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LEADING MEMORY SYSTEMS RESEARCHER RECEIVES TOP
COMPUTER ARCHITECTURE AWARD

Mark D. Hill Recognized for Seminal Contributions with Eckert-Mauchly Award

New York, NY, **June 5, 2019** – ACM, the Association for Computing Machinery, and IEEE Computer Society have announced that Mark D. Hill, a professor at the University of Wisconsin--Madison, is the recipient of the 2019 Eckert-Mauchly Award. Hill was cited for contributions to the design and evaluation of memory systems and parallel computers. Widely regarded as the leading memory systems researcher in the world today, Hill made seminal contributions to the fields of cache memories, memory consistency models, transactional memory, and simulation. Hill's work with over 160 co-authors, which has received more than 20,000 citations, has been guided by the tenet that researchers should develop designs *and* models. The Eckert-Mauchly Award is considered the computer architecture community's most prestigious award.

In the 1980s Hill developed the "3C" model of cache misses. A "cache miss" is an instance when data requested for processing by software or hardware is not found in the computer's cache. Cache misses can cause delays as the program or application must then access the data elsewhere. Hill's 3C model classified these misses into "compulsory misses," "capacity misses," and "conflict misses." The model was influential, as it led to important innovations such as victim caches and stream buffers, and is now a standard concept in computer architecture textbooks.

Many regard Hill's work in in memory consistency models as his most significant contribution. With his student Sarita Adve, he developed SC for DRF: a consistency model using sequential consistency (SC), where data races can be avoided (data race free, or DRF). Hill's SC for DRF model has had significant impact for computer architects, especially as multiprocessors became ubiquitous and architects had to reason about which memory consistency model to use in their architectures and implementations. Years after Hill developed SC for DRF, it became the basis of Java and C++ memory models and, more recently, is being used with graphics processing units (GPUs) to understand memory consistency with heterogeneous processors.

Hill's third major contribution is his work in transactional memory, a technique to minimize blocking due to critical sections. With David Wood he developed the LogTM transactional memory system, one of the first and widely-cited approaches to transactional memory. For the first time, this system enabled

transactions to overrun their buffer and cache capacities, making transactions significantly easier for programmers to implement.

Hill (with David Wood and others) also made significant contributions to the evaluation of parallel computers. The Wisconsin Wind Tunnel project, for instance, pioneered fast parallel simulation running on parallel machines. Other important tools Hill has produced to evaluate memory systems and parallel computers include his Dinero cache simulator, as well as the GEMS full system simulator and gem5, which have been cited over 3,000 times by researchers and practitioners. BadgerTrap, one of his most recent tools, studies virtual memory behavior. Hill has also had significant influence on virtual memory implementation. For example, he proposed the idea of "page reservation," which is now used in Linux.

Hill will be formally recognized with the award at the ACM/IEEE International Symposium on Computer Architecture (ISCA) to be held June 22-26 in Phoenix, Arizona.

About the ACM-IEEE CS Eckert-Mauchly Award
ACM and IEEE Computer Society co-sponsor the Eckert-Mauchly Award, which was initiated in 1979. It recognizes contributions to computer and digital systems architecture and comes with a $5,000 prize. The award was named for John Presper Eckert and John William Mauchly, who collaborated on the design and construction of the Electronic Numerical Integrator and Computer (ENIAC), the pioneering large-scale electronic computing machine, which was completed in 1947.

About ACM
ACM, the Association for Computing Machinery is the world's largest educational and scientific computing society, uniting computing educators, researchers and professionals to inspire dialogue, share resources and address the field's challenges. ACM strengthens the computing profession's collective voice through strong leadership, promotion of the highest standards, and recognition of technical excellence. ACM supports the professional growth of its members by providing opportunities for life-long learning, career development, and professional networking.

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