**COLLOQUIUM**

Department of Computer Science and Engineering

University of South Carolina

### **Torturing Storage Systems for Fun and Profit**

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Place: **Swearingen 1A03 (Faculty Lounge)**

# Abstract

Storage system failures are extremely damaging — if your browser crashes you sigh, but when your family photos disappear you cry. So we need highly reliable storage systems that can keep data safe even under failures. Such high standard of reliability is far from trivial to provide, particularly when high performance must be achieved. This leads to complex and error-prone code—even at a low defect rate of one bug per thousand lines, the millions of lines of code in a commercial online transaction processing (OLTP) database can harbor thousands of bugs.

In this talk, I will focus on two of my research efforts to better understand the reliability of data storage systems under failures. First, I will discuss a framework for evaluating solid-state drives (SSDs). This work uncovers five failure behaviors of SSDs, including bit corruption, shorn writes, non-serializable writes, metadata corruption, and total device failure. The surprising results provide important implications to the design of higher-level storage software and have led to the enhancement of power loss protection in some latest SSDs. In the second part, I will detail a framework to expose and diagnose atomicity, consistency, isolation, and durability (ACID) violations in databases under failures. Using the framework, we study eight widely-used databases. Surprisingly, all eight databases exhibit erroneous behavior. For the open-source databases, we are able to diagnose the root causes using our framework, and for the proprietary commercial databases we can reproducibly induce data loss.

**Mai Zheng** is a Ph.D. candidate in the Department of Computer Science and Engineering at The Ohio State University. His research spans software reliability, storage systems, parallel and distributed systems, operating systems, and high-performance computing. He has been in close collaboration with HP Labs since 2012. His work appears in venues such as OSDI, FAST, PPoPP, as well as in ZDNet, Splashdot, Infoworld, and the RISKS Digest. Mai earned his bachelor's degree from Qingdao University in 2006 and his master's degree from University of Science and Technology of China in 2009.