ABHIK BOSE

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PROFILE

I am a PhD student in the Department of Computer Science at IIT Bombay, advised by Prof. Mythili Vutukuru. My research areas include programmable computer networks, SDN, 5G, and operating systems. My dissertation research focuses on parsing complex application-layer messages from layer 7 applications within a P4 programmable data plane with 5G as a use case.

EDUCATION

PhD, CSE, IIT Bombay *(CPI 8.45)* (Ongoing, Thesis submitted)

MPhil, Chemistry, IIT Bombay *(CPI 8.17)* (2018)

MSc, Chemistry, IIT Delhi *(CPI 8.34)* (2015)

BSc, Chemistry, Scottish Church College, University of Kolkata *(Percentage 74%)* (2012)

TECHNICAL SKILLS

- **Programming:** Python, C++, C, P4 (data plane programming language), Shell script, Java
- **Strengths:** Programmable data plane, 5G, SDN, Computer network, Operating Systems (Windows, Linux)
- **Tools:** Intel P4 Studio (Tofino programmable switch SDE), Netronome SmartNIC SDE, DPDK
- **Research Interests:** Computer Network, Telecom Network (5G, 6G), Programmable data plane, SDN, Operating System

WORK EXPERIENCE

Student Trainee, Samsung R&D Institute India, Bangalore (SRI-B) (July 2022 - December 2022)
- *Contributions:* Building a 5G NFs on Tofino switch, Tofino switch installation, Exploring programmable data plane devices including Tofino Switch, Netronome SmartNIC and AMD FPGA

MAJOR PROJECTS

- **Unstructured message parsing framework in P4** (2020-2024): We designed unstructured-packet parsing techniques in P4 (a data plane programming language) to efficiently process complex application messages such as JSON and gRPC directly on network switches. Our approach extends P4's built-in parser, which lacks native support for unstructured message parsing, unlocking new possibilities for in-network processing of complex application-layer data. Additionally, we developed a tool that automatically selects the most suitable parser based on the specific workload type.
- **An application layer telemetry on programmable data plane** (2022-2024): We have developed a P4-based in-network application layer telemetry system for complex layer 7 applications on Intel Tofino switches. This system provides complete application transparency and avoids additional data copying, unlike existing methods like OpenTelemetry, which require code changes or use inefficient mirroring/logging. We provide a SQL-like telemetry language and corresponding compiler. We successfully processed complex 5G analytics queries on a standard 5G core, showcasing its real-world applicability.
- **A 5G UPF on P4** (2020-2022): We implemented 5G User Plane Function (UPF) in P4 across multiple real hardware platforms (Tofino switch, Netronome SmartNIC). Unlike existing P4-based UPFs that handle only user traffic, our design seamlessly processes both user traffic and complex signaling traffic within P4, reducing cost and latency while significantly improving overall performance.

PUBLICATIONS

1. Application layer telemetry in eBPF and P4 (under review)
2. Ashwin K. & Abhik Bose (equal author), et al, (2024) *Feasibility of Application Layer Header Parsing in eBPF and P4.* IFIP
3. Abhik Bose, et al, (2022). *AccelUPF: accelerating the 5G user plane using programmable hardware.* SOSR
4. Abhik Bose, et al, (2021) *Leveraging Programmable Dataplanes for a High Performance 5G User Plane Function.* APNet

ACHIEVEMENTS

- **Technical Talks:** IFIP 2024 (Greece), ARCS 2023 (India), Google Networking Research Summit 2022 (Virtual), SOSR 2022 (Virtual), APNet 2021 (Virtual)
- **External Review Committee member:** SIGCOMM CCR 2023
- **Competitive exams: AIR 2129** in GATE Computer Science 2018, **AIR 30** in NET Chemistry 2012

ADMINISTRATIVE RESPONSIBILITIES

- **Core Team Member**, Research and Innovation Symposium in Computing (RISC), CSE, IIT Bombay (2019)
- **Hostel System Administrator** (Hostel 13 & 15), IIT Bombay (2015-2018)