Autonomic Computer Systems
01 Administration

Urs Schnurrenberger, 15.09.2015
## Agenda.

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Welcome to "Autonomic Computer Systems"

Today:

- Administration
- Motivation
- Why "Autonomics"? A brief introduction to fault tolerance.
- IBM's autonomic initiative (2001)
Course overview -
Lecturers and assistants

Lecturers:  
- Prof. Dr. Christian Tschudin (de/en)  
- Dr. Massimo Monti (en)  
- Dima Mansour (en)  
- Christopher Scherb (de/en)  
- Urs Schnurrenberger (de/en)

Assistants:  
- Dima Mansour  
- Christopher Scherb  
- Urs Schnurrenberger

Which language to use?  
- All slides will be in English, some lectures too.  
- Can some lectures be given in German or not?
Course overview - Registration

Please register at

https://services.unibas.ch

and

http://courses.cs.unibas.ch

(requires an e-mail address from Uni Basel)

Otherwise, it will not be possible to charge you ECTS Credit Points! You can get 6 ECTS-CPs for this course + exercises.
Course overview - Time and place

Lectures:
- Tuesday, 14:15 - 16:00
- Thursday, 08:15 - 10:00
- Starting date: 15.09.2015

Exercises:
- Tuesday, 09:15 - 12:00
- Starting date: 22.09.2015

Location:
- Everything takes place in seminar room 00.003, Spiegelgasse 1 (just go left in the entrance of the building)
Course overview - Course profile

Prerequisites:

- Bachelor degree in Computer Science or equivalent.
- Especially: Knowledge in Operating Systems and Computer Networking.

Master level course profile:

- Includes self-studies
- Not only "established" knowledge, partly exploration.
Course overview - Organization

Lectures

Two seminar blocks:

- One lecture slot available for your preparation.
- Topics take from recent or classic research papers.
- First seminar: group of two, second seminar: single.

During exercise slots, if necessary:

- Introduction to management tools, their concepts.
- Preparation for exercises.
- Discussion of solutions.
Course overview - Grading ("Leistungsüberprüfung")

- Participation in both seminar sessions.
- Exercises: Threshold two out of three
- Oral exam: 15.12.2015 (14:00 – 16:00)  
  17.12.2015 (08:00 – 10:00)  
  + when?
- Scale: 1-6, 0.5 steps
Course overview - Motivation

Shifting gears:

- Typical Bachelor CS studies
  Getting something programmed and running, mastering complexity of hardware and algorithms.

- Software engineering and project management
  Getting large projects working.

- **In this course**
  Keeping *systems* running, managing them (-selves)
Course overview -

Goal

Adopt an "autonomic" mind set:

- Understand important aspects of managing "computer operations", at all levels (configuration to high level policy)
- Get insights in (the challenge of) running mid-scale computer systems.
- Learn about existing approaches and solutions.
- "Grand challenge" of keeping computer systems running: Peek at the new "autonomics" research topics and projects.
Course overview - Content Clusters 2015

1) Introduction - "autonomic" hype, the self-star inflation

2) Distributed algorithms

3) Fundamentals of Internetworking

4) Network Architecture I

5) (Network) System Dynamics

6) Network Architecture II: Information Centric Networking

Content wise, this course complements "Distributed Information Systems" of Prof. Schuldt.
Course overview - A network view (1/6)
Perceptive
Net-Image

Logic

Executive
Control

Detect

Sense

Sensing, receiving, measuring, monitoring… what?

- Internal state: memory, power, CPU load, interface status, reception errors, …
- Network topology: neighborhood, link state, routing state, …
- Traffic: packet arrival, congestion, delay, throughput, …
Course overview - Perception of the environment (2/6)

Sensing, receiving, measuring, monitoring… what?

- Physical environment: noise, attenuation, position, …

Detect

Sense

Perceptive Net-Image

Logic

Executive Control

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Detection of state changes (events) drive system / network operation (logic processing). For example:

- Normal events: packet arrival, neighborhood advertisements, …
- Network state: topology changes, mobility, …
- Perturbations: faults, race traffic conditions, resource exhaustion, …
Course overview - (Reactive) logic operation / analysis (4/6)

Processing algorithms

- Deterministic
- Statistical
- Inference
- Stochastic

Perceptive Net-Image → Logic → Executive Control

Sense
Course overview - Execute action / adapt to changes (5/6)

Responses to events:

- Normal communication: packet transmission, service provision, …
- (Re-)Configuration: modify state, update routing state, change name, …
- Adapt current functions: modify protocol parameters, allocate resources, …
Responses to events:

- Modify functionality: employ new functions, deploy updates, claim new role, …
Course overview - Course Foci (6/6)

1. Network operation, functions and challenges in wireless environment

2. Functional composition & modularisation as tools for adaption

3. Logic: deterministic (traditional) and non-deterministic (under exploration) algorithms

4. Control Theory in the formal study and analysis of system's stability.
## Agenda.

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## Schedule 1/3 (tentative)

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<th>Lecturer</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Tue, 15.09.2015</td>
<td>14:15 – 16:00</td>
<td>US</td>
<td>Introduction</td>
</tr>
<tr>
<td>Thu, 17.09.2015</td>
<td>08:15 – 10:00</td>
<td>CS</td>
<td>Identifiers and Network Association</td>
</tr>
<tr>
<td>Tue, 22.09.2015</td>
<td>14:15 – 16:00</td>
<td>US</td>
<td>Topology Management</td>
</tr>
<tr>
<td>Thu, 24.09.2015</td>
<td>08:15 – 10:00</td>
<td>US</td>
<td>Network Routing</td>
</tr>
<tr>
<td>Tue, 29.09.2015</td>
<td>14:15 – 16:00</td>
<td>US</td>
<td>The Network as a Shared Resource</td>
</tr>
<tr>
<td>Thu, 01.10.2015</td>
<td>08:15 – 10:00</td>
<td>CS</td>
<td>Software Defined Networking and Openflow</td>
</tr>
<tr>
<td>Tue, 06.10.2015</td>
<td>14:15 – 16:00</td>
<td></td>
<td>Seminar Preparation</td>
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<tr>
<td>Thu, 08.10.2015</td>
<td>08:15 – 10:00</td>
<td>Stud</td>
<td>Seminar</td>
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<tr>
<td>Tue, 13.10.2015</td>
<td>14:15 – 16:00</td>
<td>Stud</td>
<td>Seminar</td>
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<tr>
<td>Thu, 15.10.2015</td>
<td>08:15 – 10:00</td>
<td>Stud</td>
<td>Seminar</td>
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Seminar room: 00.003, Spiegelgasse 1

CT = Christian Tschudin, MM = Massimo Monti, US = Urs Schnurrenberger, CS = Christopher Scherb, DM = Dima Mansour
# Schedule 2/3 (tentative)

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Lecturer</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Tue, 20.10.2015</td>
<td>14:15 – 16:00</td>
<td>CT</td>
<td>Self stabilizing algorithms</td>
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<tr>
<td>Thu, 22.10.2015</td>
<td>08:15 – 10:00</td>
<td>CT</td>
<td>Logical clocks</td>
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<td>Tue, 27.10.2015</td>
<td>14:15 – 16:00</td>
<td>CT</td>
<td>Group Communication</td>
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<td>Thu, 29.10.2015</td>
<td>08:15 – 10:00</td>
<td>CT</td>
<td>Active Networking</td>
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<tr>
<td>Tue, 03.11.2015</td>
<td>14:15 – 16:00</td>
<td>CS</td>
<td>Bio Inspired Networking</td>
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<td>Thu, 05.11.2015</td>
<td>08:15 – 12:00</td>
<td>MM</td>
<td>ChemFlow</td>
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<td>Tue, 10.11.2015</td>
<td>14:15 – 16:00</td>
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<td>Compensation</td>
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<td>Thu, 12.11.2015</td>
<td>08:15 – 10:00</td>
<td>DM</td>
<td>Information Centric Networking</td>
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<td>Tue, 17.11.2015</td>
<td>14:15 – 16:00</td>
<td>DM</td>
<td>Named Function Networking</td>
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<td>Thu, 19.11.2015</td>
<td>08:15 – 10:00</td>
<td>DM</td>
<td>ICN (reserved)</td>
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## Schedule 3/3 (tentative)

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<th>Date</th>
<th>Time</th>
<th>Lecturer</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Tue, 24.11.2015</td>
<td>14:15 – 16:00</td>
<td>CS</td>
<td>Long running networks</td>
</tr>
<tr>
<td>Thu, 26.11.2015</td>
<td>08:15 – 10:00</td>
<td></td>
<td>Seminar preparation</td>
</tr>
<tr>
<td>Tue, 01.12.2015</td>
<td>14:15 – 16:00</td>
<td>Stud</td>
<td>Seminar</td>
</tr>
<tr>
<td>Thu, 03.12.2015</td>
<td>08:15 – 10:00</td>
<td>Stud</td>
<td>Seminar</td>
</tr>
<tr>
<td>Tue, 08.12.2015</td>
<td>14:15 – 16:00</td>
<td>Stud</td>
<td>Seminar</td>
</tr>
<tr>
<td>Thu, 10.12.2015</td>
<td>08:15 – 10:00</td>
<td>All</td>
<td>Repetition</td>
</tr>
<tr>
<td>Tue, 15.12.2015</td>
<td>14:15 – 16:00</td>
<td>Stud</td>
<td>Oral exams</td>
</tr>
<tr>
<td>Thu, 17.12.2015</td>
<td>08:15 – 10:00</td>
<td>Stud</td>
<td>Oral exams</td>
</tr>
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References

Content

- Prof. Dr. Christian F. Tschudin
- Dr. Manolis Sifalakis

Design

- University of Basel
- Cover picture:
  http://www.google.com/about/datacenters/gallery/#/tech

Created by

- Urs Schnurrenberger, M. Sc.
Thank you for your attention.