

# Stanford

---



## Philip Levis

Associate Professor of Computer Science and of Electrical Engineering

### CONTACT INFORMATION

- **Administrator**

Ann Harara - Administrative Associate

**Email** ann1083@stanford.edu

**Tel** (650) 725-1342

### Bio

---

#### BIO

Professor Levis' research focuses on the design and implementation of efficient software systems for embedded wireless sensor networks; embedded network sensor architecture and design; systems programming and software engineering.

#### ACADEMIC APPOINTMENTS

- Associate Professor, Computer Science
- Associate Professor, Electrical Engineering
- Affiliate, Precourt Institute for Energy

#### HONORS AND AWARDS

- Faculty Fellow, Microsoft (2008)

#### PROFESSIONAL EDUCATION

- PhD, UC Berkeley , Computer Science, Electrical Engineering (2005)

### Teaching

---

#### COURSES

##### 2021-22

- Computer Systems from the Ground Up: CS 107E (Aut)
- Embedded Systems Workshop: CS 241, EE 285 (Aut, Spr)
- Interactive Light Sculpture Project: EE 185 (Aut)
- Selected Reading of Computer Science Research: CS 114 (Spr)
- Selected Reading of Computer Science Research: CS 214 (Spr)

##### 2020-21

- Computer Systems from the Ground Up: CS 107E (Aut)

- Embedded Systems Workshop: EE 285 (Win)
- Selected Reading of Ph.D. Dissertations: CS 349G (Win)

#### 2019-20

- Computer Systems from the Ground Up: CS 107E (Spr)
- Embedded Systems Workshop: CS 241, EE 285 (Win, Spr)
- Interactive Light Sculpture Project: EE 185 (Aut, Win, Spr)
- Principles of Computer Systems: CS 110 (Aut)

## STANFORD ADVISEES

### Doctoral Dissertation Reader (AC)

Pratiksha Thaker

### Doctoral Dissertation Advisor (AC)

Hudson Ayers

### Master's Program Advisor

Minjune Hwang, Bingqi Sun, Matthew Trost, Yixing Wang, Dean Zhou

### Doctoral Dissertation Co-Advisor (AC)

Deepti Raghavan

### Doctoral (Program)

Hudson Ayers, Alex Bergman, Evan Laufer, Daniel Mendoza, Obi Nnorom Jr, Maxwell Strange

## Publications

---

### PUBLICATIONS

- **Towards Retina-Quality VR Video Streaming: 15 ms Could Save You 80% of Your Bandwidth** *ACM SIGCOMM COMPUTER COMMUNICATION REVIEW*  
Hsiao, L., Krajancich, B., Levis, P., Wetzstein, G., Winstein, K.  
2022; 52 (1): 11-19
- **Creating Hardware Component Knowledge Bases with Training Data Generation and Multi-task Learning** *ACM TRANSACTIONS ON EMBEDDED COMPUTING SYSTEMS*  
Hsiao, L., Wu, S., Chiang, N., Re, C., Levis, P.  
2020; 19 (6)
- **Accelerating Distributed Graphical Fluid Simulations with Micro-partitioning** *COMPUTER GRAPHICS FORUM*  
Qu, H., Mashayekhi, O., Shah, C., Levis, P.  
2020; 39 (1): 375–88
- **Learning in situ: a randomized experiment in video streaming**  
Yan, F. Y., Ayers, H., Zhu, C., Fouladi, S., Hong, J., Zhang, K., Levis, P., Winstein, K., USENIX Assoc  
USENIX ASSOC.2020: 495–511
- **POSH: A Data-Aware Shell**  
Raghavan, D., Fouladi, S., Levis, P., Zaharia, M., USENIX Assoc  
USENIX ASSOC.2020: 617-631
- **Design Considerations for Low Power Internet Protocols**  
Ayers, H., Crews, P., Teo, H., McAvity, C., Levy, A., Levis, P., IEEE  
IEEE COMPUTER SOC.2020: 103–11

- **Unsupervised Large-Scale Search for Similar Earthquake Signals** *BULLETIN OF THE SEISMOLOGICAL SOCIETY OF AMERICA*  
Yoon, C. E., Bergen, K. J., Rong, K., Elezabi, H., Ellsworth, W. L., Beroza, G. C., Bailis, P., Levis, P.  
2019; 109 (4): 1451–68
- **Falcon — A Flexible Architecture For Accelerating Cryptography** *2019 IEEE 16th International Conference on Mobile Ad Hoc and Sensor Systems (MASS)*  
Kinningham, K., Levis, P., Anderson, M., Boneh, D., Horowitz, M., Shih, M.  
2019
- **Challenge: Unlicensed LPWANs Are Not Yet the Path to Ubiquitous Connectivity**  
Ghena, B., Adkins, J., Shangguan, L., Jamieson, K., Levis, P., Dutta, P., Assoc Com Machinery  
ASSOC COMPUTING MACHINERY.2019
- **Automatically Distributing Eulerian and Hybrid Fluid Simulations in the Cloud** *ACM TRANSACTIONS ON GRAPHICS*  
Mashayekhi, O., Shah, C., Qu, H., Lim, A., Levis, P.  
2018; 37 (2)
- **Locality-Sensitive Hashing for Earthquake Detection: A Case Study of Scaling Data-Driven Science** *PROCEEDINGS OF THE VLDB ENDOWMENT*  
Rong, K., Yoon, C. E., Bergen, K. J., Elezabi, H., Bailis, P., Levis, P., Beroza, G. C.  
2018; 11 (11): 1674–87
- **Fonduer: Knowledge Base Construction from Richly Formatted Data.** *Proceedings. ACM-Sigmod International Conference on Management of Data*  
Wu, S., Hsiao, L., Cheng, X., Hancock, B., Rekatsinas, T., Levis, P., Re, C.  
2018; 2018: 1301–16
- **Poster Abstract: Design Considerations for Low Power Internet Protocols**  
Ayers, H., Crews, P., Teo, H., McAvity, C., Levy, A., Levis, P., Assoc Comp Machinery  
ASSOC COMPUTING MACHINERY.2018: 317–18
- **Smart Contracts for Machine-to-Machine Communication: Possibilities and Limitations**  
Hanada, Y., Hsiao, L., Levis, P., IEEE  
IEEE.2018: 130–36
- **Decoupling the Control Plane from Program Control Flow for Flexibility and Performance in Cloud Computing**  
Qu, H., Mashayekhi, O., Shah, C., Levis, P., Assoc Comp Machinery  
ASSOC COMPUTING MACHINERY.2018
- **Poster Abstract: Dynamic Multi-Clock Management for Embedded Systems**  
Chiang, H., Giffin, D., Levy, A., Levis, P., Assoc Comp Machinery  
ASSOC COMPUTING MACHINERY.2018: 347–48
- **Execution Templates: Caching Control Plane Decisions for Strong Scaling of Data Analytics**  
Mashayekhi, O., Qu, H., Shah, C., Levis, P., USENIX Assoc  
USENIX ASSOC.2017: 513–26
- **The Case for Writing a Kernel in Rust**  
Levy, A., Campbell, B., Ghena, B., Pannuto, P., Dutta, P., Levis, P., ACM  
ASSOC COMPUTING MACHINERY.2017
- **Ebb: A DSL for Physical Simulation on CPUs and GPUs** *ACM TRANSACTIONS ON GRAPHICS*  
Bernstein, G. L., Shah, C., Lemire, C., Devito, Z., Fisher, M., Levis, P., Hanrahan, P.  
2016; 35 (2)
- **Deflating link buffers in a wireless mesh network** *AD HOC NETWORKS*  
Jamshaid, K., Shihada, B., Showail, A., Levis, P.  
2014; 16: 266-280
- **Applications of Self-Interference Cancellation in 5G and Beyond** *IEEE COMMUNICATIONS MAGAZINE*  
Hong, S., Brand, J., Il Choi, J., Jain, M., Mehlman, J., Katti, S., Levis, P.  
2014; 52 (2): 114-121

- **CTP: An Efficient, Robust, and Reliable Collection Tree Protocol for Wireless Sensor Networks.** *In ACM Transactions on Sensor Networks (TOSN)*  
Gnawali, O., Fonseca, R., Jamieson, K., Kazandjieva, M., Moss, D., Levis, P.  
2014
- **CTP: An Efficient, Robust, and Reliable Collection Tree Protocol for Wireless Sensor Networks** *ACM TRANSACTIONS ON SENSOR NETWORKS*  
Gnawali, O., Fonseca, R., Jamieson, K., Kazandjieva, M., Moss, D., Levis, P.  
2013; 10 (1)
- **Measuring and analyzing the energy use of enterprise computing systems** *SUSTAINABLE COMPUTING-INFORMATICS & SYSTEMS*  
Kazandjieva, M., Heller, B., Gnawali, O., Levis, P., Kozyrakis, C.  
2013; 3 (3): 218-229
- **Long-term modification of cortical synapses improves sensory perception** *NATURE NEUROSCIENCE*  
Froemke, R. C., Carcea, I., Barker, A. J., Yuan, K., Seybold, B. A., Martins, A. R., Zaika, N., Bernstein, H., Wachs, M., Levis, P. A., Polley, D. B., Merzenich, M. M., Schreiner, et al  
2013; 16 (1): 79-U120
- **Measuring and Analyzing the Energy Use of Enterprise Computing Systems.** *In Journal of Sustainable Computing*  
Kazandjieva, M., Gnawali, O., Levis, P., Kozyrakis, C.  
2013
- **Green Enterprise Computing Data: Assumptions and Realities** *3rd International Green Computing Conference (IGCC)*  
Kazandjieva, M., Heller, B., Gnawali, O., Levis, P., Kozyrakis, C.  
IEEE.2012
- **A Scalable Server for 3D Metaverses.**  
Cheslack-Postava, E., Azim, T., Mistree, B., Horn, D., Terrace, J., Levis, P.  
2012
- **RFC 6719 - The Minimum Rank with Hysteresis Objective Function.** *In Internet Engineering Task Force (IETF), Request for Comments: 6719*  
Gnawali, O., Levis, P.  
2012
- **Unsupervised Conversion of 3D models for Interactive Metaverses.**  
Terrace, J., Cheslack-Postava, E., Levis, P., Freedman, M.  
2012
- **Experiences from a Decade of TinyOS Development.**  
Levis, P.  
2012
- **Beyond Full Duplex Wireless** *46th Asilomar Conference on Signals, Systems and Computers*  
Choi, J. I., Hong, S., Jain, M., Katti, S., Levis, P., Mehlman, J.  
IEEE.2012: 40-44
- **Connecting Low-Power and Lossy Networks to the Internet** *IEEE COMMUNICATIONS MAGAZINE*  
Ko, J., Terzis, A., Dawson-Haggerty, S., Culler, D. E., Hui, J. W., Levis, P.  
2011; 49 (4): 96-101
- **Measuring school contact networks using wireless sensor technology**  
Jones, J. H., Salathe, M., Feldman, M. W., KAZANDJIEVA, M., Lee, J. W., Levis, P.  
WILEY-BLACKWELL.2011: 263-63
- **Energy Management in Mobile Devices with the Cinder Operating System** *6th ACM EuroSys Conference on Computer Systems (EuroSys 2011)*  
Roy, A., Rumble, S. M., Stutsman, R., Levis, P., Mazieres, D., Zeldovich, N.  
ASSOC COMPUTING MACHINERY.2011: 139-152
- **Emerson: Accessible Scripting for Applications in an Extensible Virtual World.**  
Mistree, B., Chandra, B., Cheslack-Potava, E., Levis, P., Gay, D.  
2011

- **Practical, Real-time, Full-Duplex Wireless.**  
Jain, M., Choi, J. I., Kim, T., Bharadia, D., Seth, S., Srinivasan, K., Levis, P. A.  
2011
- **Buffer Sizing in Wireless Mesh Networks.**  
Jamshaid, K., Shihada, B., Xia, L., Levis, P.  
2011
- **A high-resolution human contact network for infectious disease transmission** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Salathe, M., Kazandjieva, M., Lee, J. W., Levis, P., Feldman, M. W., Jones, J. H.  
2010; 107 (51): 22020-22025
- **Physically-based models of low-power wireless links using signal power simulation** *COMPUTER NETWORKS*  
Rusak, T., Levis, P.  
2010; 54 (4): 658-673
- **An Empirical Study of Low-Power Wireless** *ACM TRANSACTIONS ON SENSOR NETWORKS*  
Srinivasan, K., Dutta, P., Tavakoli, A., Levis, P.  
2010; 6 (2)
- **Apprehending Joule Thieves with Cinder** *COMPUTER COMMUNICATION REVIEW*  
Rumble, S. M., Stutsman, R., Levis, P., Mazieres, D., Zeldovich, N.  
2010; 40 (1): 106-111
- **Achieving Single Channel, Full Duplex Wireless Communication** *16th Annual International Conference on Mobile Computing and Networking / 11th ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiCom/MobiHoc)*  
Choi, J. I., Jain, M., Srinivasan, K., Levis, P., Katti, S.  
ASSOC COMPUTING MACHINERY.2010: 1–12
- **The kappa Factor: Inferring Protocol Performance Using Inter-link Reception Correlation** *16th Annual International Conference on Mobile Computing and Networking / 11th ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiCom/MobiHoc)*  
Srinivasan, K., Jain, M., Cho, J. I., Azim, T., Kim, E. S., Levis, P., Krishnamachari, B.  
ASSOC COMPUTING MACHINERY.2010: 317–328
- **Achieving Single Channel, Full Duplex Wireless Communication.**  
Choi, J. I., Jain, M., Srinivasan, K., Levis, P., Katti, S.  
2010
- **Emerson: Scripting for Federated Virtual Worlds.**  
Chandra, B., Cheslack-Postava, E., Mistree, B., Levis, P., Gay, D.  
2010
- **Experiences in Measuring a Human Contact Network for Epidemiology Research.**  
Kazandjieva, M., Lee, J. W., Salathe, M., Feldman, M. W., Jones, J. H., Levis, P.  
2010
- **A Case for Evaluating Sensor Network Protocols Concurrently.**  
Gnawali, O., Guibas, L., Levis, P.  
2010
- **Granting Silence to Avoid Wireless Collisions.**  
Choi, J. I., Jain, M., Kazandjieva, M. A., Levis, P.  
2010
- **Whirlpool Routing for Mobility.**  
Lee, J. W., Kusy, B., Azim, T., Levis, P., Shihada, B.  
2010
- **The k-factor: Inferring Protocol Performance Using Inter-Link Reception Correlation.**

- 
- Srinivasan, K., Jain, M., Choi, J. I., Azim, T., Kim, E. S., Levis, P.  
2010
- **Scaling Virtual Worlds with a Physical Metaphor** *IEEE PERVASIVE COMPUTING*  
Horn, D., Cheslack-Postava, E., Azim, T., Freedman, M. J., Levis, P.  
2009; 8 (3): 50-54
  - **Surviving Sensor Network Software Faults** *22nd ACM SIGOPS Symposium on Operating Systems Principles*  
Chen, Y., Gnawali, O., Kazandjieva, M., Levis, P., Regehr, J.  
ASSOC COMPUTING MACHINERY.2009: 235-246
  - **The Case for a Network Protocol Isolation Layer** *7th ACM Conference on Embedded Networked Sensor Systems (SENSYS)*  
Choi, J. I., Kazandjieva, M. A., Jain, M., Levis, P.  
ASSOC COMPUTING MACHINERY.2009: 267-280
  - **Collection Tree Protocol** *7th ACM Conference on Embedded Networked Sensor Systems (SENSYS)*  
Gnawali, O., Fonseca, R., Jamieson, K., Moss, D., Levis, P.  
ASSOC COMPUTING MACHINERY.2009: 1-14
  - **Energy Dumpster Diving.** *In Second Workshop on Power Aware Computing (HotPower)*  
Kazandjieva, M., Heller, B., Levis, P., Kozyrakis, C.  
2009
  - **Burstiness and scaling in the structure of low-power wireless links.** *In ACM SIGMOBILE Mobile Computing and Communications Review*  
Rusak, T., Levis, P.  
2009
  - **TOSThreads: Thread-safe and Non-invasive Preemption in TinyOS** *7th ACM Conference on Embedded Networked Sensor Systems (SENSYS)*  
Klues, K., Liang, C. M., Paek, J., Musaloiu-E, R., Levis, P., Terzis, A., Govindan, R.  
ASSOC COMPUTING MACHINERY.2009: 127-140
  - **The Case for a Network Protocol Isolation Layer.**  
Choi, J. I., Kazandjieva, M., Jain, M., Levis, P.  
2009
  - **TOSThreads: Thread-Safe and Non-Invasive Preemption in TinyOS.**  
Klues, K., Liang, C. M., Paek, J., Razvan, M., Levis, P., Terzis, A.  
2009
  - **Collection Tree Protocol.**  
Gnawali, O., Fonseca, R., Jamieson, K., Moss, D., Levis, P.  
2009
  - **SWAT: Know Your Network** *8th International Symposium on Information Processing Sensor Networks*  
Srinivasan, K., Kazandjieva, M. A., Jain, M., Kim, E., Levis, P.  
IEEE.2009: 431-432
  - **Starburst SSD: An Efficient Protocol for Selective Dissemination** *IEEE International Conference on Communications (ICC 2009)*  
Azim, T., Mansoor, Q., Levis, P.  
IEEE.2009: 74-79
  - **Apprehending Joule Thieves with Cinder** *1st ACM Workshop on Networking, Systems, and Applications for Mobile Handhelds*  
Rumble, S. M., Stutsman, R., Levis, P., Mazieres, D., Zeldovich, N.  
ASSOC COMPUTING MACHINERY.2009: 49-54
  - **Mesh networking - Research and technology for multihop wireless networks** *IEEE INTERNET COMPUTING*  
Madden, S., Levis, P.  
2008; 12 (4): 9-11
  - **The emergence of a networking primitive in wireless sensor networks** *COMMUNICATIONS OF THE ACM*  
Levis, P., Brewer, E., Culler, D., Gay, D., Madden, S., Patel, N., Polastre, J., Shenker, S., Szewczyk, R., Woo, A.

2008; 51 (7): 99-106

- **Investigating a Physically-Based Signal Power Model for Robust Low Power Wireless Link Simulation** *11th ACM International Conference on Modeling, Analysis and Simulation of Wireless and Mobile Systems*  
Rusak, T., Levis, P.  
ASSOC COMPUTING MACHINERY.2008: 37-46
- **Quanto: Tracking Energy in Networked Embedded Systems.**  
Fonseca, R., Dutta, P., Levis, P., Stoica, I.  
2008
- **SWAT: Enabling Wireless Network Measurements** *6th ACM Conference on Embedded Networked Sensor Systems*  
Srinivasan, K., Kazandjieva, M. A., Jain, M., Kim, E., Levis, P.  
ASSOC COMPUTING MACHINERY.2008: 395-396
- **The beta-factor: Measuring Wireless Link Burstiness** *6th ACM Conference on Embedded Networked Sensor Systems*  
Srinivasan, K., Kazandjieva, M. A., Agarwal, S., Levis, P.  
ASSOC COMPUTING MACHINERY.2008: 29-41
- **Data discovery and dissemination with DIP** *7th International Symposium on Information Processing Sensor Networks*  
Lin, K., Levis, P.  
IEEE COMPUTER SOC.2008: 433-444
- **On the Scaling Properties of Low Power Wireless Links** *6th ACM Conference on Embedded Networked Sensor Systems*  
Rusak, T., Levis, P.  
ASSOC COMPUTING MACHINERY.2008: 441-442
- **Software design patterns for TinyOS** *Conference on Languages, Compilers and Tools for Embedded Systems*  
Gay, D., Levis, P., Culler, D.  
ASSOC COMPUTING MACHINERY.2007
- **Four-Bit Wireless Link Estimation.**  
Fonseca, R., Gnawali, O., Jamieson, K., Levis, P.  
2007
- **Integrating Concurrency Control and Energy Management in Device Drivers.**  
Klues, K., Handziski, V., Lu, C., Wolisz, A., Culler, D., Gay, D., Levis, P. A.  
2007
- **Opening the Sensornet Black Box.**  
Choi, J. I., Lee, J. W., Wachs, M., Levis, P.  
2007
- **Flush: A Reliable Bulk Transport Protocol for Multihop Wireless Networks** *5th ACM Conference on Embedded Networked Sensor Systems*  
Kim, S., Fonseca, R., Dutta, P., Tavakoli, A., Culler, D., Levis, P., Shenker, S., Stoica, I.  
ASSOC COMPUTING MACHINERY.2007: 351-365
- **Visibility: A New Metric For Protocol Design** *5th ACM Conference on Embedded Networked Sensor Systems*  
Wachs, M., Il Choi, J., Lee, J. W., Srinivasan, K., Chen, Z., Jain, M., Levis, P.  
ASSOC COMPUTING MACHINERY.2007: 73-86
- **The Design and Implementation of a Declarative Sensor Network System** *5th ACM Conference on Embedded Networked Sensor Systems*  
Chu, D., Popa, L., Tavakoli, A., Hellerstein, J. M., Levis, P., Shenker, S., Stoica, I.  
ASSOC COMPUTING MACHINERY.2007: 175-188
- **Improving wireless simulation through noise modeling** *6th International Symposium on Information Processing Sensor Networks*  
Lee, H., Cerpa, A., Levis, P.  
ASSOC COMPUTING MACHINERY.2007: 21-30
- **Interface contracts for TinyOS** *6th International Symposium on Information Processing Sensor Networks*  
Archer, W., Levis, P., Regehr, J.

---

ASSOC COMPUTING MACHINERY.2007: 158–165

- **Fair Waiting Protocol: Achieving Isolation in Wireless Sensornets** *5th ACM Conference on Embedded Networked Sensor Systems*  
Il Choi, J., Lee, J. W., Chen, Z., Levis, P.  
ASSOC COMPUTING MACHINERY.2007: 411–412
- **RSSI Is Under-Appreciated.**  
Srinivasan, K., Levis, P.  
2006
- **Some Implications of Low-Power Wireless to IP Routing.**  
Srinivasan, K., Dutta, P., Tavakoli, A., Levis, P.  
2006
- **Software design patterns for TinyOS** *Conference on Languages, Compilers and Tools for Embedded Systems*  
Gay, D., Levis, P., Culler, D.  
ASSOC COMPUTING MACHINERY.2005: 40–49
- **Active sensor networks** *2nd Symposium on Networked Systems Design and Implementation (NSDI 05)*  
Levis, P., Gay, D., Culler, D.  
USENIX ASSOC.2005: 343–356
- **A Unifying Link Abstraction for Wireless Sensor Networks.**  
Polastre, J., Hui, J., Levis, P., Zhao, J., Culler, D., Shenker, S.  
2005
- **Towards a Sensor Network Architecture: Lowering the Waistline.**  
Culler, D., Dutta, P., Eee, C. T., Fonseca, R., Hui, J., Levis, P.  
2005
- **Trickle: A self-regulating algorithm for code propagation and maintenance in wireless sensor networks** *1st Symposium on Networked Systems Design and Implementation*  
Levis, P., Patel, N., Culler, D., Shenker, S.  
USENIX ASSOC.2004: 15–28
- **The Firecracker Protocol.**  
Levis, P., Culler, D.  
2004
- **The emergence of networking abstractions and techniques in TinyOS** *1st Symposium on Networked Systems Design and Implementation*  
Levis, P., Madden, S., Gay, D., Polastre, J., Szewczyk, R., Woo, A., Brewer, E., Culler, D.  
USENIX ASSOC.2004: 1–14
- **The nesC language: A holistic approach to networked embedded systems** *Conference on Programming Language Design and Implementation*  
Gay, D., Levis, P., von Behren, R., Welsh, M., Brewer, E., Culler, D.  
ASSOC COMPUTING MACHINERY.2003: 1–11
- **TOSSIM: Accurate and Scalable Simulation of Entire TinyOS Applications.**  
Levis, P., Lee, N., Welsh, M., Culler, D.  
2003
- **Mate: A tiny virtual machine for sensor networks** *ACM SIGPLAN NOTICES*  
Levis, P., Culler, D.  
2002; 37 (10): 85-95
- **Mate: A Tiny Virtual Machine for Sensor Networks.**  
Levis, P., Culler, D.  
2002
- **Policies for Dynamic Clock Scheduling.**  
Grunwald, D., Levis, P., Morrey III, Charles, B., Neufeld, M.



2000