BINGHAMTON
U N I V E R S I T Y | Computer Science
STATE UNIVERSITY OF NEW YORK

COMPUTER SCIENCE RESEARCH SEMINAR

X-Containers: Breaking Down Barriers to Improve Performance and Isolation of Cloud-Native Containers

Dr. Zhiming Shen
CTO, Exotanium Inc.

Friday, May 3rd at 12 noon, Room: R15, Engineering Building

Abstract: "Cloud-native" container platforms, such as Kubernetes, have become an integral part of production cloud environments. One of the principles in designing cloud-native applications is called Single Concern Principle, which suggests that each container should handle a single responsibility well. In this paper, we propose X-Containers as a new security paradigm for isolating single-concerned cloud-native containers. Each container is run with a Library OS (LibOS) that supports multi-processing for concurrency and compatibility. A minimal exokernel ensures strong isolation with small kernel attack surface. We show an implementation of the X-Containers architecture that leverages Xen para-virtualization (PV) to turn Linux kernel into a LibOS. Doing so results in a highly efficient LibOS platform that does not require hardware-assisted virtualization, improves inter-container isolation, and supports binary compatibility and multi-processing. By eliminating some security barriers such as seccomp filters and Meltdown patch, X-Containers have up to $27\times$ higher raw system call throughput compared to Docker containers, while also achieving competitive or superior performance on various benchmarks compared to recent container platforms such as Google's gVisor and Intel's Clear Containers.

Bio: Dr. Zhiming Shen is the co-founder and CTO of Exotanium Inc (http://exotanium.io). He received his Ph.D. in Computer Science at Cornell University in 2017. His research interests are in the areas of operating systems, distributed systems, cloud computing, and virtualization. He co-founded Exotanium Inc. with his advisors Robbert van Renesse and Hakim Weatherspoon, working on commercializing the X-Containers technology he proposed for improving security, flexibility, and efficiency of cloud-native containers and Infrastructure as a Service (IaaS) platforms. Exotanium recently won a Small Business Innovation Research (SBIR) award from the National Science Foundation (NSF). Dr. Shen will be available after his talk to meet with students interested in an internship or a full-time position at Exotanium.

This event is funded by GSOCS, a subsidiary of GSO, using Student Activity Fee funds

Refreshments will be provided!