

Abdul Rehman

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Summary

Second year PhD student with six years of full-time Industrial Embedded Software development experience, who has deep understanding of computation stack from Baremetal (UEFI, RTOS), OS (Linux), Virtualization (Hypervisors) to Cloud abstractions (FaaS). My current research focus is to develop carbon efficient computing systems using Machine Learning.

Education

Indiana University Bloomington

Bloomington, United States

PhD in Intelligent Systems Engineering

Aug 2022 - Present

Advisor: Prateek Sharma

- Research area: Energy efficient cloud computing.
- CGPA 4.00/4.00
- **Courses:** Compilers, Cloud Computing, Deep Learning, Signal Processing using Machine Learning
- **Skills acquired:** Understanding of a compiler architecture with a nano-pass approach to develop and transform initial language through a series of intermediate languages into a target language. Analyzing the problem to select the most appropriate machine learning technique. Reusing, building and debugging deep neural architectures.

Research Assistant

Aug 2022 - Present

- Development of research platform for Function as a Service (publication).
- Statistical disaggregation based energy profiling tool for Function as a Service (submitted for publication).
- Development of Industrial IoT architecture for continuous prediction pipeline of sensor data using MQTT, InfluxDB and Torch Serve.
- Optimized scheduling of GPU functions in FaaS (work in progress).

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

Conference 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%

Work Experience

Siemens Industry Software Inc.

Mobile, Alabama, United States

Senior Software Engineer - Hypervisor Team

Mar 2021 - Sep 2021

- Enabling Siemens Hypervisor support on cutting edge Intel Embedded Processors Elkhartlake (2021).
 - Found, estimated and fixed issues. For instance ACPI parser, AHCI Virtualization and NVMe Virtualization components required bug-fixing.
 - Mentored a new engineer on this project.

Mentor Graphics a Siemens Business

Lahore, Pakistan

Senior Software Engineer - Hypervisor Team

Jan 2020 - Mar 2021

- Improvements to virtualized UEFI interface to make it production ready.
 - Designed and developed non-volatile variable caching infrastructure to help avoid SMI generation and provide real time guarantees for Guest RTOS.
- Improvements to NVMe Virtualization to make it production ready.
 - Improved NVMe virtualization infrastructure performance from 700 MB/s to 1.5 GB/s by making the infrastructure distributed across homogeneous processors.
 - Led a team of two engineers in bug-fixing and finalizing the deliverable.

- Enabling UEFI boot support for Guest OS (Windows, Linux, RTOS) of Siemens Hypervisor.
 - Implemented the virtualized UEFI interface using trap and emulation method for UEFI calls backed by a virtual UEFI image built using EDKII.
 - Designed and developed a UEFI driver for Intel Graphics Device (IGD) to allow early graphics for Linux and Windows guests. It is required to draw splash screen and display recovery mode menus.
- Enabling NVMe virtualization for Guest OS (Windows, Linux, RTOS) of Siemens Hypervisor.
 - Contributed to design of the infrastructure specifically interrupt handling and I/O queue segregation.
 - Developed Linux NVMe driver into a Paravirtualized Client.
 - Added interrupt handling infrastructure for utilization of PCI MSI-X capability, including emulation support for virtualized devices.
- Developing features for Mentor Embedded Hypervisor (later ACRN Intel Hypervisor).
 - Designed and developed VT-d DMAR/IOMMU driver to allow device isolation and thereby enable 1:N memory mapping of guests.
 - Developed tracing infrastructure for hypervisor to trace VMEXITs and generate useful reports.

- Ported QT GUI Framework version 5.4 to Nucleus RTOS. This port was based on a previous work done for Qt 4.0.
- Optimized performance of Ported Qt GUI Framework by profiling and removing deadcode in event loops.
- Developed unit tests for Qt based 3D Automotive Instrument Cluster HMI.

University Projects

Ilúvatar: A Fast Control Plane for Serverless Computing

Indiana University Bloomington

Aug 2022 - May 2023

- We built a new control plane in Rust to provide FaaS with low overhead.
- **Github:** <https://github.com/COS-IN/iluvatar-faas>

Python to x86 Compiler in Python

Indiana University Bloomington

Aug-Dec 2022

- Through the semester we built a Python to x86 assembly compiler by following the book Essentials of Compilation by Jeremy G. Siek
- **Github Book:** <https://github.com/IUCompilerCourse/Essentials-of-Compilation>

Awards

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|------|---|------------------|
| 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, Python (Pandas, NumPy), C/C++, Bash
Embedded Development	UEFI Driver, Linux Driver, ACPI, Lauterbach Trace-32 Debuggers, Intel x86 platform
Systems Development	Operating Systems, ACRN/XEN/MEHV/Siemens Hypervisor, Docker, containerd, Distributed Systems
Machine Learning	PyTorch, Building Deep Neural Networks