Softwareprojekt Mobilkommunikation
Summer 2009

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Computer Systems & Telematics
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Structure and Content of CST Lectures

Seminar Technische Informatik
Forschung in Mobilkommunikation, eingebettete Systeme, Internet

Embedded Internet
Protokolle, Dienste, Internet, TCP/IP, Betriebssysteme für eingebettete Systeme

Praktikum Mobilkommunikation
Medienzugriff, Mobile IP, Mobiles Web

Embedded Sensor Web
Projekte rund um Sensornetze

Mobilkommunikation
Drahtlose Übertragung, Medienzugriff, GSM, 3G, WLAN, Mobile IP, Ad-hoc-Netze, WAP

Telematik
Protokolle, Dienste, Standards, LAN, Internet, TCP/IP, WWW, Sicherheit, ISDN/IN/ATM, Dienstgüte, Multimedia, IPv6, MPLS

Praktikum Technische Informatik (TI IV)
Eingebettete Systeme, Schnittstellen, Treiber, Betriebssystem – programmieren, vernetzen, interagieren

Betriebs- und Kommunikationssysteme (TI III)
Ein-/Ausgabe, DMA/PIO, Unterbrechungen, Puffer, Prozesse/Threads, UNIX/Windows, Netze, Medienzugriff, Protokolle, TCP/IP, Internet

Rechnerarchitektur (TI II)
Harvard/v. Neumann, Mikroarchitektur, RISC/CISC, VLIW, Pipelining, Cache, Speicherhierarchie, Assembler, Multiprozessorsysteme

Grundlagen der Technischen Informatik (TI I)
Schaltnetze, Schaltwerke, Logikminimierung, Gatter, Speicher, Halbleiter, Transistoren, CMOS, AD/DA-Umsetzer

Semester
Bachelor
Master

Bachelor
Master

Content

• Goals:
  • Conduct **hands-on research** on exemplary topics from the field of mobile communications
  • Gain experience doing **real project work** (possibly with industry feedback)
  • Code up something relevant on **state-of-the-art platform**

• Participants have to ...
  • dig into the foundations of wireless communication techniques,
  • learn how to work with them, and
  • become acquainted with the advantages and flaws of current and upcoming technologies.

• Focus of this course:
  • Software architecture for mobile devices
  • Design, implement and evaluate state-of-the-art application using frameworks for distributed application development

➤ This is not an introductory course!
➤ Knowledge of telecommunications and programming skills are pre-requisites!
Course Organization

General:

- Class
  - Thursday, 14:00-18:00h, Room K60, Takustr. 9
  - Starts 16.4.09, ends 16.7.09
  - No class on 21.5.09

- Work in smaller groups
  - Up to you to schedule
  - Course is designed for 150h of work per person
    - 10 ECTS credits, 15h per credit
    - Only 37% of work done in class!

- Participation restricted due to available facilities (...)

(Irregular) Assignments:

- There will be irregular assignments, e.g.
  - Read up on background technology
  - Give a brief talk on a specific project-related question
  - Demo your current progress
  - Conduct performance evaluation
  - Write test cases, documentation, use case examples, ...

- Assignments reflect aspects of project work other than programming

- Office Hours
  - Just in or after class

- News and Updates
  - http://cst.mi.fu-berlin.de/
Criteria for Successful Participation

Two main criteria:

1. Regular participation in class
   - Minimum **n-2 times** present

2. Active participation
   - **Actively participate** in project work
   - Volunteer for a reasonable number of assignments

- Participation/assignments will be tracked on course webpage
  - *Tell me if I missed something you did!*
Literature

• Lecture Notes:
  • Telematics / Mobile Communications
    ➢ Sold for € 5,- at secretary’s office (room 155)

• Books:
  • Larry L. Peterson, Bruce S. Davie: Computernetze - Eine
    systemorientierte Einführung, 3. Auflage. dpunkt Verlag,
  • Jochen Schiller: Mobilkommunikation, 2. Auflage. Pearson

• Research Papers:
  • Various, available online, specified as course progresses
Softwareprojekt Mobilkommunikation
Introduction and Project Description

- Ad hoc Networking
- Push Service for Mobile Devices
- P2P / Push Services
- Google Android Platform
Ad hoc Networking

• Ad hoc network: Networking without infrastructure

• Different scenarios emphasize different aspects of ad hoc networking:
  • Mesh networks – Routing, backbone services (mostly IP)
  • Vehicular networks – Mobility, changing topology
  • Sensor networks – Highly embedded, constrained resource

• Big topics (mostly solved):
  • PHY/MAC, e.g. 802.11 in ad hoc mode
  • Routing, e.g. proactive vs. reactive (vs. domain specific) protocols

➤ Killer application?
Use Case #1 (Address Book)

Setup:
- User A gives ID# of his user profile (stored on PDA) to user B
- User B adds user A’s profile to address book of his mobile phone by entering ID#
- User A authorizes user B’s access to his profile
  - User A’s profile is now part of address book on user B’s mobile phone

Benefits:
- If user A changes his contact data in his profile, these changes propagate automatically to user B’s address book.
- In case user B’s mobile phone is switched off or disconnected, the data is synchronized at a later point.
Use Case #2 (Distributed Notes)

Setup:
- User A creates note on his PDA and generates ID# for publication
- User A gives ID# of note to user B
- User B accesses user A’s note on his mobile phone by entering ID#
- User A authorizes user B’s to access note
  - User A’s note is now accessible on user B’s mobile phone

Benefits:
- If user A or user B make changes to the note, these changes propagate automatically to the other copies of the note.
- In case a device is switched off or disconnected, the data synchronized at a later point.
Use Case #3 (Real-time Pictures)

Setup:
- User A and B have shared their profiles as described above
- User A takes picture of himself and adds it to his profile
  - Picture appears next to user A’s entry in user B’s address book

3. User B may select whether he wants to be notified whenever user A’s picture changes or whether this should happen in background

Benefits:
- Shared content may include multi-media data.
- Synchronization works in real-time whenever connected.
Architecture / Implementation

- **Push Service for Mobile Devices**

  ![Diagram](image)

  **Components:**
  - Push Service: Share data items between mobile devices
  - Authentication Module: Control access to shared data items
  - Service Adapter: Integrate service into applications
Networking Aspects

- **Client/Server vs. P2P for Push Services**

  **Client/Server**
  - **Pro:** Ease of implementation
  - **Contra:** Single point of failure, provider controlled service

  **Peer-to-Peer**
  - **Pro:** Naturally matches application, no central control
  - **Contra:** Requires end-to-end connectivity, Complexity (e.g. cryptography)

  ➢ We start with client/server and expand to P2P later on.
Google Android Platform

Android:
- Software stack for mobile devices
- Includes operating system, middleware and key applications

Android SDK:
- Managed code in Java language
- Device control via Google-developed Java libraries
- Development tools
  - Debugger / Libraries
  - QEMU-based handset emulator
  - Documentation, samples, tutorials, ...
- Supported development platforms
  - Linux (any modern distribution)
  - Mac OS X 10.4.8 or later
  - Windows XP or Vista
- Eclipse (>=3.2 supported IDE)
  - Android Development Tools (ADT) Plug-in
  - Command line tools available
Next Steps

Lightening talks (max. 10 mins, ca. 5 slides, to the point):

- Talk #1 (Oliver K., Michael D.): Introduction to Android
- Talk #2 (Adrian A., Carlos D.): Android Simulator / Hello World
- Talk #3 (Thilo M., Karsten G.): Android Java Specifics / Basic IO
- Talk #4 (Silke R., Alexander E.): Android API - Networking
- Talk #5 (Lars R., Janosch K.): Android API - UI
- Talk #6 (Christoph M., Anja C.): Peer-to-Peer
- Talk #7 (W. Yu, L. AiQuan, Hans-Christoph S.): Version Control / SVN
- Talk #8 (Till W., Ronald S.): Software Engineering
- Talk #9 (Georg W.): Planning

- Talks to be held during first part of class next week (23.4.)
  - Slide template at http://www.fu-berlin.de/cd/
  - Final version of slides due on 21.4. (noon)!