Nombre y email del profesor DAC que lo promueve: Josep Lluis Larriba Pey, larri@ac.upc.edu

Nombre del profesor que da el seminario:
Varios: R. Pastor-Satorras (UPC, FEN), Josep Ginebra (UPC, IOE), Marta Pérez (UPC, MAII), Horst Bunke (consultor, ex profesor), Josep Lladós (CVC, Centre de Visió per Computador, UAB), Josep Maria Brunat (UPC, MAII), David Domínguez (UPC, DAMA–UPC), TBD (URV) and others to be determined.

Título:
"Workshop Graph Databases: from technology to analysis and applications"

Descripción breve:
The workshop intends to create a forum for discussion among scientists and practitioners who are using the graph as a means to do research. During the workshop, the speakers will explain their latest advances in different areas like, image pattern recognition, parallel processing for graphs, graph modelling, graph algorithms, etc.

Duración: (días o semanas, horas de clase por día)
1, day. Morning and afternoon sessions.

Fecha de impartición: (aproximada o exacta)
19th February, 10 hours.

Número de créditos ETCS (según horas de clase, actividades fuera de clase, etc. ya sabéis ...):
1 ECTS

Tipo de actividades (clase / lab / activs en grupo, ...): (1 ECTS aprox. igual a 25 h de trabajo total) (por defecto clases)
Class, plus work on summarization and in depth understanding of one of the topics.

Tipo de evaluación: (por defecto examen final)
A report on the summarization of two papers about the most attractive talk for each student.

Máster donde se oferta: (todos / CANS / MIRI / especialidad del MIRI)
todos

URL (opcional):
NA yet
Nombre y email del profesor DAC que lo promueve: Luis Velasco (lvelasco@ac.upc.edu)

Nombre del profesor que da el seminario: Luis Velasco
Título: Computer Networks, Datacenters and Services Design

Descripción breve:
The course focuses on the design of both computer networks and datacenters, and reviews strategies for deploying services. Mathematical programing models and algorithms are presented to solve a wide range of related problems. In addition, recent research works on each selected topic are reviewed.
The topics of the course are:
1. Network Design Problem Modeling
2. Location and Topological Design
3. Design of Resilient Networks
4. Virtualization.
5. Datacenter Modeling and optimization.
6. Services in the cloud.
7. Highly available services

Duración: 2 meses / 8 horas por semana
Fecha de impartición: A convenir, p.e. Abril-Mayo
Número de créditos ETCS: 3 ECTS
Tipo de actividades: Clases, trabajo en grupo.
Tipo de evaluación: Assignments y Proyecto
Máster donde se oferta: MIRI, CANS
PROPOSTA DE SEMINARI PER IMPARTIR AL MÀSTER MIRI:

Període d’impartició:

- **Curs 2012-13, Quadrimestre de Tardor**
- **Dates: del 1 al 5 de juliol (ambdós inclosos)**
- **Lloc: Aula Màster del Campus Nord de la UPC (ja està reservada)**
- **Nombre de crèdits: 3 ECTS**


Resum del projecte EULER:

The main objective of the EULER project is to investigate new routing paradigms so as to design, develop, and validate experimentally a distributed and dynamic routing scheme suitable for the future Internet and its evolution. The resulting routing schemes are intended to address the fundamental limits of current stretch-1 shortest-path routing in terms of routing table scalability, but also topology and policy dynamics (perform efficiently under dynamic network conditions).

Therefore, this project investigates trade-offs between routing table size (to enhance scalability), routing scheme stretch (to ensure routing quality) and communication cost (to efficiently and timely react to various failures). The driving idea of this research project is to make use of the structural and statistical properties of the Internet topology (some of which are hidden) as well as the stability and convergence properties of the Internet policy in order to specialize the design of a distributed routing scheme known to perform efficiently under dynamic network and policy conditions when these properties are met. The project will develop new models and tools to exhaustively analyse the Internet topology, to accurately and reliably measure its properties, and to precisely characterize its evolution. These models, that will better reflect the network and its policy dynamics, are being used to derive useful properties and metrics for the routing schemes and provide relevant experimental scenarios.

Furthermore, the project is developing the appropriate tools to evaluate the performance of the proposed routing schemes on large-scale topologies (order of 10k nodes); prototyping of the routing protocols as well as their functional validation and performance benchmarking on the iLAB experimental facility and/or virtual experimental facilities such as PlanetLab/OneLab will allow validating under realistic conditions the overall behaviour of the proposed routing schemes.

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1 EULER project (Ref.: STREP FP7-ICT-2009-5) is a 3-year STREP exploratory research project targeting Challenge 1, "Technologies and Systems architectures for the Future Internet" of, the FP7. The project scope being the Objective ICT-2009.1.6 part b: "Future Internet experimentally-driven research".
ACTIVITATS DEL SEMINARI I AVALUACIÓ DELS ESTUDIANTS

Aquest apartat recull l’activitat que haurà de dur a terme els/les estudiants que es matricularin a aquest seminari per obtenir els 3 ECTS que té assignats, així com la d’avaluació d’aquesta activitat.

Llista d’activitats:

- **Assistència: 30 hores**
  Aquesta activitat consistirà en la assistència i participació activa a totes les ponències del seminari (veure programa annex).

- **Treball en grup: 10 hores**
  Aquesta activitat consistirà en la preparació d’un informe tècnic relacionat amb la temàtica del seminari per a la seva presentació pública. Aquesta activitat es portarà a terme en paral·lel amb el desenvolupament de les ponències (és a dir entre els dies 1 i 5 de juliol), es farà en grups de 3 estudiants i la seva presentació està prevista per a l’últim dia del seminari (veure programa annex).

- **Treball personal: 35 hores**
  Aquesta activitat es portarà a terme durant les tres setmanes següents al seminari, és a dir entre el 8 i el 26 de juliol, i consistirà en la realització d’un “blog” individualment per part de cadascun dels estudiants que reflecteixi el grau d’aprenentatge que els estudiants han assolit en cadascun del temes adreçats en el seminari, inclosos aquells presentats pels propis estudiants. Aquest “blog” s’haurà de finalitzar i fer públic pel 28 de juliol de 2013.

Avaluació:

- **Assistència: 20% de la nota final**
- **Treball en grup: 40% de la nota final**
- **Treball personal: 40% de la nota final**
A continuació s’inclou un a versió preliminar\textsuperscript{2} del programa de la First Euler Summer School que es compartirà amb el seminarí.

**DAILY SCHEDULE**

09:30 – 11:00 Morning Talk (1/2)
11:00 – 11:30 Coffee Break
11:30 – 13:00 Morning Talk (2/2)
13:00 – 14:30 Lunch
14:30 – 16:00 Afternoon Talk
16:00 – 16:30 Coffee Break
16:30 – 18:00 Evening Talk

**FIRST DAY**

08h00 – 9h.30 Registration

**Talks already confirmed**

Introduction of the Winter School topics
- Olivier Bonaventure (UCL)

Overview of the Winter School topics
- Dimitri Papadimitriou (ALB)

**SECOND DAY (Algorithmic graph theory and Graph dynamic modelling)**

- J.Fabrega from Research Group on Combinatorics, Graph Theory and Applications of UPC and/or C.Balbuena, Dep de Matemáticà Aplicada III of UPC
- A.Raspaud, Laboratoire de Recherche, LaBRI (Bordeaux)

**THIRD DAY (Algorithmic graph theory and Graph dynamic modelling cont.)**

- José M. Rodríguez García, Departamento de Matemáticas, Universidad Carlos III de Madrid

**FOURTH DAY (Routing models and algorithmic)**

Compact routing
- Pierre Fraigniaud, if not David Peleg or Ittai Abraham

Geometric routing
- R. Kleinberg or Marian Boguñá

**FIFTH DAY (Routing models and algorithmic cont.)**

Stochastic routing (9.30 – 11.30)
- E. Gelenbe (imperial College)

Operational aspects (12.00 – 14.00)
- P. Festa (if not B. Fortz (ULB))

14:30 – 17.00 Exercises/Student presentations

\textsuperscript{2} Tot i que l'estructura general ja està decidida, encara faltan per confirmar alguns detalls.
PATC TRAINING COURSES @ BSC

2012 - 2013
The mission of BSC-CNS is to investigate, develop and manage information technology in order to facilitate scientific progress. The BSC-CNS is the National Supercomputing Facility in Spain and manages MareNostrum, one of the most powerful supercomputers in Europe, located at the Torre Girona chapel. The BSC-CNS is organised into 6 core departments: Computer Sciences, Life Sciences, Earth Sciences, Operations, Computer Applications in Science & Engineering (CASE), and Management. There are various scientific research groups, which focus their activities on the study of hardware and system software for the supercomputers of the future and on the application of computer simulation to the underlying physical processes of nature, with particular focus on Life, Earth and Engineering sciences. Key to the success of the BSC-CNS are the many people of different backgrounds that work and collaborate with the institute. We are currently over 350 people from more than 25 countries worldwide, among that are 85 PhD and 29 Postdoc students.
PRACE Advanced Training Centre Courses @ BSC

Autumn 2012 – Summer 2013

PRACE, the Partnership for Advanced Computing in Europe (www.prace-ri.eu), has established six of its members’ sites: Barcelona Supercomputing Center (Spain), CINECA - Consorzio Interuniversitario (Italy), CSC - IT Center for Science Ltd (Finland), EPCC at the University of Edinburgh (UK), Gauss Centre for Supercomputing (Germany) and Maison de la Simulation (France) as the first PRACE Advanced Training Centres.

The mission of the PRACE Advanced Training Centres (PATCs) is to carry out and coordinate training and education activities that enable the European research community to utilise the computational infrastructure available through PRACE.

This session we are offering a set of brand new courses such as the Parallel Programming workshop and the series of courses introducing tools and environments for the application areas of Engineering, Earth and Life Sciences as well as the introduction of the new MareNostrum III.

We are also continuing to offer the well-established and sought after courses in Performance Analysis, Heterogeneous Programming and Introduction to CUDA.

This year again you will have the opportunity to learn about novel developments in computer architecture on the ARM-based prototypes workshop.

PATC courses are attended by specialists from across Europe and all lectures and materials are in English. The attending students can benefit from the hands-on sessions and communication with our internationally renowned instructors.

Participants will be issued a Certificate of Attendance.
The PATCs do not charge fees for their courses.

The number of seats for all courses is limited. Please if you want to attend register in time.

Further details for the courses and application form can be found at: http://www.bsc.es/marenostrum-support-services/hpc-trainings/prace-trainings

About PRACE you can learn more at: http://www.prace-ri.eu/

If you have any questions for project placements and further postgraduate opportunities at BSC, please contact us at education@bsc.es
PATC @ BSC Courses in 2012-2013 Academic year

Timetable

1. Parallel Programming Workshop - 26 to 30 November 2012
2. Introduction to simulation environment for Earth Sciences - 13 and 14 December 2012
3. Engineering simulation tools: ALYA, FALL3D & PANDORA - 6 to 8 February 2013
4. Simulation environment for Life Sciences -14 and 15 March 2013
5. Systems Workshop: Programming MareNostrum III - 17 and 18 April 2013
7. Heterogeneous Programming on GPUs with MPI + OmpSs - 15 and 16 May 2013
8. Programming ARM based prototypes - 17 May 2013
9. Introduction to CUDA Programming - 3 to 7 June 2013 (with CCOE)
PATC Course: Parallel Programming

URL: http://www.bsc.es/marenostrum-support-services/hpc-events-trainings/prace-trainings/26-30-nov-2012-patc-parallel

Offered to: MIRI

Duration: 5 days

Date of Delivery:

ECTS: 4

Assessment: For Pass the students have to have 100% presence and submit their practical exercises.

Area: Core HPC Curriculum

Level: for trainees with some theoretical and practical knowledge

Convener: Eduard Ayguade, BSCenter Computer Sciences Department Associate Director and UPC,
E-mail: eduard.ayguade@bsc.es

Lecturers:
- Xavier Martorell, BSC, UPC
- Rosa M. Badia, BSC
- Vassil Alexandrov, BSC, ICREA
- David Vicente, BSC
- Janko Strassburg, BSC

Prerequisites: Fortran, C or C++ programming. All examples in the course will be done in C.

Objectives: The course starts with the objective of setting up the basic foundations related with task decomposition and parallelization inhibitors, using a tool to analyze potential parallelism and dependences. The course follows with the objective of understanding the fundamental concepts supporting shared-memory and message-passing programming models. The course is taught using formal lectures and practical/programming sessions to reinforce the key concepts and set up the compilation/execution environment. The course covers the two widely used programming models: OpenMP for the shared-memory architectures and MPI for the distributed-memory counterparts. The use of OpenMP in conjunction with MPI to better exploit the shared-memory capabilities of current compute nodes in clustered architectures is also considered. Paraver will be used along the course as the tool to understand the behavior and performance of parallelized codes.
Learning Outcomes: On completion of this course students should be able to:
Understand the use of task decomposition and the inhibitors of the potential parallelism in a sequential algorithm.
Understand the fundamentals of shared-memory and message-passing models.
Implement simple algorithms using OpenMP for shared-memory and MPI for message-passing.
Compile, execute and debug simple OpenMP and MPI codes.
Understand the performance of OpenMP and MPI codes.

Course Program Outline:

Day 1
Session 1 / 10:00 am – 1:00 pm
Introduction to parallel algorithms design and performance parameters (1 hour)
SsGrind: tool to analyze potential parallelism and its inhibitors (2hours)
Practical: simple heat diffusion application

Session 2 / 2:00pm – 5:00 pm
Introduction to Paraver: tool to analyze and understand performance
Practical: hybrid MPI/OpenMP trace analysis

Day 2
Session 1 / 10:00 am - 1:00 pm
Introduction to MPI: Overview of MPI
Point-to-point communication, collective communication
Practical: How to compile and run MPI applications, distributed matrix computations (matrix multiply or/and heat equation)

Session 2 / 2:00 pm - 5:00 pm
Blocking and non-blocking communications
Communicators, Topologies
Practical: Distributed matrix computations (same examples as in session 1)

Day 3
Session 1 / 10:00 am - 1:00 pm
MPI I/O issues, Error handling, Parallel libraries
Scalability, xSim and Dimemas simulator
Practical: Scalability simulations using xSim and Dimemas

Session 2 / 2:00 pm - 5:00 pm
Practical: Scalability simulations using xSim and Dimemas (cont.)
Outlook - Fault tolerance, FT-MPI, MPI 3.0
Day 4
Session 5 / 10:00am – 1:00 pm
Shared-memory programming models, OpenMP fundamentals
Parallel regions and work sharing constructs
Synchronization mechanisms in OpenMP
Practical: heat diffusion

Session 6 / 2:00pm – 5:00 pm
Tasking in OpenMP
Programming using a hybrid MPI/OpenMP approach
Practical: heat diffusion

Day 5 / Session 7 / 10:00 am – 1:00 pm
Introduction to the OmpSs programming model
Programming using a hybrid MPI/OmpSs approach
Practical: TBD

END of COURSE
PATC Course: Introduction to simulation environments for Earth Sciences

URL: http://www.bsc.es/marenostrum-support-services/hpc-events-trainings/prace-trainings/13-14-dec-patc-evaluation-earth

Offered to: All MSc Courses

Duration: 2 days          Date of Delivery: 13, 14 December 2012

ECTS: 2

Assessment: For Pass the students have to have 100% presence and submit their practical exercises.

Area: Computational Science (Scientific Visualization; Modeling & Simulation) and HPC skills for Scientists

Level: for trainees with very little knowledge

Convener: Jose Maria Baldasano, BSC Earth Sciences Department Director
          E-mail: jose.baldasano@bsc.es

Lecturers: Oriol Jorba, BSC Earth Sciences
           Kim Serradell, BSC Earth Sciences

Prerequisites: Degree or formation in progress on Earth Sciences, Computer Sciences or related, Basic knowledge of UNIX, Knowledge of C, FORTRAN, MPI or openMP is recommended, Knowledge of Earth Sciences data formats is recommended (grib, netcdf, hdf,…)

Objectives: The objective of this course is to cover the main basic topics of HPC environment oriented to Earth Sciences applications. Attendants will learn how to access an HPC facility, install some Earth Sciences models and utilities, run specific test cases, monitoring an execution in batch mode, and visualize the results.

More specifically, the course will cover:

- Basic usage of shell environment, compilers, and parallel programming paradigms (MPI, openMP)
- Build a targeted Earth Science application
- Execution and monitorization of submitted experiment
- Introduction to some commonly used tools to visualize and analyse model outputs
Learning Outcomes: The students who finish this course will be able to access, build, run, and visualize a collection of Earth Sciences numerical models. Furthermore, the students will gain a general knowledge on Earth Sciences applications within an HPC environment. The course will provide basic HPC skills for future Earth Sciences modelers.

Agenda:

Day 1 / Session 1
- Introduction to Earth Sciences modeling
- Introduction to the HPC environment applied to Earth Sciences applications

Session 2
- HPC environment tutorial (filesystem handle, compilation, job submission and monitoring)
- Application cases: WRF, CMAQ, WAM,… models; Models hands-on

Day 2 / Session 3
- Visualization packages (ncview, panoply, grads, ncl, visit)
- Visualization Hands-on

Session 4
Free hands-on
PATC Course: Engineering simulation tools
ALYA, FALL3D & PANDORA

URL:  http://www.bsc.es/marenostrum-support-services/hpc-events-trainings/prace-trainings/6-8-feb-patc-engineering

Offered to: All MSc Courses

Duration: 3 days       Date of Delivery: 6th to 8th February 2013

ECTS: 3

Assessment: For Pass the students have to have 100% presence and submit their practical exercises.

Area: Computational Science (Scientific Visualization; Modeling & Simulation); Additional HPC Topics (GPU Computing; HPC libraries; Parallel I/O)

Level: For trainees with some theoretical and practical knowledge

Convener: Jose Maria Cela, BSC Computer Applications in Science and Engineering Director
E-mail: josem.cela@bsc.es

Lecturers: Guillaume Houzeaux, BSC CASE department, ALYA team leader.
Mariano Vazquez, BSC CASE department, ALYA team leader.
Arnau Folch, BCS CASE department, FALL3D team leader.
Xavier Rubio, BSC CASE department, PANDORA team leader.

Prerequisites: For ALYA and FALL3D students should have an intermediate knowledge on numerical methods for PDEs and some basic skill in FORTRAN programming. For PANDORA there is not any prerequisite about Agent Based Models, because the course will include a theory base introduction. Some knowledge about Object Oriented programming will be required.

In all the cases the students should be able to work independently as UNIX applications users.
Objectives: The objective of this course is to show some computational tools able to model complex engineering problems. Specifically, three tools developed by BSC will be showed in parallel sessions:

- **ALYA**: to simulate complex multiphysics engineering problems.
- **FALL3D**: to simulate volcanic dust dispersion.
- **PANDORA**: to develop Agent Based Models using HPC platforms.

Learning Outcomes: The students who finish this course will be able to use these computational tools in real engineering problems.
Agenda:

**FALL3D**

**Day 1 / Session 1 / 9am - 1 pm:** (3 lecture blocks with 5 min breaks in between)
1. Introduction to explosive volcanism
2. Introduction to atmospheric transport modeling
3. Introduction to the physics model in FALL3D

**Day 2 / Session 2/ 9am- 1 pm:** (3 practical session)
1. Installing and compiling FALL3D
2. Auxiliary tools for pre and post processing
3. Definition of Input/Output files

**Day 3 / Session 2/ 9am- 1 pm:** (Practical session)
1. Practical exercises with different volcano cases

**ALYA**

**Day 1 / Session 1:** Advanced Numerical Methods in Computational Mechanics
1. Introduction to computational mechanics
2. Space-time discretization

**Session 2:** Advanced Numerical Methods in Computational Mechanics
1. Stabilization of a numerical scheme

**Day 2 / Session 1:** Parallel algorithms in Computational Mechanics
1. MPI paradigm applied to a Computational Mechanics code
2. Iterative solvers: implementation issues

**Session 2:** Alya tutorial
1. Alya data files
2. Solution of basic benchmark tests with Alya (fluid mechanics).

**Day 3 / Session 1:** Alya tutorial
1. Solution of advanced problems.
2. Introduction to Turbulence models in Alya.
3. Post-procesing results and checking convergence.
Session 2: Alya applications in Fluid Mechanics
1. Solution of a test case on a supercomputer.
2. Mesh partitioning as a preprocess.
3. Visualization with Paraview.

PANDORA

Day 1 / Session 1 (3h lectures with 5 min breaks on the hour)
1. Introduction to Social Science Modelling and Simulation
2. Introduction to Agent-Based Modelling
3. Pandora: an ABM framework for social science simulation in HPC

Session 2 (3h practical session)
1. Deployment and first steps with Pandora
2. Exercise 1: Creating an ABM prototype with pyPandora
3. Exercise 2: Analyzing simulation results with Cassandra

Day 2 / Session 3 (3h practical session)
1. Exercise 3: Development of C++ distributed ABM (3 hours)

Session 4 (3h practical session)
1. Exercise 4: Using geospatial data in Pandora Simulations (1 hour)
2. Exercise 5: Analysing simulation results using GRASS GIS and R statistical package (2 hours)

END of COURSE
PATC Course: Simulation Environment for Life Sciences


Offered to: All MSc Courses

Duration: 2 days  Date of Delivery: 14, 15 March 2013

ECTS: 2

Assessment: For Pass the students have to have 100% presence and submit their practical exercises.

Area: HPC skills for Scientists

Level: For trainees with some theoretical and practical knowledge; those who finished the beginners course

Convener: Josep Gelpi, BSC Life Sciences Department
E-mail: josep.gelpi@bsc.es

Lecturers: Modesto Orozco BSC-IRB, LS director
Agustí Emperador, IRB
Adam Hospital, INB, IRB

Prerequisites:
Basic knowledge of structural bioinformatics
Basic knowledge of parallelization strategies

Material will be provided during the course, students are welcome to provide their own use cases.

Objectives: The course will make the attendants familiar with simulation technologies used in Life Sciences and their specific adaptation to HPC environment

Detailed outline:
- Introduction to bio molecular simulation
- Coarse-grained and atomistic simulation strategies
- Automated setup for simulation
- HPC specifics: Large scale parallelization, use of GPU’s
- Storage and strategies for large scale trajectory analysis
Learning Outcomes: The students who finish this course will be able to setup, execute, and analyze standard simulations in HPC environment.

Course Program Outline:

Day 1
Session 1 CET am
Introduction to Molecular Simulations
Simulation Strategies and HPC

Session 2 CET pm
Setup of protein simulation system using MDWeb (Hands-on)
Basic analysis of trajectories (Hands-on)

Day 2
Session 3 CET am
HPC simulation specifics.
Storage strategies, and data management

Session 4 CET pm
Guided Hands on Practical
Hands-on session with problems from the students

End of Course
PATC Course: Systems Workshop - MareNostrum III


Offered to: All MSc Courses

Duration: 2 days Date of Delivery: 17, 18 April 2013

ECTS: 2

Assessment: For Pass the students have to have 100% presence and submit their practical exercises.

Area: Core HPC

Level: Some theoretical knowledge advisable

Convener: David Vicente, BSC Operations, User Support Manager
Email: david.vicente@bsc.es

Prerequisites: Any potential user of a HPC infrastructure will be welcome

Objectives: The objective of this course is to present to potential users the new configuration of MareNostrum and a introduction on how to use the new system (batch system, compilers, hardware, MPI, etc). Also It will provide an introduction about RES and PRACE infrastructures and how to get access to the supercomputing resources available.

Learning Outcomes: The students who finish this course will know the internal architecture of the new MareNostrum, how it works, the ways to get access to this infrastructure and also some information about optimization techniques for its architecture.
Agenda:

Day 1 / Session 1 / 9am - 1 pm: (3h lectures with 5 min breaks on the hour).
1. Introduction to BSC and the NEW MareNostrum
   1.1 – BSC
   1.2 – MN Hardware
   1.3 – MN Software
   1.4 – MN filesystems and BSC as Data Center
2. How to use it
   2.1 Access
   2.2 Batch system
   2.3 Compilers
3. Practical Session (part 1)

Day 1 / Session 2 / 2 pm - 6 pm: (3h practical session)
1. Tunning applications for MN
2. Practical Session (part 2)

Day 2 / Session 3 / 9am - 1 pm: (3h practical session)
1. Introduction to RES and PRACE
2. How to get resources of HPC
3. TBD

END of COURSE
PATC Course: Performance Analysis and Tools

URL: http://www.bsc.es/marenostrum-support-services/hpc-events-trainings/prace-trainings/

Offered to: MIRI

Duration: 2 days          Date of Delivery: 13, 14 May 2013

ECTS: 3

Assessment: For Pass the students have to have 100% presence and submit their practical exercises.

Area: Core HPC Curriculum

Level: for trainees with some theoretical and practical knowledge;

Convener: Judit Gimenez, BSC Tools Group Manager
          E-mail: judit.gimenez@bsc.es

Lecturers: Harald Servat, German Llort, Juan Gonzalez

Prerequisites: none

Objectives:
The objective of this course is to learn how Paraver and Dimemas tools can be used to analyze the performance of parallel applications and to familiarize with the tools usage as well as instrumenting applications with Extrae.

Learning Outcomes:
The students who finish this course will have a basic knowledge on the usage of the BSC performance tools. They will be able to apply the same methodology to their applications, identifying potential bottlenecks and getting hints on how to improve the applications performance.
Timetable

Day 1 / Session 1 / 09am - 1 pm:
1. Introduction to Paraver
2. Paraver guided demo

Day 1 / Session 2 / 2 pm- 6 pm:
Paraver Hands-on

Day 2 / Session 3/ 9am- 1 pm:
1. Advanced analysis
2. Introduction to Dimemas
3. Dimemas guided demo

Day 2 / Session 4 / 2 pm- 6 pm:
Tools Hands-on

END of COURSE
PATC Course: 
Heterogeneous Programming on GPUs with MPI + OmpSs

URL: http://www.bsc.es/marenostrum-support-services/hpc-events-trainings/prace-trainings/

Offered to: MIRI

Duration: 2 days Date of Delivery: 15, 16 May 2013

ECTS: 3

Assessment: For Pass the students have to have 100% presence and submit their practical exercises.

Area: Core HPC Curriculum

Level: for trainees with some theoretical and practical knowledge, able to work independently and requiring guidance for solving complex problems

Convener: Xavier Martorell, UPC and BSC 
E-mail: xavier.martorell@bsc.es

Lecturers: Rosa Badia, BSC

Prerequisites: Good knowledge of C/C++
Basic knowledge of CUDA/OpenCL
Basic knowledge of Paraver/Extrae

Objectives: The tutorial will motivate the audience on the need for portable, efficient programming models that put less pressure on program developers while still getting good performance for clusters and clusters with GPUs. More specifically, the tutorial will:
- Introduce the hybrid MPI/OmpSs parallel programming model for future exascale systems
- Demonstrate how to use MPI/OmpSs to incrementally parallelize/optimize:
  - MPI applications on clusters of SMPs, and
  - Leverage CUDA kernels with OmpSs on clusters of GPUs
Learning Outcomes: The students who finish this course will be able to develop benchmarks and simple applications with the MPI/OmpSs programming model to be executed in clusters and clusters of GPUs.

Timetable

Day 1

Session 1 / 9am – 11am:
Introduction to OmpSs

Session 1 / 11:30am – 1pm:
OmpSs single node programming hands-on

*Lunch Break 1pm to 2pm*

Session 2 / 2 pm- 3 pm:
More on OmpSs: GPU/CUDA programming

Session 2 / 3 pm- 6 pm:
OmpSs single node programming hands-on with GPUs

Day 2

Session 3/ 9am- 10 am:
Introduction to MPI/ OmpSs

Session 3/ 10am- 1 pm:
MPI/ OmpSs hands-on

*Lunch Break 1pm to 2pm*

Session 4/ 2pm- 6 pm:

Free hands-on: Students use OmpSs environment with prepared examples, except in the free hands-on session were they can bring their own application.

END of COURSE

May 15 – 16, 2013
PATC Course: Programming ARM based prototypes

URL: http://www.bsc.es/marenostrum-support-services/hpc-events-trainings/prace-trainings/

Offered to: MIRI

Duration: 1 day                       Date of Delivery: 17 May 2013

ECTS: 1

Assessment: For Pass the students have to have 100% presence and submit their practical exercises.

Area: Systems Workshop

Level: for trainees with some theoretical and practical knowledge; those who finished the beginners course; Standard HPC users,

Convener: Alex Ramirez UPC, BSC
   E-mail: alex.ramirez@bsc.es

Lecturers: David Vicente, BSC

Objectives:
Get a comprehensive view of the architecture of the ARM-based prototypes at BSC (ARM multicore cluster and ARM+CUDA GPU cluster) and how to program these machines efficiently.

Learning Outcomes:
Understand how ARM multicore and ARM+GPU clusters work. Work with some example codes, compiling, debugging and executing through system queues.
Get a global view of the machines with their specific configuration (Operating system, batch system, debuggers, compilers, how to access to the machines, how to use the resources, etc)
Course Outline:

Session 1
1. The Montblanc Project
2. ARM based machines: Architecture Overview
3. Discussion

Lunch Break (13:00 to 14:00)

Session 2 (lecture + 1h hands-on):
Using ARM based machines (How to get access, Job Execution, Support) (1:30h)

Session 3 (lecture + hands-on):
Developing application on ARM based machines (GNU tool chain, examples, etc...)

END of COURSE
PATC Course: Introduction to CUDA Programming

URL: http://www.bsc.es/marenostrum-support-services/hpc-events-trainings/prace-trainings/

Offered to: All MSc Courses

Duration: 5 days        Date of Delivery: 3 – 7 June, 2013

ECTS: 4

Assessment: For Pass the students have to have 100% presence and submit their practical exercises.

Area: Core HPC Curriculum

Level: BEGINNERS: for trainees from different background and very little knowledge

Convener: Isaac Gelado Senior Researcher, Heterogeneous Architectures, BSC
E-mail: isaac.gelado@bsc.es

Lecturers: Javier Cabezas, Barcelona Supercomputing Center
           Marc Jorda, Barcelona Supercomputing Center

Prerequisites:
Basic knowledge of C/C++ programming
Attendees will need to bring their own laptops with a SSH client

Objectives:
The aim of this course is to provide students with knowledge and hands-on experience in developing applications software for processors with massively parallel computing resources. In general, we refer to a processor as massively parallel if it has the ability to complete more than 64 arithmetic operations per clock cycle. Many commercial offerings from NVIDIA, AMD, and Intel already offer such levels of concurrency. Effectively programming these processors will require in-depth knowledge about parallel programming principles, as well as the parallelism models, communication models, and resource limitations of these processors. The target audiences of the course are students who want to develop exciting applications for these processors, as well as those who want to develop programming tools and future implementations for these processors.
Learning Outcomes:
The students who finish this course will learn how to program massively parallel processors and achieve high performance, functionality, maintainability, and scalability across future generations.
The students who finish this course will acquire technical knowledge required to achieve the above goals by learning principles and patterns of parallel algorithms, processor architecture features and constraints, and programming API, tools and techniques.

Timetable:
Day 1 / Session 1 / 9am - 1 pm: (3h lectures with 5 min breaks on the hour)

1. Introduction to CUDA
2. CUDA Threading Model (I)
3. CUDA Threading Model (II)

Session 2 / 2 pm- 6 pm: 3h practical session – lab exercises

Day 2 / Session 3 / 9am- 1 pm: (3h practical session)

1. CUDA Memory Model
2. Matrix Multiplication – Shared Memory
3. 2D Convolution – Constant Memory

Session 4 / 2 pm- 6 pm: 3h practical session – lab exercises

Day 3 / Session 5 / 9am- 1 pm: (3h practical session)

1. CUDA Memory Model
2. Matrix Multiplication – Shared Memory
3. 2D Convolution – Constant Memory

Session 6 / 2 pm- 6 pm: 3h practical session – lab exercises

Day 4 / Session 7 / 9am- 1 pm: (3h practical session)

1. Parallel Reductions
2. Memory Bandwidth Considerations
3. Prefix Scan

Session 8 / 2 pm- 6 pm: 3h practical session – lab exercises

Day 5 / Session 8 / 9 am – 1 pm: 3h practical session – lab exercises
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