北京大学海外名家讲学计划

INTERCONNECT FABRICS, NEAR THRESHOLD OPERATION AND 3D DIE STACKING

Trevor Mudge

Bredt Family Professor

The University of Michigan, Ann Arbor

2013年12月16日 星期一 09:00am

英杰交流中心第八会议室

ABSTRACT: In this talk we will overview some of our recent experimental prototypes. Specifically, we will discuss: Interconnect fabrics: We will discuss a new class of interconnect fabrics suitable for small to medium size multicore systems on a chip—those with less than 100 processors. The basis of this class of interconnects is a crossbar. Crossbars have several advantageous properties: simple one hop routing; ease of implementing QoS policies. On the other hand their scalability is limited and multicast operations can be clumsy to implement. We show that the limits of scalability are not as severe as often thought. Additionally we show how we solve multicast and implement common QoS policies. To support our arguments we will present performance data from several prototype chips that we have built and show how they can be used to create multicore systems.

Near threshold operation: Subthreshold circuit design, while energy efficient, has the drawback of performance degradation. To retain the energy efficiency while reducing performance loss, we have proposed near subthreshold operation for chip multiprocessors (CMP). In our talk we will discuss near threshold computing (NTC). We show that, in the near threshold regime, logic and memory cells have different optimal supply and threshold voltages. We then explore a design space in which several slower cores clustered together share an L1 cache. We show that an architecture such as this is optimal for energy efficiency. In particular, SPLASH2 benchmarks show a 53% energy reduction over the conventional CMP approach (70% energy reduction over a single core machine).

3D die stacking: We will present results from a recent experimental prototype in 3D die stacking and NTC, Centip3De. It is has 128 ARM cores and caches stacked on four layers. The DRAM memory system adds another two layers.

BIOGRAPHY: Trevor Mudge received the Ph.D. in Computer Science from the University of Illinois. He is now at The University of Michigan. He was named the Bredt Professor of Engineering after a ten-year term as Director of the Advanced Computer Architecture Laboratory—a group of a dozen faculty and sixty graduate students. He is the author of numerous papers on computer architecture, programming languages, VLSI design, and computer vision. He has also supervised about fifty theses in these areas. He is a Fellow of the IEEE, a member of the ACM, the IET, and the British Computer Society.

主办单位：北京大学国际合作部、北京大学高能效计算与应用中心