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Md Ashfaqur Rahaman

Research Interests

My research interest is in the intersection of operating systems, networking, and distributed systems.

Education

Aug. 2021 **Ph.D. in Computer Science**, *University of Utah*, Salt Lake City, Utah, USA
Advisor: Ryan Stutsman

2012-2019 **B.Sc. in Naval Architecture and Marine Engineering**, *Bangladesh University of Engineering and Technology (BUET)*, Dhaka, Bangladesh

Experience

Research

2021-Present **Graduate Research Assistant**, *Utah Scalable Computer Systems Lab*, University of Utah, Utah
- A new software architecture for building services that centers around coherent accelerators and rack-scale shared memory
- A new programmable, efficient, and scalable framework for remote memory access and function offloading exploiting the programmability and offloading capability of smartNICs

2020-2021 **Research Assistant**, *Prof. Baris Kasikci's Lab*, University of Michigan, Ann Arbor
Mentor: Tanvir Ahmed Khan
Load-time code layout optimization of large application binaries in warehouse scale computers

2018-2019 **Research Assistant**, *Climate Modeling and Simulation Lab*, IWFM, BUET
Advisor: A.K.M. Saiful Islam
I worked as a system developer in real-time Flash Flood Early Warning System (FFEWS) project

Professional

2018-2019 **Software Engineer**, *NextGen DigiTech*, Dhaka
I worked on NextGen Tower, a desktop application for designing wind turbines. I contributed in the core software architecture and developed the GUI.

2017-2018 **Firmware Engineer**, *2RA Technology Limited*, Dhaka
I worked on various embedded systems projects based on Raspberry Pi and AVR Microcontrollers.

Selected Research Projects

2023-Present **Software Architectures for Large-Scale Coherent Shared Memory**
Emerging standards for cache coherent accelerators (e.g. CXL) will soon transform how memory-intensive large-scale systems are developed. Cache coherent accelerators are programmable (via FPGAs), and they can interpose on CPU memory accesses at cache line granularitiy. Low-overhead, granular access tracking with these coherent accelerators enable efficient memory disaggregation. But disaggregation alone will not fundamentally change application architecture. In this work we are designing a new software architecture for building large scale services that centers around coherent accelerators and rack-scale shared memory.

2021-Present **NIC Accelerated Active Messaging**
RDMA is gaining popularity in datacenters for high-throughput and low-latency network communication for building dis-aggregated systems. However, there are many issues that are holding RDMA back from being widely deployed. Current RDMA verbs are limited for diverse workloads, they are difficult to program, and multiple round trips are required to do complicated memory operations e.g. walking a hash table. We are working on creating a new network abstraction to make remote memory access more programmable, efficient, and scalable exploiting the programmability and offloading feature of smartNICs. In our system, functions can be written in a high level language ensuring easy programmability, then these are converted into verifiable bytecode and run on the NIC or host based on the system resource usage. Program transformation, dynamic decisions, all these are transparent to the developer.

Selected Courses

Fall 2023	Advanced Networking, University of Utah
Spring 2022	Software Security, University of Utah
Fall 2021	Advanced Operating Systems, University Of Utah

Teaching Assistantship

Fall 2022	Distributed Systems, University Of Utah
Spring 2022	Operating Systems, University Of Utah

Services

2022	Artifact Evaluation Committee Member, OSDI'22
2021	Artifact Evaluation Committee Member, SOSP'21

Bachelor Thesis

Title	*Power Efficient Remotely Operated Underwater Vehicle Using Buoyancy Chambers*
Supervisor	Dr. Md. Mashud Karim

Skills

Languages	C, C++, Rust, Go, Python, Shell Script, Assembly(ARM, X86)
Tools	CXL, eBPF, RDMA, DPDK, NVIDIA DOCA, LLVM, Linux perf, BOLT
Platforms	NVIDIA BlueField 2, AVR Microcontrollers, Raspberry Pi, Arduino
Text Editing	Vim, LaTeX