

Arpan Gujarati

Assistant Professor, CS, UBC, Vancouver

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Education

- 2014–2020 **Ph.D. in Computer Science (*Summa Cum Laude*)**
Max Planck Institute for Software Systems (MPI-SWS), Saarbrücken/Kaiserslautern, Germany
and Technical University of Kaiserslautern (TU-KL), Kaiserslautern, Germany
Advisor: Björn B. Brandenburg (tenured faculty, head of the Real-Time Systems Group, MPI-SWS)
Thesis: *Towards “Ultra-Reliable” CPS: Reliability Analysis of Distributed Real-Time Systems*
(submitted in December 2019, defended in October 2020)
- 2012–2014 **Preparatory Phase (Graduate Coursework)**
Max Planck Institute for Software Systems (MPI-SWS), Saarbrücken/Kaiserslautern, Germany
and Saarland University (UdS), Saarbrücken, Germany
- 2007–2011 **B.E. (Hons.) in Computer Science**
Birla Institute of Technology and Science (BITS), Pilani, India

Work Experience

- 2023– **Tenure-Track Assistant Professor**
Computer Science Department, University of British Columbia (UBC), Vancouver, Canada
Focus areas: Cyber-physical systems, real-time systems, distributed systems
- 2021–2023 **Research Associate**
Computer Science Department, University of British Columbia (UBC), Vancouver, Canada
Manager: Margo Seltzer
Focus areas: Securing industrial cyber-physical systems like robotic arms; specifically, self-driving laboratories in the Hein Lab in the Chemistry department at UBC
- 2022 **Sessional Lecturer (six months)**
Electrical and Computer Engineering Dept., University of British Columbia (UBC), Vancouver, Canada
Focus areas: Teaching Real-Time System Design (CPEN 432)
- 2020–2021 **Postdoctoral Researcher**
Max Planck Institute for Software Systems (MPI-SWS), Saarbrücken/Kaiserslautern, Germany
Advisor: Jonathan Mace
Focus areas: Building efficient systems for deep neural network inference serving in cloud
- 2020 **Visiting International Research Student (VIRS) (one month)**
Electrical and Computer Engineering Dept., University of British Columbia (UBC), Vancouver, Canada
Hosts: Sathish Gopalakrishnan and Karthik Pattabiraman
Focus areas: Building reliable machine learning frameworks for resilient intelligence at the edge
- 2012–2019 **Graduate Research Assistant**
Max Planck Institute for Software Systems (MPI-SWS), Saarbrücken/Kaiserslautern, Germany
Advisor: Björn B. Brandenburg
Focus areas: Scheduling and fault-tolerance in real-time systems

- 2015 **Research Intern (three months)**
 Microsoft Research, Redmond, WA, USA
 Mentors: Kathryn S. McKinley, Sameh Elnikety, Yuxiong He
 Focus areas: Distributed autoscaling of machine learning inference services
- 2011–2012 **Software Development Engineer**
 Cloud Networking Group, Citrix R&D, Bengaluru, India
 Manager: Sanjay Gupta
 Focus areas: Management Service VM for the Xen Server
- 2011 **Software Development Intern (six months)**
 Visual and Parallel Computing Group, Intel, Bengaluru, India
 Team: Display Features and Miniport
 Focus areas: Prototype code optimizations for kernel-mode graphics drivers

Honors and Awards

- Dagstuhl '23 **Invited to attend Dagstuhl seminar 23341**
 on Functionally Safe Multi-Core Systems
- RTSS '22 **Best Paper Award**
 43rd IEEE Real-Time Systems Symposium
- QRS '21 **Best Paper Award**
 21st IEEE International Conference on Software, Quality, Reliability, and Security
- SIGBED '21 **Paul Caspi Memorial Dissertation Award**
 ACM Special Interest Group on Embedded Systems
- SYSTOR '21 **Distinguished Reviewer Award**
 14th ACM International System and Storage Conference
- OSDI '20 **Distinguished Artifact Award**
 14th USENIX Symposium on Operating Systems Design and Implementation
- RTAS '20 **Distinguished Paper Award**
 26th IEEE Real-Time and Embedded Technology and Applications Symposium
- ECRTS '18 **Best Presentation Award**
 30th Euromicro Conference on Real-Time Systems
- Middleware '17 **Best Student Paper Award**
 18th ACM/IFIP/USENIX International Middleware Conference
- HLF '14 **Young Researcher**
 2nd Heidelberg Laureate Forum
- ECRTS '13 **Outstanding Paper Award**
 25th Euromicro Conference on Real-Time Systems

Research Grants Applications

- UBC GCRC **SCy-Phy: Security for Cyber Physical Systems**
 Funding opportunity: UBC's Grants for Catalyzing Research Clusters (2022/23 Competition)
 Co-applicants: Margo Seltzer (primary applicant), Thomas Pasquier, Mathias Lecuyer, and Aastha Mehta (UBC CS), Jason Hein (UBC Chem), and Robert Rohling (UBC ECE)
 Result: Rejected

GM Timing Analysis for Pub-Sub Communication Architecture

Funding opportunity: 120,000 USD grant from General Motors for research collaboration (2021/22)
Co-applicant: Prachi Joshi (General Motors)
Result: The company agreed to fund the proposal; we failed to secure the funding because UBC's University-Industry Liason Office took several weeks to respond.

NVIDIA Secure, Scalable, and Predictable ML Inference Serving at the Edge

Funding opportunity: NVIDIA Academic Hardware Grant Program (2021)
Co-applicant: Aastha Mehta (UBC CS)
Result: Rejected

Advising & Mentoring

2023 Adarsh Govindan (UBC Engineering Physics)

Summer co-op: *Engineering a BFT Fault-Tolerant Inverted Pendulum*

2021-2023 Zainab Wattoo (UBC CS)

Masters thesis: *Intrusion Detection for Self-Driving Laboratories* (co-advising with Margo Seltzer)

2021-2022 Ningfeng Yang (UBC ECE)

Undergraduate research assistant: *Interactive Consistency for Distributed Real-Time Systems*

2017-2018 Malte Appel (UdS)

Undergraduate thesis: *A BFT Key-Value Store for Safety-Critical Distributed Real-Time Systems*

2016 Rohith R (BITS Pilani)

Summer internship: *An Empirical Evaluation of the Temporal Behavior of Linux's CFS Scheduler*

2015 Akshay Aggarwal (IIT Kanpur)

Summer internship: *An Analysis of CAN in the Presence of Host and Network Faults*

Teaching

(all courses were one semester long, i.e., roughly four months each)

2022 Sessional Lecturer, Real-Time System Design (CPEN 432), Department of Electrical and Computer Engineering, University of British Columbia

Class size: 18, classes: two lectures and one tutorial per week, overall Student Experience of Instruction score: 4.9/5, student level: upper undergrad

2017 Teaching Assistant, Operating Systems, MPI-SWS and Saarland University

2016 Teaching Assistant, Distributed Systems, MPI-SWS and Saarland University

2014 Teaching Assistant, Foundations of Cyber-Physical Systems, MPI-SWS and TU-KL

2010 Teaching Assistant, Data Structures and Algorithms, BITS Pilani

Professional Activities

Technical Program Committee

ECRTS Euromicro Conference on Real-Time Systems (2023)

Middleware International Middleware Conference (2023)

RTAS Real-Time and Embedded Technology and Applications Symposium (2022)

RTSS Real-Time Systems Symposium (2021, 2022, 2023)

SYSTOR International Systems and Storage Conference (2021, 2022)

ICDCS International Conference on Distributed Computing Systems (2021)

Journal Reviewer

- RTS Real-Time Systems: The International Journal of Time-Critical Computing Systems (2022)
- JSys Journal of Systems Research (2021, 2023)
- TECS ACM Transactions on Embedded Computing Systems (2019, 2020)
- TDSC IEEE Transactions on Dependable and Secure Computing (2019)

Invited Talks

- 2023 **Achal and Clockwork: A Tale of Two Predictable Systems**
University of British Columbia. Host: Mark Greenstreet
Simon Fraser University. Host: Yasutaka Furukawa
University of Sydney. Host: Joachim Gudmundsson
Boston University. Host: Renato Mancuso
TU Delft. Host: Lydia Chen
University of Waterloo. Host: Mahesh Tripunitra
Institute of Science and Technology Austria. Host: Lefteris Kokoris-Kogias
- 2020, 2022 **Serving DNNs like Clockwork: Performance Predictability from the Bottom Up**
Real-time And intelliGent Edge computing workshop (RAGE), co-located with DAC 2022
Brown University. Host: Malte Schwarzkopf
- 2019-2020 **Towards “Ultra-Reliable” CPS: Reliability Analysis of Distributed Real-Time Systems**
George Mason University. Host: Hakan Aydin
Washington University at St. Louis. Host: Sanjoy Baruah
Oregon State University. Host: Rakesh Bobba
IMDEA Software Institute. Host: Manuel Hermenegildo
George Washington University. Host: Gabriel Parmer
University of Pennsylvania. Host: Linh Thi Xuan Phan

Peer-Reviewed Publications

Conference Publications

- RTSS '22 **In-ConcReTeS: Interactive Consistency meets Distributed Real-Time Systems, Again!**
Arpan Gujarati, Ningfeng Yang, and Björn B. Brandenburg
43rd IEEE Real-Time Systems Symposium, Houston, USA
- DSN '22 **Arming IDS Researchers with a Robotic Arm Dataset**
Arpan Gujarati, Zainab Saeed Wattoo, Maryam Aliabadi, Sean Clark, Xiaoman Liu, Parisa Shiri, Amee Trivedi, Ruizhe Zhu, Jason Hein, and Margo Seltzer
52nd IEEE/IFIP International Conference on Dependable Systems and Networks, Baltimore, USA
- DSN '22 **The Fault in Our Data Stars: Studying Mitigation Techniques against Faulty Training Data in ML Applications**
Abraham Chan, Arpan Gujarati, Karthik Pattabiraman, and Sathish Gopalakrishnan
52nd IEEE/IFIP International Conference on Dependable Systems and Networks, Baltimore, USA
- QRS '21 **Understanding the Resilience of Neural Network Ensembles against Faulty Training Data**
Abraham Chan, Niranjana Narayanan, Arpan Gujarati, Karthik Pattabiraman, and Sathish Gopalakrishnan
21st IEEE International Conference on Software, Quality, Reliability, and Security

- OSDI '20 **Serving DNNs like Clockwork: Performance Predictability from the Bottom Up**
 Arpan Gujarati, Reza Karimi, Safya Alzayat, Wei Hao, Antoine Kaufmann, Ymir Vigfusson, and Jonathan Mace
 14th USENIX Symposium on Operating Systems Design and Implementation
- RTAS '20 **Real-Time Replica Consistency over Ethernet with Reliability Bounds**
 Arpan Gujarati, Sergey Bozhko, and Björn B. Brandenburg
 26th IEEE Real-Time and Embedded Technology and Applications Symposium
- ECRTS '19 **From Iteration to System Failure: Characterizing the FITness of Periodic Weakly-Hard Systems**
 Arpan Gujarati, Mitra Nasri, Rupak Majumdar, and Björn B. Brandenburg
 31th Euromicro Conference on Real-Time Systems, Stuttgart, Germany
- ECRTS '18 **Quantifying the Resiliency of Fail-Operational Real-Time Networked Control Systems**
 Arpan Gujarati, Mitra Nasri, and Björn B. Brandenburg
 30th Euromicro Conference on Real-Time Systems, Barcelona, Spain
- EuroSys '18 **Tableau: A High-Throughput and Predictable VM Scheduler for High-Density Workloads**
 Manohar Vanga, Arpan Gujarati, and Björn B. Brandenburg
 13th European Conference on Computer Systems, Porto, Portugal
- Middleware '17 **Swayam: Distributed Autoscaling to Meet SLAs of Machine Learning Inference Services with Resource Efficiency**
 Arpan Gujarati, Sameh Elnikety, Yuxiong He, Kathryn S. McKinley, and Björn B. Brandenburg
 18th ACM/IFIP/USENIX International Middleware Conference, Las Vegas, USA
- RTSS '15 **When is CAN the Weakest Link? A Bound on Failures-In-Time in CAN-Based Real-Time Systems**
 Arpan Gujarati and Björn B. Brandenburg
 36th IEEE Real-Time Systems Symposium, San Antonio, USA
- RTSS '14 **Linux's Processor Affinity API, Refined: Shifting Real-Time Tasks towards Higher Schedulability**
 Felipe Cerqueira, Arpan Gujarati, and Björn B. Brandenburg
 35th IEEE Real-Time Systems Symposium, Rome, Italy
- ECRTS '13 **Schedulability Analysis of the Linux Push and Pull Scheduler with Arbitrary Processor Affinities**
 Arpan Gujarati, Felipe Cerqueira, and Björn B. Brandenburg
 25th Euromicro Conference on Real-Time Systems, Paris, France
- [Journal Publications](#)
- RTS '18 **Correspondence Article: A Correction of the Reduction-Based Schedulability Analysis for APA Scheduling**
 Arpan Gujarati, Felipe Cerqueira, Björn B. Brandenburg, and Geoffrey Nelissen
 Real-Time Systems, August 2018
- RTS '15 **Multiprocessor Real-Time Scheduling with Arbitrary Processor Affinities: From Practice to Theory**
 Arpan Gujarati, Felipe Cerqueira, and Björn B. Brandenburg
 Real-Time Systems, Volume 51, Issue 4, pp. 440–483. Springer Verlag, 2015

Workshop Publications

WoSoCER '20 **New Wine in an Old Bottle: N-Version Programming for Machine Learning Components**

Arpan Gujarati, Sathish Gopalakrishnan, and Karthik Pattabiraman,
10th IEEE International Workshop on Software Certification

CERTS '18 **Using Schedule-Abstraction Graphs for the Analysis of CAN Message Response Times**

Mitra Nasri, Arpan Gujarati, and Björn B. Brandenburg
3rd Workshop on Security and Dependability of Critical Embedded Real-Time Systems, Luxembourg