ILLINOIS INSTITUTE OF TECHNOLOGY

Scalable Computing Software Laboratory Technical Report

Department of Computer Science

Illinois Institute of Technology

Concurrent Average Memory Access Time

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May 2012

Technical Report №. IIT/CS-SCS2012-05

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ABSTRACT

Concurrency is the most common technique used in modern memory systems. However, the effectiveness of memory concurrency is application dependent. It varies largely from application to application and from implementation to implementation. Understanding and utilizing memory systems' performance is a vital and timely task for data intensive applications. Traditional memory performance metrics, such as Average Memory Access Time (AMAT), are designed for sequential data accesses, and have inherent limitations in characterizing concurrency. In this study, we propose Concurrent Average Memory Access Time (C-AMAT) as an accurate metric for modern memory systems. C-AMAT has the ability to examine concurrent behavior and provides a quantitative performance measurement at both the component and system level of modern memory systems. First, the concept and formulation of C-AMAT is introduced. Then, several processor architecture and cache design choices, such as multiple issue pipeline, non-blocking cache, CMP, etc., are studied to validate the feasibility and validity of the C-AMAT metric. Finally, experimental results show some of the rules of thumb used in today's industry are confirmed by C-AMAT as optimal design choices. C-AMAT is a good guide for design choices, while other conventional memory metrics often mislead in measurement when concurrency is present.

Categories and Subject Descriptors

D.4.8 [**Performance**]: Performance

C.4 [**Performance of Systems**]: Measurement techniques, Modeling techniques, Performance attributes

General Terms

Measurement, Performance

Keywords

Memory concurrency; memory metric; memory performance measurement