

JOINT ICTP-INFM SCHOOL IN "HIGH PERFORMANCE COMPUTING ON LINUX CLUSTERS"

Starts on: 31 January 2002 at 09:00

Ends on: 15 February 2002

Location: ICTP

Chair: Stefano Cozzini

Description: *The availability of high-speed networks and increasingly powerful commodity microprocessors are making the usage of clusters, or networks, of computers an appealing vehicle for cost effective parallel computing. Clusters, built using commodity-of-the-shelf (COTS) hardware components as well as free, or commonly used, software, are playing a major role in redefining the concept of high performance computing. The School aims to provide the skills needed to benefit from this generation of HPC solutions, giving a basic knowledge of programming, administering and tuning, as well purchasing or building Linux-based clusters. As a provisional program there will be lectures on:*

- Interconnections solutions (characteristics and performances)*
- Parallel programming techniques*
- Optimization and profiling techniques for clusters*
- Operating system issues: parallel file systems and IO*
- System Administration of a Linux cluster*

These lectures will be complemented by hands-on lab sessions where participants, grouped in small teams, will build their own cluster from scratch; during the first week of the school these clusters will be assembled, configured and tested. In the second part of the course, some representative parallel codes in the areas of computational condensed matter, engineering and weather forecast will be distributed to the participants. These codes will be presented in a series of tutorials illustrating their usage and the parallelisation strategies they adopt. During Lab sessions, the participants will be asked to install, analyse and profile some of these codes on the previously built clusters.

PLEASE CONSIDER THE FOLLOWING PROGRAM AS PRELIMINARY (IT COULD CHANGE SIGNIFICANTLY)

Material: . [application form](#)
 . [more information](#)

[<http://agenda.ictp.trieste.it/age.php?id=a01127>]
 [last update: 10 December 2001]

Session 1	Day 1
Session 2	Day 2
Session 3	Day 3
Session 4	Day 4: Parallel programming techniques
Session 5	Day 5
Session 6	Day 6
Session 7	Day 7
Session 8	Day 8
Session 9	day 9
Session 10	Day 10: Monday
Session 11	Day 11
Session 12	Day 12
Session 13	Day 13: Experiences in building Linux Cluster
Session 14	Day 14

Session 1: Day 1

Material: . [more information](#)

31 January 2002

09:00		Registration (1h00')	
10:30		Introduction (1h00') (web_page)	S.Cozzini <i>INFN udr. Sissa, Trieste, Italy</i>
		A brief presentation of school and an overview of HPC and the impact of linux cluster approach	
11:30		The Linux O.S. : an overview (1h00')	to be defined
		An overview of the Linux .O.S. will be presented. Pros and Cons of this OS with respect to other operating systems will be adressed and discusses	
12:30		Lunch Lunch	
14:30	Computer Lab. (M)	Lab Session: presentation (15')	Director, Lab people
		Introduction: how to use the lab sessions	
14:45	Computer Lab. (M)	Tutorial: installing Linux (1h00')	Carlo Fonda <i>ICTP</i>
		How to install Linux on a PC-box	
15:45	Computer Lab. (M)	Practical: Install your own linux box (2h00')	
		Every student is supposed to install a Linux Box	

Session 2: Day 2

Room: [Adriatico Guest House Small Lecture Room](#)

01 February 2002

09:00		Cluster Hardware: PC and networks (2h00')	R. Innocente <i>SISSA</i>
		The basic hardware to build a linux cluster	
11:00		Tutorial: Oscar for linux cluster (2h00')	J. Enos <i>NCSA</i>
		OSCAR is a fully integrated easy to install bundle of software designed to make it easy to build and use a cluster for high performance computing. Everything you need to build, maintain, and use a modest sized Linux cluster is included in OSCAR.	
13:00		Lunch	
14:30		Tutorial: Oscar (II) (2h00')	J. Enos <i>NCSA</i>
16:30	Computer Lab. (M)	Practical I (1h30')	
		Assembly the parts of your Linux Cluster	

Session 3: Day 3

Room: Computer Lab. (M)

02 February 2002

09:00	Practical: Install Oscar (2h30')	
11:30	Student Presentation (1h00') How we build our first linux cluster...	Students' presentations

Session 4: Day 4: Parallel programming techniques

Description: *Learn how to program parallel machines*

04 February 2002

09:00		Parallel Programming in MPI (I) (2h00')	Carlo Cavazzoni <i>Cineca</i>
11:00	<u>Computer Lab. (M)</u>	practical:MPI examples (2h00') Run your first MPI programs	Lab people
13:00	Lunch		
14:30		OpenMp programming (2h00')	Tim Mattson <i>Intel</i>
16:30	<u>Computer Lab. (M)</u>	Practical: OpenMP at work (1h30')	Tim Mattson <i>INTEL</i>

Session 5: Day 5

Room: Adriatico Guest House Small Lecture Room

05 February 2002

09:00		Linux Cluster Management I (2h00') To be defined	S. Martinelli <i>Cineca</i>
11:00		Intel tools for Linux clusters: (2h00') Intel compilers + Intel Libraries	Tim Mattson <i>Intel</i>
13:00	Lunch		
14:30	<u>Computer Lab. (M)</u>	Practical: play with INTEL tools (1h30')	
16:00		MPI programming II (1h00') Adanced Topic in MPI	C. Cavazzoni <i>Cineca</i>
17:00	<u>Computer Lab. (M)</u>	Practical: Free Exercises on MPI/Open MP (1h30')	

Session 6: Day 6**Room:** Adriatico Guest House Small Lecture Room**06 February 2002**

09:00		Linux Tools for HPC: compilers and libraries (2h00')	S. Cozzini <i>INFM udr</i> <i>SISSA</i>
		topics: which compilers are available for HPC on Linux: free compilers gnu compilers/ intel compilers commercial compilers: absoft/pgi/NAG free libraries: FFTW// / ATLAS LAPACK / SCALAPACK	
11:00		Linux Cluster Management II (2h00')	S. Martinelli <i>Cineca</i>
13:00	Lunch		
14:30	<u>Computer Lab.</u> (M)	Practical: configuring PBS and run PBS (1h00')	
15:30	<u>Computer Lab.</u> (M)	Practical: Install free libraries for HPC (1h00')	
16:30	<u>Computer Lab.</u> (M)	Practical: Use compilers and compare performances (2h00')	

Session 7: Day 7**Room:** Adriatico Guest House Small Lecture Room**07 February 2002**

09:00		Again on Hardware: High -end Processors and High Speed Network (2h00')	R. Innocente <i>Sissa</i>
		A survey of the high-end processors available and high speed networks	
11:00		Profiling and Optimization Techinque (I) (1h00')	Luiz De Rose <i>ACTC -IBM</i>
12:00		Itanium IA64 architecture (1h00')	Tim Mattson <i>Intel</i>
13:00	Lunch		
14:30	<u>Computer Lab.</u> (M)	Practical: Install and test free libraries (2h00')	
16:30	<u>Computer Lab.</u> (M)	Practical: MPI Parallel programming using libraries (1h30')	

Session 8: Day 8 **Room:** Adriatico Guest House Small Lecture Room

08 February 2002

09:00		Profiling and Optimization technique (II) (2h00')	Luiz De Rose <i>ACTC IBM</i>
11:00		Portable MPI Tools at Work - Cracking Performance Problems (2h00') Abstract Vampir, the leading MPI performance analysis tools, is now available in a new and improved version. Vampir features a streamlined user-interface, additional displays and source-code display, while keeping all the unique features of previous Vampir releases. This presentation will cover - brief introduction to Pallas, a leading european vendor of software tools for parallel computing. - Vampir, visualization and analysis of MPI programs, focus on 'news' - Vampirtrace, low overhead MPI profiling library, news on Linux - TotalView 5, multi-process debugger	Werner Krotz-Vogel <i>Pallas</i>
13:00	Lunch		
14:30	<u>Computer Lab. (M)</u>	Practical: Optimize these codes ! (2h00') hands-on session on code optimization	
16:30	<u>Computer Lab. (M)</u>	Practical: Vampir at work (1h30')	

Session 9: day 9 **Room:** Computer Lab. (M)

09 February 2002

09:00	Lab Session (3h00') A free lab session in order to 1. Complete/repeat previous day work 2. Install and run your own code 3. Test different Solution
12:00	Group Presentation (1h20') A 10 minutes presentation for each group where results obtained, problem encountered are presented and discussed

Session 10: Day 10:Monday

11 February 2002

09:00		Advanced Topic: Parallel Filesystems GPFS (2h00') (. minutes)	Luiz De Rose <i>ACTC -IBM</i>
11:00		Case study A: Engineering application (1h00')	Carmen Borges <i>Universidade Federal do Rio de Janeiro Escola de Engenharia - Departamento de Eletrotécnica</i>
12:00	Lunch		
13:30	Computer Lab. (M)	case A tutorial (1h00')	Carmen Borges <i>Universidade Federal do Rio de Janeiro Escola de Engenharia - Departamento de Eletrotécnica</i>
14:30	Computer Lab. (M)	Case A Practical (1h30')	

Session 11: Day 11

Room: Adriatico Guest House Small Lecture Room

12 February 2002

09:00		Advanced Topic: Mosix cluster approach (2h00')	Moshe Bar <i>Mosix's Group</i>
11:00		Case study B : Metereological Application (1h00')	Andy Heaps <i>Centre for Global Atmospheric Modelling Reading, UK.</i>
		The Met Office climate model is a world class model used for the study of climate change. The model will be briefly described and examples of it's use for the understanding of the climate system will be shown. Experience and results of using the model on various 64 bit and 32 bit platforms and interconnects will be discussed.	
13:00	Lunch		
14:30	Computer Lab. (M)	Case B Tutorial (1h00')	Andy Heaps
15:30	Computer Lab. (M)	Case B Practical (1h30')	

Session 12: Day 12

13 February 2002

09:00		Performances of Parallel chemistry codes on Linux Cluster (1h00')	Guest (To be confirmed) <i>Daresbury</i>
10:00		Advanced Topic: the high performance QsNet network (1h00')	Milton Romero <i>QSW</i>
11:00		Case Study C: Condensed matter application (1h00')	S. Cozzini <i>INFN udr Sissa</i>
13:00	Lunch		
14:30	<u>Computer Lab.</u> (M)	Case C tutorial (1h00')	S. Cozzini
15:30	<u>Computer Lab.</u> (M)	Case C practical (1h30')	

Session 13: Day 13: Experiences in building Linux Cluster

14 February 2002

09:00		How to build and run a 128 Processor Cluster. (1h00')	S. Martinelli <i>Cineca</i>
10:00		How to build a cluster for Monte Carlo Simulation (1h00')	D. Galli <i>Dip. Fisica Milano</i>
11:00		The VRANA project (1h00')	Lubiana Guy (to be confirmed) <i>Ljubjiana</i>
12:00		Daresbury Experience (1h00')	Guest (To be confirmed)
13:00	Lunch		
14:30	<u>Computer Lab.</u> (M)	Practical: free exercises (3h00')	
16:30		Group Presentation (1h00') Each Group will present results on the three different test cases	

Session 14: Day 14

Description: *This session is still to be completed*

15 February 2002

09:00	Future Trend: GRID COMPUTING (1h00')	Guest (? To be confirmed) <i>Daresbury l</i>
10:00	Future Trends: Java for HPC (1h00')	M. Ronchetti <i>Universita' di Trento</i>
11:00	Student's talks (1h30') Students who want to present their work related to cluster are welcome (20 minutes each talk)	
12:30	Conclusions (20')	S.Cozzini, A. Nobile

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