

Location-based Systems

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Course Layout

- consists of two parts: lecture and assignments
- Lecture
 - introduction to mobile computing
 - introduction to pervasive computing
 - locating techniques
 - locating systems & applications
- Assignments
 - short talks about special topics + paper

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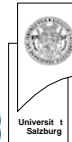


Course Layout

- Grading system
 - short talk + literature survey + paper
 - assignments
- Material
 - slides of the lecture
 - library introduction
 - website:
<http://www.softwareresearch.net/site/teaching/SS2004/LBS/LBS.html>

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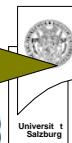
Overview



Timeline

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Overview

- This advances result in paradigm shifts:


<p>Reactive</p> <p>Nominal</p> <p>Individual</p> <p>Visible</p> <p>Local Data</p> <p>Fixed</p>	➔	<p>Proactive</p> <p>Personal</p> <p>Collaborative</p> <p>Invisible</p> <p>Shared Data</p> <p>Mobile</p>
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Overview

<p>Distributed systems</p> <ul style="list-style-type: none"> • Remote communication • Fault tolerance • High availability • Remote information access • Security • ... 	<p>Mobile computing</p> <ul style="list-style-type: none"> • Mobile networking • Mobile information access • Adaptive applications • Energy-aware systems • Location sensitivity • ... 	<p>Pervasive computing</p> <ul style="list-style-type: none"> • Smart spaces • Invisibility • Localized scalability • Uneven conditioning • ...
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Timeline 

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Distributed System Intro.

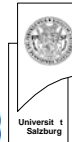
- Definition

A distributed system consists of a collection of autonomous computers linked by a computer network and equipped with distributed system software.

- Scenario
 - A computer lab consisting of ten workstations interconnected by an Ethernet LAN.

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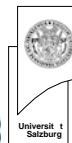


Distributed Systems (I)

- Remote Communication
 - protocol layering
 - RPC
- Fault tolerance
 - atomic transactions
 - two phase commit
 - distributed and nested transactions

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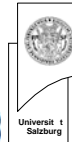


Distributed Systems (II)

- High availability
 - replication control
 - mirrored execution
 - recovery mechanisms
- Remote information access
 - caching
 - distributed file systems (AFS, Coda, ...)
 - distributed databases

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Distributed Systems (III)

- Security
 - authentication
 - privacy

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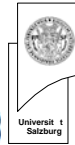


Mobile Computing Intro.

- Definition
 - No standard definition available.
 - *A distributed system with mobile nodes.*
- Scenario
 - A computer lab with ten workstations and three notebooks and two personal digital assistants eventually interconnected by an Ethernet LAN.

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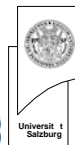


Mobile Computing (I)

- Mobile networking
 - Mobile IP
 - ad hoc networking
 - spontaneous networking
 - wireless communication
- Mobile information access
 - disconnected operations
 - bandwidth-adaptive file access
 - selective control of data consistency

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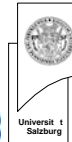
Mobile Computing (II)

- Support of adaptive applications
 - transcoding techniques (e.g., proxies)
 - adaptive resource management
- System level energy saving techniques
 - energy-aware applications
 - variable speed processor scheduling
 - energy sensitive memory management

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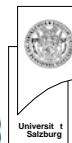
Mobile Computing (III)

- Location sensitivity
 - location sensing
 - location-aware system behaviour

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Pervasive Computing Intro.

- Definition
 - Lots of research is going on → lots of discussions about definitions
 - ... we characterized a pervasive computing environment as one **saturated with computing and communication capability**, yet so gracefully integrated with users that it becomes a **"technology that disappears."**
(Satyanarayanan, 2001)

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Pervasive Computing Scen. I

- Jane is at Gate 23 in the Pittsburgh airport, waiting for her connecting flight. She has edited many large documents, and would like to use her wireless connection to e-mail them. Unfortunately, bandwidth is miserable because many passengers at Gates 22 and 23 are surfing the Web. Aura observes that at the current bandwidth Jane won't be able to finish sending her documents before her flight departs. Consulting the airport's network weather service and flight schedule service, Aura discovers that wireless bandwidth is excellent at Gate 15, and that there are no departing or arriving flights at nearby gates for half an hour. A dialog box pops up on Jane's screen suggesting that she go to Gate 15, which is only three minutes away. It also asks her to prioritize her e-mail, so that the most critical messages are transmitted first. Jane accepts Aura's advice and walks to Gate 15. She watches CNN on the TV there until Aura informs her that it is close to being done with her messages, and that she can start walking back. The last message is transmitted during her walk, and she is back at Gate 23 in time for her boarding call.

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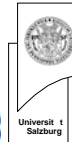


Pervasive Computing Scen. II

- Fred is in his office, frantically preparing for a meeting at which he will give a presentation and software demonstration. The meeting room is a 10-minute walk across campus. It is time to leave, but Fred is not quite ready. He grabs his PalmXXII wireless handheld computer and walks out of the door. Aura transfers the state of his work from his desktop to his handheld, and allows him to make his final edits using voice commands during his walk. Aura infers where Fred is going from his calendar and the campus location tracking service. It downloads the presentation and the demonstration software to the projection computer, and warms up the projector. Fred finishes his edits just before he enters the meeting room. As he walks in, Aura transfers his final changes to the projection computer. As the presentation proceeds, Fred is about to display a slide with highly sensitive budget information. Aura senses that this might be a mistake: the room's face detection and recognition capability indicates that there are some unfamiliar faces present. It therefore warns Fred. Realizing that Aura is right, Fred skips the slide. He moves on to other topics and ends on a high note, leaving the audience impressed by his polished presentation.

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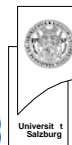


Pervasive Computing (I)

- Effective use of smart spaces
 - the gate is wired
 - software can sense present persons
- Invisibility
 - otherwise would be too clumsy

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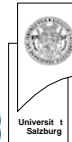
Pervasive Computing (II)

- Localized scalability
 - local communication bandwidth requirements
 - battery power
 - what happens if there are 1000+ users at the gate?
- Masking uneven conditioning
 - no uniform penetration
 - different „smartness“ of devices

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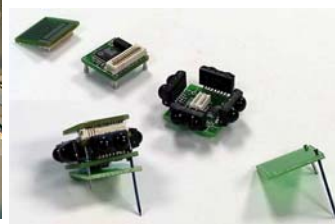
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Case Studies

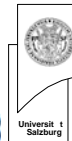
- Smart dust
- Push-pin computing



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Assignment

- Write an example of pervasive computing, you already experience.
- ½ page