

Amy Babay

www.pitt.edu/~babay

814-528-4205

babay@pitt.edu

August 2022

Education

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

Academic Appointments

Assistant Professor

*University of Pittsburgh, School of Computing and Information
Department of Informatics and Networked Systems; Department of Computer Science*

August 2019-Present
Pittsburgh, PA

Director of the Resilient Systems and Societies Lab (RSSLab): www.rsslabs.io

Honors and Awards

- **Best Paper Runner Up** **June 2021**
IEEE/IFIP International Conference on Dependable Systems and Networks (DSN 2021)
For *Toward Intrusion Tolerance as a Service: Confidentiality in Partially Cloud-Based BFT Systems*, selected as one of the top 3 papers out of 295 submissions
- **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

Teaching

University of Pittsburgh

- **CS 2520/TELCOM 2321: Wide Area Networks** **Fall 2021, Fall 2022**
 Graduate course on wide-area computer networks, covering fundamentals and recent research results.
- **CS 1652: Data Communication and Computer Networks** **Spring 2022**
 Undergraduate course on computer networks.
- **INFSCI 1630/TELCOM 2310: Communication Networks** **Fall 2020, Spring 2021**
 Cross-listed undergraduate and graduate course on computer networks.
- **CS 3551: Advanced Topics in Distributed Information Systems** **Spring 2020**
 Graduate seminar course focusing on recent results in distributed systems research.
- **INFSCI 0017: Fundamentals of Object-Oriented Programming** **Fall 2019**
 Undergraduate course covering basic concepts of object-oriented programming using Java (first programming course for information science majors).

Johns Hopkins University

- **CS 310: Software for Resilient Communities** **Spring 2018**
Co-instructor and co-designer (with Yair Amir)
 New project-based undergraduate course. Students work in small teams to design and develop useful open-source software products that support our communities.
- **CS 220: Intermediate Programming (C/C++)** **Fall 2017, Fall 2015,
Spring 2014, Fall 2013**
Co-instructor (with Yair Amir)
 Undergraduate course covering intermediate programming in C and C++ (second programming course for computer science majors).

Publications and Products

Released Software

- [S-4] **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 December 2020 (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.spire-sys.org).
 Related publications: C-8, C-6, C-4, I-2, W-4, P-2, P-1

- [S-3] 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 December 2020 (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).
Related publications: C-4, C-3, C-1, I-1, W-3, W-2, T-2
- [S-2] 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 December 2020 (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).
Related publications: C-4
- [S-1] 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).
Related publications: C-2, W-1, T-1

Refereed Conference Papers

- [C-10] The Impact of COVID-19 on Communication Network Outages**
Farris Alotibi, Alekyhya Velagapudi, Kuheli Sai, Akshay Madan, Abhishek Viswanathan, Amy Babay, David Tipper, and Prashant Krishnamurthy, in *Proceedings of the 18th International Conference on the Design of Reliable Communication Networks (DRCN)*, Virtual Event, March 2022, pp. 1-8.
URL: <https://ieeexplore.ieee.org/abstract/document/9758011>
DOI: 10.1109/DRCN53993.2022.9758011
- [C-9] Controlling Epidemic Spread using Probabilistic Diffusion Models on Networks**
Amy Babay, Michael Dinitz, Aravind Srinivasan, Leonidas Tsepenekas, Anil Vullikanti, in *Proceedings of the 25th International Conference on Artificial Intelligence and Statistics (AISTATS)*, Virtual Event, March 2022, pp. 11641-11654.
URL: <https://proceedings.mlr.press/v151/babay22a.html>
- [C-8] Toward Intrusion Tolerance as a Service: Confidentiality in Partially Cloud-Based BFT Systems**
Maher Khan and Amy Babay, in *Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN)*, Virtual Event, June 2021, pp. 14-25. **Best paper runner up.** (One of top 3 papers out of 295 submissions)
URL: <https://ieeexplore.ieee.org/abstract/document/9505127>
DOI: 10.1109/DSN48987.2021.00019
- [C-7] Identifying Vulnerable Critical Infrastructure Zones in Smart Cities**
Abdulaziz Alqahtani, David Tipper, Katrina Kelly-Pitou and Amy Babay, in *Proceedings of the 16th International Conference on the Design of Reliable Communication Networks (DRCN)*, Milano, Italy, 2020, pp. 1-7.
URL: <https://ieeexplore.ieee.org/abstract/document/9089374>
DOI: 10.1109/DRCN48652.2020.1570613452

- [C-6] Deploying Intrusion-Tolerant SCADA for the Power Grid**
Amy Babay, John Schultz, Thomas Tantillo, Samuel Beckley, Eamon Jordan, Kevin Ruddell, Kevin Jordan, and Yair Amir, in *Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN)*, Portland, OR, June 2019, pp. 328-335.
URL: <https://ieeexplore.ieee.org/abstract/document/8809554>
DOI: 10.1109/DSN.2019.00043
- [C-5] Characterizing Demand Graphs for (Fixed-Parameter) Shallow-Light Steiner Network**
Amy Babay, Michael Dinitz, and Zeyu Zhang, in *Proceedings of the 38th IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS)*, Ahmedabad, India, December 2018, pp. 33:1-33:22.
URL: <https://drops.dagstuhl.de/opus/volltexte/2018/9932/>
DOI: 10.4230/LIPIcs.FSTTCS.2018.33
- [C-4] Network-Attack-Resilient Intrusion-Tolerant SCADA for the Power Grid**
Amy Babay, Thomas Tantillo, Trevor Aron, Marco Platania, and Yair Amir, in *Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN)*, Luxembourg City, Luxembourg, June 2018, pp. 255-266.
URL: <https://ieeexplore.ieee.org/abstract/document/8416488>
DOI: 10.1109/DSN.2018.00036
- [C-3] Timely, Reliable, and Cost-Effective Internet Transport Service using Dissemination Graphs**
Amy Babay, Emily Wagner, Michael Dinitz, and Yair Amir, in *Proceedings of the 37th IEEE International Conference on Distributed Computing Systems (ICDCS)*, Atlanta, GA, June 2017, pp. 1-12.
Best paper award. (Top 1 out of 531 submissions)
URL: <https://ieeexplore.ieee.org/abstract/document/7979950>
DOI: 10.1109/ICDCS.2017.63
- [C-2] Fast Total Ordering for Modern Data Centers**
Amy Babay and Yair Amir, in *Proceedings of the 36th IEEE International Conference on Distributed Computing Systems (ICDCS)*, Nara, Japan, June 2016, pp. 669-679.
URL: <https://ieeexplore.ieee.org/abstract/document/7536565>
DOI: 10.1109/ICDCS.2016.20
- [C-1] Practical Intrusion-Tolerant Networks**
Daniel Obenshain, Thomas Tantillo, Amy Babay, John Schultz, Andrew Newell, Md. Endadul Hoque, Yair Amir, and Cristina Nita-Rotaru, in *Proceedings of the 36th IEEE International Conference on Distributed Computing Systems (ICDCS)*, Nara, Japan, June 2016, pp. 45-56.
URL: <https://ieeexplore.ieee.org/abstract/document/7536504>
DOI: 10.1109/ICDCS.2016.99

Invited Papers

- [I-2] Toward an Intrusion-Tolerant Power Grid: Challenges and Opportunities**
Amy Babay, John Schultz, Thomas Tantillo, and Yair Amir, in *Proceedings of the 38th IEEE International Conference on Distributed Computing Systems (ICDCS)*, Vienna, Austria, July 2018, pp. 1321-1326. (Vision Track, Invited).
URL: <https://ieeexplore.ieee.org/abstract/document/8416395>
DOI: 10.1109/ICDCS.2018.00132

- [I-1] Structured Overlay Networks for a New Generation of Internet Services**
Amy Babay, Claudiu Danilov, John Lane, Michal Miskin-Amir, Daniel Obenshain, John Schultz, Jonathan Stanton, Thomas Tantillo, and Yair Amir, in *Proceedings of the 37th IEEE International Conference on Distributed Computing Systems (ICDCS)*, Atlanta, GA, June 2017, pp. 1771-1779. (Vision Track, Invited).

URL: <https://ieeexplore.ieee.org/abstract/document/7980115>

DOI: 10.1109/ICDCS.2017.119

Refereed Workshop Papers, Posters, and Student Forum Papers

- [W-4] Data-Centric Analysis of Compound Threats to Critical Infrastructure Control Systems**
Sahiti Bommareddy, Benjamin Gilby, Maher Khan, Imes Chiu, Mathaios Panteli, John W. van de Lindt, Linton Wells II, Yair Amir, and Amy Babay, in *52nd Annual IEEE/IFIP International Conference on Dependable Systems and Networks Workshops (DSN-W)*, Baltimore, MD, June 2022, pp. 72-79.

URL: <https://ieeexplore.ieee.org/abstract/document/9833853>

DOI: 10.1109/DSN-W54100.2022.00022

- [W-3] Timely, Reliable, and Cost-Effective Internet Transport Service using Dissemination Graphs**
Amy Babay, Emily Wagner, Michael Dinitz, and Yair Amir, *N2Women Workshop*, New York, NY, October 2016. (Poster).

- [W-2] Timely, Reliable, and Cost-effective Transport Service Using Dissemination Graphs**
Amy Babay, in *IEEE/IFIP International Conference Dependable Systems and Networks (DSN)*, Rio de Janeiro, Brazil, June 2015. (Student Forum).

- [W-1] Fast Total Ordering for Modern Data Centers**
Amy Babay and Yair Amir, in *Proceedings of the 35th IEEE International Conference on Distributed Computing Systems (ICDCS)*, Columbus, OH, June 2015, pp. 762-763. (Extended Abstract and Poster).

URL: <https://ieeexplore-ieee-org.pitt.idm.oclc.org/document/7164975>

DOI: 10.1109/ICDCS.2015.97

Theses

- [T-2] Timely, Reliable, and Cost-Effective Internet Transport Service using Structured Overlay Networks**

Amy Babay, PhD Thesis, Johns Hopkins University, September 2018.

URL: <https://jscholarship.library.jhu.edu/handle/1774.2/60095>

- [T-1] The Accelerated Ring Protocol: Ordered Multicast for Modern Data Centers**

Amy Babay, MSE Thesis, Johns Hopkins University, May 2014.

URL: <https://jscholarship.library.jhu.edu/handle/1774.2/37100>

Patents

- [P-2] Systems and Methods for Cloud-Based Control and Data Acquisition with Abstract State**
Yair Amir, Amy Babay, and Thomas Tantillo, US Patent 10990083 B2 (International Patent Application PCT/US18/15451), filed January 2018, issued April 27, 2021.

[P-1] Network-Attack-Resilient Intrusion-Tolerant SCADA Architecture

Yair Amir, Amy Babay, and Thomas Tantillo, US Patent US 11140221 B2 (International Patent Application PCT/US17/38565), filed June 2017, issued October 5, 2021.

Funding

University of Pittsburgh subcontract PI, with DoD PI Imes Chiu, on DoD/EPA/DOE Strategic Environmental Research and Development Program (SERDP, <https://www.serdp-estcp.org/>) grant “**Severe Impact Resilience: Framework for Adaptive Compound Threats**”, October 2020 – September 2023, \$1,715,040 (University of Pittsburgh contract \$515,614).

Co-PI, with PI Abhishek Viswanathan (PhD advisee) and Co-PI Rosta Farzan on University of Pittsburgh Year of Data and Society grant “**Enriching Citizen-Science data using context, feedback and community-oriented communication**”, October 2021 – October 2022, \$8,000.

Co-PI, with PI Adam Lee, and Co-PIs Jacob Biehl, Adriana Kovashka, Olga Kuchinskaya, Stephen Lee, Eleanor Mattern, on Pitt Cyber Accelerator Grant “**Sensing Infrastructure**”, March 2020 – March 2021, \$15,000.

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

Mentoring

PhD Advising

- Aren Alyahya. PhD in progress (enrolled 2022), Information Science, University of Pittsburgh.
- Huzaifah Nadeem. PhD in progress (enrolled 2022), Computer Science, University of Pittsburgh.
- Maher Khan. PhD in progress (enrolled 2018), Computer Science, University of Pittsburgh.
- Abhishek Viswanathan. PhD in progress (enrolled 2017), Information Science with a concentration in Telecommunications, University of Pittsburgh.

Research Project Advising

- Benjamin Gilby, SCI Summer Scholars Program, Externally Funded Research (Computer Science BS) **Summer 2021-Present**
- Shixiang Long (Information Science MS) **Summer 2021-Present**
- Ge Zeng (Computer Science BS) **Summer 2020-Summer 2022**
- Derrick Hicks, Externally Funded Research (Computer Science BS) **Summer 2022**
- Kyle Tissue, CS 2910 MS Project (Computer Science MS) **Spring 2022**
- Aren Alyahya, INFSCI 2950 Independent Study (Information Science MS) **Summer-Fall 2021**
- Manal Alshahrani, INFSCI 2950 Independent Study (Information Science MS) **Summer-Fall 2021**
- Vasco Xu (Computer Science BS) **Spring 2020-Summer 2021**
- Nicholas Pilotti, CS 1950 Capstone (Computer Science BS) **Summer 2021**
- Gerasimos Palaiopanos, CS 2002 Project (Computer Science PhD) **Spring 2021**

- Jian Liu, CS 2002 Project (Computer Science PhD) **Spring 2021**
- Maxwell Trdina, INFSCI 1730 Independent Study (Information Science BS) **Spring 2021**
- Ismael Alonso, CS 2910 MS Project (Computer Science MS) **Fall 2020**
- Erhu He, CS 2002 Project (Computer Science PhD) **Spring 2020**
“Power-Aware Operator Placement Based on Overlay Network”
- Edmund (Ned) Duhaime. MSE May 2017, Johns Hopkins University. Co-advised with Yair Amir. Study:
“Seamless Overlays for Application Use.”
- Emily Wagner. MSE December 2016, Johns Hopkins University. Co-advised with Yair Amir. Project:
“The Playback Network Simulator: Overlay Performance Simulations with Captured Data.”

Selected Talks

- **Severe Impact Resilience: Assessment Framework for Compound Threats**
DoD SERDP/ESTCP Symposium (Virtual) December 2021
- **Toward Intrusion-Tolerant Critical Infrastructure**
Cornell University, Systems Lunch October 2021
University of Pennsylvania, Distributed Systems Lab Seminar (Virtual) September 2021
- **Panel: Cybersecurity for Critical Infrastructure**
IEEE Conference on Communications and Network Security (CNS) (Virtual) October 2021
- **Panel: Residential, coastal, rural, urban, and cybersecurity resilience**
Texas Academy of Medicine, Engineering, Science & Technology (TAMEST) October 2021
Natural Hazards Summit (Virtual)
- **Spire: Intrusion-Tolerant SCADA for the Power Grid**
Electric Power Industry Conference (EPIC) October 2019
Army Corps of Engineers Webinar November 2018
Army Engineer Association Seminar August 2018

External Professional Service

- **Conference Organization**
Webmaster: IEEE/IFIP Int. Conference on Dependable Systems and Networks (DSN) 2022
Demo & Poster Co-Chair: IEEE Int. Symposium on Reliable Distributed Systems (SRDS) 2021
Publication Chair: ACM Internet Measurement Conference (IMC) 2020
Publicity Co-Chair: IEEE Int. Symposium on Reliable Distributed Systems (SRDS) 2020
- **Conference Program Committees**
IEEE/IFIP Int. Conference on Dependable Systems and Networks (DSN) 2021, 2022
IEEE Int. Symposium on Reliable Distributed Systems (SRDS) 2019, 2020, 2021, 2022
IEEE Int. Conference on the Design of Reliable Communication Networks (DRCN) 2020, 2021
IEEE/IFIP Int. Conference on Dependable Systems and Networks (DSN), Doctoral Forum 2020
IEEE Int. Conference on Distributed Computing Systems (ICDCS) 2020
- **Journal Reviews**
ACM Computing Surveys (CSUR) 2020
IEEE Transactions on Dependable and Secure Computing (TDSC) 2020, 2019

IEEE Transactions on Cloud Computing (TCC)

2020

- **Funding Agency Reviews**

National Science Foundation (NSF) Review Panel

2021

Additional Professional Experience

Partner

Spread Concepts LLC

July 2018-Present

Bethesda, MD

Bridging the gap between academic research and technologies and the commercial world.

Software Engineer

LTN Global Communications

May 2014-August 2014

Savage, MD

Worked on software development projects for a global-scale video flow transport and delivery service, including an access control system and a log management system.