Aspects of large scale high speed computing – Building blocks of a cloud

DAAD / UFPR

Department of Computer Science

March/April 2011, Curitiba
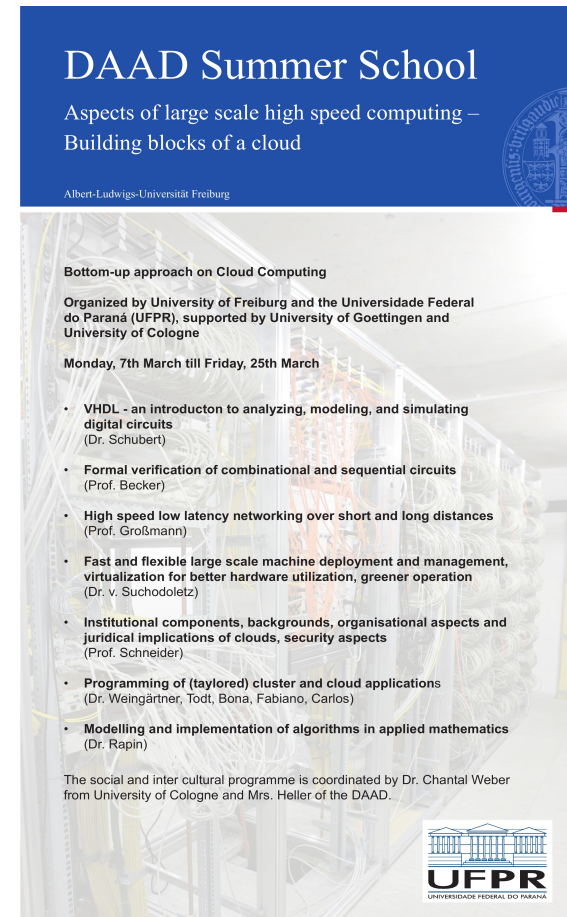
Welcome to the Summer School

- DAAD – German Academic Exchange Service and its program

- Faculty of Engineering and University of Freiburg

- Syllabus and Scope

  - Topics and time line

  - Summary of each course

  - Extra parts

- Short introduction of lecturers

- Extra-academic activities

DAAD Summer School

Aspects of large scale high speed computing –
Building blocks of a cloud

Albert-Ludwigs-Universität Freiburg

Bottom-up approach on Cloud Computing

Organized by University of Freiburg and the Universidade Federal do Paraná (UFPR), supported by University of Goettingen and University of Cologne

Monday, 7th March till Friday, 25th March

- VHDL - an introducton to analyzing, modeling, and simulating digital circuits
  (Dr. Schubert)

- Formal verification of combinational and sequential circuits
  (Prof. Becker)

- High speed low latency networking over short and long distances
  (Prof. Großmann)

- Fast and flexible large scale machine deployment and management, virtualization for better hardware utilization, greener operation
  (Dr. v. Suchodoletz)

- Institutional components, backgrounds, organisational aspects and juridical implications of clouds, security aspects
  (Prof. Schneider)

- Programming of (taylored) cluster and cloud applications
  (Dr. Weingärtner, Todt, Bona, Fabiano, Carlos)

- Modelling and implementation of algorithms in applied mathematics
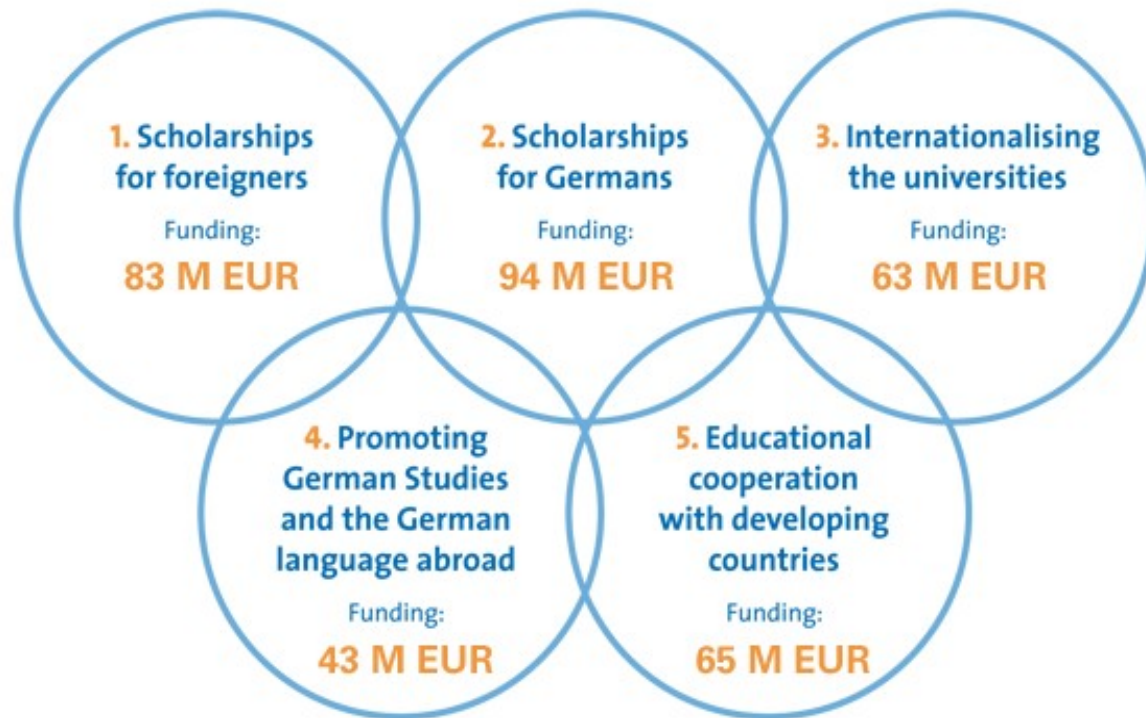 (Dr. Rapin)

The social and inter cultural programme is coordinated by Dr. Chantal Weber from University of Cologne and Mrs. Heller of the DAAD.

UFPR
UNIVERSIDADE FEDERAL DO PARANÁ

German Academic Exchange Service (DAAD)

- DAAD is the largest funding organization in the world supporting the international exchange of students and scholars

  – Since it was founded in 1925, more than 1.5 million scholars in Germany and abroad have received DAAD funding

- Head office: Bonn (former German capital)

  – 14 regional offices and 50 information centres

- **Brasil**: Rio de Janeiro www.rio.daad.de

  – São Paulo (Information Center)

DAAD – Funding

1. Scholarships for foreigners
Funding:
83 M EUR

2. Scholarships for Germans
Funding:
94 M EUR

3. Internationalising the universities
Funding:
63 M EUR

4. Promoting German Studies and the German language abroad
Funding:
43 M EUR

5. Educational cooperation with developing countries
Funding:
65 M EUR

➢ German Federal Foreign Office

➢ European Union

➢ A number of enterprises, organizations

➢ Foreign governments

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Strategic Goals of DAAD Program

- Encourage outstanding young students and academics from abroad to come to Germany for study and research visits

- Qualify young German researchers and professionals at the very best institutions around the world in a spirit of tolerance and openness

- Promote the internationality and appeal of Germany's institutions of higher education

- Support German language, literature and cultural studies at foreign universities

- Assist developing countries in the southern hemisphere and reforming countries in the former Eastern Bloc in the establishment of effective higher education systems

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Organizers of the DAAD Summer School

- Joint project of the State University of Parana and University of Freiburg

  - Idea born during the 4th German-Brazil Symposium in October 2009 in Curitiba

  - Program idea and concept in beginning of 2010

  - Application to the DAAD in September of 2010

  - Visit of a professor of dept. of computer science in Freiburg in October 2010

  - Grant received six weeks later

  - Detailed planning

- Realized for the start of the new semester at UFPR

The Faculty

- Pretty young: 11th faculty of the university

  - Founded in 1994 comprises of the institutes of computer science and micro system technology

  - Over 25 professorships in different fields like algorithms, data structures, artificial intelligence, machine learning, computer networks and telematics, software engineering, databases, ...

The University of Freiburg

- University of Freiburg

  – Founded in 1457 the university celebrated 2007 its 550th anniversary

  – One of the oldest universities in Germany

  – Today the university boasts a variety of degree programs in any of more than 60 fields in 11 faculties

  – 21,500 students

  – 5000+ personnel

The City of Freiburg

- – Humanities at the University have a long and illustrious tradition, e.g. philosophers like Heidegger
- Freiburg typical university town with some more research organisations present (Max Planck Society, Fraunhofer Institutes, ...)

South-west of Germany in a city of 200.000 inhabitants, pleasantly located in the Upper Rhine Graben

In the German State of Baden-Württemberg

"Capital of the Black Forest" renowned for the best weather in Germany

Syllabus and Scope

- General program of the DAAD Summer School

    - Formal verification of combinational and sequential circuits

    - VHDL – An introduction to analyzing, modeling, and simulating digital circuits

    - Storage Networks – An overview to a major facet of cloud computing

    - Managing Clouds – Fast and flexible large scale machine deployment and management, virtualization for better hardware utilization and greener operation

Syllabus and Scope

- General program of the DAAD Summer School (cont.)

  - Cloud Organization – Institutional components, backgrounds, organizational aspects and juridical implications of clouds, security aspects

  - Cloud Applications – Modeling and implementation of algorithms in applied mathematics

  - Presentations at the Research Seminar (Seminário da Pós graduação)

Syllabus and Scope

- Matthew Lewis: *Formal Verification of combinational and sequential circuits*

  - Introduction to formal verification

  - Decision Diagrams

  - Satisfiability Solver

  - Equivalence checking

  - Property checking / Bounded model checking

  - Verification of hybrid systems

- Starting tomorrow, Auditório

Syllabus and Scope

- Tobias Schubert: *VHDL – An introduction to modeling, analyzing, and simulating digital circuits*

  - Short history

  - Entities, architectures, processes, signals, ...

  - Rapid prototyping

  - Semantics / simulation of VHDL specifications

- Starting: This Friday, Auditório (computer lab)

Syllabus and Scope

- Christian Schindelhauer: *Storage Networks – An overview to a major facet of cloud computing*

  - Introduction to storage systems and technologies

  - Virtualization of Storage: RAID, SAN, and Internet Storage

  - Networking for large storage systems

  - Data placement in storage systems

  - Data safety and data encodings

  - Peer-to-Peer-Storage Systems

- Starting: 24th March (2nd week), Auditório

Syllabus and Scope

- Dirk von Suchodoletz: *Fast and flexible large scale machine deployment and management*

  - Overview on management of large scale computer setup and deployment, especially on scalability issues, LAN and WAN scenarios

  - Virtualization options

  - Flexible boot infrastructures with dynamic operating system selection for testing and optimal compute job routing

  - Distributed filesystems and block devices

- Starting: Tomorrow, Auditório and computer lab 4

Syllabus and Scope

- Gerhard Schneider: *Cloud Organization – Institutional components, backgrounds, ...*

  - Definition of a Cloud

  - Historical background

  - Description of ideas

  - Build your own cloud – and why?

  - Legal issues

  - Identity management: Who is who – and when?

- Starting: Tomorrow, Auditório

Syllabus and Scope

- Gerd Rapin: Modeling *and Implementation of Parallel Algorithms in Applied Mathematics using MPI*

    - Basics of parallel computing

    - Introduction to MPI

    - Parallel Treatment of vectors and matrices

    - Poisson Problem and Finite Differences

    - Parallelisation of Iterative Methods for the Solution of Linear Systems

    - Conjugate Gradient (CG) Method and Preconditioning

- Starting: 23rd March, Auditório (computer lab)

Syllabus and Scope

- Supporting courses by the UFPR lecturers:

    - Fabiano Silva: *CUDA Parallel Programming*

    - *Luis C. E. de Bona: Digital Preservation*

    - *Carlos Carvalho: Software Mirror fine tuning*

    - *Eduardo Todt: VHDL Rapid Prototyping*

    - *Eduardo Almeida: Peer-to-peer Networks*

    - *Daniel Weingaertner: Multi-core Parallel Programming*

- Starting: Tomorrow

Syllabus and Scope

- Questions and Answers by the UFPR lecturers and DAAD lecturers on topics taught during the summer school

    - Early evening: One Q&A this week, two Q&A's the second and third week

    - Absolutely voluntary and not part of the official program

    - Chance to have a chat with the lecturers on additional topics, research questions, ...

- Starting: Friday

Evaluation

- For those matriculated in CI815b:

  - Evaluation is mandatory:
    - A (9-10), B (8-9), C (7-8) or D (<7)
  - Deliver a 6 pages, English written paper on a topic related to the Summer School
  - Will be evaluated by DInf Professors
  - Deadline: **30.June.2011**
  - Submit to: summerschool2011@inf.ufpr.br
  - IEEE format, PDF.

Extracurricular Activities

- Study and DAAD program information open to the general university public (venue: Auditório de Química)

  - Thursday, the 17th March (early evening) – Chantal Weber & Gerhard Schneider on the German University System (functions and organizational background) and reports from two students that came/went to/from Germany and Brazil

  - Wednesday, the 23rd March – Chantal Weber / Isabel Heller (local DAAD representative) on DAAD program, Studying in Germany (general) and Freiburg

  - Wednesday, the 30th March – Chantal Weber on exchange program at Freiburg University and Head of int. office Carlos Siqueira: presentation of UFPR programs

Extracurricular Activities

- Colloquium/Research seminar at the Department of Computer Science (venue: Auditório de Química)

    - Tuesday, the 15th March, early evening

        - Gerhard Schneider: *Running your own GSM network / Privacy in GSM*

        - Dirk von Suchodoletz: *Challenges of Longterm Preservation of Digital Data*

    - Thursday, the 24th March

        - Matthew Lewis: *Run-time Soft Error Injection and Testing of a Microprocessor using FPGAs*

        - Tobias Schubert: *#SAT Solving*

Extracurricular Activities

- Colloquium at the Department of Computer Science

    - Tuesday, the 29^{h} March

        - Gerd Rapin: *Introduction to Computational Fluid Dynamics (CFD) with Applications*

        - Christian Schindelhauer: *TBA*

- Excursion

    - Visiting Siemens Curitiba, Wednesday the 16th in the afternoon, see email sent by Daniel Weingartner

- Summer School Dinner/Churrasco

    - Tuesday, the 22nd March, evening, location is to be announced

Venues / Online Information

- Most courses will take place here in the Auditório de Informática

  - Practical courses will be held in the computer lab 4 (announced by the lecturers)

  - The Research Seminars and the general study information will take place in the Auditório de Química

- Online information is available on: http://www.inf.ufpr.br/summerschool2011/

- Mailing list: summerschool2011@listas.inf.ufpr.br

- We will send information out on the evening program by email too

Time Line: 1ˢᵗ Week (15 – 18 March)

Monday 3/14/2011	Tuesday 3/15/2011	Wednesday 3/16/2011	Thursday 3/17/2011	Friday 3/18/2011
Official Opening by the Rector				
Coordination/Setup				
Coordination/Setup		Excursion I / Siemens Curitiba		
Warm up / Introduction of lecturers and courses		Excursion I / Siemens Curitiba		
Weber Inform. Warm Up	Public colloquium at the Comp. Science Dept.			Q & A

Time Line: 2ⁿᵈ Week (21 – 25 March)

Monday 3/21/2011	Tuesday 3/22/2011	Wednesday 3/23/2011	Thursday 3/24/2011	Friday 3/25/2011
			Excursion II	
		Excursion II		
Q & A				Q & A

Time Line: 3rd Week (28 – 31 March)

Monday 3/28/2011	Tuesday 3/29/2011	Wednesday 3/30/2011	Thursday 3/31/2011	Friday 4/1/2011
				Evaluation
				Feedback on Evaluation / Farewell
		Excursion III		
		Excursion III		
Q & A			Q & A	

German Lecturers of the Summer School

- University of Freiburg

- University of Cologne

- University of Göttingen / VW Wolfsburg

University of Cologne: Chantal Weber

- Research Assistant, Japanese Studies

    - Master of Arts (Japanese Studies, Archeology, Art History) in 2003

    - Ph.D. in Japanese Studies 2010

    - Lectures on Japanese History & Culture

    - Lectures for International Students and on Intercultural Communication

    - Computer Center, University of Freiburg 2003/04 and 2006

    - International Office, University of Freiburg 2006-2008

University of Freiburg: Matthew Lewis

- Lecturer/Researcher for the chair of Computer Architecture

  - MSc. & BSc. in Computer Engineering
    - Queen's University (Canada)
  - Ph.D. in Computer Science 2010
    - University of Freiburg (Germany)
  - Responsible for courses such as:
    - Hardware praktikum, computer aided engineering, embedded systems, ...
  - Current research topics include:
    - Parallel SAT/QBF, formal verification, and testing

VW Wolfsburg: Gerd Rapin

- Since 2008 CFD Engineer at the Development & Research Center of VW, Wolfsburg

    – Diploma in Mathematics in 1999

    – Ph.D. in Applied Mathematics 2003

    – 1999-2008 Researcher/ Lecturer in Applied Mathematics at the University of Göttingen

    – Research in Turbulence Modelling, HPC for CFD, Finite Elements, Domain Decomposition Methods

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University of Freiburg: Gerhard Schneider

- Professor for Communication Systems
  Director of the University IT centre

  - 1981 Ph.D. in Mathematics
  - 1992 Professor for Decentralized Systems, Karlsruhe
  - 1997 Director of GWD Göttingen, Professor in Göttingen
  - 2002 University of Freiburg
  - 2003-2008 Vice Rector of the University
  - 2008 – now   CIO of the University
  - Member of various committees of DFG, MPG, DFN

University of Freiburg: Christian Schindelhauer

- **Chair in Computer Networks and Telematics**

  - Diploma Computer Science, Univ. Darmstadt, Germany, 1991

  - PhD Univ. Lübeck, Germany 1996

  - Post-Doc ICSI, Berkeley, USA, 1999-2000

  - Lecturer Univ. Paderborn, Germany, 2002-2006

  - Chair of Computer Networks and Telematics, Univ. Freiburg, Germany, 2006-today

  - Resarch Topics: network algorithms, sensor networking, ad hoc networks, parallel and distributed computing, storage networks

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University of Freiburg: Tobias Schubert

- Principal researcher at the chair of computer architecture

  - Diploma in Computer Science in 2000

  - Ph.D. in Computer Science 2008

  - Research interests: SAT, SMT, QBF (more general: verification of embedded systems)

University of Freiburg: Dirk von Suchodoletz

- Lecturer/Researcher at the chair in Communication Systems

  - Diploma in Mathematics in 2002
    - Göttingen University
  - Ph.D. in Computer Science 2008
    - Freiburg University
  - Organizing the lectures, seminars, …
  - Supervising student theses, projects, …
  - Research in LBS, privacy, large scale machine management, stateless Linux desktops and cluster nodes, ...

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Thank you for your Attention!

We wish all of us an informative and successful time!

Questions?

Faculty of Engineering

University of Freiburg

Germany