

# What Students Really Need

...beyond Learning Content:

*Ubiquitous Shared-connectivity Services to Foster Learning  
Communities on the Campus*

A Field-study and First Prototype at TU Graz

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# Agenda

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- Introduction
- Campus Life
- Developing Mobile Applications
- Adhoc Networking: PAN@Campus

# Introduction: mobile Learning

## *The problem and the objective*

- The current trend is:
  - the usage of m(obile)-learning technologies
  - the integration of LMS (Learning Management Systems)
  - the application of E-learning 2.0 (whatever you mean with this)..

→ and all this has (mostly) the same objective:  
the delivery and management of e-learning resources.
- Have you ever asked students what they really need regarding their interest in applications on their mobile devices in order **to enhance their communication and group-working activities?**

→ In this talk: some highlights of possible answers (and the solution we propose)!

## *“What do users want?”*

- Devices available
  - 2009; TU Graz; 97 test subjects (74% studying Computer Sciences, 26% Mechanical or Electrical Engineering)
  - 81% have own mobile phones; 75% have own notebook
  - mobile phones in use: 40% Java-capable; 10% Symbian S40, 9% Symbian S60; 7% Windows Mobile;..

→ let's build on Java!
- What students say
  - The most-popular features on mobile devices are (most-used first): surfing the Web, checking emails, calendar, multimedia options, read news, keep informed about different topics,..

## *The Need of Collaborative Applications*

- Imagine:
  - *a **collaboration application**, which gives you the possibility to use your mobile devices [..] for your **communication and group-working activities**. The main feature [..] will be **free source code**. [..] The result [of this project] will be a communication framework that you can use, adapt and upgrade individually with **self-made services**. [Examples of services are] the following: **'Messaging'** (a chat over Bluetooth or ad-hoc WLAN; Paging), **'Searching'** (find people in your surrounding by searching for their devices), **'Data transfer'** (the possibility to exchange data or to work together on something by sharing data), [..]*

## *The Need of Collaborative Applications*

- What students say
  - 85% → such an application would solve problems like costs, signal reception in the lecture halls, information distribution and provision of relevant materials
- "Hottest" services
  - time management service
  - fast data transfers with people within range
  - proactive information services (which inform them about new grades or about the menu of the day in the campus restaurant or for example if an enrolled course has been cancelled)
- Also hot → open source API

## *The Need of Collaborative Applications*

- Benefits for teachers: e.g.
  - automatic attendance-testing services
  - broadcasting messages (on-demand, on-site) to the present students and asking them to reply
  - specialised services may also simplify the process of performing surveys or course evaluations
  - sending out files to all the students would also be interesting in the context of exams
  - ..

# Developing Mobile Applications

## *The challenges*

- Main challenges while developing for mobile devices..  
→ three perspectives:
  - **software development,**
  - **market segments,** and
  - **interconnectivity.**
- The main question is: to develop my application, on which mobile device(s) should I build on?
  - the device for which the best IDE exists? “best IDE”?
  - the ones based on an “open-source” operating system?
  - the most “trendy” ones?
  - the manufacturer with the “broadest market”?
  - the device with the “most-advanced features”?

# Developing Mobile Applications

## *Developing perspectives (the problems)*

- Developing for **Mobile Operating Systems (mOS)**
  - ..a lot of **distinct mobile devices** with a lot of **distinct operating platforms**, all supporting **distinct device types**, their manufacturers offer **distinct SDKs**, AND **most OSs are incompatible to each other!**
  - **Windows Mobile** (free IDEs/SDKs; count with mysterious behaviour); **Apple** (user-friendly; forces developers to publish **iPhone** applications via App Store); **Blackberry** (you must sign any application that makes use of certain restricted functions); **Limo** (advanced tools in popular open-source IDEs, e.g. Eclipse); **Android** (Java-based; still not affordable); **Symbian** (several SDKs, but some with restrictive license terms);..
- **Targeting at “most-known” mOS is difficult, cost-intensive and time-consuming!**

# Developing Mobile Applications

## *Developing perspectives (the problems)*

- Developing for **Mobile Device Users**
  - each manufacturer exposes **distinct device advantages**, e.g. technical, design or ergonomic features,..
  - First thought: bet on the (“statistically”!) best horse.  
→ **Nokia’s Symbian platform owned about 60% of the mobile market in 2008!**
  - Second view: this 60% is composed of all Symbian devices, ergo, all versions of available platforms (S40, S60, S80, UIQ, etc). **Talking about Symbian is not talking about a single mobile platform!**
  - The problem: these platform versions are not compatible with each other; even more, versions of them may “contain” incompatibilities as well ☹
- **there is not really a dominant and ruling mOS in today’s mobile market!**

# Developing Mobile Applications

## *Developing perspectives (the problems)*

- Developing for **Shared Connectivity** (1/2)
  - Regarding our purpose: which devices integrate which communication technologies?
  - Regarding our focus: **WLAN**, **Bluetooth**, **MANETs**.
  - The device dilemma
 

Android is restricted to few phones, not available everywhere; iPhone is widespread, but you must publish through App Store; RIM's market share is not big; Symbian “is popular”, but some SDKs have restricted licenses; Microsoft still sells their mOS, but offers a complete SDK.
  - The technology dilemma
 

WLAN-capable mobile devices are (usually) expensive, i.e. still not affordable for students. Bluetooth is in (almost) all available mobile phones and enables to create piconets.

# Developing Mobile Applications

## *Developing perspectives (the problems)*

- Developing for **Shared Connectivity** (2/2)
  - Problems:
    - WLAN is expensive, and further, it consumes “too much” electricity!
    - MANETs are interesting (the hosts are able to interconnect without pre-existing network infrastructures!), but e.g., packet losses, mobility-induced root changes, battery constraints, etc.
  - A simple, but restricted, way out:
    - short-range wireless communication vía Bluetooth!
    - Bluetooth allows interconnection with relatively little electricity consumption.
    - Piconets are flexible.

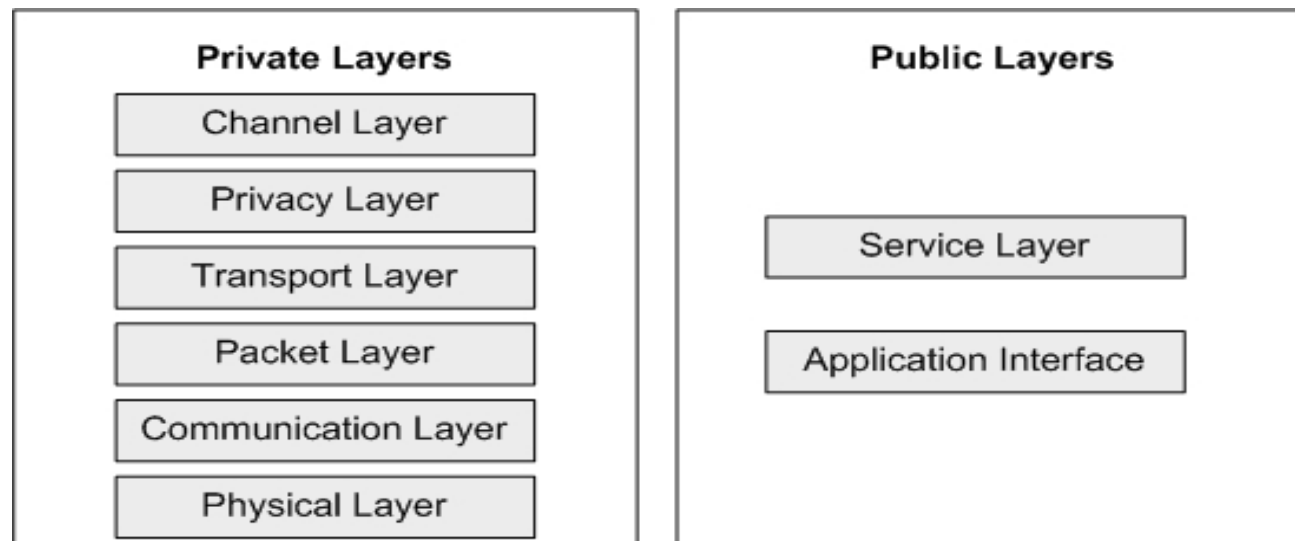
## Main Requirements

- students need a service on their mobile devices to **synchronise their calendars or To-Do lists** with those of other people, thereby indicating time slots in which everybody would be free
- students need a service for **fast data transfers to devices of people within range**, being thus able to share documents by being independent of a (mostly expensive) provider
- collaborative services should offer students the possibility to **share documents**, e.g., after modifying a document, the application should **multicast the document** to co-authors, eventually also to the lecturer for review purposes
- **provide personalized portfolios**, where students can decide which information they want to disclose to colleagues
- **send messages** to other people, or voice messages to other devices, **free of charge!!!**

# Adhoc Networking: PAN@Campus

## Main Architecture

- Layer-based (logic), but (technically) service-oriented
- privacy-enhancing (private vs. public)

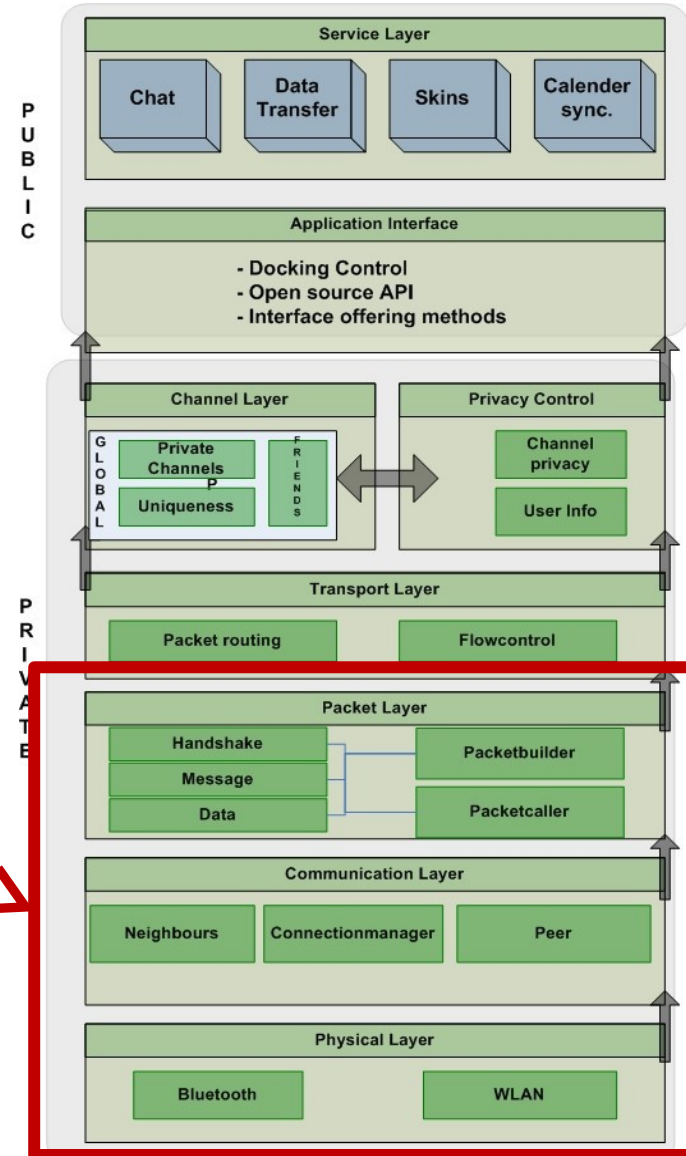


# Adhoc Networking: PAN@Campus

Current work → “CCA”

- Core functions:  
**Communication and Collaboration Area (CCA)**

=  
Packet layer +  
Communication layer +  
Physical layer



# Summary

## PAN @ Campus

- ❖ *Avoid developing applications for the majority of mobile operating systems: it is expensive and time consuming.  
→ building on Java middleware seems to be more feasible  
→ based on which mobile devices the students HAVE NOW, not what they wish to have!*
- ❖ *WLAN-supporting phones are still expensive for students  
→ Bluetooth makes sense for short-range communication, e.g. because it is economical in power consumption*
- ❖ *most-needed service @ TU Graz: time management!  
→ others: fast and simple ways of communicating, transferring data, and possibilities to work together on documents.*
- ❖ *The current state of our Communication and Collaboration Area (CCA) of our PAN@CAMPUS system supports the selection of the aforementioned services.*