Distributed Systems **Fall 2016, Fall 2014, Fall 2012**  
*Johns Hopkins University*  
Met with students to answer questions and review project designs, graded programming and theoretical assignments.
- **Undergraduate Course Assistant**, Intermediate Programming (C/C++) **Spring 2012**  
*Johns Hopkins University*  
Assisted students one-on-one during tutorials and graded programming assignments, providing individualized feedback based on careful code review.

## Talks

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- **Spire: Intrusion-Tolerant SCADA for the Power Grid**  
Army Corps of Engineers Webinar November 2018  
Army Engineer Association Seminar August 2018  
Northeastern University October 2017
- **Structured Overlay Networks for a New Generation of Internet Services**  
IFIP Working Group 10.4 July 2018
- **Network-Attack-Resilient Intrusion-Tolerant SCADA for the Power Grid**  
IEEE/IFIP DSN 2018 June 2018

- **Timely, Reliable, and Cost-Effective Internet Transport Service using Dissemination Graphs**

Virginia Tech	January 2018
Carnegie Mellon University	November 2017
Cornell University	November 2017
Princeton University	November 2017
Johns Hopkins University ACM	November 2017
IFIP Working Group 10.4	June 2017
IEEE ICDCS 2017	June 2017

- **Fast Total Ordering for Modern Data Centers**

IEEE ICDCS 2016	June 2016
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- **Timely, Reliable, and Cost-Effective Transport Service using Dissemination Graphs**

IEEE/IFIP DSN 2015, Student Forum	June 2015
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## **Funded External Grants**

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“AitF: EXPL: Wide-area Dissemination under Strict Reliability, Timeliness, and Cost Constraints,” National Science Foundation, September 2015 – August 2018, \$400,000. PI: Michael Dinitz, Co-PI: Yair Amir.