Abdul Rehman

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Summary

Ph.D. student with 8+ years of systems software development (6 years of full time industrial position) and systems research (2 years) experience. During my time in industry I have worked on UEFI firmware, Nucleus RTOS and NVMe virtualization. For past two years, my focus has been on serverless computing, linux scheduling and machine learning. I have added Rust, eBPF and deep learning approach using pyTorch to my toolbox. I am working under the guidance of Prateek Sharma at Indiana University Bloomington. I enjoy diving deep into complex problems, trying to find the last ounce of performance boost in myraid of interconnected components.

Education

Indiana University Bloomington *Bloomington, United States*

PhD in Intelligent Systems Engineering *Aug 2022 - Present*

Advisor: Prateek Sharma

- Research area: cloud computing
- CGPA 3.91/4.00
- **Courses:** Applied Algorithms, Cloud Computing, Compilers, Operating Systems, Deep Learning, Signal Processing using Machine Learning

Research Assistant *Aug 2022 - Present*

- Current Research: Targeted Scheduling for a serverless platform (Linux, eBPF, SchedExt, Rust)
- Development of Realtime Data Analytics System using MQTT, InfluxDB and Torch Serve (see projects).
- Contriubted to the development of a serveless platform written in Rust ground up (publication).

National University of Sciences and Technology *Islamabad, Pakistan*

Electrical Engineering *Aug 2011 - June 2015*

- CGPA 3.92/4.00
- **Courses:** Embedded Systems, Digital System Design, Digital Signal Processing

Publications

Published

[1] Alexander Fuerst, **Abdul Rehman**, Prateek Sharma. Ilúvatar: A Fast Control Plane for Serverless Computing. *High-Performance Parallel and Distributed Computing(HPDC) '23*, Acceptance Rate 21%

Under Preparation

[1] **Abdul Rehman**, Prateek Sharma. λSched: A fine grained scheduling solution for an Energy Efficient Serverless Platform. *pending*, submission

Projects

Targeted CPU Scheduling for a serverless platform

Indiana University Bloomington *Mar 2024 - Present*

- A custom CPU scheduling solution (using SchedExt framework) that uses function metadata to improve the performance of the serverless platform.
- **Project Page:** https://abrehman94.github.io/projects/schedext_based_scheduling.html

Edge-IoT-Analytics-Box - Extensible Data Analytics System

Indiana University Bloomington *Dec 2023 - May 2024*

- A data analytics system that can be deployed on edge devices (protyped on Jetson Orin) to perform real-time data analytics.
- **Project Page:** https://abrehman94.github.io/projects/dataanalytics.html

Iluvatar a Serverless Control Plane in Rust

Indiana University Bloomington *Aug 2022 - May 2023*

- A radical approach to serverless computing - monolithic, worker centric platform.
- **Project Page:** https://abrehman94.github.io/projects/iluvatar.html

Work Experience

Siemens Industry Software Inc.
Mobile, AL, United States

Senior Software Engineer - Hypervisor Team
Mar 2021 - Sep 2021

- Siemens Hypervisor support on Intel Embedded Processors Elkhartlake (2021).
  - Release critical bug-fixes: ACPI parser, AHCI Virtualization, NVMe Virtualization
  - Mentoring a new engineer.

Mentor Graphics a Siemens Business
Lahore, Pakistan

Senior Software Engineer - Hypervisor Team
Jan 2020 - Mar 2021

- Virtualized UEFI interface
  - Design and development of a non-volatile variable caching infrastructure to avoid SMI generation and provide real time gurantees for Guest RTOS.
- NVMe Virtualization
  - Performance improvement of NVMe virtualization infrastructure from 700 MB/s to 1.5 GB/s. Improved the infrastructure to process requests across SMP cores.
  - Led a team of two engineers to deliver the project.

Software Engineer - Hypervisor Team
Aug 2016 - Jan 2020

- Virtualized UEFI interface
  - Implementation of UEFI boot support for Guest OS (Windows, Linux, RTOS) on Siemens Type 1 Hypervisor.
  - Design and development of a UEFI driver for Intel Graphics Device (IGD) to allow early graphics for Linux and Windows guests.
- NVMe Virtualization
  - Design and development of the infrastructure. Specifically, interrupt handling (PCI MSI-X capability) and I/O queue segregation for the virtual devices and hardware backend.
  - Adapting the Linux NVMe driver to act as a Paravirtualized Client for testing purpose.
- Feature Releases for Mentor Embedded Hypervisor (Type 1)
  - Design and development of VT-d DMAR/IOMMU driver to allow device isolation and memory remapping of guests.

Software Engineer - Embedded UI Graphics Team
Jun 2015 - Aug 2016

- Qt GUI Framework version 5.4 on Nucleus RTOS
  - Porting of the framework based on a previous work for Qt 4.0.
  - Performance optimization of the ported framework.

Awards

2023 **Travel Grant**, High-Performance Parallel and Distributed Computing 2023 *Orlando, USA*

2016 **Appreciation Certificates: exceptional debugging skills, high quality work**, Mentor a Siemens Business *Lahore, Pakistan*

Skills

Programming Languages	Rust, C/C++, Bash, Python (Pandas, NumPy)
Application Level	Distributed Systems (serverless, InfluxDB), Containerization(Docker, containerd)
Close to hardware	eBPF, Linux Kernel, Type 1 Hypervisors (ACRN/XEN/MEHV/Siemens), UEFI Driver, ACPI, x86, Lauterbach Trace-32 Debuggers
Machine Learning	PyTorch, Application of Deep Learning approach
Tools	tmux, vim, ssh, perfetto