

# 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

## Academic Appointments

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**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](http://www.rsslabs.io)

The RSSLab is a computer systems research group, with a focus on dependable infrastructure.

## Honors and Awards

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- **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**  
*Johns Hopkins University Cognitive Science Department*

May 2012

Awarded annually to a graduating Cognitive Science major for academic excellence and outstanding accomplishment in research

## Publications and Products

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*\* In author lists, students I have advised at the University of Pittsburgh appear in **bold**.*

### Released Software

- [S-4] **Spire intrusion-tolerant SCADA system for the power grid**, co-creator  
Yair Amir, Trevor Aron, Amy Babay, Thomas Tantillo, Sahiti Bommareddy, and **Maher Khan**.  
First release May 2017, latest release January 2023 (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](http://www.spire-sys.org)).  
Related publications: C-12, C-8, C-6, C-4, I-2, W-5, 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](http://www.spines.org)).  
Related publications: C-8, 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](http://www.dsn.jhu.edu/prime)).  
Related publications: C-8, 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](http://www.spread.org)).  
Related publications: C-2, W-1, T-1

### Journal Papers

- [J-2] **Availability Analysis of Multi-Connectivity for Providing URLLC**  
David Tipper, Prashant Krishnamurthy, and Amy Babay, IEEE Networking Letters, Early Access July 2023.  
URL: <https://ieeexplore.ieee.org/abstract/document/10185463>  
DOI: 10.1109/LNET.2023.3296350
- [J-1] **Spotting anomalous trades in NFT markets: The case of NBA Topshot**  
Konstantinos Pelechrinis, Xin Liu, Prashant Krishnamurthy, and Amy Babay, PLoS ONE 18(6): e0287262, June 2023.  
URL: <https://doi.org/10.1371/journal.pone.0287262>

## Refereed Conference Papers

- [C-12] **Making Intrusion Tolerance Accessible: A Cloud-Based Hybrid Management Approach to Deploying Resilient Systems**  
Maher Khan and Amy Babay, to appear in *Proceedings of the 42<sup>nd</sup> IEEE Symposium on Reliable Distributed Systems (SRDS)*, Marrakesh, Morocco, September 2023. (Accepted)
- [C-11] **A Resilience Assessment Framework for Coupled Power and Communication Infrastructure**  
Mohamed Lotfi, Mathaios Panteli, Linton Wells II, Kathryn Blackmond Laskey, John W. van de Lindt, Yair Amir, Amy Babay, Imes Chiu, in *Proceedings of the IEEE Power & Energy Society General Meeting (PESGM)*, Orlando, Florida, July 2023, pp. 1-5.  
URL: <https://ieeexplore.ieee.org/abstract/document/10252712>  
DOI: 10.1109/PESGM52003.2023.10252712
- [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 25<sup>th</sup> International Conference on Artificial Intelligence and Statistics (AISTATS)*, Virtual Event, March 2022, pp. 11641-11654. (29.2% acceptance rate)  
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, 16.3% overall acceptance rate)  
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. (21.4% acceptance rate)  
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 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. (35.8% acceptance rate)

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. (28% acceptance rate)

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 37<sup>th</sup> IEEE International Conference on Distributed Computing Systems (ICDCS)*, Atlanta, GA, June 2017, pp. 1-12. **Best paper award.** (Top 1 out of 531 submissions, 16.9% overall acceptance rate)

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 36<sup>th</sup> IEEE International Conference on Distributed Computing Systems (ICDCS)*, Nara, Japan, June 2016, pp. 669-679. (17.6% acceptance rate)

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 36<sup>th</sup> IEEE International Conference on Distributed Computing Systems (ICDCS)*, Nara, Japan, June 2016, pp. 45-56. (17.6% acceptance rate)

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 38<sup>th</sup> 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 37<sup>th</sup> 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-5] Real-Time Byzantine Resilient Power Grid Infrastructure: Evaluation and Trade-offs**

Sahiti Bommarreddy, **Maheer Khan**, David J Sebastian Cardenas, Carl Miller, Christopher Bonebrake, Yair Amir, and Amy Babay, in *1<sup>st</sup> International Workshop on Explainability of Real-time Systems and their Analysis (ERSA) at IEEE Real-Time Systems Symposium (RTSS)*, Houston, TX, December 2022.

- [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 *52<sup>nd</sup> 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 35<sup>th</sup> 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.

## Selected Talks

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- **Panel: Thriving and Engaged Communities**  
Southwest Pennsylvania Decarbonization Forum March 2023
- **Toward Intrusion-Tolerant Critical Infrastructure**  
Williams College, Computer Science Colloquium December 2022  
Cornell University, Systems Lunch October 2021  
University of Pennsylvania, Distributed Systems Lab Seminar (Virtual) September 2021
- **Severe Impact Resilience: Assessment Framework for Compound Threats**  
DoD SERDP/ESTCP Symposium (Virtual) December 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

## Teaching

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### University of Pittsburgh

- **TELCOM 2310: Applications of Networks** Fall 2023,  
Graduate introductory course on computer networks. Spring 2021
- **CS 2510: (Distributed) Computer Operating Systems** Spring 2023  
Graduate course on distributed systems, covering fundamentals and recent research results.
- **CS 2520/TELCOM 2321: Wide Area Networks** Fall 2022, Fall 2021  
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/Applications of Networks** Fall 2020  
Cross-listed undergraduate and graduate introductory 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).

## Mentoring

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### PhD Advising

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

### Research Project Advising

- Birju Patel, CS 2910 MS Project (Computer Science MS) **Summer 2023**
- Chao Shi (Information Science MS) **Summer 2022-Spring 2023**
- Wentao Wu, CS 1950 Capstone (Computer Science BS) **Fall 2022**
- Aaron Wu, CS 2910 MS Project (Computer Science MS) **Fall 2022**
- Shixiang Long (Information Science MS) **Summer 2021-Fall 2022**
- Benjamin Gilby, SCI Summer Scholars Program, Funded Research (Computer Science BS) **Summer 2021-Summer 2022**
- Ge Zeng (Computer Science BS) **Summer 2020-Summer 2022**
- Derrick Hicks, 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 Palaioanos, 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.”



## External Professional Service

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- **Conference and Workshop Organization**

<i>Program Committee Co-Chair: ApPLIED workshop at PODC</i>	2023
<i>Doctoral Forum Co-Chair: IEEE/IFIP Int. Conference on Dependable Systems and Networks (DSN)</i>	2023
<i>Travel Grants Committee: IEEE/IFIP Int. Conference on Dependable Systems and Networks (DSN)</i>	2023
<i>Webmaster: IEEE/IFIP Int. Conference on Dependable Systems and Networks (DSN)</i>	2022
<i>Demo &amp; Poster Co-Chair: IEEE Int. Symposium on Reliable Distributed Systems (SRDS)</i>	2021
<i>Publication Chair: ACM Internet Measurement Conference (IMC)</i>	2020
<i>Publicity Co-Chair: IEEE Int. Symposium on Reliable Distributed Systems (SRDS)</i>	2020

- **Conference Program Committees**

<i>IEEE/IFIP Int. Conference on Dependable Systems and Networks (DSN)</i>	2023, 2022, 2021
<i>IEEE/IFIP Int. Conference on Dependable Systems and Networks (DSN), Disrupt Track</i>	2023
<i>IEEE Int. Symposium on Reliable Distributed Systems (SRDS)</i>	2022, 2021, 2020, 2019
<i>IEEE Int. Conference on the Design of Reliable Communication Networks (DRCN)</i>	2020, 2021
<i>IEEE/IFIP Int. Conference on Dependable Systems and Networks (DSN), Doctoral Forum</i>	2020
<i>IEEE Int. Conference on Distributed Computing Systems (ICDCS)</i>	2020

- **Journal Reviews**

<i>IEEE Transactions on Parallel and Distributed Systems (TPDS)</i>	2023
<i>ACM Computing Surveys (CSUR)</i>	2020
<i>IEEE Transactions on Dependable and Secure Computing (TDSC)</i>	2020, 2019
<i>IEEE Transactions on Cloud Computing (TCC)</i>	2020

- **Funding Agency Reviews**

<i>National Science Foundation (NSF) Review Panel</i>	2021
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## Additional Professional Experience

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**Partner****July 2018-Present***Spread Concepts LLC**Bethesda, MD*

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

**Software Engineer****May 2014-August 2014***LTN Global Communications**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.