UCF DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCEINCE

Spring 2015 Seminar Series

Presented by the ECE Division

Data Storage Caching with SSD Technologies

Friday, February 20th, 2015

10:30 AM - HEC 356

Big data applications demand high speed, reliable, and energy efficient data storage systems. Traditional storage architectures have fundamental limitations because of legacy systems that have centered on spinning hard disk drives. With rapid advances in nonvolatile memories such as NAND-gate flash, phase change memory, Memristor, and magnetic RAM, a great opportunity exists for optimizing storage architectures. We introduce a new concept: "Content Locality" for storage cache design. Based on this new concept, a novel I/O architecture is proposed that is composed of an array of a flash memory SSD (solid state disk) and a hard disk drive (HDD) that are intelligently coupled by a special algorithm. We call this architecture I-CASH: Intelligently Coupled Array of SSD and HDD. The idea is to exploit the fast read performance of SSDs and the high speed computation of modern multi-core CPUs to replace and substitute, to a great extent, the mechanical operations of HDDs. At the same time, we avoid runtime SSD writes that are slow and wearing. Experimental results with standard benchmarks show that I-CASH reduces the average I/O response time by an order of magnitude compared to existing disk I/O architectures such as RAID and SSD/HDD storage hierarchy, and provides up to 2.75x speedup over state-of-the-art pure SSD storage. Furthermore, I-CASH reduces random writes to SSD implying reduced wearing and prolonged life time of the SSD.

Dr. Qing Yang

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Qing Yang is Distinguished Engineering Professor in the Department of Electrical, Computer, and Biomedical Engineering at University of Rhode Island, where he has been a faculty member since 1988. He is a director of High Performance Computing Lab (HPCL) of URI and is a recipient of several accomplishment awards at URI. His research interests include computer architecture, memory and storage systems, computer networks, embedded computer systems and applications in neural-machine interface and biomedical engineering. He has published over 100 technical articles in these areas and held over a dozen issued patents and over a dozen pending applications. Majority of his patents have been licensed to computer industry with significant practical impact. Four high tech startup companies have been formed based on his patents. His latest startup, VeloBit, was based on I-CASH architecture and was successfully acquired by Western Digital in July 2013. Yang is a Fellow of IEEE.

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