ELECTRICAL AND COMPUTER ENGINEERING SEMINAR

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Rethinking Operating System and Hardware Abstractions for Good and Evil
Thursday February, 20th
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12:00pm- 1:00pm

Abstract: Current hardware and operating system abstractions were conceived at a time when we had minimal security threats, scarce compute and memory resources, and limited numbers of users. These assumptions are not true today. On one hand, attacks such as Spectre and Meltdown have shown that current hardware is plagued by vulnerabilities. On the other hand, new emerging cloud paradigms like microservices and serverless computing have led to the sharing of computing resources among hundreds of users at a time. In this new era of computing, we can no longer afford to build each layer separately. Instead, we have to rethink the synergy between the operating system and hardware from the ground up.

In this talk, I will focus on rethinking the virtual memory abstraction. First, I will introduce Microarchitectural Replay Attacks, a novel family of side-channel attacks that exploit existing virtual memory mechanisms. These attacks leverage the fact that, in modern out-of-order processors, a single dynamic instruction can be forced to execute many times. Then, I will describe Elastic Cuckoo Page Tables, my proposal to rebuild the virtual memory abstraction for parallelism. Finally, I will conclude by describing ongoing and future directions towards redesigning the hardware and the operating system layers.

Bio: Dimitrios Skarlatos is a PhD student at the University of Illinois at Urbana-Champaign (UIUC), working with Professor Josep Torrellas. His research lies at the intersection of computer architecture, security, and operating systems. He particularly enjoys questioning the fundamental assumptions behind computer design decisions. He builds practical solutions that improve the performance and bolster--or sometimes break--the security guarantees of computing systems.

Dimitrios is a UIUC College of Engineering Mavis Future Faculty Fellow. He is the recipient of the W. J. Poppelbaum Memorial Award, the David J. Kuck Outstanding MS Thesis Award, the UIUC Computer Science Excellence Fellowship, a 2020 MICRO Top Picks in Computer Architecture, and a 2019 MICRO Top Picks Honorable Mention. He was invited to participate in the Rising Stars in Computer Architecture workshop. He has earned an MS from UIUC and a BS in Electronic and Computer Engineering from the Technical University of Crete in Greece.