Parallel Computing and Visualization

Workshop Sponsored by C3.ca and MACI
University of Alberta, Edmonton
April 29 – May 3, 2002

Date	Time	Course	University of Alberta, other Academic Site	Non-University
April 29	9 am – Noon	Introduction to Parallelism and the MACI Facilities	Free	Free
April 29	1 pm – 4:30 pm	Visualization Techniques and Packages	$50	$100
April 30	9 am - Noon	OpenMP from /scratch	$50	$100
April 30	1 pm – 4:30 pm	MPI and PVM	$50	$100
May 1	8:30am - 4:30pm	SPECIAL EVENT, See enclosed brochure for more into.	Keynote Speaker Dr. Ian Foster	$100 for all attendees
May 2 May 3	9 am – 4:30 pm 9 am – 4:30 pm	SGI Tools I and II	$75	$150

About the Course Series

Researchers in Canadian universities now have access to powerful computational facilities. The increase in capabilities has brought forth the need for new skills to get maximum benefit from the new infrastructure. This workshop is intended to introduce the tools, concepts and strategies needed to take full advantage of our modern advanced computing facilities. We are also preparing for the future of Grid Canada.

Who Should Attend

- Anyone using or planning to use high performance parallel computers.
- Anyone interested in high end visualization of complex data sets.

While the courses focus mainly on parallel computers with shared memory, much of the material will also be useful to users interested in parallel computing with distributed memory machines.

Course Descriptions

Introduction to MACI Facilities

Presenters: Dr. Richard Marchand, Ron Senda
Time and Place: April 29, 9 am – 10 am, GSB 315

This is a brief presentation of the present MACI facility, and an overview of the planned upgrades

Introduction to Parallel and Distributed Programming

Instructor: Dr. Nelson Amaral
Time and Place: April 29, 10 am – Noon, GSB 315

We motivate interest in parallel and distributed computing through a discussion of problems that cannot be solved in a reasonable time by single processor systems. We then introduce basic parallel processing concepts, such as absolute and relative speedups, limitations on speedup caused by data dependencies, communication, synchronization, and the total
amount of work in a computation. We discuss the learning curve to program parallel machines efficiently. We present classical memory organizations such as shared, distributed, and distributed-shared memory organizations. For shared memory machines we introduce the concept of memory consistency model and the effect on cache performance that the choice of a model might have. We then introduce the concept of multi-threading, explicit parallelism for instruction level parallelism and its effect on high performance computing. We introduce some concepts related to cluster computing and present some examples of cluster organizations.

Visualization Techniques and Packages

Instructors: Dr. Jon Johansson
Time and Place: April 29, 1 pm – 4:30 pm, Physics 145

This course presents principles and methods for visualizing data resulting from scientific measurements and computations. The emphasis is on using 2D and 3D graphics to gain insights into multidimensional data sets. We discuss basic principles of scientific visualization and aspects of successful visualizations.

We will discuss 2d, 3d and multi-dimensional visualization techniques such as color mapping, data representation, volume rendering, surface extraction, rendering, glyphs for high dimensional data sets, visualization of gaseous and fluid information (scalar fields), isolines and isosurfaces, coloring, particle tracing and animation, as well as some vector field (pathline, streamline, streakline) and stereo visualization as time permits. In addition we will provide an example of single frame animation and mpeg encoding using freely available tools. We also discuss some of the visualization software available through campus computing and some useful packages available free for download.

OpenMP from /scratch

Instructor: Dr. Edmund Sumbar
Time and Place: April 30, 9 am – Noon, Physics 145

Most of us are familiar with the use of command-line switches for invoking the features of a compiler. This technique applies the selected features to all the source code in the compilation. Some compilers support a facility for selectively applying certain compiler features to portions of the code through the use of Fortran directives or C/C++ pragmas. These directives or pragmas are explicitly introduced by the user at critical points in the code to achieve a localised effect (inlining, loop nesting, etc.). Unfortunately, the syntax of these directives varies from one compiler vendor to another. SGI MIPSPro, IBM XL, and some desktop compilers feature parallel code generation. OpenMP allows you to invoke this very desirable compiler feature in a portable way through a standardised set of directives and pragmas. OpenMP enables parallel programming by leveraging the capabilities of existing Fortran and C/C++ compilers. It is not a parallel programming language. Through the use of elementary worked examples, this session will introduce you to parallel programming using this simple, yet

powerful, approach. No previous parallel programming experience is required.

Introduction to MPI and PVM

Instructor: Dr. Masao Fujinaga

Time and Place: April 30, 1 pm – 4:30 pm, Physics 145

This presentation is intended for those people having little or no prior experience with parallel programming. The focus is on distributed-memory programming with the Message Passing Interface (MPI), using a few simple examples in Fortran.MPI requires you to design a program specifically for parallel processing. However, in contrast to using OpenMP, an MPI program can be run on either a shared memory or a distributed memory machine.

SGI Tools

Instructor: Jimmy Scott, SGI
Time and Place: May 2, 9 am – 4:30 pm, Physics 145
May 3, 9 am – 4:30 pm, Physics 145

This course explains the tools available on SGI Origin systems to examine your code and see where your programs are spending their time. You will learn how to use tools to visually inspect for bottlenecks in your programs and see what limits your program's performance. We also show how compiler switches and code modifications can then be used to improve performance. The tools are also explained within the context of parallel programming using either the OpenMP or MPI programming models.

Hands-on examples will be run on the SGI Origin at the University of Alberta. An exercise code will be provided which can be used to practice the techniques of the course. Attendees are encouraged to bring their code to the class so that they can work on it and have expert guidance in explaining what is being said by the tools.

While the tools are specific to SGI, the techniques are universal for performance tuning and parallel coding on any system.

Instructors

Dr. Jose Nelson Amaral is an Associate Professor of Computing Science at the University of Alberta. He received his Ph.D. in Electrical and Computer Engineering from the University of Texas in Austin in 1994 for his design and evaluation of a parallel computer architecture for symbolic computing. Since receiving his Ph.D., he has worked as a professor of Electrical Engineering at PUCRS in Brazil and as a post-doctoral fellow with the Computer Architecture and Parallel Systems Laboratory (CAPSL) at the University of Delaware. His current research interests include compiler design and optimization, computer architecture, and high-performance computer systems.

Dr. Edmund Sumbar holds a PhD in electrical engineering. His previous research interests included finite element modeling of electromagnetic heating phenomena in soils. Currently, he is a member of the HPC support team at the University of Alberta.

Dr, Masao Fujinaga is a member of the Research Computing Support team at the University of Alberta. He has a Ph. D. in biochemistry from the University of Alberta. He has used various high performance computers in the fields of crystallography and computational chemistry. He is currently using parallel computers and genetic algorithms for a crystallographic optimization problem.

Dr. Jon Johansson holds a Ph.D. in nuclear physics from the University of Alberta. He is a member of the Research Computing Support Team at CNS. Jon is interested in computer graphics, scientific visualization and the analysis of large data sets.

Jimmy Scott joined Silicon Graphics in the merger with Cray Research Inc. in 1996. He is a National Systems Specialist specializing in High Performance Computing on both the highend Origins and Cray systems all over Canada. Jimmy is a Computer Science graduate from Concordia University and has been with Cray Research since graduation. At Cray Research Jimmy was a Systems Analyst maintaining the Unix software on Cray systems. He later moved into presales where he helps customers port and tune codes on Cray and Origin systems.

Grid Computing in Canada

One-day workshop
May 1, 2002
Edmonton, Alberta

This day-long event brings together researchers and technicians from across Canada to advance the development of grid computing and facilitate the interconnection of grid computing projects in Canada.

Agenda

8:30 am - 11:30 am WORKSHOP

The morning session, led by one of the world's leading researchers in grid computing, will provide an overview of grid computing in an international context, and discuss current challenges in the field.

Dr. Ian Foster

Argonne National Laboratory and the University of Chicago, Global Grid Forum Steering Group

noon - 1:30 pm LUNCHEON with GUEST SPEAKER

Hosted by the Alberta Informatics Circle of Research Excellence (iCORE)

A catered lunch will be followed by a presentation.

By an invited guest speaker TBC

1:30 pm - 3 pm ADVANCES IN CANADIAN COMPUTING GRIDS

This session will provide a forum for the cross-pollination of ideas and developments on grid computing project across Canada. Presentations about major projects will be followed by an open forum on future directions for Canadian grid computing in the context of international developments.

Current participants include:

- Alberta Innovation Grid
  Netera Alliance
- CA*net 4
  Bill St Arnaud, CANARIE
- Canadian Bioinformatics Resource
  Christoph Sensen, University of Calgary
- Global Grid Forum
  Ian Foster, Argonne National Laboratory
- Grid Canada
  C3.ca
- National Research Council
  Roger Impey
- WestGrid
  Jonathan Schaeffer, University of Alberta
  Brian Unger, University of Calgary

3:30 pm - 5 pm — BREAK OUT MEETINGS

Smaller groups will break out to discuss specific technical, strategic and usage issues related to grid computing. Meetings tentatively scheduled include:

meeting 1	Canadian gridmasters
meeting 2	Grid users

5 pm - 7 pm — RECEPTION

Registration

Cost to participants: $100 (includes lunch, and wine and cheese reception)
To register, use registration form below.

Sponsors

This event is organized by Netera Alliance in conjunction with Computing and Network Services at the University of Alberta. We are grateful to C3.ca for additional support of this workshop.

registration form

Personal Information: Last name:_____ First name:_____

❏ University-based (faculty or department) _____

❏ Industry/business (name of company) _____

❏ Government (role or position) _____

Briefly describe your computing background (years of experience, programming languages, etc.):

_____

_____

Describe your computing project:

_____

_____

Address for correspondence concerning this registration:

Company/Department name (if applicable) _____

Address _____ City _____ Province _____

Country _____ Postal Code _____ Phone ( ) _____ Fax ( ) _____

E-Mail Address: _____

Payment Information (full payment must accompany this registration):

Course	Date and Time	Academic Fee	Non-Academic Fee
❏ Introduction to MACI Facilities	April 29 – 9:00 to 10:00 am	free	free
❏ Introduction to Parallel and Distributed Programming	April 29 - 10:00 am to 12:00 noon	free	free
❏ Visualization Techniques and Packages	April 29 – 1:00 to 4:30 pm	$50	$100
❏ OpenMP from /scratch	April 30 – 9:00 to noon pm	$50	$100
❏ Introduction to MPI and PVM	April 30 – 1:00 pm to 4:30 pm	$50	$100
❏ Grid Computing in Canada ***	May 1 - 8:30 to 4:30 pm	$100	$100
❏ SGI Tools	May 2 - 9:00 am to 4:30 pm May 3 - 9:00 am to 4:30 pm	$75 for two-day course	$150 for two-day course

***** See enclosed agenda for this day.**

Method of Payment ❏ Cash (in person) ❏ University of Alberta indent/cheque (enclosed)

❏ Visa ❏ MasterCard

❏ Credit Card # _____ Expiry Date: _____

Registrant's Signature _____

Enrolment is limited. Please send this application by fax or e-mail or hand-deliver it to:

Ron Senda, 352 General Services Building
University of Alberta
Edmonton, Alberta T6G 2H1 fax (780) 492-1729 e-mail: ron.senda@ualberta.ca