

Mobile Systeme

Grundlagen und Anwendungen standortbezogener  
Dienste

*Location Based Services in the Context of Web 2.0*

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Department of Informatics - MIN Faculty - University of Hamburg  
Lecture Summer Term 2007

Dr. Thilo Horstmann

**CLDC**

NMEA

**MIDP**

**Google Earth**

**OpenGIS**

**SQL**

KML

**Bluetooth**

**Mash-Ups**

**Web 2.0**

**J2ME**

Loxodrome

Euler  
Spaces

**RDMS**

GPS

**PostGIS**

GPX

**Maps**

**JSR 179**

Polar

**API**

**Threads**

Coordinates

# Today: Introduction

- What are Location Based Services, Why are they important?
- General Building Blocks of LBS applications
- How do we get on from here?
- Organization, Literature

# What are Location Based Services?

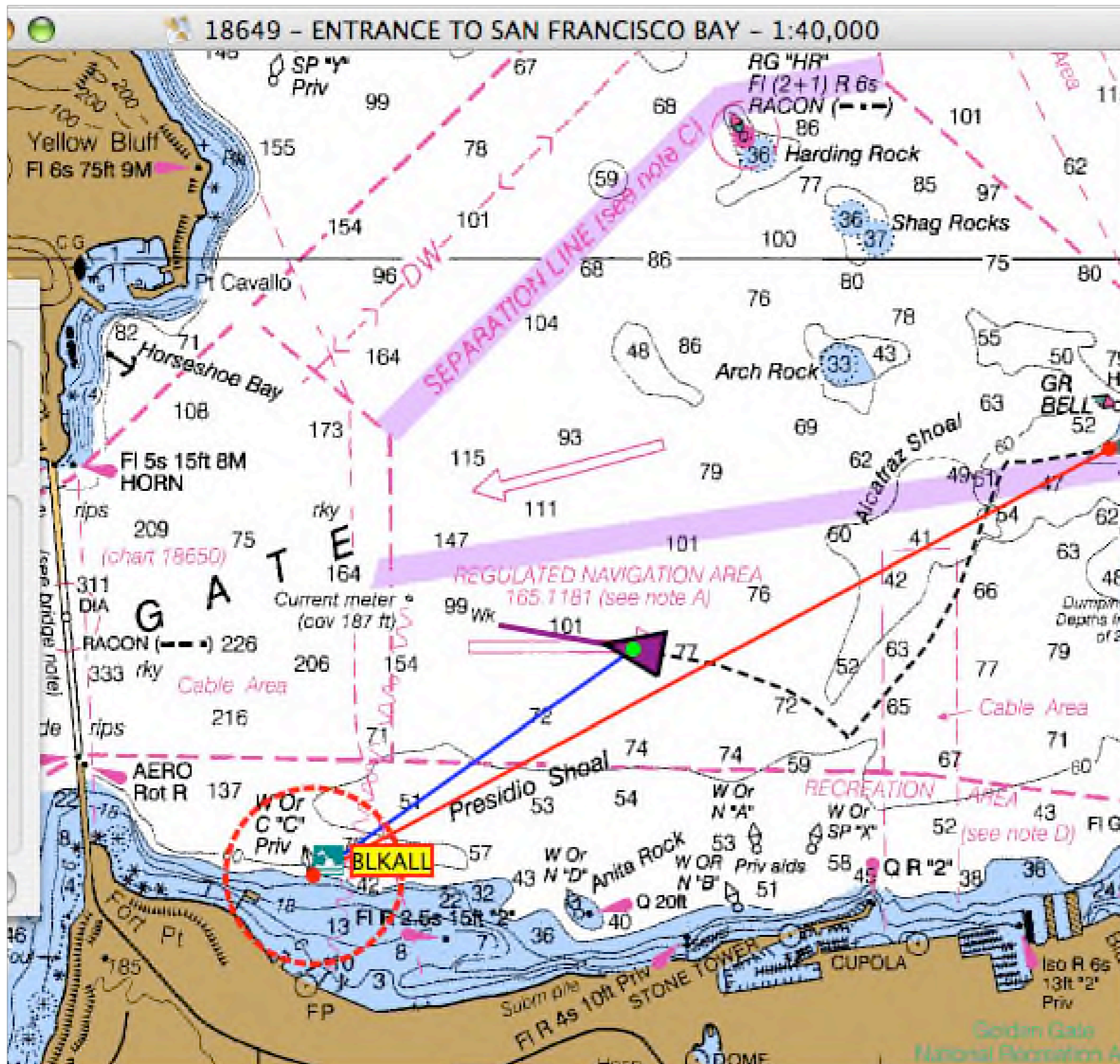
## Location Based Services

<b>Location</b>	<b>Services</b>
Lat = 54,4554 N, Lon = 009,3465 E	Traffic Jam Information
Hamburg	Restaurant Dictionary
Cell Tower, Cell ID	Emergency Service
134.100.9.77	City Guide

The term “Location-Based Services” (LBS) is a rather recent concept that integrates geographic location with the general notion of services.

(Schiller, J., Voisard, A. 2004)

Let's see some examples ...



Current and Future Navigation Systems

# Navigation Systems

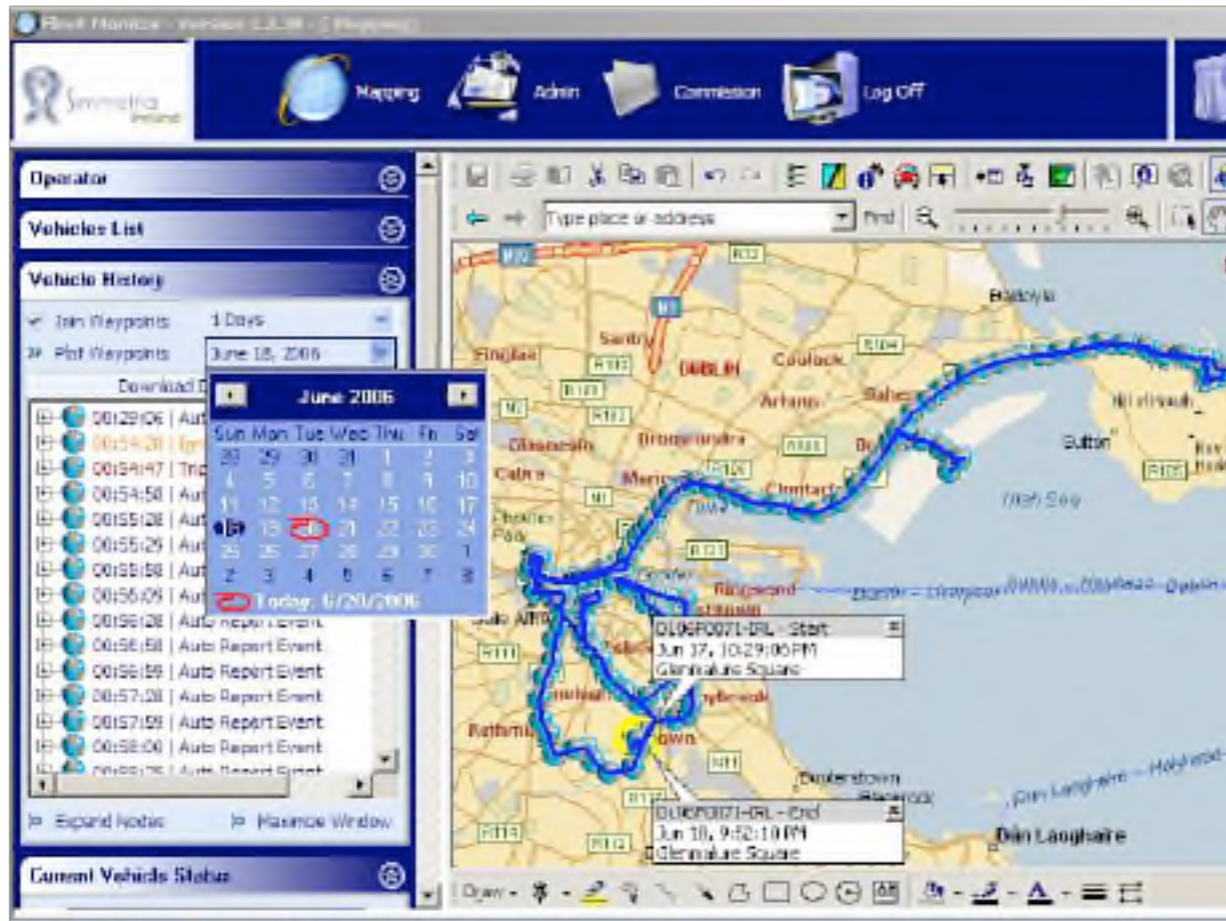
<b>Location</b>	<b>Services</b>
<p>high accuracy via GPS, e.g. Lat = 54,4554 N, Lon = 009,3465 E</p>	<p>e.g. Traffic Jam Information (TMC), Directions Future: City Guide, Buddy Finder</p>



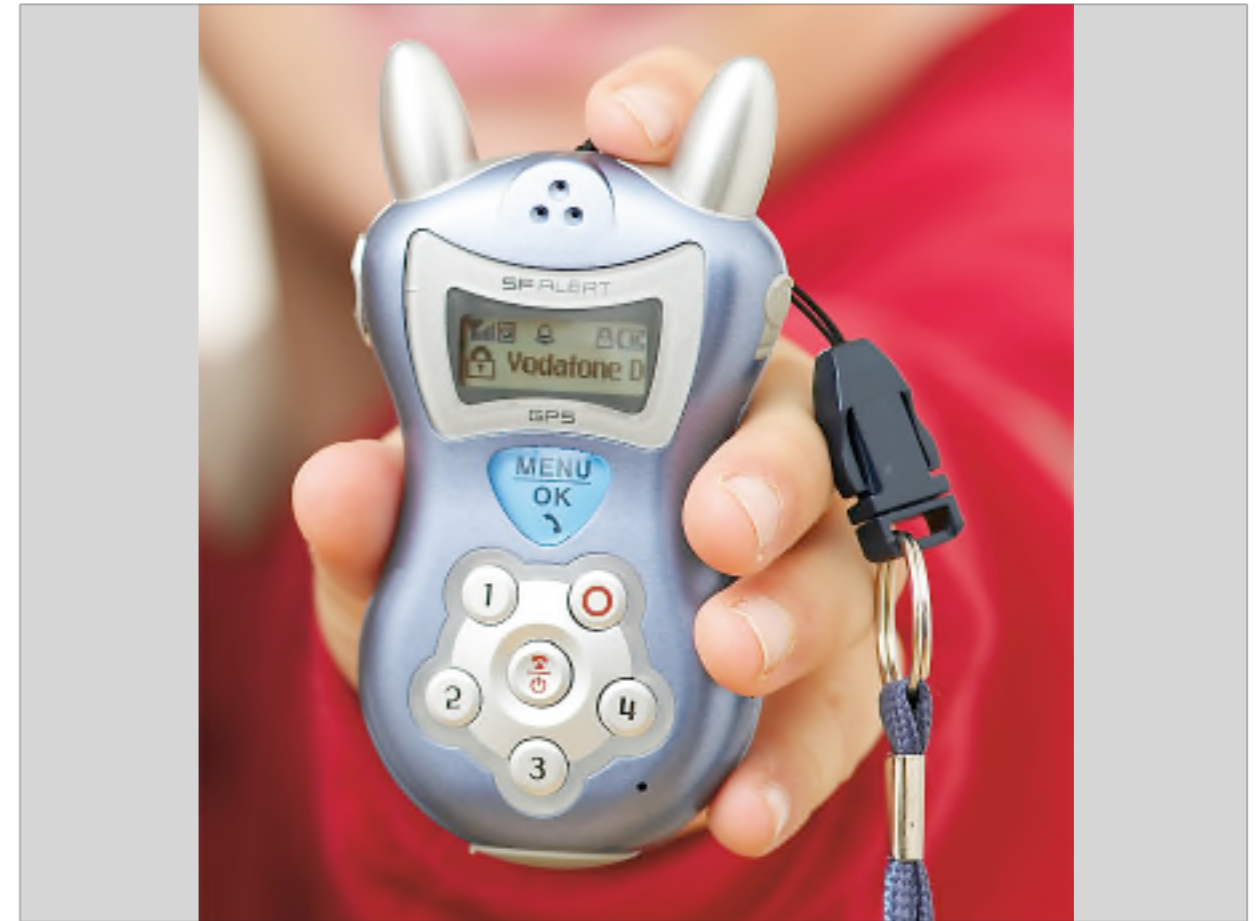
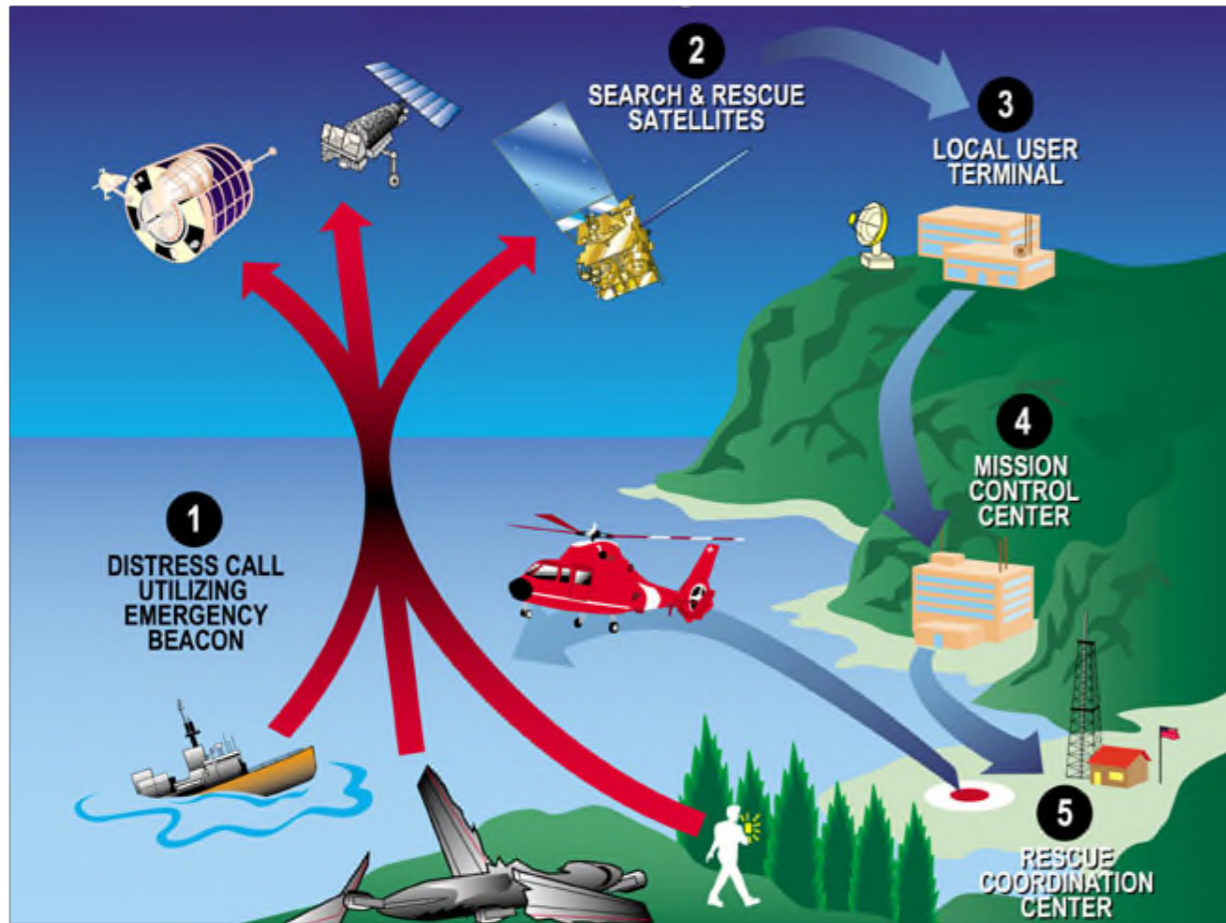
# Examples (1): Navigation Systems

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- “What is the fastest way to the university”, “Where is the next pub?”, “I’m lost, where is the next tube station?”
- Basically, the user’s current position and the directions to the destination are shown on a map
- Different systems for use in aircrafts, ships, and cars
  - Stand-alone or Client-Server based
  - Vector vs. bitmap maps
- Built-in devices (car, plane, ship), Mobile Phones, PDAs, Laptops
- Future: 3D-Navigation systems using networked services



Simple vehicle tracking professional fleet monitoring software (l.), in Google Earth (r.)



Emergency Services: COSPAS-SARSAT, iKID GPS cell phone

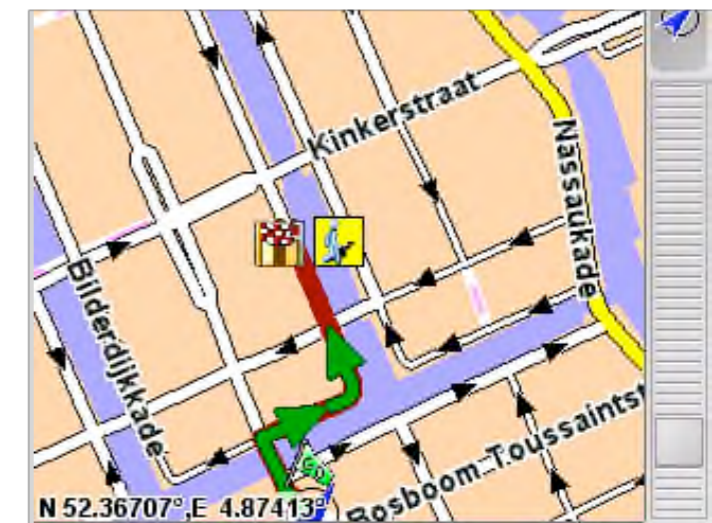
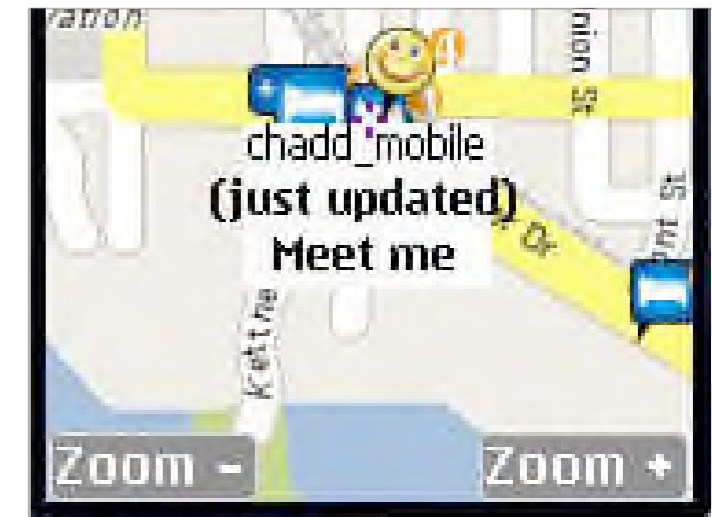
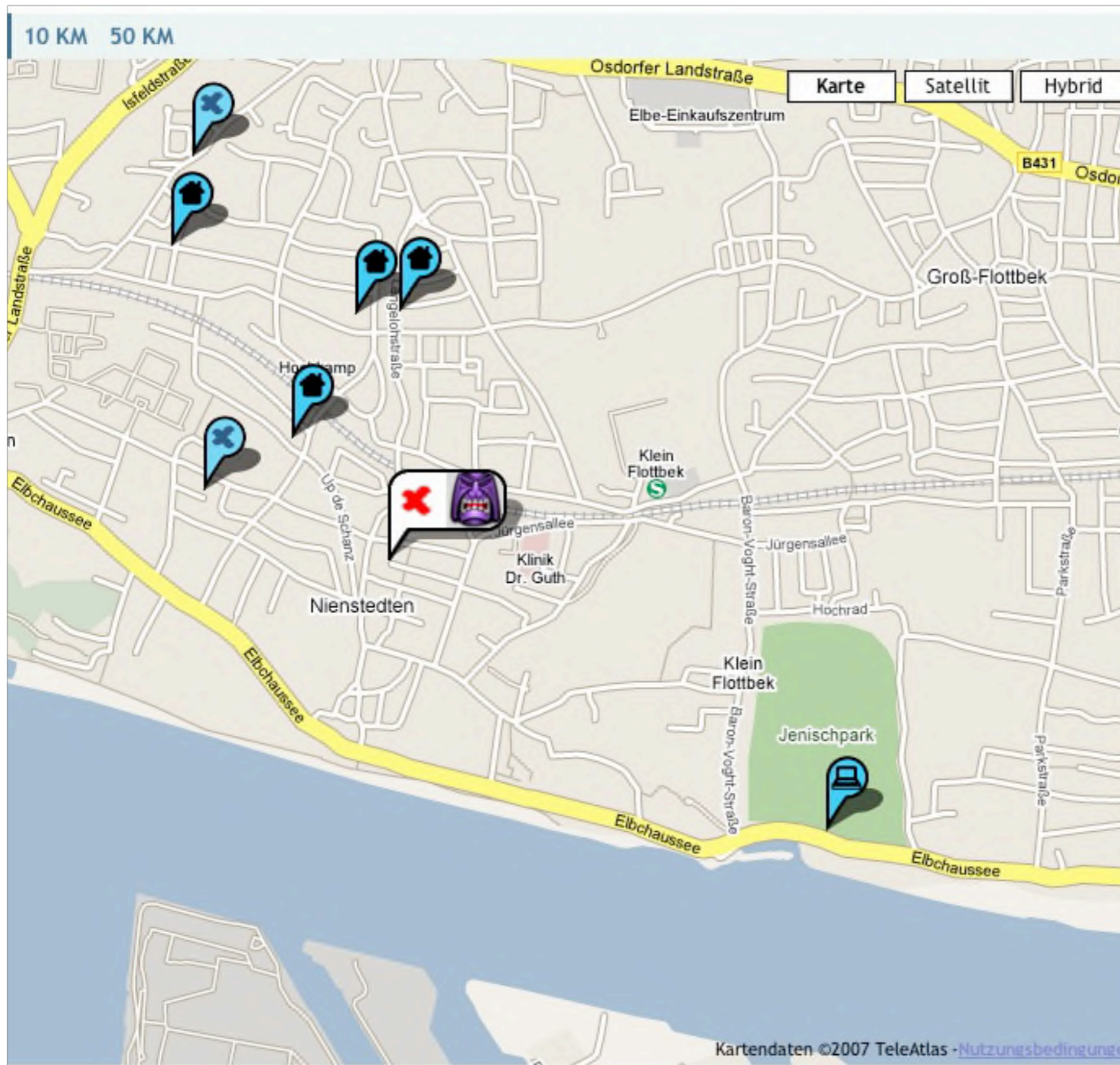
# Tracking Systems

<b>Location</b>	<b>Services</b>
<p>high accuracy via GPS, e.g. Lat = 54,4554 N, Lon = 009,3465 E</p>	<p>e.g. Route Optimization, Emergency Services, Theft Detection</p>

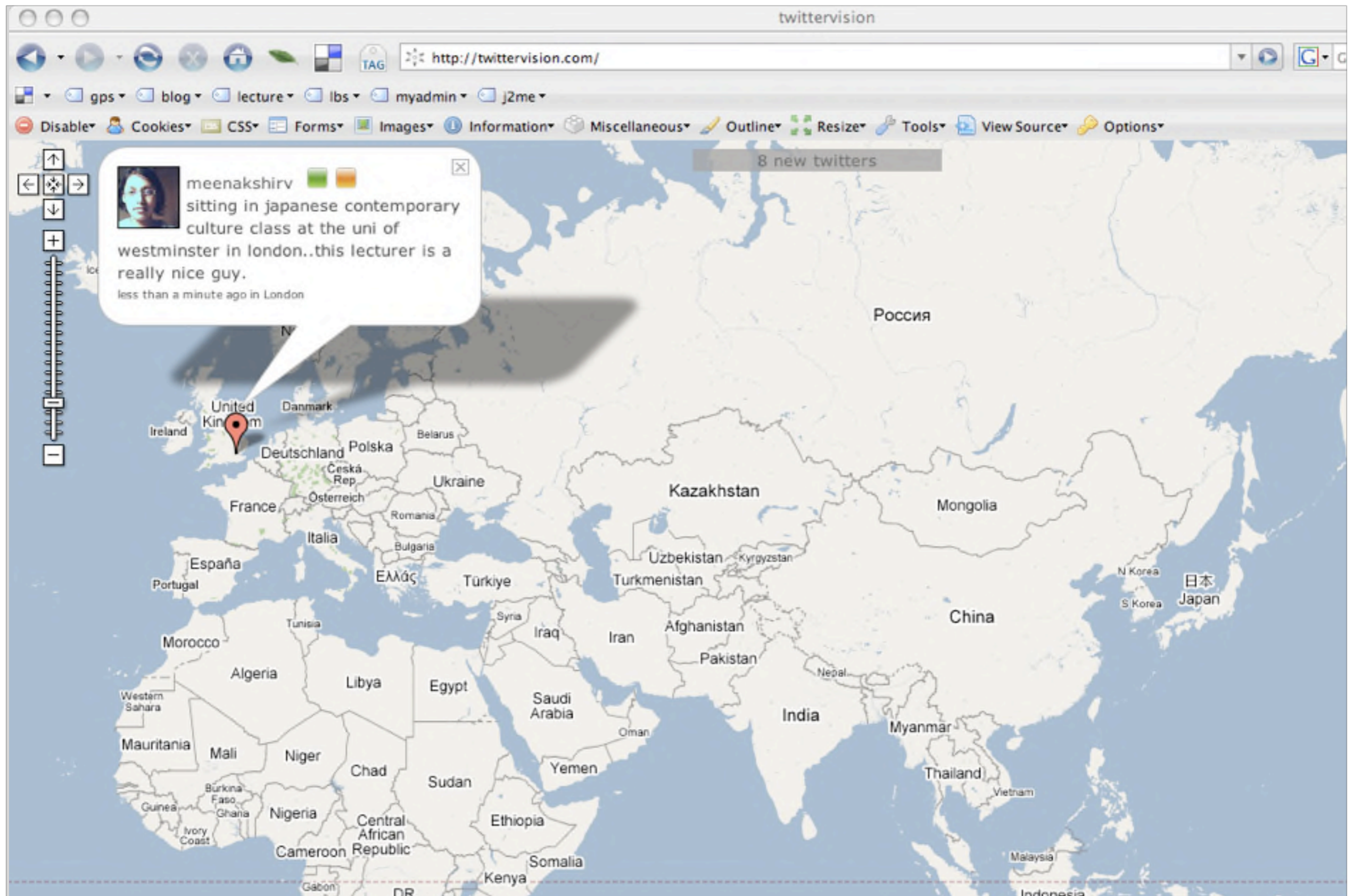
# Examples (2): Tracking Applications

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- Active vs. passive tracking of moving objects
  - Active: GPS-Position of object is periodically updated via GSM network (SMS, GPRS) to a central server
  - Passive: GPS-Position data is logged (locally stored) and processed later
- Applications are ranging from large scale fleet management systems to low-cost solutions for personal use
  - “Where is my fleet?”, “Where are my sailing boats?”
  - “Notify me if my child leaves a pre-defined area”
  - “Notify me if my dog runs away”



“Web 2.0” LBS-Applications: plazes.com, checkmates (Yahoo!), Jaiku



Twittervision: Simple location aware Web 2.0 mash-up

# **(Location Aware) Community Systems**

<b>Location</b>	<b>Services</b>
GPS, IP-Lookup, Manual, Geocoded (Address lookup)	Chat, Buddy Finder, Tracking, Media Integration



# Examples (2): Localized Social Community Systems

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- “Where are my friends/colleagues/buddies?”, “What are my buddies currently doing?”
- Social Community Systems support the unstructured, informal way of communication / collaboration
- Simplicity: Inaccurate location information accepted (IP lookup), often even entered manually
- Often built as “Mash-Up”, i.e. by accessing different services and APIs on the Web (google, yahoo, amazon, etc.)
  - Mash-up as a SOA (Service Oriented Architecture) in the context of Web 2.0

loc.alize.us - Explore your world through everyone's eyes

http://loc.alize.us/#/geo:53.54984,9.97326,13,k/

loc.alize.us Find your place!

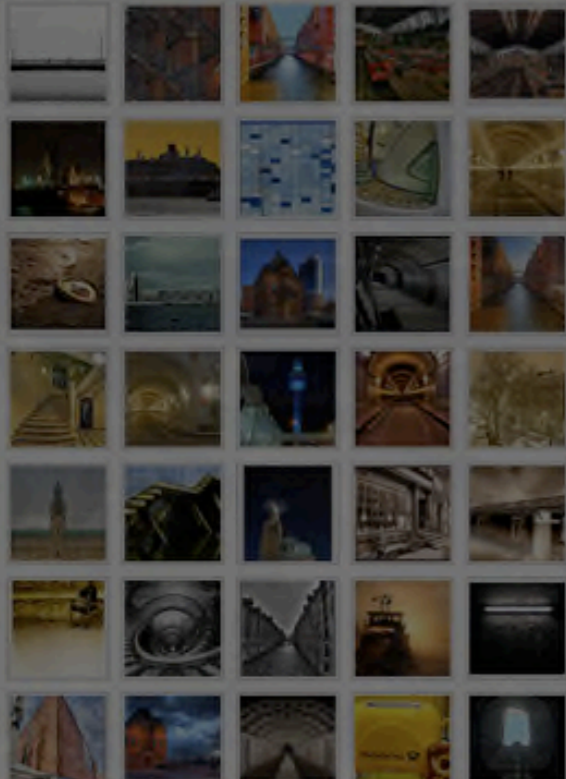
Karte Satellit Hybrid

Explore Create Help About


People Search  
Find your buddy to display only his/her photos.

Tags Search  
3xp 510fav anawesomeshot aplusphoto architecture black blue building bw deutschland elbe explore flickrtour fujis3pro germany green hafen hamburg harbour hdr i500 nacht night photomatrix ship sigma1020 speicherstadt tunnel wasser water

Photos Sort by: date interestingness



17417 photos << Page 1 / 20+ >>



http://www.flickr.com/photo.gne?id=134709163

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loc.alize.us: Mash-up of geotagged digital photos (flickr) and Google Maps

# Examples (3): Location aware media

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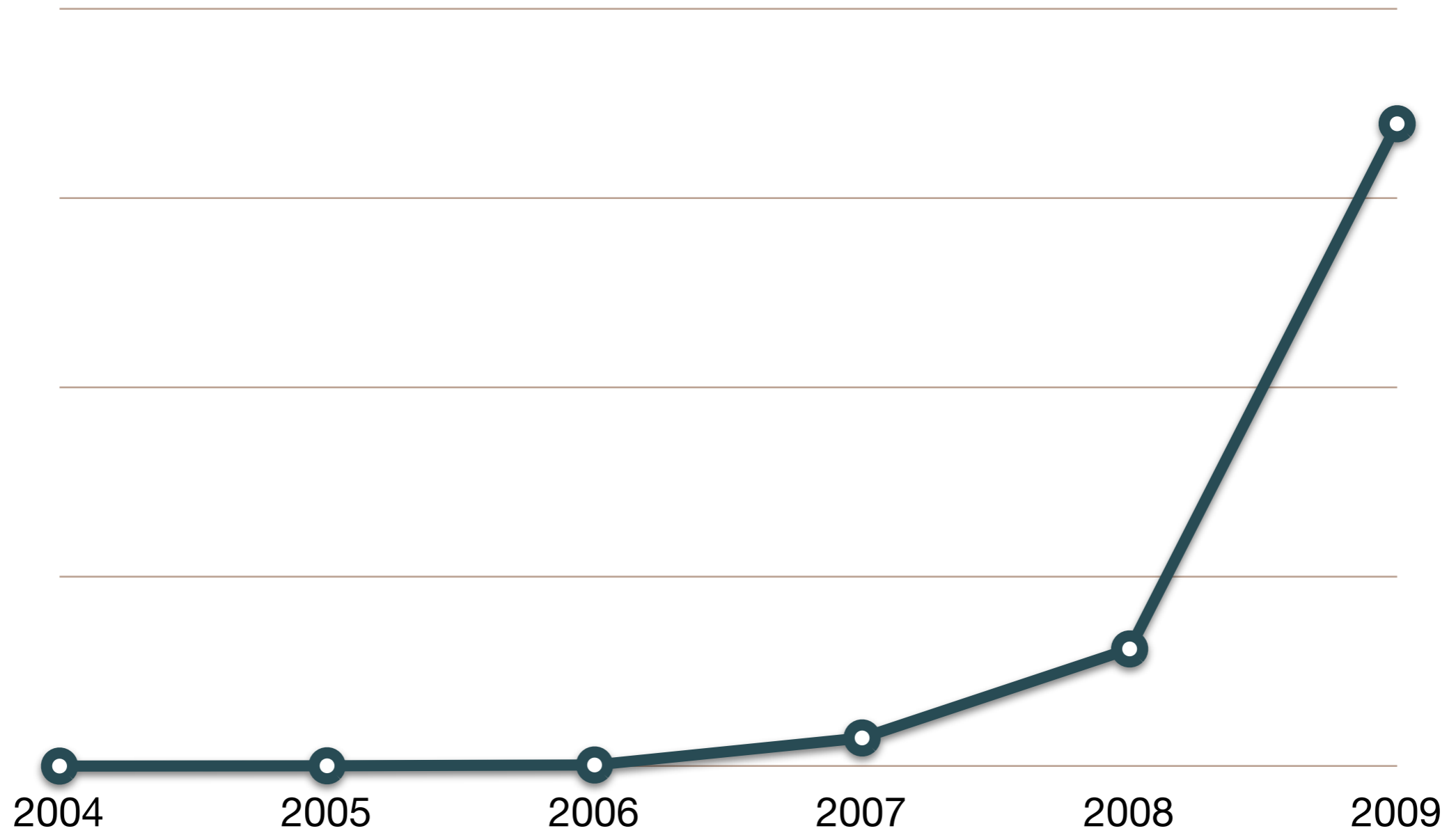
- “Show my (geotagged) digital photos in Google Earth and flickr”
  - Idea: Add the location of the digital media photo to its set of meta tags.
- Geotagging may be archived
  - via GPS enabled cameras or mobile phones,
  - correlation between a GPS track and the capture time of the photo
  - manually
- Geotags are (or will) be supported in many applications including flickr.
- Future: Geotagging of videos

# Further Examples:

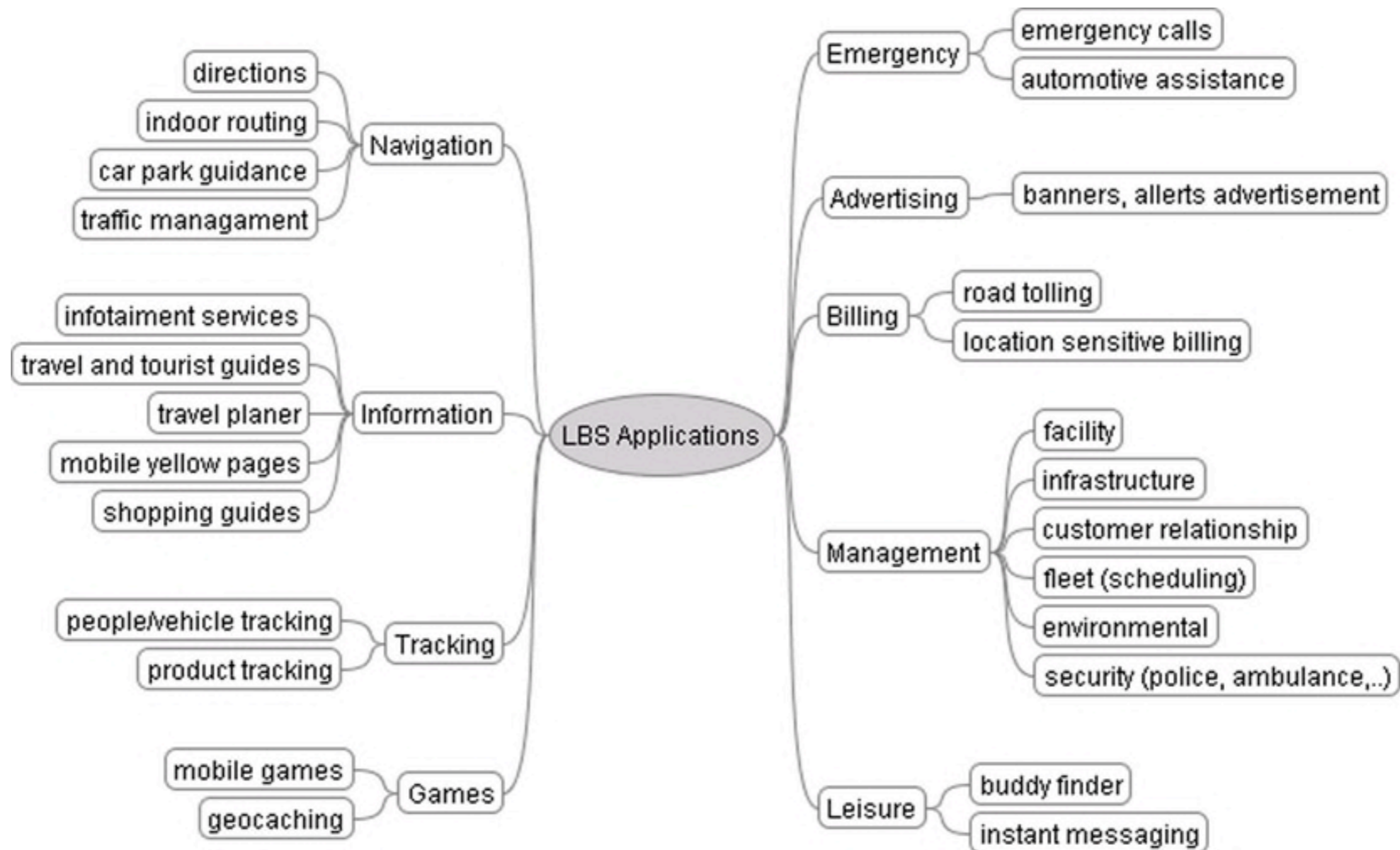
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- GPS-based tracking of activities: An user's trail is being recorded on the device's flash memory and uploaded later at home.
  - Research: Mobota (Fraunhofer FIT), PDA based
  - Commercial: Garmin Forerunner 305
- Mobile games, Geocaching
- Mobile Advertising:
  - "Send me an voucher on my cell phone when I'm close to McDonald's in Mönckebergstraße", European Research Project e-Iba

... and many many more!



# LBS application categories (Steiniger et al., 2006)



# Towards a definition of LBS

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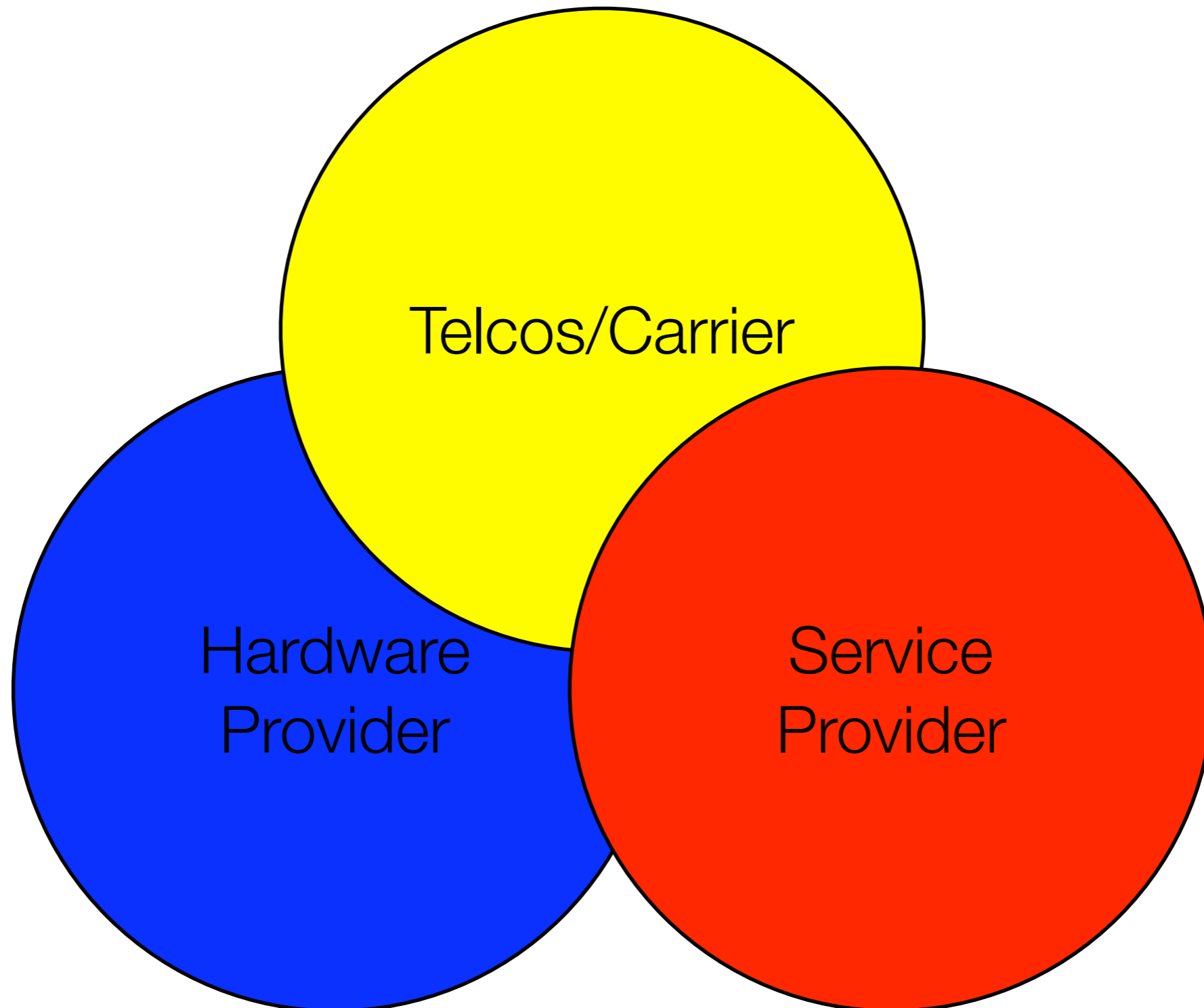
- LBSs are information services accessible with mobile devices through the mobile network and utilizing the ability to make use of the location of the mobile device. (Virrantaus et al. 2001)
- A wireless-IP service that uses geographic information to serve a mobile user. Any application service that exploits the position of a mobile terminal. (OpenGeospatial Consortium (OGC) 2005)
- **The term “location-based services” (LBS) is a rather recent concept that integrates geographic location with the general notion of services. Examples of applications include emergency services, navigation systems, or information delivery for tourists. With the development of mobile communication, these applications represent a novel challenge both conceptually and technically. (Schiller, J., Voisard, A. 2004)**

Are LBS important?



# LBS between Mobile Carriers, Hardware and Service Providers

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# Carriers, e.g. Sprint (USA)

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- Microsoft and Sprint are jointly developing a range of new, location-based services (LBS) for Sprint's wireless customers in the U.S. The initial offering, available now, enables users to search, via Windows Live Search for Mobile, for location-based content from the Internet, such as nearby stores and restaurants, according to Microsoft. (Nov. 17, 2006)

# Service Provider, e.g. Google

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- Deep Nishar, Director Product Management Google, Nov. 2006:
  - Google already introduced new services designed specifically for mobile devices. In January, it released the **Google Personalized Home**, which lets people access Gmail, news, RSS feeds and other information from their personalized Google home page on mobile phones and PDAs. This summer Google launched a downloadable Java application for Google Maps, enabling cell phone users to get information about local restaurants and movies theaters as well as live traffic information on the map.
  - The second big category Google is focusing on is **location-based services**.
  - In mobile, a one-size-fits-all solution won't work. Given that our mission is to organize the world's information, it's important to make sure **our applications work everywhere** in the world.

# Hardware Provider, e.g. Nokia

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- “We see that location based experiences, such as search, mapping and navigation will be a fundamental platform for many applications in Nokia Nseries devices going forward.” (Anssi Vanjoki, Executive Vice President and General Manager, Multimedia, Nokia, Oct. 2006)
- Nokia acquired gate5, a supplier of mapping, routing and navigation software and services.
- Navigation software and maps can be downloaded and used for free
- Nokia has signed a licensing deal with Trimble Navigation that gives the mobile phone maker access to hundreds of technology patents for providing location-based services (Oct 2006)

# Some business figures

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- Frost & Sullivan reveals that revenue in this industry totaled just \$91.2 million in 2004 and can reach over \$600 million by 2008. (Frost & Sullivan, Jan 2006).
- Total revenue garnered from these [LBS] services may exceed \$3.6 billion by the end of the decade. (ABI Research, Nov. 2006)
- Berg Insight forecasts that LBS revenues will grow by 50 percent annually. In 2010, about 18 million users will subscribe to location billing plans. (Berg Insight, September 2006)

But do not take them too seriously ;-)

# Why now?

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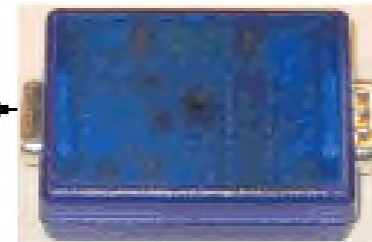
- Advances in Technology:
  - Smaller, faster mobile devices: Smart phones / PDAs, Cameras, Media devices (TV, Music, Video), Car entertainment, better network support (UMTS, WLAN): UMTS Transfer rates up to 3,6 Mbit/s (Download), Lower Power Consumption
  - Satellite Navigation (Global Positioning System), introduction of powerful GPS chips (e.g. Sirf Star III)
- Google Maps, MS Virtual Earth, NASA World Wind et al. available
- Business demands
  - Cell phone penetration in western countries already high, no increase
  - Average Revenue per User (ARPU) decreasing

# Devices are getting more powerful

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- Example: Nokia N95 Mobile Phone (April 2007)
- Network: WLAN (802.11b/g), UPnP
- GPS built in
- CPU ARM-926 Architecture, 220 MHz
- Memory: 40 MB/160 MB
  - 2 GByte microSD card slot
- Screen: 240x320, 24 bit per pixels
- USB 2.0
- Video, Sound







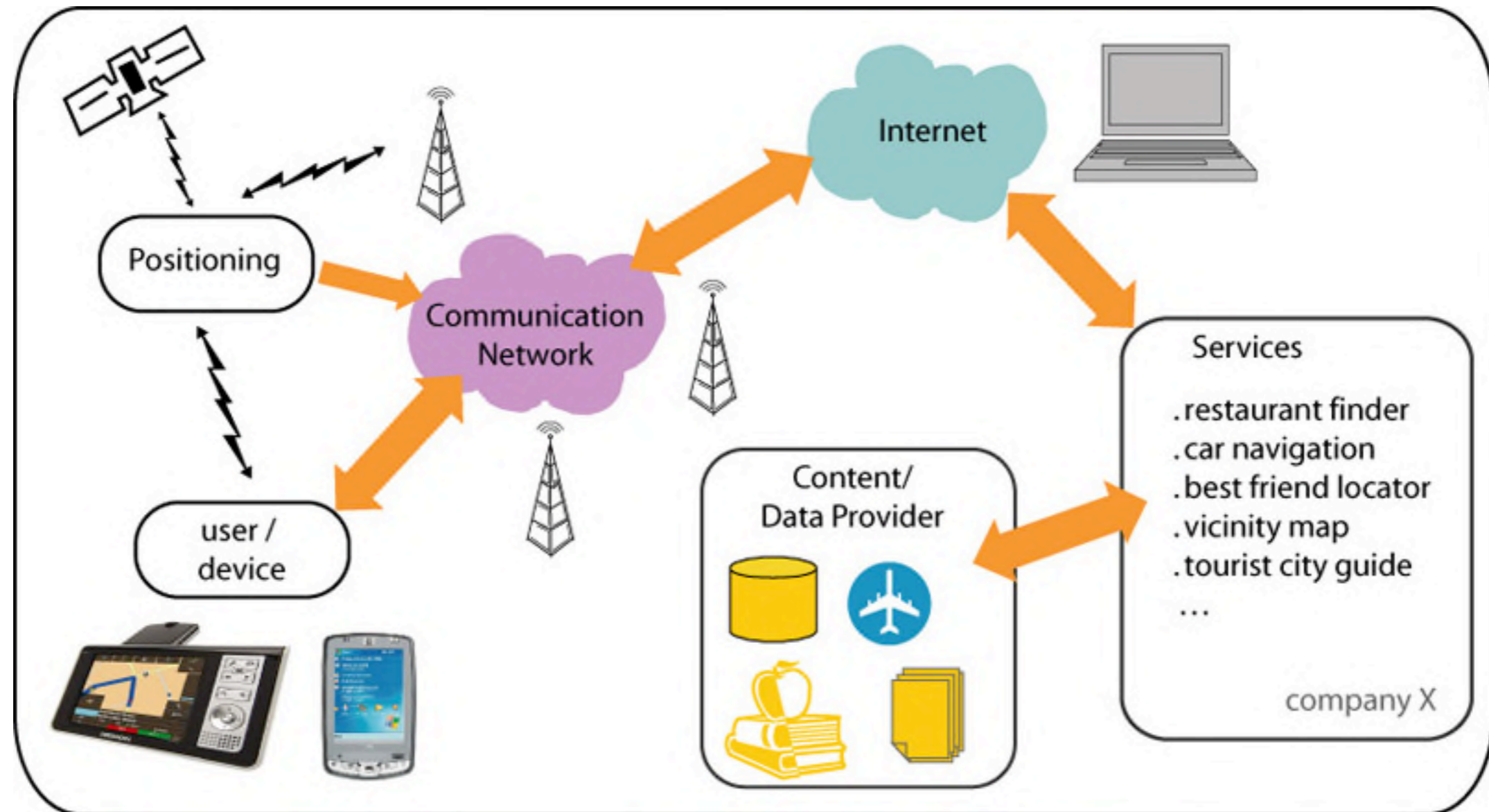
# But ...

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- Mobile phones are still mainly used for regular voice calls
- Data transmission costs still high, especially globally (roaming)
  - data flat rate (like voice flat rate) will push LBS dramatically
- Still some research to do:
  - Study of context aware computing
  - Study of usage patterns in mobile computing
  - Privacy (mobile devices are very personal)
  - Network technology, ad-hoc networks
  - Persistency and fast data retrieval of geo coded data

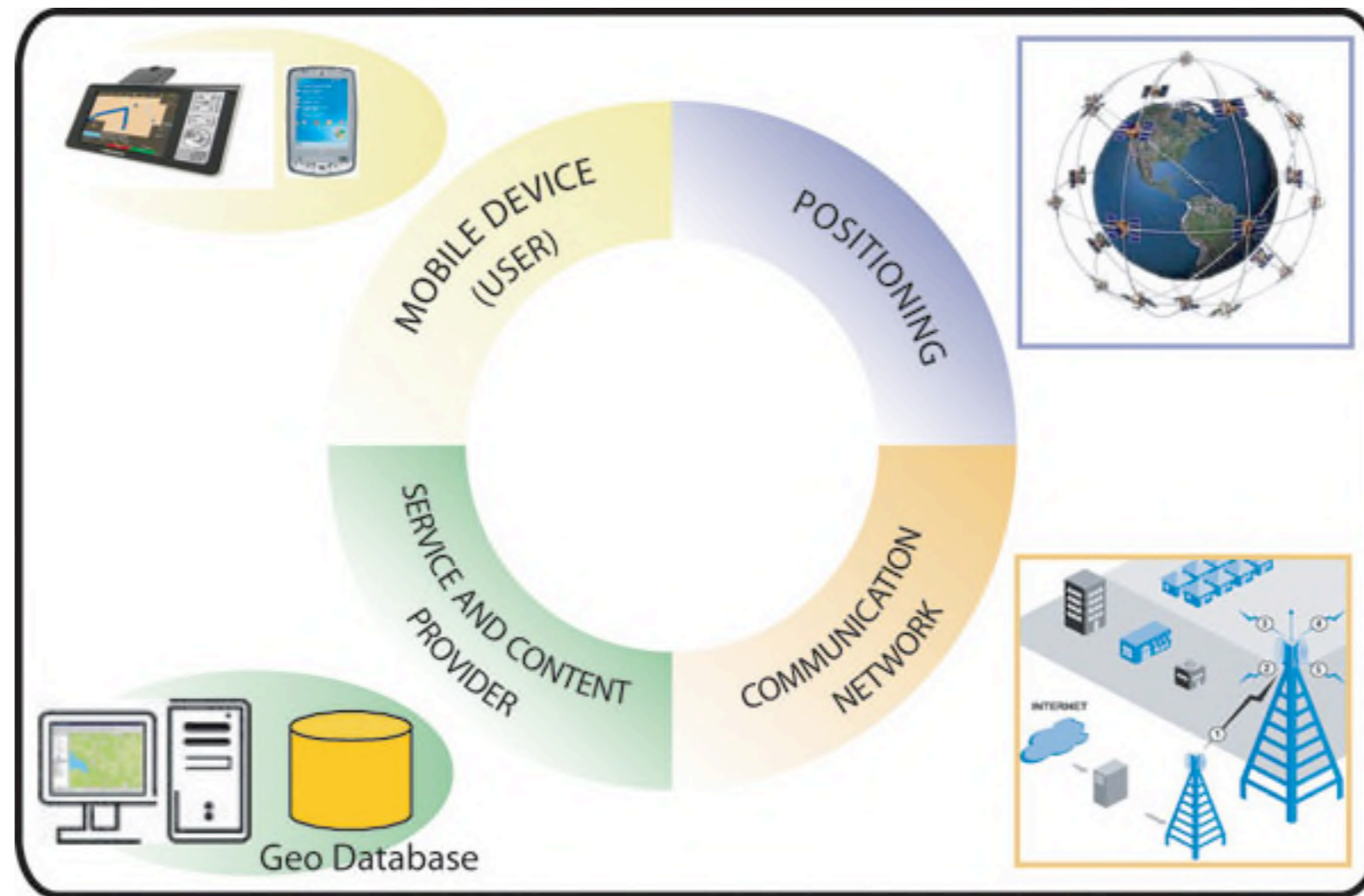
# Building Blocks of a LBS application

# LBS components and information flow



# Basic Components of an LBS

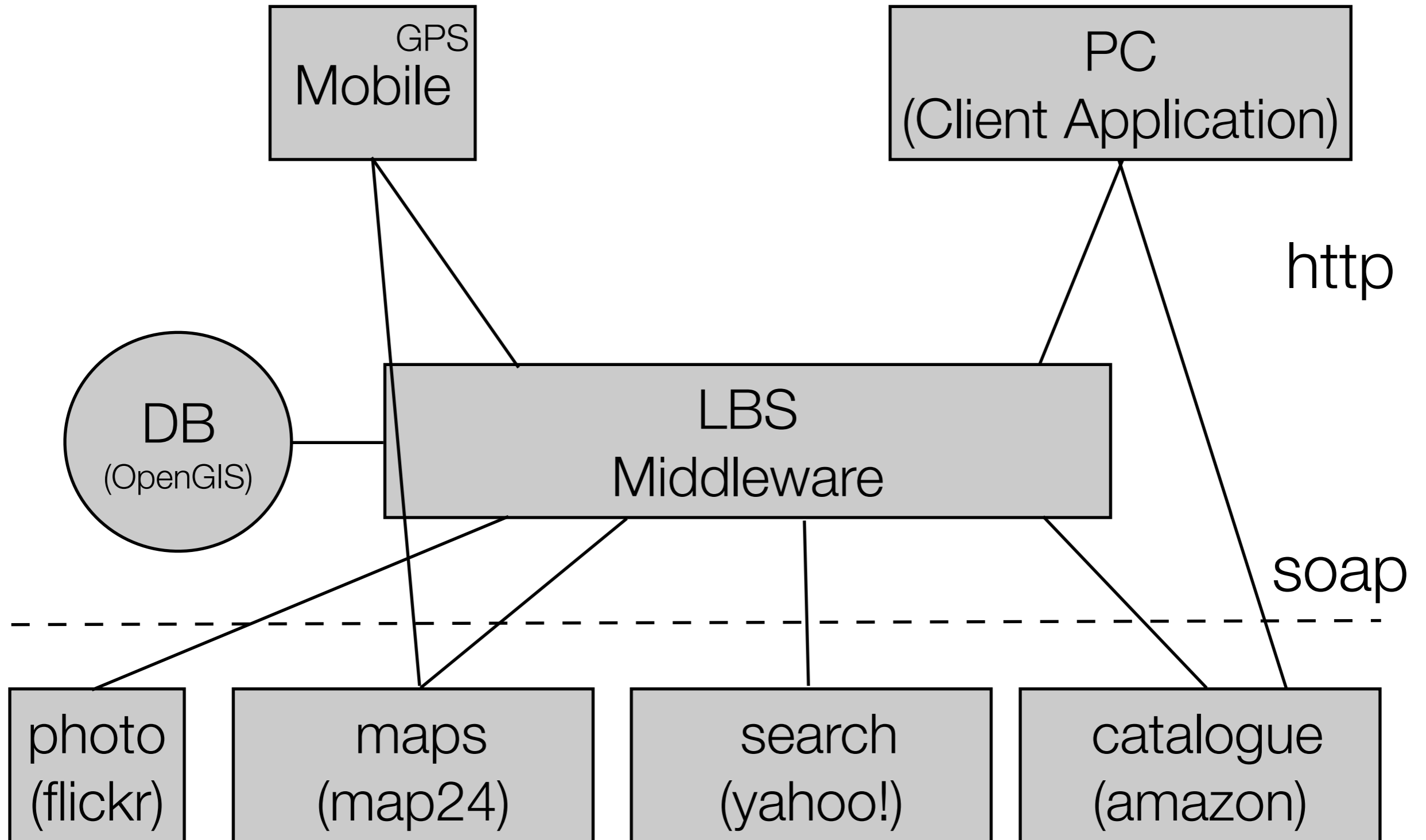
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Steiniger et al., 2006

# Simplified LBS Application Architecture

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beta ;-)

How do we get on  
from here?

**CLDC**

NMEA

**MIDP**

**Google Earth**

**OpenGIS**

**SQL**

KML

**Bluetooth**

**Mash-Ups**

**Web 2.0**

**J2ME**

Loxodrome

Euler  
Spaces

**RDMS**

GPS

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GPX

**Maps**

**JSR 179**

Polar

**API**

**Threads**

Coordinates

# Block I: Mobile Computing / J2ME

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- Introduction, Devices, Requirements
  - MIDP, CLDC, “Hello World”
- User Interface Programming
  - Event Model, Forms, Canvas
- Network
  - Internet, WebServices
- APIs / JSR
  - Bluetooth, Location API



# Block II: Geoinformatics

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- Spatial Objects and Reference Systems
  - Geo objects, Geometry of Geo Objects, Topology, Metric / Euclidian Spaces, Polar Coordinates, Basic Spatial Operations
- Map Projections
  - Azimuthal, Cylindrical and Conic Projections, Earth Ellipsoid, Geoid (WGS-84, Gauss-Krüger)
- Positioning
  - GPS, Cell tower localisation, NMEA, GPX

# Block III: Persistence of Spatial Data

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- Introduction: Relational Data Bases
- Persistence of Spatial Data
  - Data storage, retrieval and operations, Spatial indices
- OpenGIS / PostGIS
  - Simple Features Specification for SQL

# Block IV: Software Architecture / Integration

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- Software Architecture (“Mash-up”) of a typical LBS application
  - LBS-Middleware, Integration of Services, Sample APIs and WebServices (flickr, google, amazon)
- User Interfaces / Clients
  - Google Earth, Keyhole Mark-up (KML), Client-APIs (Maps)

# Literature

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- Breymann, U., Mosemann, H.: Java ME – Anwendungsentwicklung für Handys, PDA und Co., Hanser, 2006, [www.java-me.de](http://www.java-me.de)  
(Chapter 1, 2, 3, 4, 5, 6, 10, 13, 14, 15)
- Küpper, A.: Location-based Services - Fundamentals and Operation, John Wiley & Sons, 2005
- de Lange, N.: Geoinformatik in Theorie und Praxis, Springer, 2006  
(Chapter 5, 6)

# This Lecture

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- Bin Jiang, Xiaobai Yao: Location-based services and GIS in perspective (2006)
  - [www.hig.se/~bjg/LBS.pdf](http://www.hig.se/~bjg/LBS.pdf)
- Stefan Steiniger, Moritz Neun and Alistair Edwardes: Foundations of Location Based Services (2006)
  - [http://www.geo.unizh.ch/publications/cartouche/lbs\\_lecturenotes\\_steinigeretal2006.pdf](http://www.geo.unizh.ch/publications/cartouche/lbs_lecturenotes_steinigeretal2006.pdf)
- Applications: [twittervision.com](http://twittervision.com), [loc.alize.us](http://loc.alize.us), [plazes.com](http://plazes.com), [jaiku.com](http://jaiku.com)

# Thank you!

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