Integrated Communication Systems

Courses, Research, and Thesis Topics

Prof. Paul Müller

University of Kaiserslautern
Department of Computer Science
Integrated Communication Systems ICSY
http://www.icsy.de
Courses @ ICSY

Thesis  Project
Lecture  Seminar
Courses @ ICSY

¬ Lectures (Summer Term)
  – Service-oriented Architectures (SOA)
  – Introduction to High Performance Computing

¬ Lectures (Winter Term)
  – Grid & Cloud Computing
  – Multimedia Systems
  – High Performance Computing on GPGPUs

¬ Project (Winter Term)
  – Service-oriented Computing

¬ Seminar (Summer Term)
  – Service-orientation in Communication and Applications
Lecture (2C+1R), 4 CP

Educational objectives:
- Systematically understanding of SOA
- Theoretical background
- Overview of current technologies and standards
- Design techniques for SOA-based applications
- Approaches for the evolution of SOA based applications

Content:
- Theoretical background (communication, coordination, state, security)
- Architecture (common principles, life-cycle of a service, analysis, design)
- History of service-orientation
- Technologies and standards (Web services, BPEL, WS-*, ...)
- Implementation with Java
Lecture (2C+1R), 4 CP

Educational objectives:
- Basics, techniques and tools for Grid & Cloud Computing
- The distributed access to any kind of heterogeneous resources over a network using open standards

Contents:
- Foundations of service-oriented architectures
- Architecture of a Grid middleware (OGSA)
- Accessing Grid resources (WSRF)
- Quality of Service, Virtual Organisations, Service-level Agreements, monitoring, accounting, and billing
- Cloud Stack: IaaS, PaaS, SaaS,…
- Virtualization Techniques
- Cloud Applications
Multimedia Systems

- Lecture (2C+1R), 4 CP

Educational objectives:
- In-depth understanding of goals and requirements of multimedia systems
- Components and boundary conditions for the development of modern multimedia systems

Content:
- Introduction to the topic "Multimedia" (from ASCII to graphical user interfaces)
- Aspects of distribution in multimedia systems (end-to-end QoS,...)
- Compression techniques (introduction to information theory; entropy coding, source coding, and hybrid coding; audio/video coding)
- System requirements (synchronisation, scheduling, ...)
- Applications (CSCW, tele-conferencing, tele-immersion, ...)

ICSY, University of Kaiserslautern
Introduction to High Performance Computing

- Lecture (2C+2R), 5 CP

- Educational objectives:
  - Basics of High Performance Computing
  - Basics of Shared Memory Programming (Threads) and Message Passing
  - Accessing High Performance Clusters

- Content:
  - Architectures of High Performance Computers: past, present and future
  - Accessing remote computers and writing batch scripts
  - Programming and compiling on LINUX systems
  - Parallel programming with OpenMP on all kernels of one CPU
  - Parallel programming with MPI on several CPUs
High Performance Computing on GPGPUs

- Lecture (3C+1R), 6 CP

- Educational objectives:
  - Understanding of the programming model for Graphical Processing Units
  - Foundations of Graphical Processing Units
  - Parallel programming on GPUs with CUDA

- Content:
  - SIMD programming model
  - Memory hierarchies on GPUs
  - Programming GPUs with CUDA
  - OpenACC and new programming paradigms for accelerators
Service-oriented Computing

- Project (4P), 8 CP
- Duration: 3 Months
- Minimum number of participants: 6

- Applying Service-Orientation
  - Service-Oriented Architectures
  - Service-oriented analysis and design
  - SOA Infrastructures & Tools
  - SOA Integration
- Programming with Java
- Deployment of distributed services
- Tests and evaluation

- Cooperation with Software AG, Darmstadt
Service-orientation in Communication and Applications

- Seminar (2P), 4 CP
- Minimum number of participants: 3

Wide range of topics relevant for the scope of
- Service-oriented Architectures (SOA)
- Grid & Cloud
- Future Network Architectures

Organization
- Paper work
- Presentation
Research @ ICSY
Inter-Faces

Prof. Dr. Paul Müller
Head of the research group

Dr. Bernd Reuther
Branch of Future Internet Technologies

Joachim Götze
Branch of Service-orientation and Cloud Technologies
Future Internet Technologies

Focus
- Flexible network architectures
  - Ability to adapt to application requirements and network constraints
  - Ability to evolve to a new Internet
- Experimentation in real networks

Areas of Interest
- Service Oriented Network Architectures
  - Service Description
  - Service Selection
  - Service Composition
- Topology management tools
Focus

- Flexible service-based applications
  - Development strategies and implementation technologies
  - Quality of Service
- Internet of Services

Areas of Interest

- Service composition and deployment
- Reliability and dependability of service-based applications
- SOA evolution management
- Monitoring, accounting, and billing
Current Projects

- iGreen (Intelligent Knowledge Management in Agriculture)
- IESE Transfer Project (SCA in the Cloud)
- G-Lab (Future Internet Research and Experimentation)
- G-Lab Deep-G (Deepening G-Lab for Cross-Layer Composition)
- G-Lab Ener-G (Improving the Sustainability of G-Lab Through Increased Energy Efficiency)
- PRUNO (Prospects for Realizing User-centric Network Orchestration)
- Euro-NF (European Network of Excellence)
- GpENI (Great Plains Environment for Network Innovation)
A Selection of Current Partners

- SAP
- IBM
- Siemens
- Fraunhofer
- John Deere
- Software AG
- Deutsches Forschungszentrum für Künstliche Intelligenz GmbH
- Deutsche Telekom
- Leibniz Universität Hannover
- Technische Universität Darmstadt

ICSY, University of Kaiserslautern
Thesis @ ICSY
Bachelor and Master Theses

- Short list of available theses topics online
- Visit our staff for more topics
- You may also discuss your own ideas with our staff

<table>
<thead>
<tr>
<th>SOA &amp; Grid</th>
<th>Future Internet</th>
<th>Multimedia</th>
<th>HPC on GPUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring</td>
<td>Service Composition</td>
<td>E-Learning</td>
<td>Compiling on GPUs</td>
</tr>
<tr>
<td>Accounting</td>
<td>Workflows</td>
<td>Live Streaming</td>
<td>Benchmarking</td>
</tr>
<tr>
<td>Content Distribution</td>
<td>Protocol Prototypes</td>
<td>Collaboration</td>
<td>Application programming</td>
</tr>
<tr>
<td>Workflows</td>
<td>Network Emulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life-cycle Management</td>
<td>Benchmarking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evolution Support</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Questions?