

COMPUTER ARCHITECTURE LABORATORY



www.ece.cmu.edu/calcm

The Computer Architecture Laboratory at Carnegie Mellon (CALCM) is composed of ten participating faculty and approximately 40 graduate students from the Departments of Electrical and Computer Engineering and Computer Science.

CALCM was founded in 2001 to bring together researchers at Carnegie Mellon interested in computer architecture from several related and connected disciplines to bridge and complement the research strengths in computer systems at Carnegie Mellon. CALCM researchers lead the academic and research communities with interdisciplinary projects ranging from programming paradigms and architectures for massively-parallel single-chip systems, circuit- and technology-aware chip architectures for technologies at nanoscale CMOS level and beyond, and fully-synthesizable integrated hardware and software solutions for signal processing applications.

CALCM researchers engage extensively in both local and global collaborations with peers in academia and industry. Locally, CALCM projects include collaborations with the Databases Group, the Center for Silicon System Implementation (CSSI), the MARCO Center for Circuit and System Solutions (C2S2), and Intel Research Pittsburgh.

Overall, CALCM research covers the following thrust areas:

- **Technology-aware scalable systems** The trends toward scaling manufacturing processes have resulted in high system complexity, power dissipation, and reduction in reliability. Our solutions mitigate these challenges via integrated software, architecture, and circuit solutions to provide power-aware reliable systems that scale in cost/performance.
- **High-performance memory systems** Disparities between logic and DRAM fabrication processes have led to a prohibitive performance gap between processors and memory. We are exploring streaming architectures that exploit repetitive, albeit irregular, access patterns to enhance memory-level parallelism, and reconfigurable architectures to tailor on-chip SRAM to meet an application's demand.
- **Specialized computer systems** Domain-specific systems afford application-specific optimizations with tremendous gain over general-purpose systems. We are investigating custom architectural mechanisms for important applications such as databases, security, and digital signal/media processing.
- **Future computer systems** Future technologies enable revolutionary computing paradigms. We are exploring spatial computing to enable direct synthesis of applications into nanotechnology fabrics, and dynamic physical rendering technologies to create a substrate for 3-dimensional animated virtual reality objects.
- **Methodologies** With the ever-growing size and complexity of modern systems, software simulators to evaluate novel designs have become four or more orders of magnitude slower than hardware. We are exploring the fast, accurate and flexible simulation of systems via rigorous statistical sampling, and hybrid simulation/prototyping platforms using FPGAs.

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