

Annus Zulfiqar

Graduate Student and Research Assistant,
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EDUCATION

University of Michigan

Ph.D. in Computer Science & Engineering
Dissertation: Rearchitecting the End Host Network for the Terabit Per Second Era
Advisor: Muhammad Shahbaz

Ann Arbor, MI
Sep 2021 - Present

National University of Sciences and Technology (NUST)

Bachelor of Electrical Engineering
Thesis: Forest Cover Detection and Change Estimation using Deep Learning
Advisors: Muhammad Shahzad, Faisal Shafait

Islamabad, PK
Sep 2015 - May 2019

HONORS AND AWARDS

- Broadcom Research Award for Celeris, CAL 2025 2025
- Selected as mentor for P4 Language Consortium, Google Summer of Code (GSoC) 2025
- Distinguished Artifact Award for Homunculus, ASPLOS 2023 2023
- Conference travel grants: ASPLOS 2022, SIGCOMM 2022, NSDI 2025, SIGCOMM 2025 2022-25
- Ross Fellowship at Purdue University 2021
- National P@SHA Information and Communication Technology (ICT) Award Winner, Pakistan 2021
- Travel award for graduate EEcamp at KAIST, South Korea 2018
- One-year internship offered at DFKI, Kaiserslautern, Germany (passed) 2018
- DAAD-funded internship at Technical University of Kaiserslautern (TUK), Germany 2018
- NUST merit scholarship for top academic performance (4.00/4.00 GPA) 2015-19

PUBLICATIONS

Conference Papers

NSDI. Murayyiam Parvez*, Annus Zulfiqar*, Sylee Beltiukov, Shir Landau-Feibish, Arpit Gupta, Walter Willinger, and Muhammad Shahbaz. SPLIDT: Partitioned Decision Trees for Scalable Stateful Inference at Line Rate. 2025. *Acceptance rate: 22.1% (*equal contribution)* Paper

MICRO. Gerasimos Gerogiannis, Charles Block, Dimitrios Merkouriadis, Annus Zulfiqar, Muhammad Shahbaz, and Josep Torrellas. NETSPARSE: Hardware Acceleration for Distributed Sparse Kernels. 2025. *Acceptance rate: 20.7%* Paper

ASPLOS. Annus Zulfiqar, Ali Imran, Venkat Kunaparaju, Gianni Antichi, Ben Pfaff, and Muhammad Shahbaz. GIGAFLOW: Pipeline-Aware Sub-Traversal Caching for Modern SmartNICs. 2025. *Acceptance rate: 19%* Paper/Code

ASPLOS. Tushar Swamy, Annus Zulfiqar, Muhammad Shahbaz, Luigi Nardi, and Kunle Olukotun. HOMUNCULUS: Auto-Generating Efficient Data-Plane ML Pipelines for Datacenter Networks. 2023. *Acceptance rate: 20%* Paper/Code
Distinguished Artifact Award

Journal Articles

IEEE CAL. Ertza Warraich, Ali Imran, Annus Zulfiqar, Shay Vargaftik, Sonia Fahmy, and Muhammad Shahbaz. Reimagining RDMA Through the Lens of ML. 2025 Paper
Broadcom Research Award

- SIGCOMM CCR.** *Annus Zulfiqar*, Gianni Antichi, Ben Pfaff, William Tu, and Muhammad Shahbaz. The Slow-Path Needs an Accelerator Too! 2023 Paper
- Journal of Applied Remote Sensing (JARS).** *Annus Zulfiqar*, Muhammad M. Ghaffar, Muhammad Shahzad, Christian Weis, Muhammad I. Malik, Faisal Shafait, and Norbert Wehn. AI-ForestWatch: Semantic Segmentation Based End-to-End Framework for Forest Estimation and Change Detection using Multi-Spectral Remote Sensing Imagery. 2021 Paper

Preprints

Under Review. Ertza Warraich, Ali Imran, *Annus Zulfiqar*, Shay Vargaftik, Sonia Fahmy, and Muhammad Shahbaz. CELERIS: A Resilient and Tail-Optimal RDMA NIC For Distributed ML Workloads. 2025

Conference & Workshop Extended Abstracts

- SIGCOMM.** *Annus Zulfiqar*, Ben Pfaff, Gianni Antichi, Arpit Gupta, and Muhammad Shahbaz. KAIRO: Incremental View Maintenance for Scalable Virtual Switch Caching. 2025 Poster
- NSDI.** Murayyiam Parvez*, *Annus Zulfiqar**, Sylee Beltiukov, Shir Landau-Feibish, Arpit Gupta, Walter Willinger, and Muhammad Shahbaz. BRANCHPIPE: Scalable Decision Trees for Stateful Processing at Line Rate. 2025 Poster
- NSDI.** *Annus Zulfiqar*, Ali Imran, Venkat Kunaparaju, Gianni Antichi, Ben Pfaff, and Muhammad Shahbaz. A Smart Cache for a SmartNIC! Rethinking Caching, Locality, & Revalidation for Modern Virtual Switches. 2025 Poster
- SRC TECHCON.** Marilyn Rego, Murayyiam Parvez, *Annus Zulfiqar*, Sylee Beltiukov, Shir Landau-Feibish, Arpit Gupta, Walter Willinger, and Muhammad Shahbaz. SPLIDT: Partitioned Decision Trees for Scalable Stateful ML Inference at Line Rate. 2025
- Hot Chips.** *Annus Zulfiqar*, Ali Imran, Venkat Kunaparaju, Gianni Antichi, Ben Pfaff, and Muhammad Shahbaz. A Smart Cache for a SmartNIC! – Scaling End-host Networking to 400Gbps & Beyond. 2024 Poster
- SRC TECHCON.** Venkat Kunaparaju, *Annus Zulfiqar*, Ali Imran, Gianni Antichi, Ben Pfaff, and Muhammad Shahbaz. GigaFlow: A Scalable and Efficient Hardware Fast-Path for Open vSwitch. 2024

INVITED TALKS, DEMOS, AND POSTERS

Gigaflow: Pipeline-Aware Sub-Traversal Caching for Modern SmartNICs

- Intel Corporation, San Jose Oct 2025
- Google Networking Summit Oct 2025
- P4 Workshop Demo At Open Compute Project (OCP) [Link](#) Oct 2025
- ACE Center for Evolvable Computing — Demo at Annual Meeting [Link](#) Oct 2025
- P4 Developer Days Event [Link](#) Jun 2025
- NetSyn Lab, Princeton University Apr 2025
- IBM Thomas J. Watson Research Center Apr 2025
- Networked Systems Group (NSG), ETH Zurich Apr 2025
- ACM ASPLOS Conference Apr 2025
- Network Operations and Internet Security Lab, University of Chicago Mar 2025
- Systems Seminar, University of Michigan Mar 2025
- Politecnico di Milano Mar 2025
- ACE Center for Evolvable Computing — Demo at Annual Meeting [Link](#) Oct 2024
- ACE Center for Evolvable Computing — Demo at Spring Meeting [Link](#) Mar 2024

Homunculus: Auto-Generating Efficient Data-Plane ML Pipelines for Datacenter Networks

- ACE Center for Evolvable Computing ([Link](#))
- PurNet Seminar, Purdue University

Jul 2023
Sep 2023

The Slow Path Needs an Accelerator Too!

- VMware Research Group (VRG)

Aug 2022

OPEN SOURCE PROJECTS AND CONTRIBUTIONS

- **aisuite** [★ 12.8K, 📄 1.3K] <https://github.com/andrewyng/aisuite>
- **AI-ForestWatch** [★ 31, 📄 8] <https://github.com/annusgit/ForestCoverChange>
- **Taurus In-Network ML** <https://gitlab.com/dataplane-ai/tutorials/sigcomm22>
- **Gigaflow vSwitch** <https://github.com/gigaflow-vswitch>
- **Homunculus Framework** <https://gitlab.com/dataplane-ai/homunculus/artifact-asplos23>

EXPERIENCE

Next-Generation Architectures Lab, University of Michigan

Graduate Student Research Assistant

Advisor: Muhammad Shahbaz

Rearchitected the end host network for the terabits per second era

Ann Arbor, MI
Jan 2025 - Present

VMware Research Group

Research Intern

Mentor: Ben Pfaff

Characterized the Open vSwitch slow path performance bottlenecks and proposed an accelerator for the SDN slow path

Palo Alto, CA
May - Aug 2022

Next-Generation Architectures Lab, Purdue University

Research Assistant

Advisor: Muhammad Shahbaz

Explored architectures for the slow path in SDN; Built a Neural Architecture Search (NAS) framework, Homunculus, for data plane ML

West Lafayette, IN
Aug 2021 - Dec 2024

Pervasive Parallelism Laboratory, Stanford University

Remote Researcher

Mentor: Muhammad Shahbaz

Designed discrete-event network simulations for data center load balancing algorithms

Stanford, CA
Sep 2020 - Jan 2021

Center for Advanced Research in Engineering

Design Engineer

Designed Ethernet/WiFi/LTE/BLE-capable, PoE-enabled, IoT Sensor Networks for industrial machine sensing and telemetry

Islamabad, PK
Jun 2019 - Jul 2021

Technical University of Kaiserslautern

Research Intern

Advisors: Norbert Wehn, Christian Weis

Worked on multi-temporal forest cover change detection to analyze the largest afforestation drive in Pakistan using remote sensing and deep learning

Kaiserslautern, DE
Jun - Sep 2018

TUKL Lab, NUST

Research Intern

Advisors: Faisal Shafait, Muhammad Shahzad

Worked on document processing and land cover classification problems using object detection and sequence learning techniques from deep learning

Islamabad, PK
Jun 2017 - May 2019

PROFESSIONAL SERVICE

- Program Committee (PC) Member – SIGCOMM 2025 Artifact Evaluation Aug 2025
- Program Committee (PC) Member – NSDI 2026 Artifact Evaluation Jul 2025
- Mentor – P4 Language Consortium, Google Summer of Code (GSoC) Jan 2025
- Volunteer Reviewer – Ph.D. Admissions Committee, University of Michigan Jan 2025

MENTORING EXPERIENCE

- Advay Singh, undergrad at University of Michigan – Cloud Infrastructure 2025 - Present
- Murayyiam Parvez, Ph.D. student at Purdue University – ML for Systems 2024 - Present
- Ali Imran, Ph.D. student at University of Michigan – SmartNICs, ML Systems 2024 - Present
- Venkat Kunaparaju, undergrad at Purdue University – Cloud Infrastructure 2023 - 2024

TEACHING EXPERIENCE

SIGCOMM. Tushar Swamy, *Annus Zulfiqar*, Alex Rucker, Muhammad Shahbaz, Kunle Olukotun. [Link/Code](#)
In-Network Machine Learning using Taurus. 2022

Purdue University. CS 38100 – Introduction to the Analysis of Algorithms (GTA). Fall 2023

CERTIFICATIONS

Intel Connectivity Academy – Level 1A/B: Tofino Native Architecture (TNA) & P4 [Link](#)

REFERENCES

1. **Muhammad Shahbaz**
Assistant Professor of Computer Science and Engineering (CSE) msbaz@umich.edu
University of Michigan
2. **Gianni Antichi**
Associate Professor of Computer Science gianni.antichi@polimi.it
Politecnico di Milano
3. **Ben Pfaff**
Chief Engineer/Co-Founder blp@cs.stanford.edu
Feldera