

ALI RAZA

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Boston, MA, USA

OVERVIEW

Interests: Operating Systems, Computer Networks, Cloud Computing, Distributed Systems, Performance Analysis and Tuning

Skills: Linux Kernel Programming, Systems Programming, C, Python, Bash, C++

EDUCATION

2017 - Fall 2022
(expected) | **Ph.D. Computer Science**
BOSTON UNIVERSITY
Advisor: [Prof. Orran Krieger](#)

2014 - 2016 | **M.S. Computer Science**
LAHORE UNIVERSITY OF MANAGEMENT SCIENCES, PAKISTAN

2008 - 2012 | **B.S. Electrical Engineering**
LAHORE UNIVERSITY OF MANAGEMENT SCIENCES, PAKISTAN

EXPERIENCE

May 2018 - Present | **Research Intern**
RED HAT, BOSTON

SELECTED PROJECTS

PhD Thesis - Unikernel Linux (UKL)

This research, which I lead, explores if unikernel techniques (e.g., highly optimized transitions between kernel and application code, customized code paths, run-to-completion, link-time optimization of kernel and application code, etc.) can be integrated into Linux while preserving its battle-tested code, development community, and ecosystem of tools, applications, and supported hardware. Our prototype, called Unikernel Linux (UKL) demonstrates that it is possible, and can support a large class of unmodified applications and hardware, and result in significant performance improvements. Complex unmodified applications (e.g., Redis, Memcached) can improve by over 10% in 99th tail latency and throughput, and small modifications to the applications can result in more than 20% improvement. Further, we have shown 95x improvement for simple latency sensitive workloads. A group of Red Hat Linux developers is working with us to submit the core UKL 550 line patch upstream; the full set of optimizations is just over 1200 LoC. We are exploring a broad set of use cases ranging from accelerating cloud applications and core infrastructure services, to enabling new device driver models.

Github Link: <https://github.com/unikernelLinux/ukl>

Elastic Secure Datacenter

This research, which I participated in at the start of my PhD, explored how we can securely and rapidly multiplex physical servers between many different tenants while

minimizing trust in the provider. The Bolted prototype we developed enabled tenants to use existing unmodified provisioning systems for HPC, enterprise and cloud services. Security sensitive tenants can deploy their own attestation services to ensure that previous tenants did not compromise the firmware. Keylime attestation service used in Bolted has developed a large open source community and is being used in both Red Hat products and IBM's public cloud. The fundamental mechanisms from this work have now been adapted by the OpenStack community, and are currently being integrated and tested at the MGHPCC data center.

MS Thesis - Context Aware WiFi Bitrate Adaptation

Indoor wireless channel conditions suffer from signal attenuation, multi-path interference and shadowing effects, decreasing Wi-Fi throughput, especially when high data rates are used. On the contrary, in outdoor settings, better channel conditions allow higher bit rates, thus improving throughput. For mobile devices, especially those which frequently transition between indoor and outdoor settings, WiFi bitrates need to quickly adapt to channel conditions. But the WiFi protocol (IEEE 802.11 family) estimates channel conditions over timescales of hundreds of packets or needs to be trained to understand the SNR-BER relationship, and is better suited to stationary devices. In this work, we design an indoor-outdoor detection system which uses sensors present in mobile devices such as accelerometer, light sensor and GPS etc., and use this information to quickly adapt WiFi bitrate. Our results show faster WiFi bitrate adaptation and better average throughput for a mobile device.

PUBLICATIONS

- **Unikernel Linux (UKL): Integrating Unikernel Optimizations in a General Purpose OS**
arXiv preprint arXiv:2206.00789 [[PDF](#)]
- **Unikernels: The Next Stage of Linux's Dominance**
Workshop on Hot Topics in Operating Systems (**HotOS '19**), Bertinoro, Italy, May 2019. [[PDF](#)]
- **Using SGX-Based Virtual Clones for IoT Security**
2018 IEEE 17th International Symposium on Network Computing and Applications (**IEEE NCA**), Boston, MA, USA, Nov 2018. [[PDF](#)]
- **A Secure Cloud with Minimal Provider Trust**
10th USENIX Workshop on Hot Topics in Cloud Computing (**HotCloud 18**), Boston, MA, USA, July 2018. [[PDF](#)]
- **It's All in the Name: Why Some URLs are More Vulnerable to Typosquatting**
IEEE International Conference on Computer Communications (**IEEE INFOCOM 2018**), Honolulu, Hawaii, USA, April 2018. [[PDF](#)]
- **An Anomaly Detection Fabric for Clouds Based on Collaborative VM Communities**
17th IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing (**CCGrid**), Spain, May 2017. [[PDF](#)]

TALKS AND PRESENTATIONS

- DevConf.us 2021 [video](#)
- DevConf.us 2020 [video](#)
- Red Hat Research Day 2020 [video](#)
- DevConf.us 2019 [video](#)
- DevConf.us 2018 [video](#)