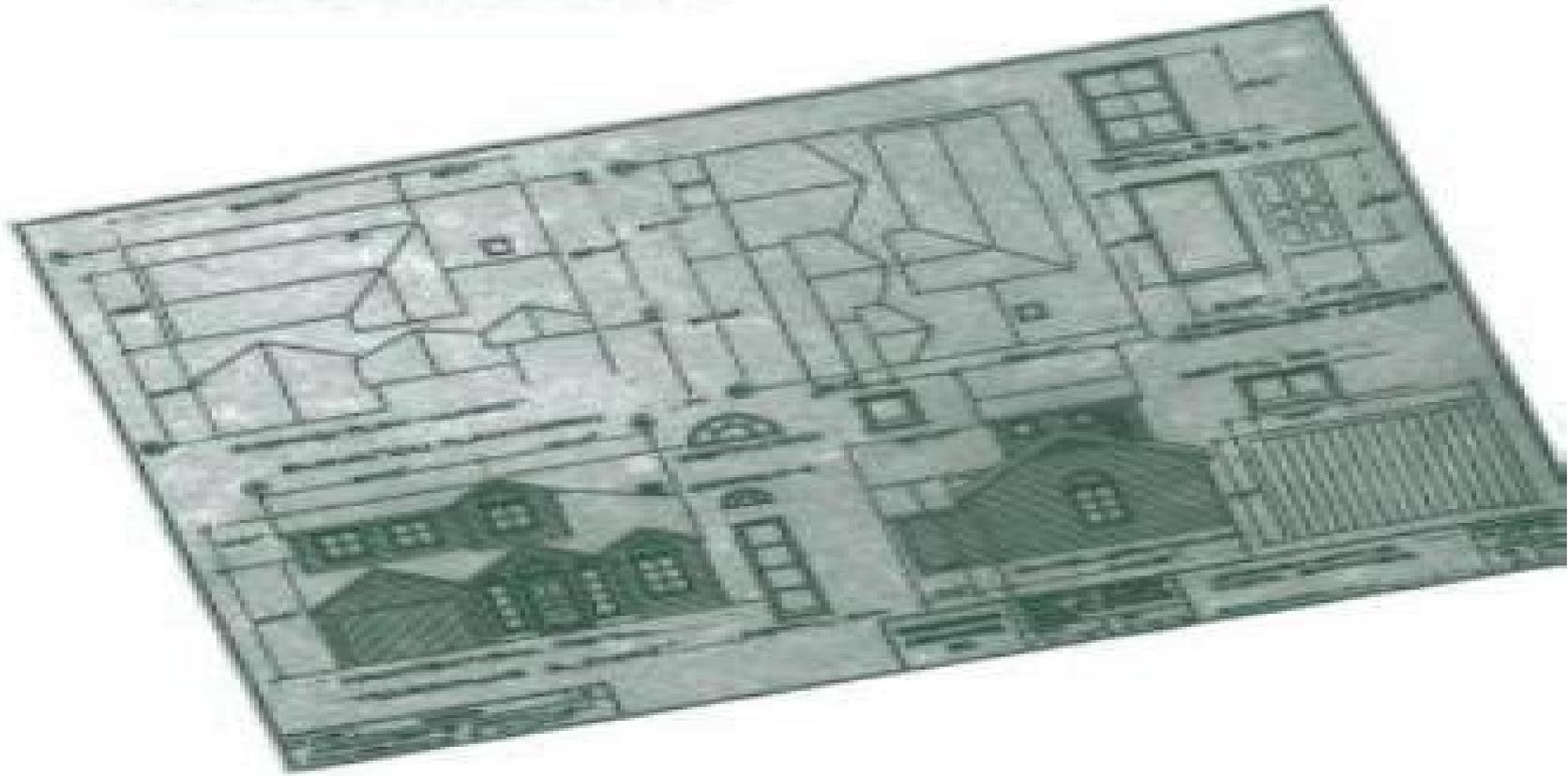


THE CACHE COHERENCE PROBLEM IN SHARED-MEMORY MULTIPROCESSORS SOFTWARE SOLUTIONS

Igor Tontaji and Vesjko Mihirovic



Cache Coherence Problem In Shared Memory Multiprocessors

Igor Tartalja, Veljko Milutinović



Cache Coherence Problem In Shared Memory Multiprocessors:

The Cache Coherence Problem in Shared-Memory Multiprocessors Igor Tartalja, Veljko Milutinović, 1996-02-13 The book illustrates state of the art software solutions for cache coherence maintenance in shared memory multiprocessors It begins with a brief overview of the cache coherence problem and introduces software solutions to the problem The text defines and details static and dynamic software schemes techniques for modeling performance evaluation mechanisms and performance evaluation studies

The Cache Coherence Problem in Shared-memory Multiprocessors University of Washington. Dept. of Computer Science, James K. Archibald, 1987 *A Primer on Memory Consistency and Cache Coherence* Daniel Sorin, Mark Hill, David Wood, 2022-11-10 Many modern computer systems and most multicore chips chip multiprocessors support shared memory in hardware In a shared memory system each of the processor cores may read and write to a single shared address space For a shared memory machine the memory consistency model defines the architecturally visible behavior of its memory system Consistency definitions provide rules about loads and stores or memory reads and writes and how they act upon memory As part of supporting a memory consistency model many machines also provide cache coherence protocols that ensure that multiple cached copies of data are kept up to date The goal of this primer is to provide readers with a basic understanding of consistency and coherence This understanding includes both the issues that must be solved as well as a variety of solutions We present both highlevel concepts as well as specific concrete examples from real world systems Table of Contents Preface Introduction to Consistency and Coherence Coherence Basics Memory Consistency Motivation and Sequential Consistency Total Store Order and the x86 Memory Model Relaxed Memory Consistency Coherence Protocols Snooping Coherence Protocols Directory Coherence Protocols Advanced Topics in Coherence Author Biographies

Scalable Shared Memory Multiprocessors Michel Dubois, Shreekanth S. Thakkar, 2012-12-06 The workshop on Scalable Shared Memory Multiprocessors took place on May 26 and 27 1990 at the Stouffer Madison Hotel in Seattle Washington as a prelude to the 1990 International Symposium on Computer Architecture About 100 participants listened for two days to the presentations of 22 invited The motivation for this workshop was to speakers from academia and industry promote the free exchange of ideas among researchers working on shared memory multiprocessor architectures There was ample opportunity to argue with speakers and certainly participants did not refrain a bit from doing so Clearly the problem of scalability in shared memory multiprocessors is still a wide open question We were even unable to agree on a definition of scalability Authors had more than six months to prepare their manuscript and therefore the papers included in this proceedings are refinements of the speakers presentations based on the criticisms received at the workshop As a result 17 authors contributed to these proceedings We wish to thank them for their diligence and care The contributions in these proceedings can be partitioned into four categories 1 Access Order and Synchronization 2 Performance 3 Cache Protocols and Architectures 4 Distributed Shared Memory Particular topics on which new ideas and

results are presented in these proceedings include efficient schemes for combining networks formal specification of shared memory models correctness of trace driven simulations synchronization various coherence protocols

A Study of Strategies for Dealing with Cache Coherence Problems in Shared Memory Multiprocessor Systems Jarar Ali Shah, 1996

Cache and Interconnect Architectures in Multiprocessors Michel Dubois, Shreekanth S. Thakkar, 2012-12-06

Cache And Interconnect Architectures In Multiprocessors Eilat Israel May 25 261989 Michel Dubois University of Southern California Shreekanth S Thakkar Sequent Computer Systems

The aim of the workshop was to bring together researchers working on cache coherence protocols for shared memory multiprocessors with various interconnect architectures Shared memory multiprocessors have become viable systems for many applications Bus based shared memory systems Eg Sequent s Symmetry Encore s Multimax are currently limited to 32 processors The first goal of the workshop was to learn about the performance of applications on current cache based systems The second goal was to learn about new network architectures and protocols for future scalable systems These protocols and interconnects would allow shared memory architectures to scale beyond current limitations The workshop had 20 speakers who talked about their current research The discussions were lively and cordial enough to keep the participants away from the wonderful sand and sun for two days The participants got to know each other well and were able to share their thoughts in an informal manner The workshop was organized into several sessions The summary of each session is described below This book presents revisions of some of the papers presented at the workshop

The Cache-coherence Problem in Shared-memory Multiprocessors Milo Tomašević, Veljko Milutinović, 1993 A tutorial on the nature of the cache coherence problem and the wide variety of proposed hardware solutions currently available A number of the most important papers in this field are included within seven sections

introductory issues memory reference characteristics of parallel programs

Computer Architecture Michael J. Flynn, 1995 Computer Architecture Software Engineering

Cache Memory Design and Performance Issues in Shared-memory Multiprocessors Farnaz Mounes-Toussi, 1995

Memory Referencing Behavior and Cache Performance in a Shared Memory Multiprocessor David J. Lilja, David Michael Marcovitz, Pen-Chung Yew, 1988 Also the cache coherence problem further reduces the effectiveness of the caches as the number of processors is increased A trace driven simulator is used to show that when data prefetching is combined with a cache the miss ratio is no longer a good metric for evaluating processor performance The standard deviation of intermiss distance multiplied by the miss ratio is proposed as a new performance metric which accurately correlates with execution time

Proceedings of the 1993 International Conference on Parallel Processing C.Y. Roger Chen, P. Bruce Berra, 1993-08-16 This three volume work presents a compendium of current and seminal papers on parallel distributed processing offered at the 22nd International Conference on Parallel Processing held August 16 20 1993 in Chicago Illinois Topics include processor architectures mapping algorithms to parallel systems performance evaluations fault diagnosis recovery and tolerance cube networks portable software synchronization compilers

hypercube computing and image processing and graphics Computer professionals in parallel processing distributed systems and software engineering will find this book essential to their complete computer reference library

Windows 2000 Performance Guide Mark Friedman, Odysseas Pentakalos, 2002 For repairing performance loss or maximizing current potential this guide aims to provide the information and conceptual framework that will enable readers to be performance experts Includes information on processor performance application profiling and hardware considerations

Parallel Computer Architecture David Culler, Jaswinder Pal Singh, Anoop Gupta, 1999 This book outlines a set of issues that are critical to all of parallel architecture communication latency communication bandwidth and coordination of cooperative work across modern designs It describes the set of techniques available in hardware and in software to address each issues and explore how the various techniques interact

High Performance Computing - HiPC'99 Prith Banerjee, Viktor K. Prasanna, Bhabani P. Sinha, 2004-06-01 These are the proceedings of the Sixth International Conference on High Performance Computing HiPC 99 held December 17 20 in Calcutta India The meeting serves as a forum for presenting current work by researchers from around the world as well as highlighting activities in Asia in the high performance computing area The meeting emphasizes both the design and the analysis of high performance computing systems and their scientific engineering and commercial applications Topics covered in the meeting series include Parallel Algorithms Scientific Computation Parallel Architectures Visualization Parallel Languages Compilers Network and Cluster Based Computing Distributed Systems Signal Image Processing Systems Programming Environments Supercomputing Applications Memory Systems Internet and WWW based Computing Multimedia and High Speed Networks Scalable Servers We would like to thank Alfred Hofmann and Ruth Abraham of Springer Verlag for their excellent support in bringing out the proceedings The detailed messages from the steering committee chair general co chair and program chair pay tribute to numerous volunteers who helped us in organizing the meeting October 1999 Viktor K Prasanna Bhabani Sinha Prithviraj Banerjee Message from the Steering Chair It is my pleasure to welcome you to the Sixth International Conference on High Performance Computing I hope you enjoy the meeting the rich cultural heritage of Calcutta as well as the mother Ganges the river of life

A Survey of Shared-memory Multiprocessor Cache Coherence Schemes Hock-Beng Lim, 1989 *Parallel Processing* Bruno Buchberger, Jens Volkert, 1994-08-30 Proceedings Parallel Computing

Implementation of Cache Coherence Protocols in Simulated Shared-memory Multiprocessors Chao-Chang Su, 1994 **Shared Memory Multiprocessing** Norihisa Suzuki, 1992 Shared memory multiprocessors are becoming the dominant architecture for small scale parallel computation This book is the first to provide a coherent review of current research in shared memory multiprocessing in the United States and Japan It focuses particularly on scalable architecture that will be able to support hundreds of microprocessors as well as on efficient and economical ways of connecting these fast microprocessors The 20 contributions are divided into sections covering the experience to date with multiprocessors cache coherency software systems and examples of scalable shared memory

multiprocessors

Fundamentals of Parallel Multicore Architecture

Yan Solihin, 2015-11-18 Although multicore is now a mainstream architecture there are few textbooks that cover parallel multicore architectures Filling this gap Fundamentals of Parallel Multicore Architecture provides all the material for a graduate or senior undergraduate course that focuses on the architecture of multicore processors The book is also useful as a ref

A Primer on Memory Consistency and Cache Coherence, Second Edition Vijay Nagarajan, Daniel J. Sorin, Mark D. Hill, David A. Wood, 2022-05-31 Many modern computer systems including homogeneous and heterogeneous architectures support shared memory in hardware In a shared memory system each of the processor cores may read and write to a single shared address space For a shared memory machine the memory consistency model defines the architecturally visible behavior of its memory system Consistency definitions provide rules about loads and stores or memory reads and writes and how they act upon memory As part of supporting a memory consistency model many machines also provide cache coherence protocols that ensure that multiple cached copies of data are kept up to date The goal of this primer is to provide readers with a basic understanding of consistency and coherence This understanding includes both the issues that must be solved as well as a variety of solutions We present both high level concepts as well as specific concrete examples from real world systems This second edition reflects a decade of advancements since the first edition and includes among other more modest changes two new chapters one on consistency and coherence for non CPU accelerators with a focus on GPUs and one that points to formal work and tools on consistency and coherence

The book delves into Cache Coherence Problem In Shared Memory Multiprocessors. Cache Coherence Problem In Shared Memory Multiprocessors is a vital topic that must be grasped by everyone, from students and scholars to the general public. This book will furnish comprehensive and in-depth insights into Cache Coherence Problem In Shared Memory Multiprocessors, encompassing both the fundamentals and more intricate discussions.

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 - Chapter 4: Cache Coherence Problem In Shared Memory Multiprocessors in Specific Contexts
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web now realizing that heating and cooling curves represent the amount of heat absorbed or released by a substance during phase changes remember heat uses the variable q here we have a heating curve versus a cooling curve in a heating curve our substance is absorbing heat

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web describe the processes represented by typical heating and cooling curves and compute heat flows and enthalpy changes accompanying these processes explain the construction and use of a typical phase diagram

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web 11 12 heating and cooling curves when a substance isolated from its environment is subjected to heat changes corresponding changes in temperature and phase of the substance is observed this is graphically represented by heating and cooling curves

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web determine the final temperature and state of the ammonia once the system reaches equilibrium assuming that no heat is lost to the surroundings use the information below normal boiling point of NH_3 33 3 c Δh_{vap} 23 4 kJ mol specific heat NH_3 l 4 74 J g K specific heat NH_3 g 2 06 J g K

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web apr 3 2023 the experiment described above can be summarized in a graph called a heating curve figure below figure 11

16 1 11 16 1 in the heating curve of water the temperature is shown as heat is continually added changes of state occur during plateaus because the temperature is constant

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web mar 29 2013 heating curves imagine that you have a block of ice that is at a temperature of 30 c well below its melting point the ice is in a closed container as heat is steadily added to the ice block the water molecules will begin to vibrate faster and faster as they absorb kinetic energy

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web the cooling curve a plot of temperature versus cooling time in figure pageindex 4 plots temperature versus time as a 75 g sample of steam initially at 1 atm and 200 c is cooled although we might expect the cooling curve to be the mirror image of the heating curve in figure pageindex 3 the cooling curve is not an

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web once all of the material has solidified at the time indicated by point c the cooling will continue at a rate determined by the heat capacities of the two solids a and b the composition and of course the geometry of the experimental set up by measuring cooling curves for samples of varying composition one can map the entire phase

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web for water this temperature is 100 c because the boiling point for water is 100 c different substances have different melting points and boiling points but the shapes of their heating curves are very similar for example this is the heating curve

for iron a metal that melts at 1538 c and boils at 2861 c cooling curves

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