Organisatorisches (1)

Lehrstuhl „Echtzeitsysteme und Kommunikation“

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Web-Adresse

http://ivs.cs.uni-magdeburg.de/EuK/lehre/lehrveranstaltungen/

- Folien der Vorlesung (in englisch)
- Übungsaufgaben
- Mitteilungen
- Literaturhinweise

Organisatorisches (2)

Übungen

- Übungsleiter: Georg Lukas
- Email:
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- Wöchentlich ab 14. KW (8. April 2010)

- Vermittlung praktischer Kenntnisse in der Anwendung
- Wenn erforderlich, gewünscht ...: Aufarbeitung des Vorlesungstoffs

Kriterien für erfolgreiche Teilnahme bzw. Prüfungszulassung

- Erfolgreiche Bearbeitung der praktischen und theoretischen Aufgaben

Prüfung

- schriftlich oder mündlich, wahlweise in Englisch
- Terminabsprache mit mir via e-mail

Mobile Computer Communication

Summer Term 2010

OvG - Uni Magdeburg
Computer Science
Real-Time Systems and Communications Group

Edgar Nett

Introduction

General Trend

We are moving towards the mobile, global information society

- The Internet is the technical backbone of globalization
- It provides the universal communication standard
- Classically, this is realized based on wired communication technology

Mobility is becoming the pendant to globalization

- ➔ need for ***portable equipment***
- portable devices today already constitute the fastest growing segment in computer industry
- getting increasingly small, cheap, rich (of applications) (cameras, mobile phones, music players etc)
- and ***portable*** (laptops, notebooks, PDA's etc)

Integration of information and communication technology

Communication Technology Trend

Mobility creates the need for ***wireless*** communication

- wireless communication essentially means radio communication
- characteristics are much different than those of a classical physical medium (cable, fibre optics)
- local networks constitute the basis of the communication infrastructure
- connected to the Internet they are no longer isolated islands
- additionally it needs worldwide standards

How to realize communication in such wireless local computer networks?

- Topic of this lecture

General objectives:

- Substitution of an inflexible wired infrastructure (stationary and wireless)
- Mobile/Wireless access to a wired infrastructure (mobile and wired/wireless)
- Creating totally new possibilities for communication (mobile and wireless)

Major advantages:

- Flexibility
  - no infrastructure --> no cables, plugs, hubs, switches …..
  - no a priori planning that already must consider all future communication needs
- Mobility (2 aspects)
  - *device mobility*: devices can be connected (wireless or wired) anytime, anywhere to an existing network (*portability)*
  - *user mobility*: users can communicate wireless anytime, anywhere with anyone without any additional infrastructure needed
- Robustness
  - against disasters (earthquakes, fire etc)
  - against misuse (pulling a plug etc)
- Cost efficiency

Application scenarios (1)

Home and Small Companies

- Computers and peripheral devices are connected wirelessly
- Wireless access to Internet via AP (access point)
- Construction of a company in-house network without infrastructure (also in historical buildings

Mobile labs and offices

- Work can be done location independent
- Creates the mobile employee and supports the traveling salesman
  - direct access to customer files stored in a central location
  - consistent databases for all agents
- Allows better combining business and private aspects of life

Dynamic working groups

- organizing meetings, conferences, trade fairs….
- local ad-hoc network with vehicles close-by to prevent accidents
- replacement of a fixed infrastructure in case of earthquakes, hurricanes, fire etc.

Application scenarios (2)

Creating hot spots

- Mobile access to Internet in public buildings (airports, stations, hotels etc)

E-learning and entertainment

- Creating virtual classrooms and lecture-rooms
- intelligent travel guide with up-to-date location dependent information
- ad-hoc networks for multi-user games

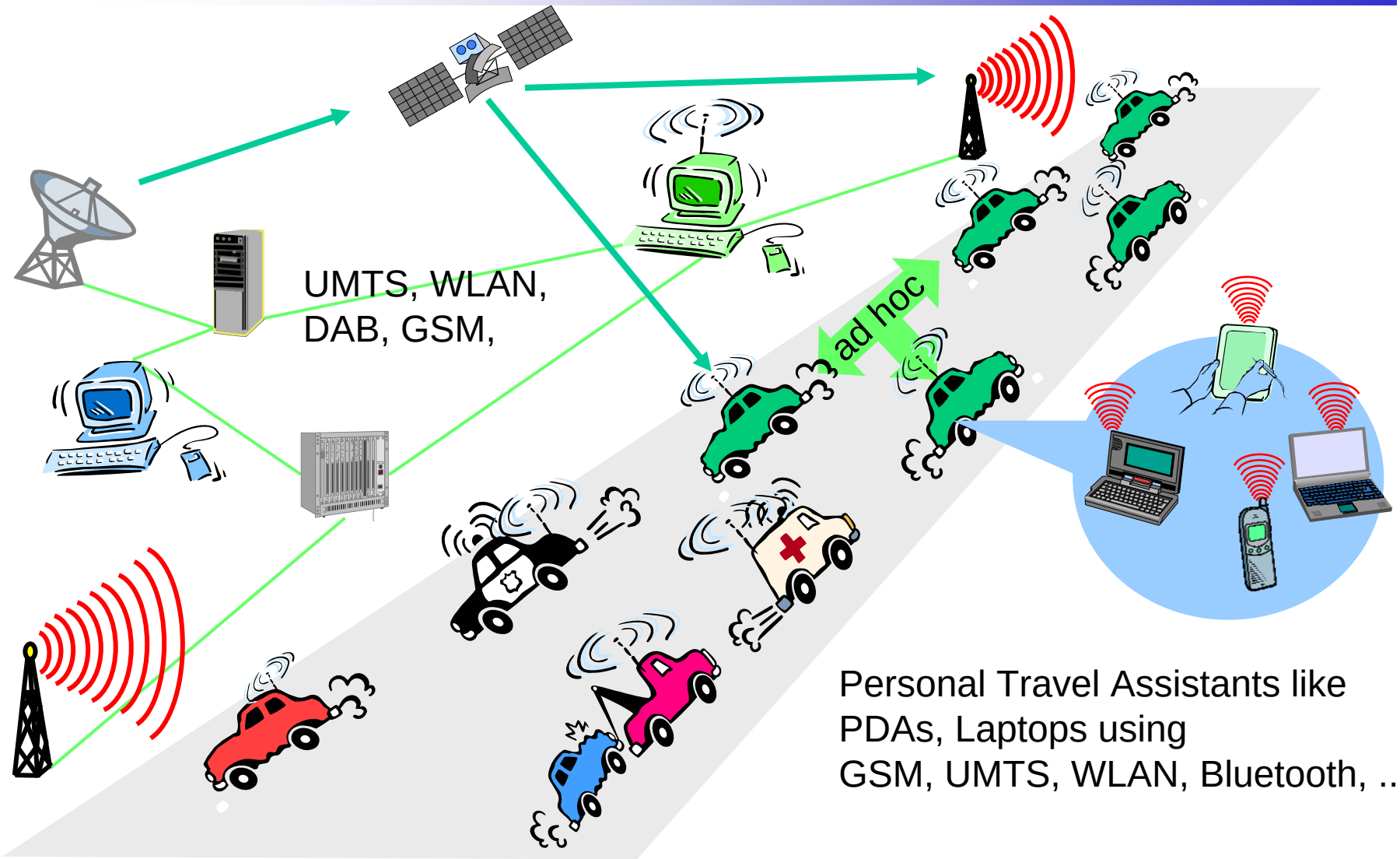
Mobile data acquisition

- early transmission of patient data to the hospital, current status, first diagnosis
- vehicle date (e.g., from busses, high-speed trains) can be transmitted in advance for maintenance
- transmitting centralized data to mobile inspection units

Flexible production and manufacturing

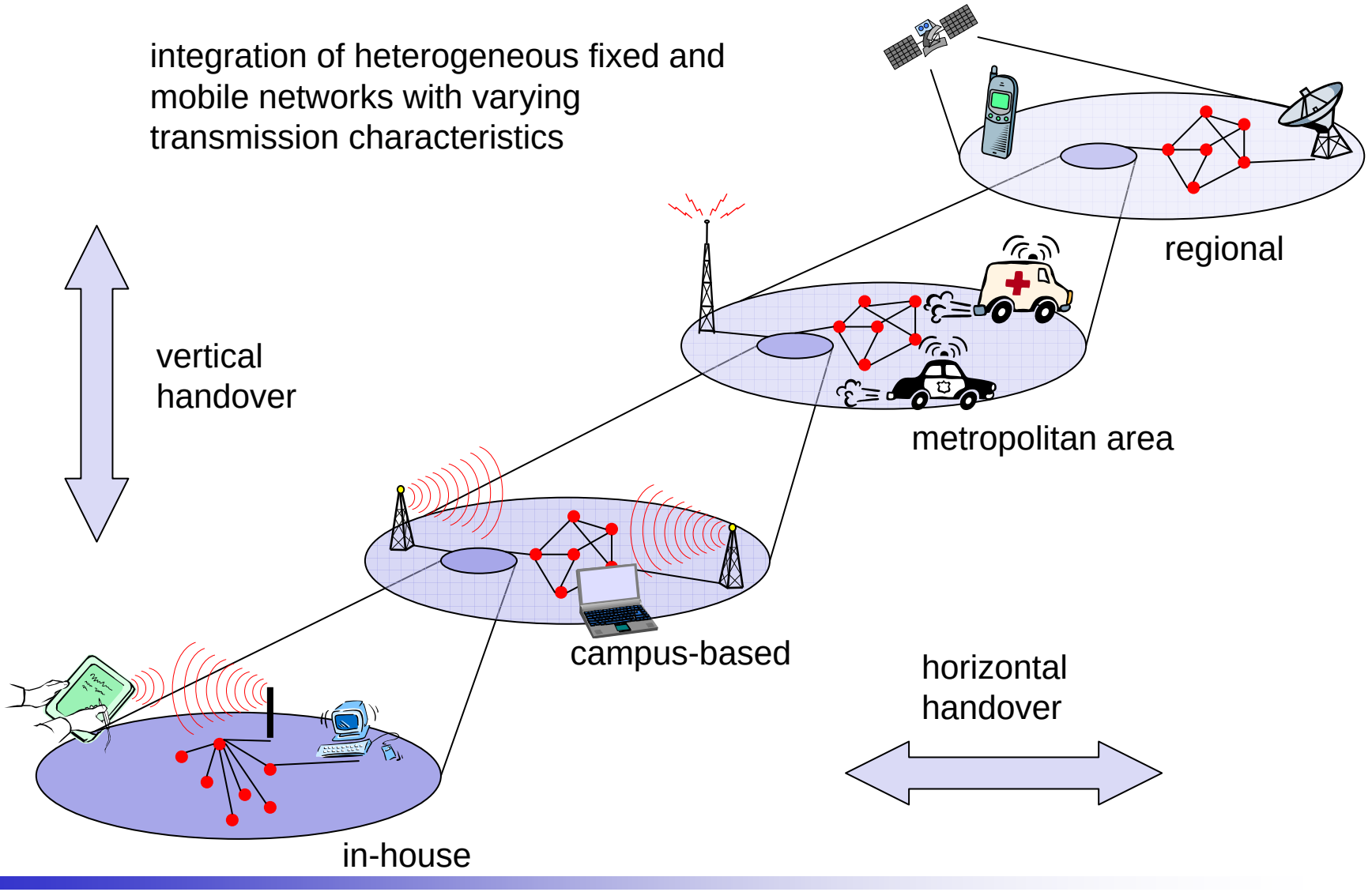
- controlled by complex and networked computer systems
- easy adaptation to configuration changes in the production process
- adopting methods of mobile data acquisition for diagnosis

Integrated (heterogeneous) application: road traffic



Overlay Networks - the global goal (Future)

integration of heterogeneous fixed and mobile networks with varying transmission characteristics



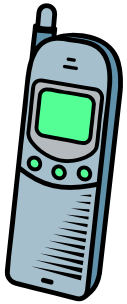
Mobile devices

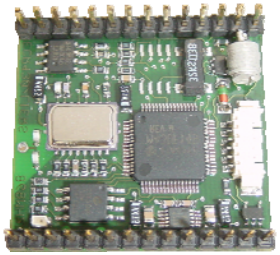
Pager
- receive only
- tiny displays
- simple text messages

PDA
- graphical displays
- character recognition
- simplified WWW

Laptop/Notebook
- fully functional
- standard applications

Sensors, embedded controllers





www.scatterweb.net

Mobile phones
- voice, data
- simple graphical displays

Palmtop
- tiny keyboard
- simple versions of standard applications

performance

Problems and trends of device mobility

Problems:

- Limited power supply
  - limits need for more computing applications and communication
  - limited battery capacity
- Limited user interfaces
  - compromise between size of fingers and portability, low quality displays
  - requires innovative input/output (speech,touch screen)

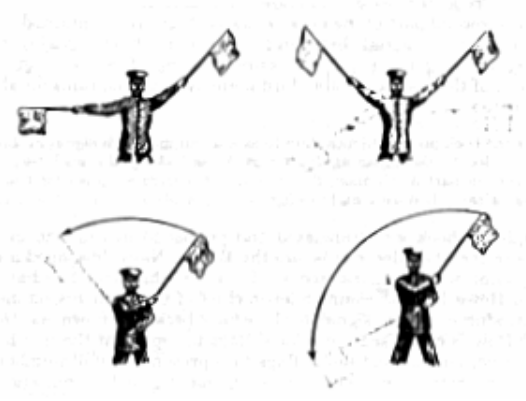
Trend (not only regarding networks but also regarding devices):

- Integration of (tele)communication and computer(networking) technology
  - ➔ Mobile phones are becoming mobile computers
  - ➔ From analogue data transfer to computer communication protocols (IP)
  - ➔ From computers to wireless, portable devices

Early history of wireless communication

Many people in history used light for communication

- signal towers, flags,…
- 150 BC smoke signals for communication; (Polybius, Greece)
- 1794, optical telegraph, Claude Chappe



Based on electromagnetic waves:

- 1831 Faraday demonstrates electromagnetic induction
- J. Maxwell (1831-79): theory of electromagnetic fields, wave equations (1864)
- H. Hertz (1857-94): demonstrates 1886 with an experiment the wave character of electrical transmission through space (experimental validation of Maxwell's equations)

History of wireless communication

1895 Guglielmo Marconi

- first demonstration of wireless telegraphy (digital!)
- long wave transmission, high transmission power necessary (> 200kw)

1907 Commercial transatlantic connections

- huge base stations (30 100m high antennas)

1915 Wireless voice transmission New York - San Francisco

1920 Discovery of short waves by Marconi

- reflection at the ionosphere
- smaller sender and receiver, possible due to the invention of the vacuum tube (1906, Lee DeForest and Robert von Lieben)

1926 Train-phone on the line Hamburg - Berlin

- wires parallel to the railroad track

History of modern wireless communication