4. B2C,B2E Systems: Concepts and Architectures

4.1 Business-to-Consumer Systems

Architectures and Components

Shop Functionalities, Selected Components

4.2 Electronic Fulfillment & Payment

Secure Communication, Security and Trust

Encryption: Standards, Authentication: Digital Signatures, Certification Authorities

Electronic Payment Models, Standards and Systems

4.3 Mobile E-Commerce and Location-Based Services

Mobile E-Commerce

What is Mobile E-Commerce (MEC)?

Mobile E-Commerce (MEC) is defined as any type of transaction of an economic value conducted through a mobile terminal that uses telecommunications network for communication with the e-commerce infrastructure.

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Department of Informatics and Telecommunications

Mobile Terminals

Four categories (based on processor, memory, battery capacity, application capabilities (SMS,WAP,Web), physical size and weight):

- Usual voice handsets with SMS capability
- WAP phones (see below)
- Communicators/PDA+wireless communication capability
- Laptops with wireless communication facilities

Characteristics

- Small screens, small and multifunction keypads -> require appropriate interfaces, different than the PC or laptop
- Less resources: memory, disk capacity, computational power
- Their operation relies on finite energy provided by batteries
- More vulnerable: easier to be stolen, damaged or lost -> higher risks to data stored and transactions performed

Standards for Global Wireless Networks

- GSM
- HSCSD
- GPRS
- UMTS

Global System for Mobile Communication (GSM)

Frequency: 900 or 1800 or 1900 MHz

1900 used in the US (usually supporting also the other frequencies with so-called tri-band phone technology)

Bandwidth: 9,6 kbits/s

Transmission of speech data for mobile phones

Suitable also for data transmission of any kind

Connection-oriented transmission (more expensive, 'dial in' functionality)

High Speed Circuit Switched Data (HS-CSD)

Bundle of multiple GSM channels

Bandwidth: up to 57,6 kbits/s

Data transmission with exclusive channels for a user

Payment w.r.t. time of use

General Packet Radio Service (GPRS)

Exploitation of GSM channels

Bandwidth: 53,6 kbits/s
(in Coding Scheme 2)

Packet-oriented data transmission, multiple users

Payment for volume ('always on' functionality)

Universal Mobile Telecommunication System (UMTS)

Frequency: 1900-2170 MHz

Bandwidth: up to 2 mbits/s (only in urban regions)

Packet-oriented data transmission

Standards for Local Wireless Networks

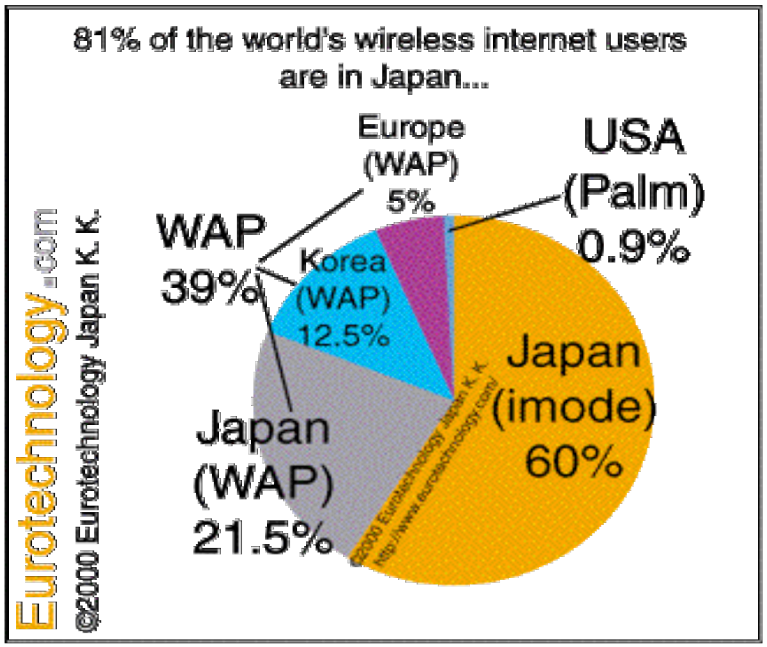
- IEEE 802.11 (laptops)
  - ❑10 Mbits/s
- Bluetooth (mobile phones, cameras, PDAs)
  - ❑ Dynamic configuration
  - ❑ Spontaneous networking

The Wireless World Today

i-mode: 60% of the world's wireless internet users

WAP: 39% of the world's wireless internet users

Palm: 1% of the world's wireless internet users



WAP

WAP Forum alliance of carriers & handset manufacturers, promising uniformity of deployment

WML Derived from Phone.com's HDML

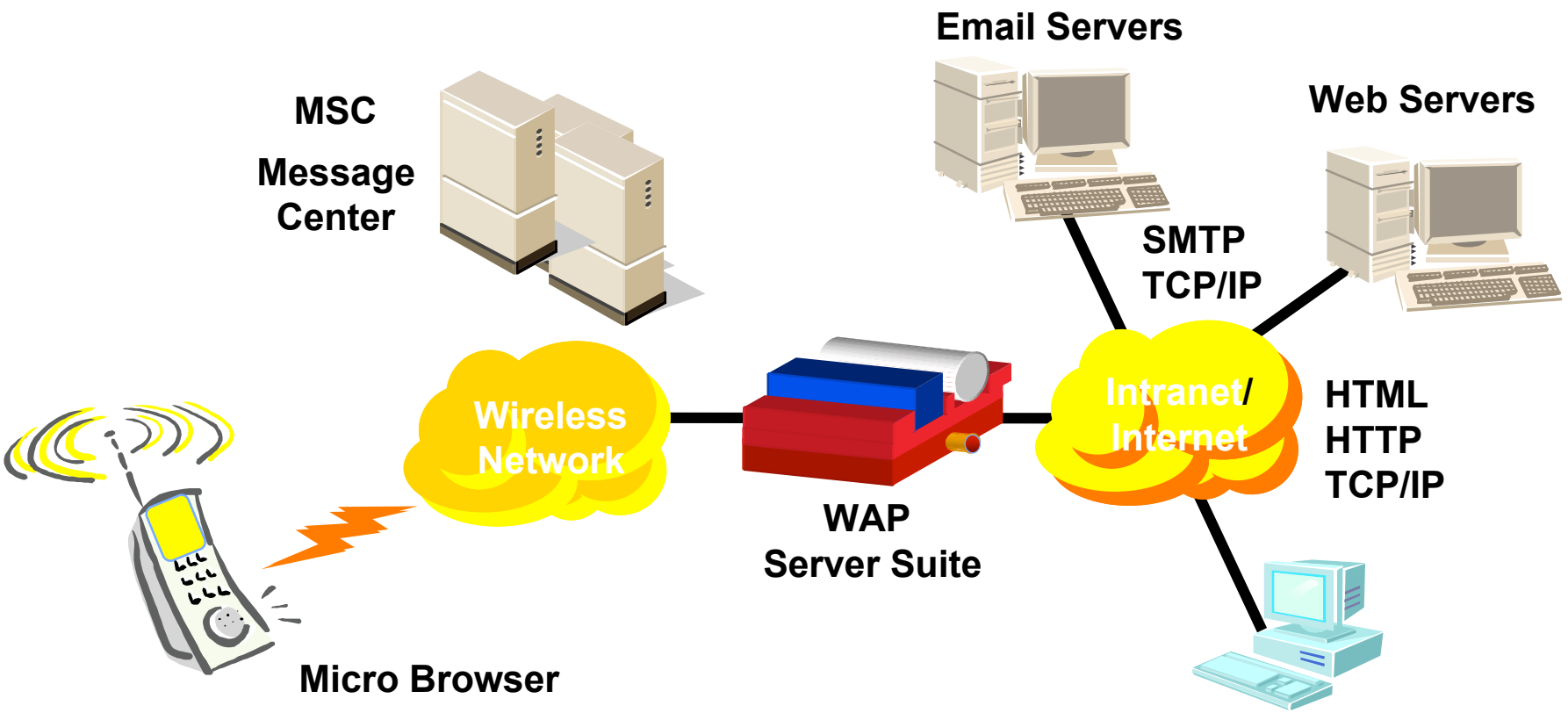
WML is an XML language

WAP incorporates its own scripting language and security stack

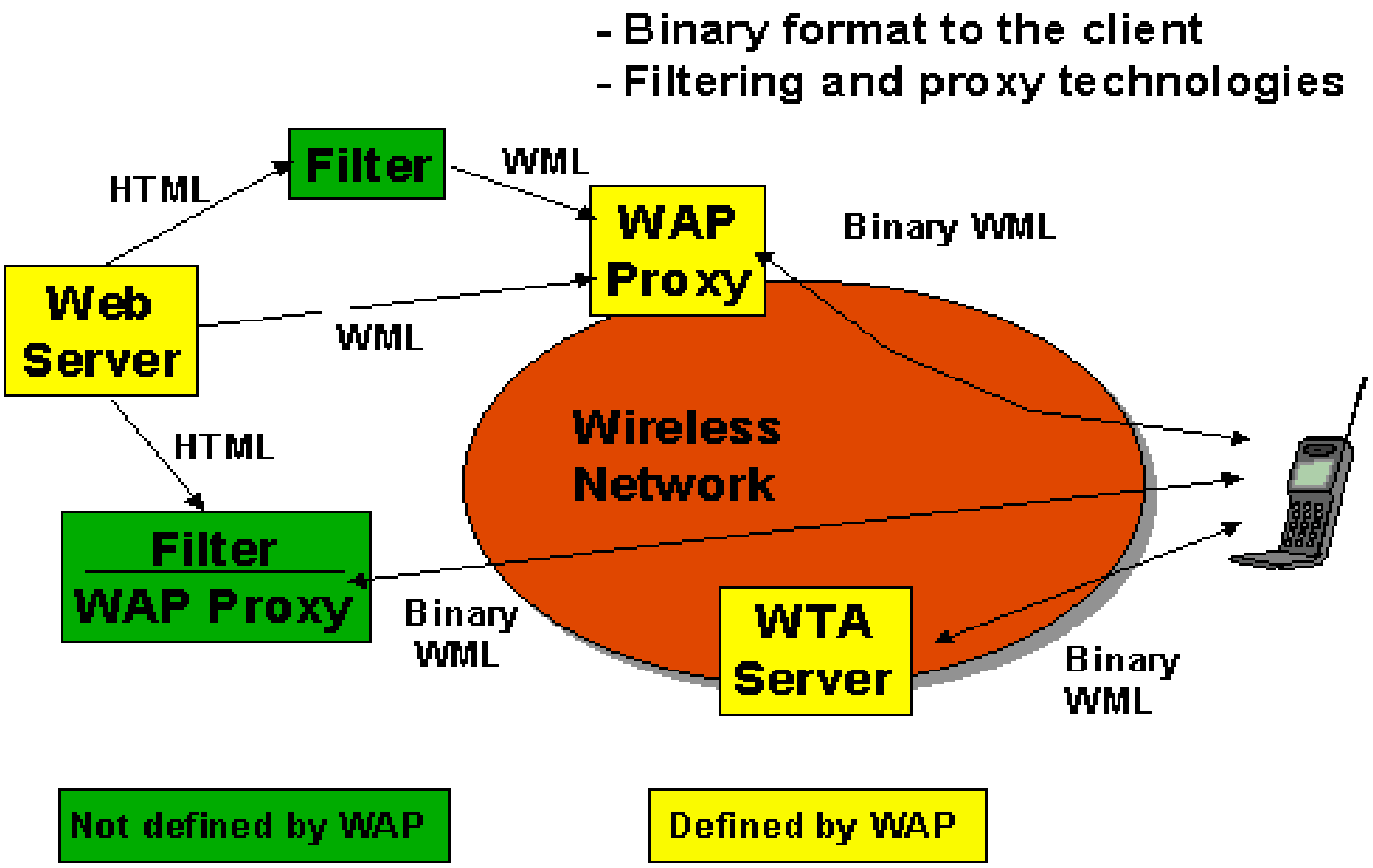
Optimized for network constraints

WAP in USA & Europe is far more limited than WAP in Japan

The WAP Idea

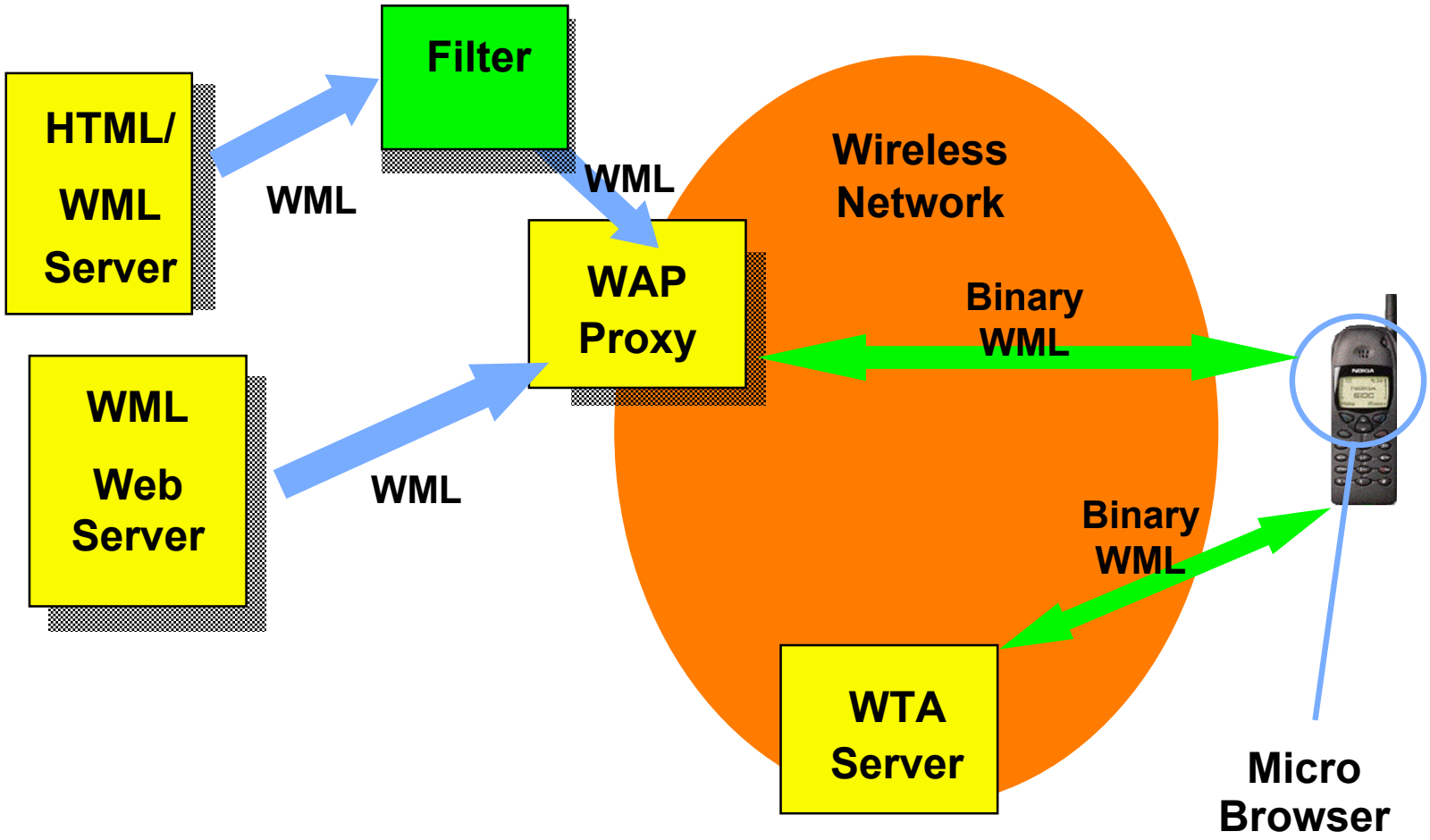

Email Servers
MSC
Message Center
Web Servers
SMTP
TCP/IP
Wireless Network
Intranet/ Internet
HTML
HTTP
TCP/IP
WAP
Server Suite
Micro Browser

WAP Infrastructure

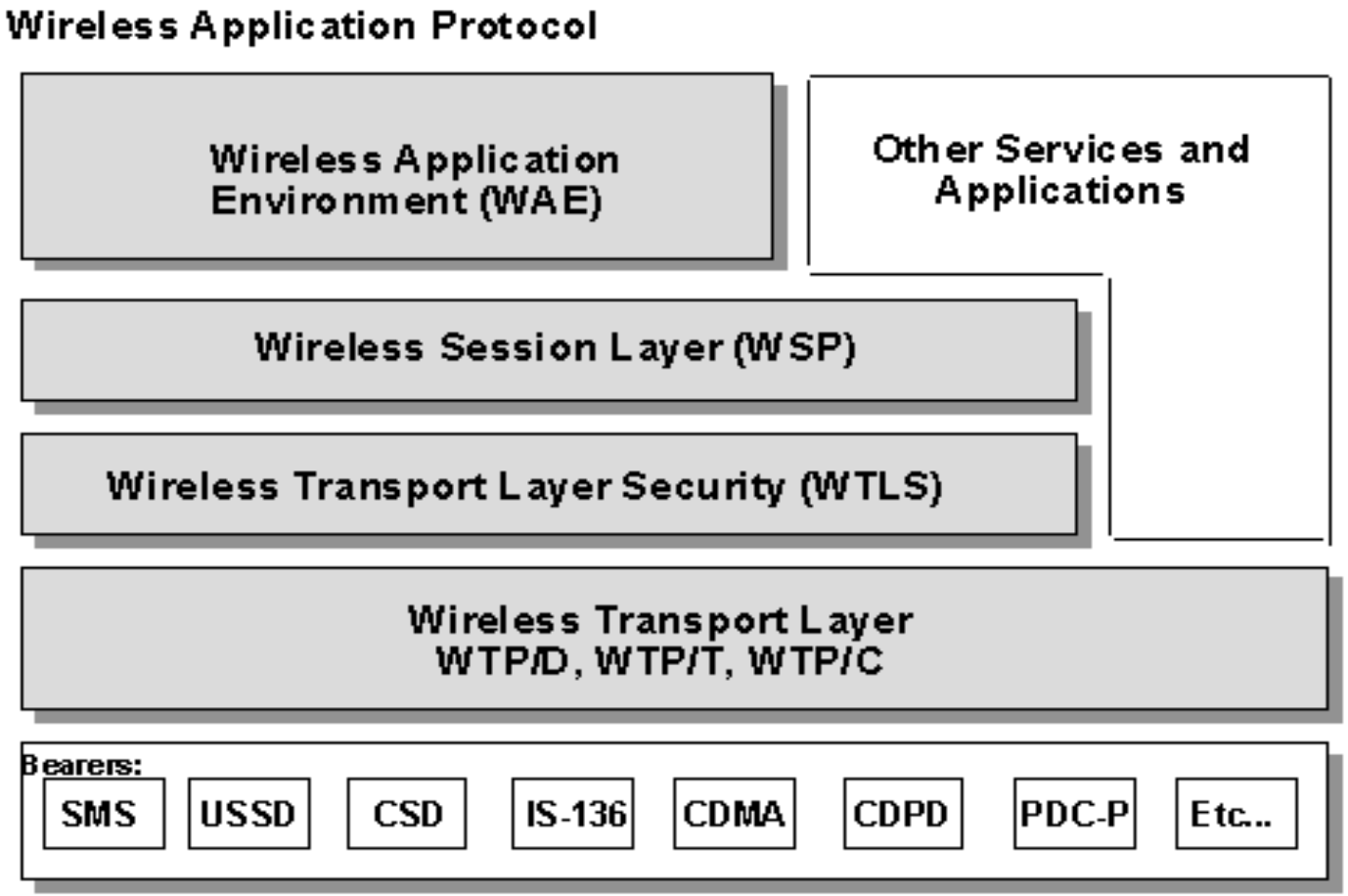


WTA = Wireless Telephony Application

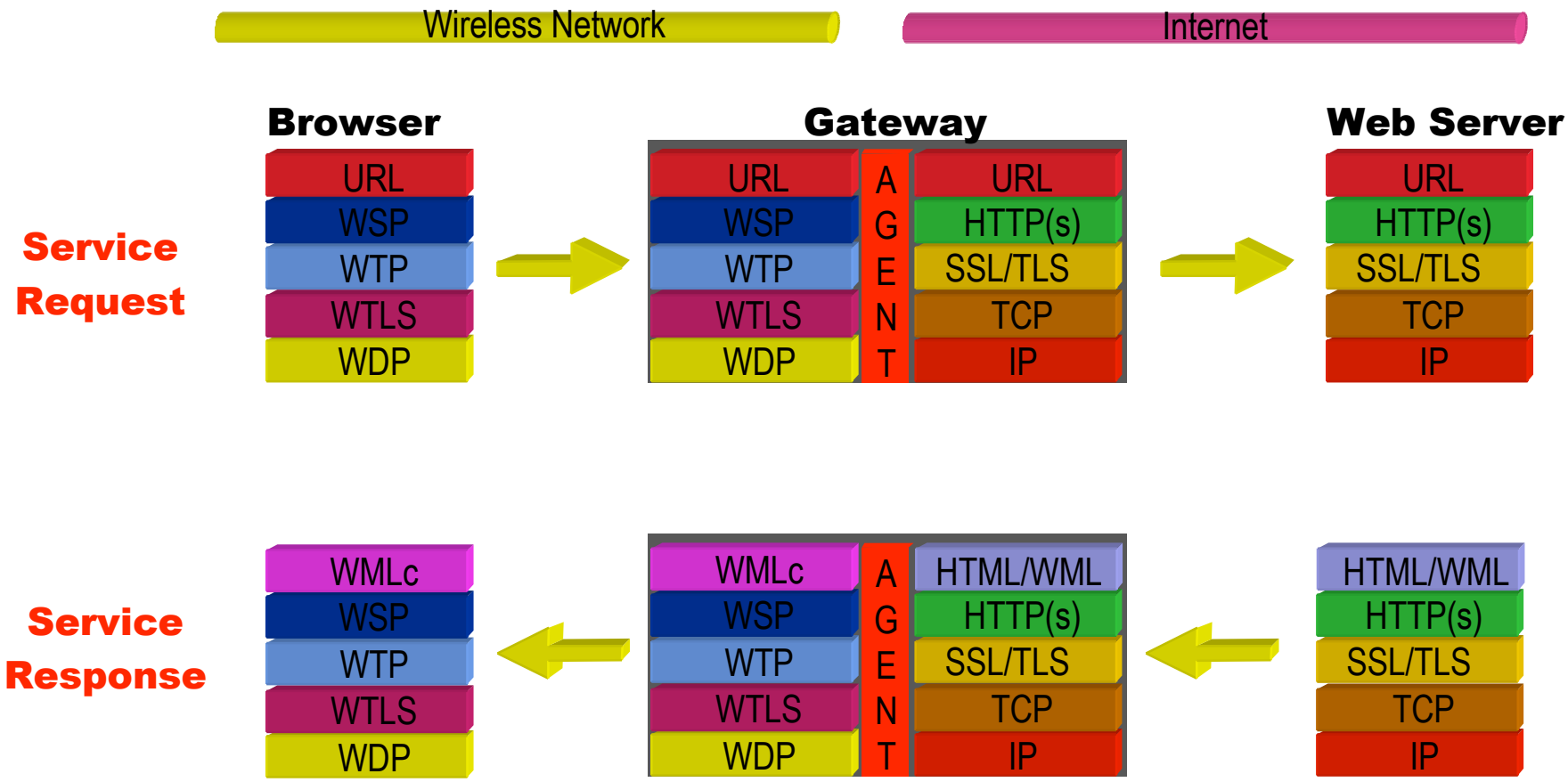
WAP Infrastructure



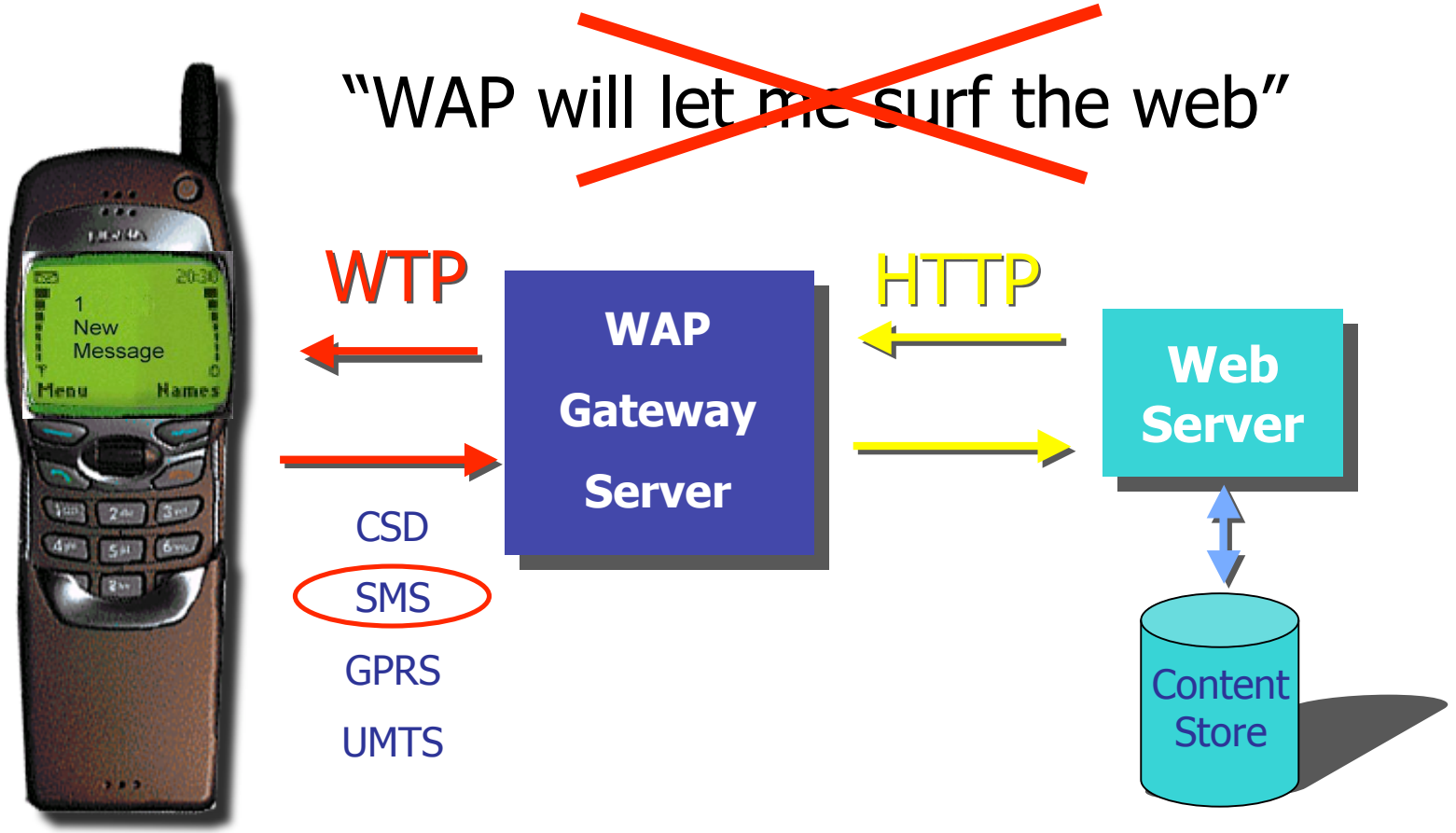
WAP Architecture



Protocol Translation



How does WAP work?



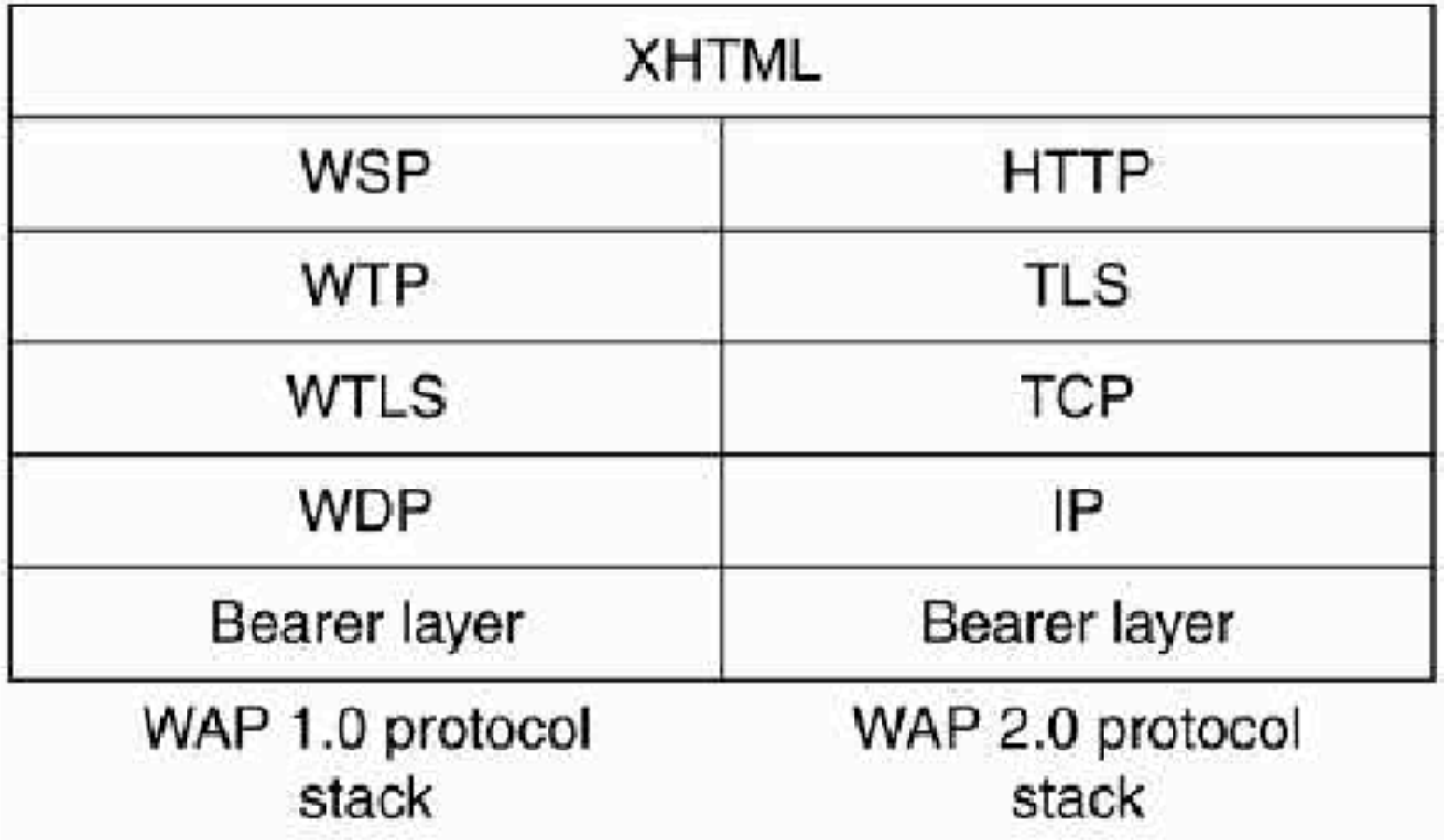
Comparing WAP and I-Mode

Feature	WAP	I-mode
What it is	Protocol stack	Service
Device	Handset, PDA, notebook	Handset
Access	Dial up	Always on
Underlying network	Circuit-switched	Two: circuit + packet
Data rate	9600 bps	9600 bps
Screen	Monochrome	Color
Markup language	WML (XML application)	cHTML
Scripting language	WMLscript	None
Usage charges	Per minute	Per packet
Pay for shopping	Credit card	Phone bill
Pictograms	No	Yes
Standardization	WAP forum open standard	NTT DoCoMo proprietary
Where used	Europe, Japan	Japan
Typical user	Businessman	Young woman

Second Generation Wireless Networks

- WML replaced by **XHTML, which is a new, stricter and cleaner version of HTML**

WAP 2.0 supports two protocol stacks.



i-mode

A presentation language, a protocol, and a carrier all in one

NTT has a near monopoly

Packet Network – 9.6kbs [64-384kbs begin 10/01], always on

Devices are RIGIDLY enforced to i-mode specs

- NTT sets the standards, the handset manufacturers comply
- Guaranteed 16 chars [8 double-byte chars] by 6 lines

Phones have an IP stack, and most offer SSL / TLS support

J2ME ← J2SE ← J2EE

The smallest of the Java continuum

Targeting mobile devices, runtime of equivalent size to WAP 2.0 / imode 3.0 browser stacks

MIDlets installed via a Palm-like synchronization

- Over the air install in October - Nextel

MIDlets offer persistence, offline use

Licensing of J2ME requires passing compatibility test suite (Motorola, Nokia, RIM, etc.)

Watch Nextel, Cingular, and Sprint

Example Services

•Internet e-commerce services using a mobile terminal. They utilise WAP or I-Mode… Examples:

- ❑ Information
- ❑ Banking
- ❑ Retailing
- ❑ Travel
- ❑ Entertaintment
- ❑ Payment

• Mobile e-commerce services without the need of an IP network. They utilise location-based service technology, Bluetooth,...

• Ticketing

• Payment

- ❑ On line electronic money
- ❑ Transferable electronic values

• Location-Based Services

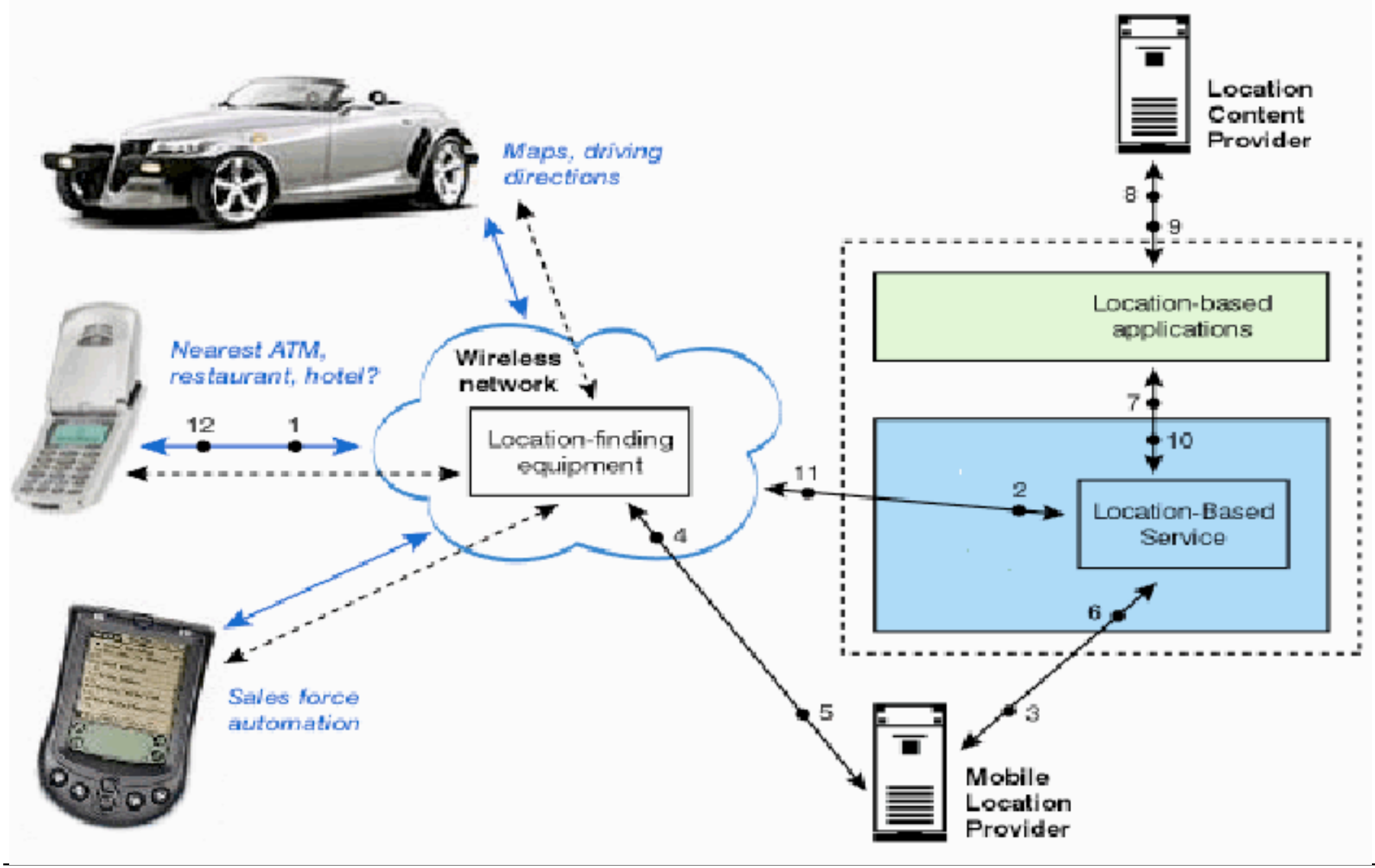
Location-Based Services (LBS)

- Information services, e.g. give me list of nearby petrol stations
- Functional services, e.g. order a taxi
- Location-aware services (push type of services)
- Searching services
- Tracking services

Requirements for LBS Geographical Information Services

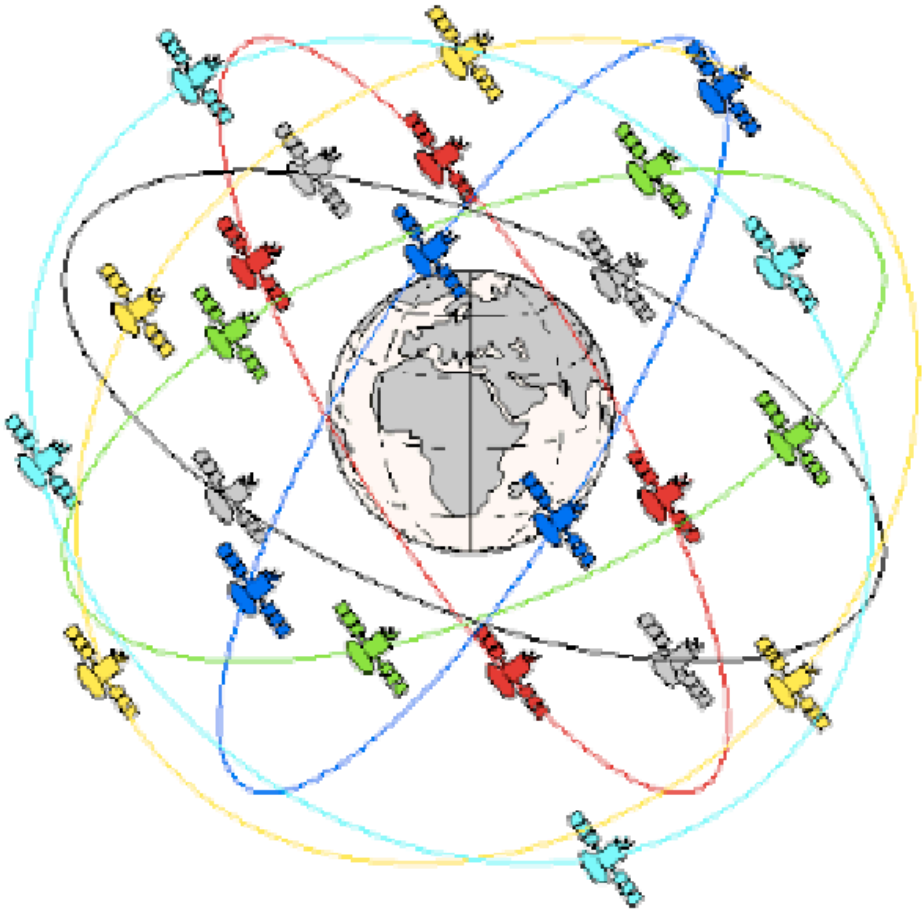
- Security and Privacy Requirements
  - ❑ Authorization, authenticaction, non-repudation, integrity, confidentiality
- Global Infrastructure Requirements
  - ❑ Global coordinate reference system (e.g. WGS-84)
  - ❑ Globally unique ids for the terminals (e.g. phone # or IP#) and users (private key)
  - ❑ Location service that returns the location of the terminal in global coordinate reference system coordinates whenever and where ever the terminal is
  - ❑ Mapping mechanism that finds the appropriate location service directory server whenever global coordinates of the terminal are fed in

The Application Scenario



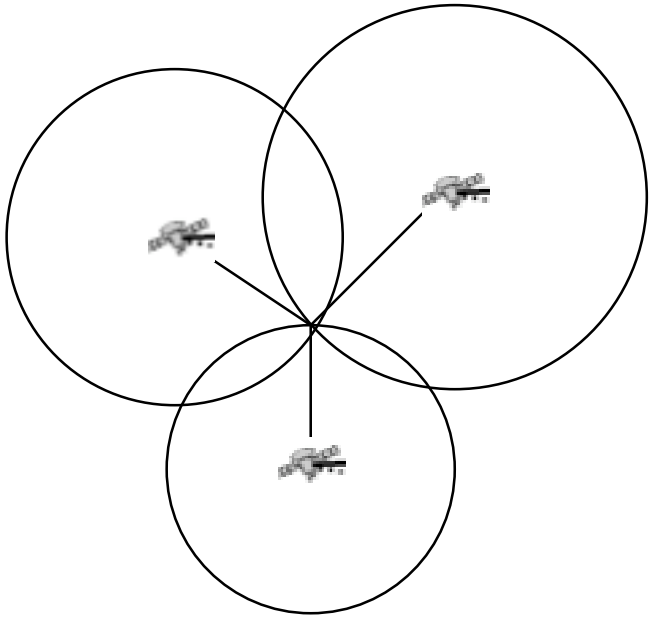
Positioning Outside of Buildings

- GPS: Global Positioning System (satellite-based)



GPS / Galileo

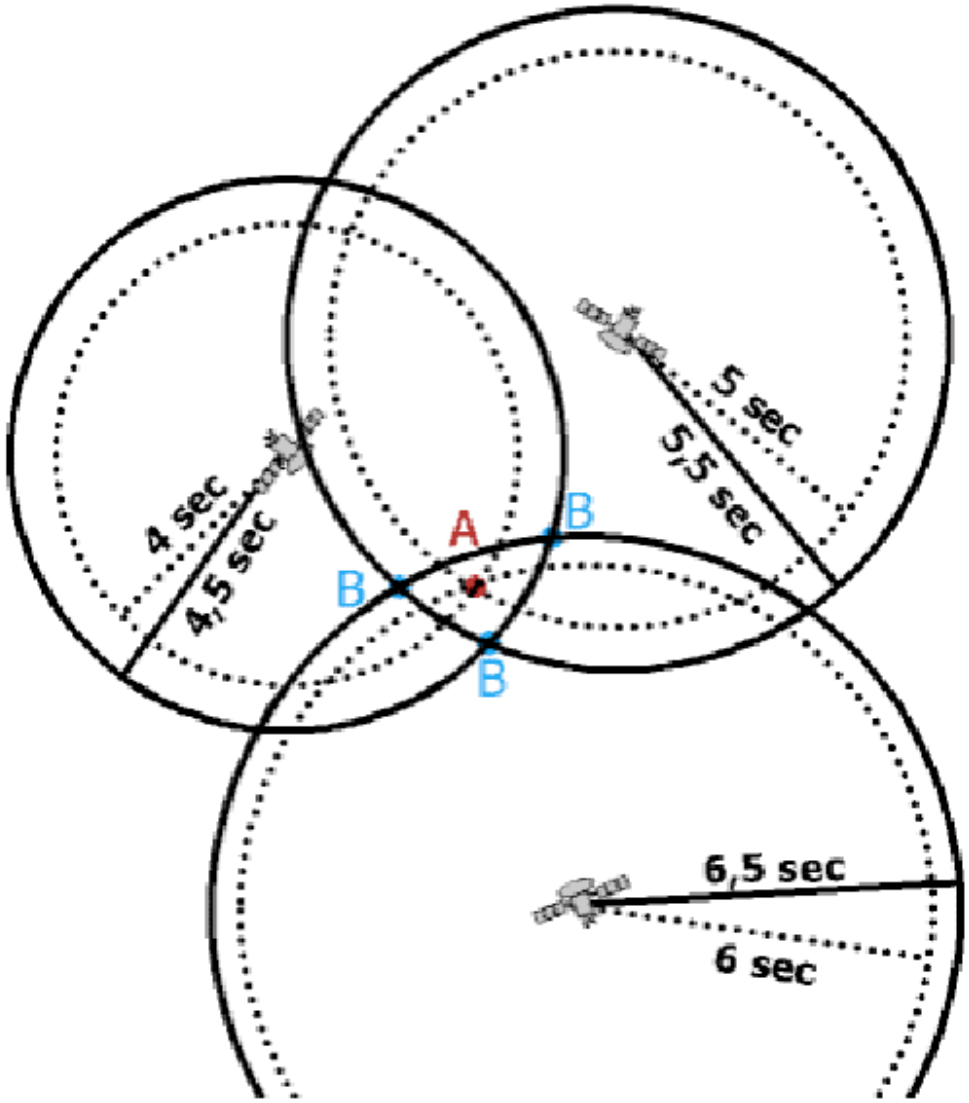
- Idea: Measure signal transmission times
- Satellites' height: 20200km
- Signal sent by satellites contains position data and time point
- Signal spreading times in aerial medium known



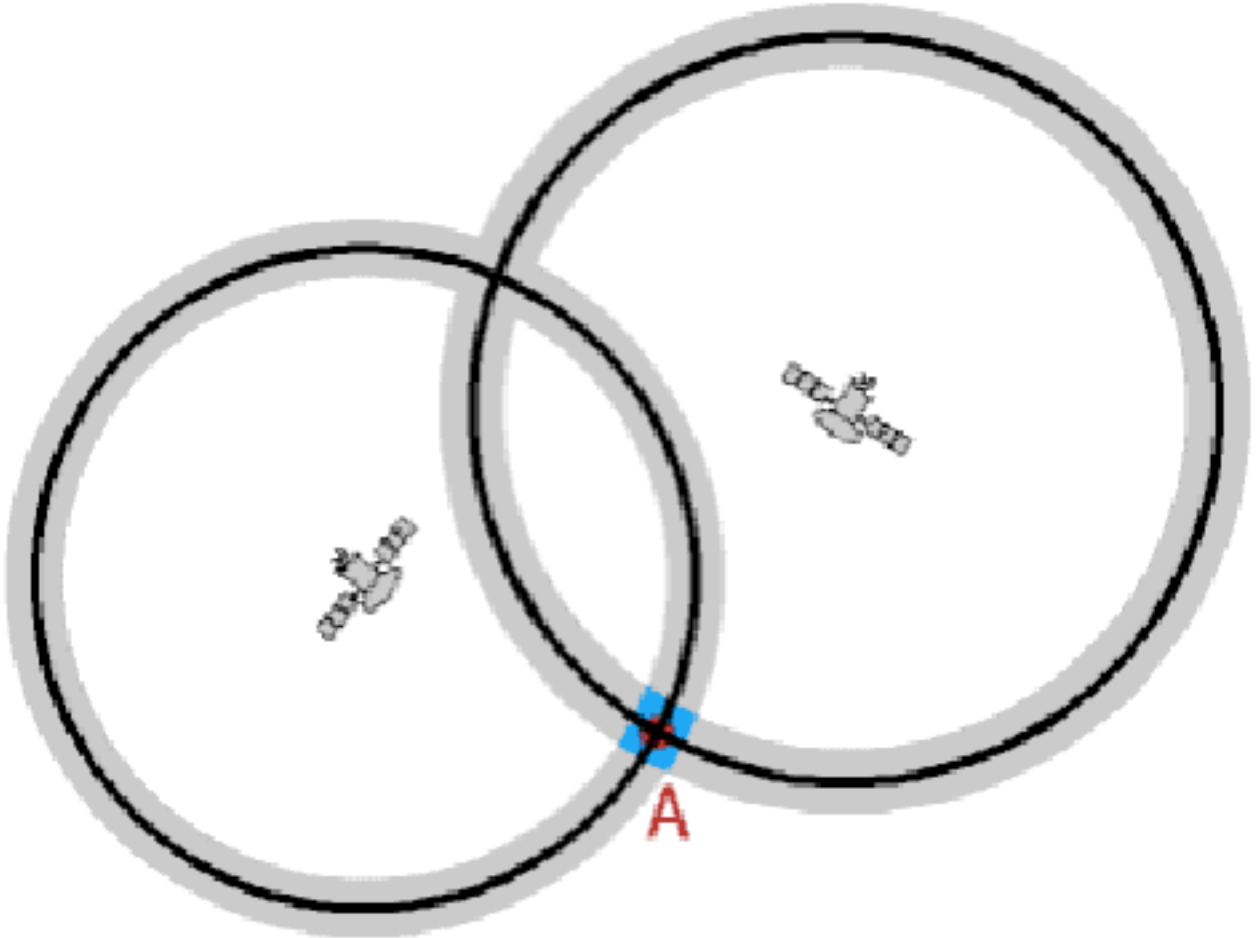
Problems

- Clock deviation
- Rounding errors
- Selective availlability
- Satellite geometry
- Satellite orbit
- Reflection effects
- Structure of the atmosphere

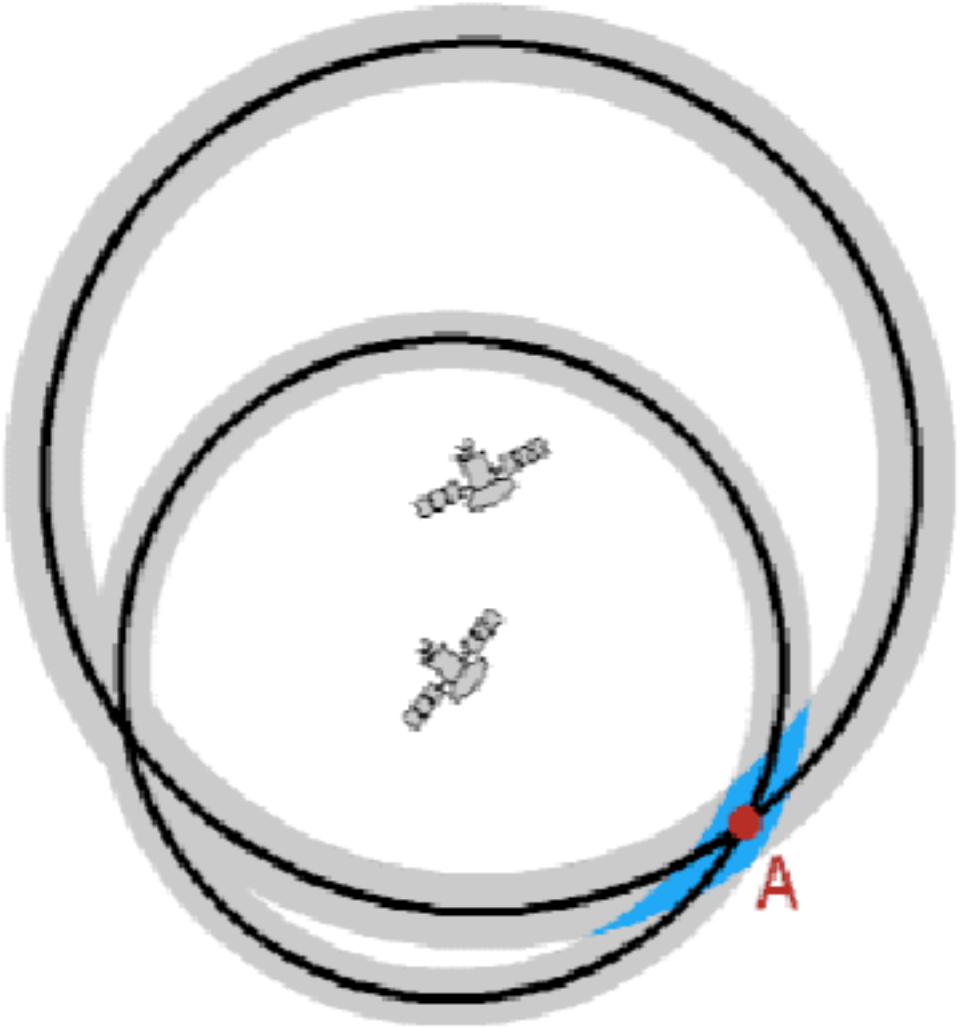
Correction of Clock Deviations



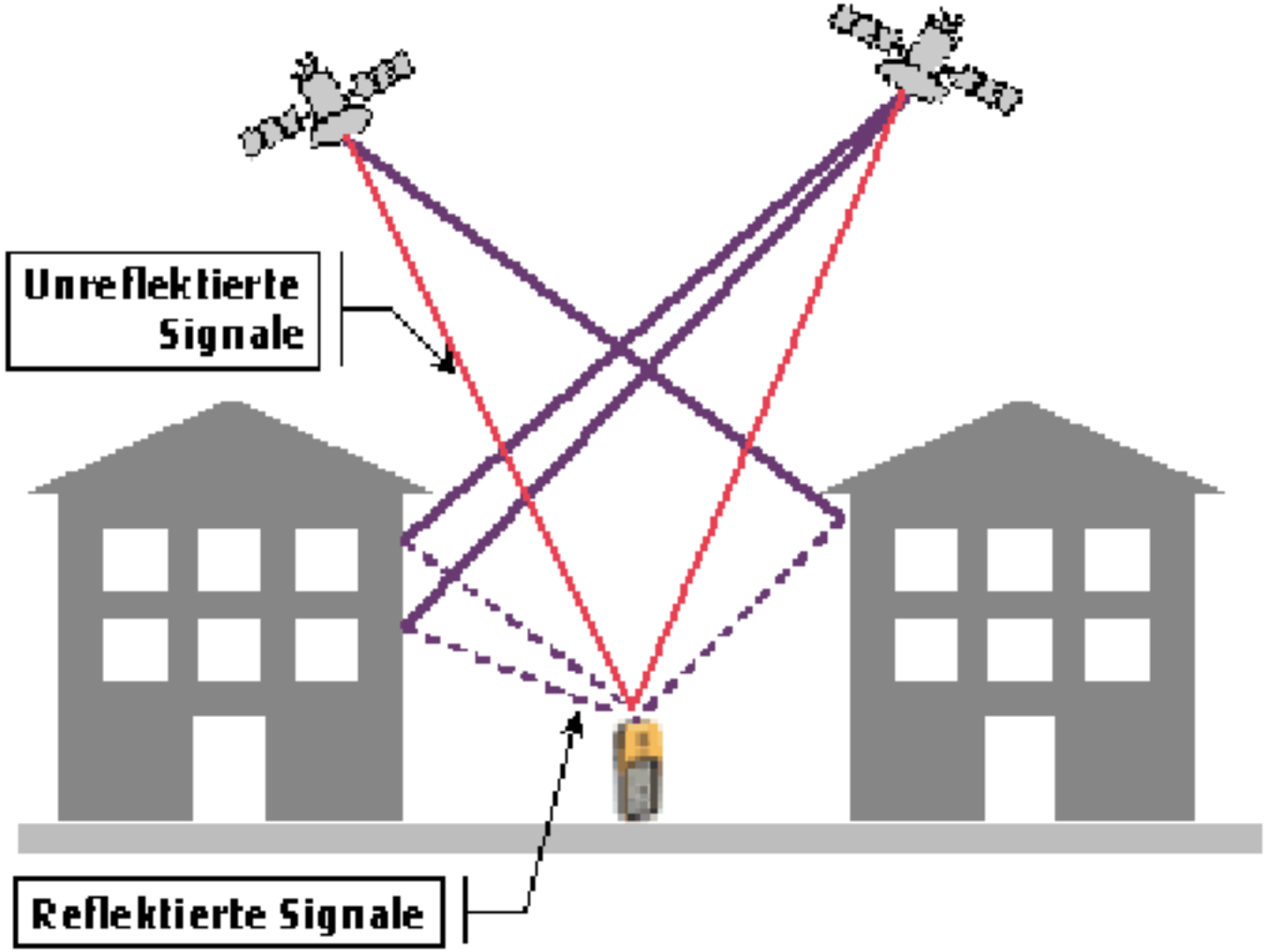
Satellite geometry (good)



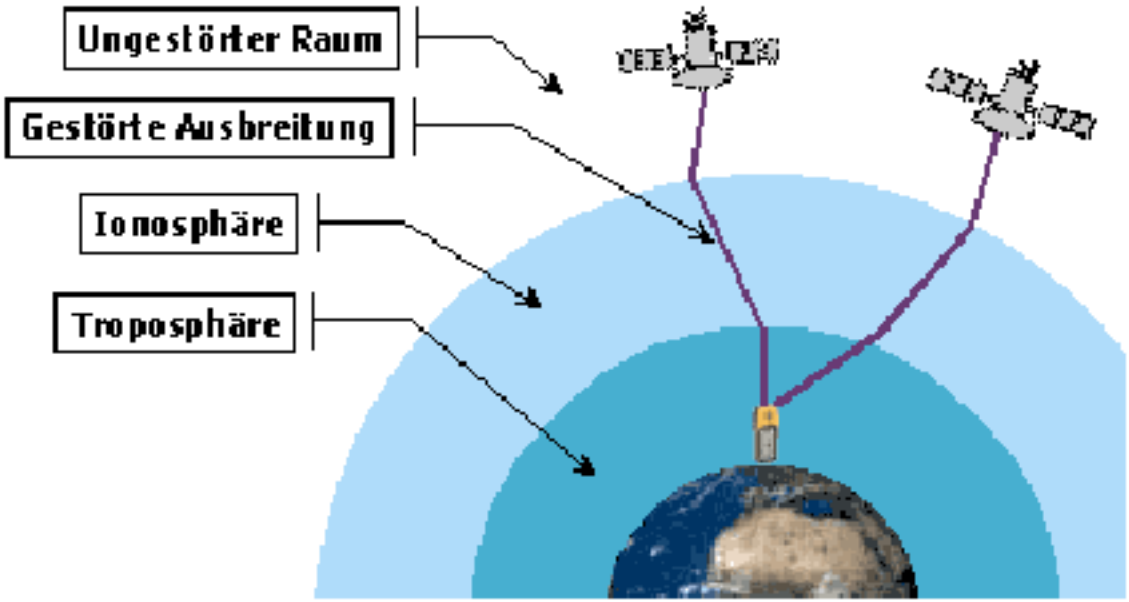
Satellite geometry (bad)



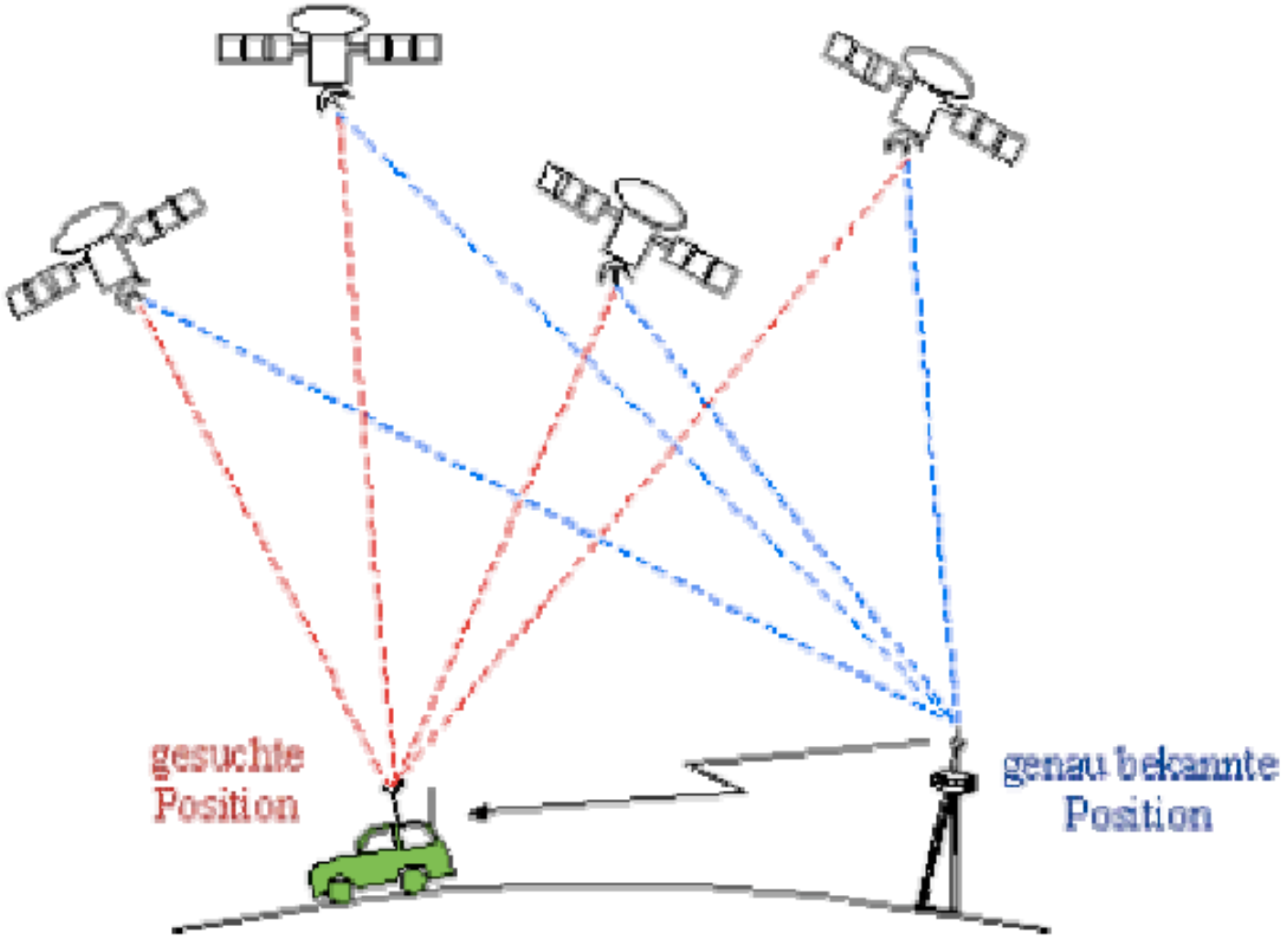
Reflection effects



Structure of the Atmosphere

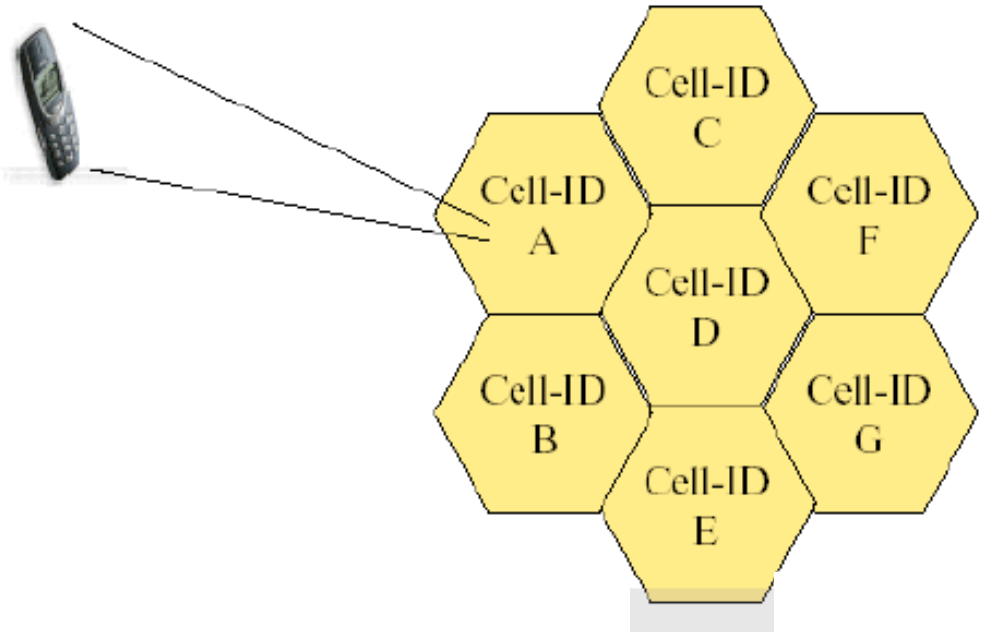


Differential GPS (D-GPS)



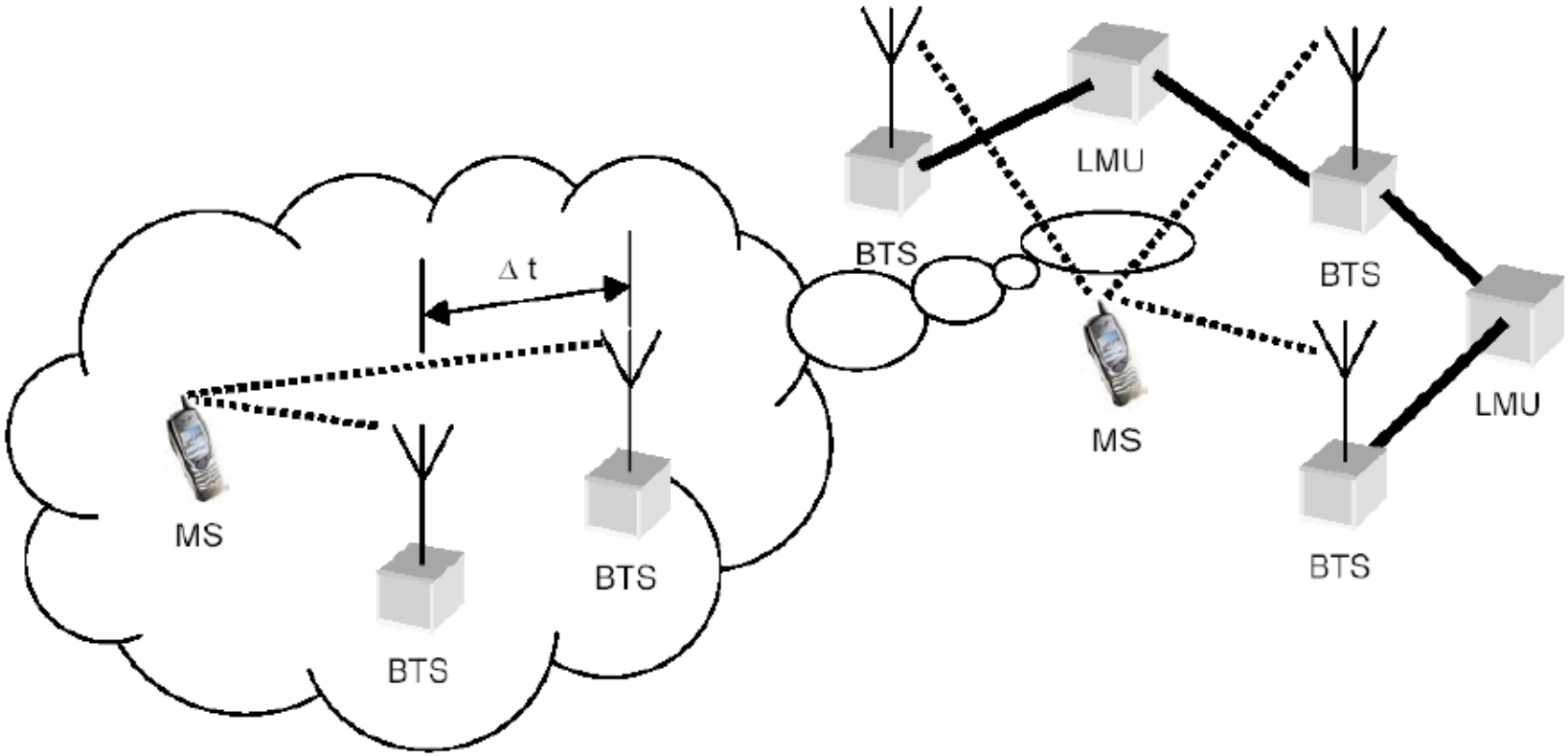
Network-based Positioning

- Cell-of-Origin (COO)
- Cell Global Identity – Timing Advance (CGI-TA) (more exact)



Cell-ID	X,Y
A	54.2N,0.5E
B	54.1N,0.5E
C	54.....
D	
E	
F	

Enhanced Observed Time Difference (E-OTD)



Positioning Inside (and Outside) Buildings

- Easy: Use coodinates of IEEE 802.11 wireless access point (AP)

Geography Matters…

What do we mean by SPATIAL?

Linking **location** to information

Estimates say: 80% of all data contains a “spatial” component

Scenarios

- ❑ Store chain management
  - Where are my potential customers?
  - Where are my competitors?
- ❑ Crime analysis
  - Where are the crimes occurring…and why THERE?
- ❑ Emergency response
  - What parcels are located in potential flood zones?

What is GIS?

Many definitions...

- ❏ “Smart maps”
- ❏ A way to link databases to maps
- ❏ A tool for analyzing data by location

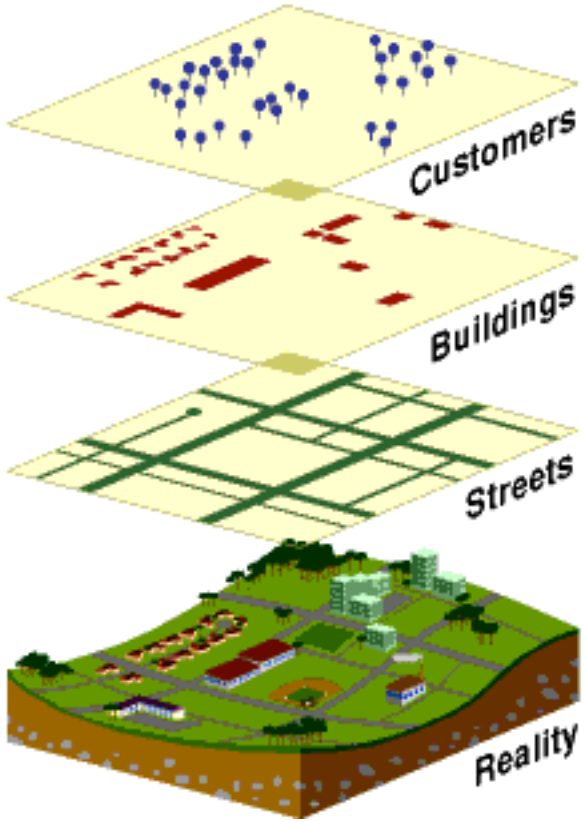
Database:

ID	CITY_NAME	POP 1990
1	San Francisco	4053800

Map: Spatial presentation

The Spatial Data Model

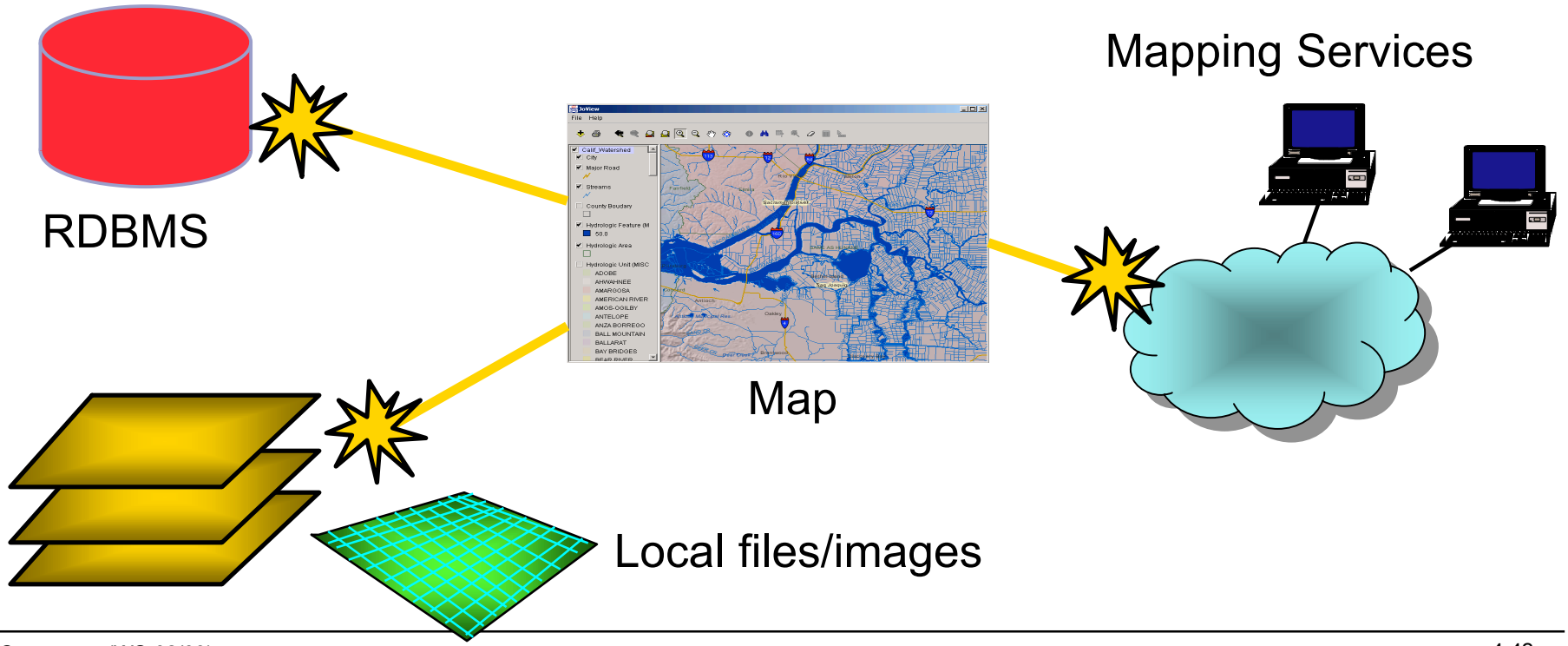
- Layers of data overlay themselves in a “Map”
- Layers of data are “integrated” from differing Layer sources
- Distributed GIS: Layer sources come from (served from) different locations, across different platforms
- Layers contain “features”: georeferenced geometry
- Layers of data, combined into a map, model the real world



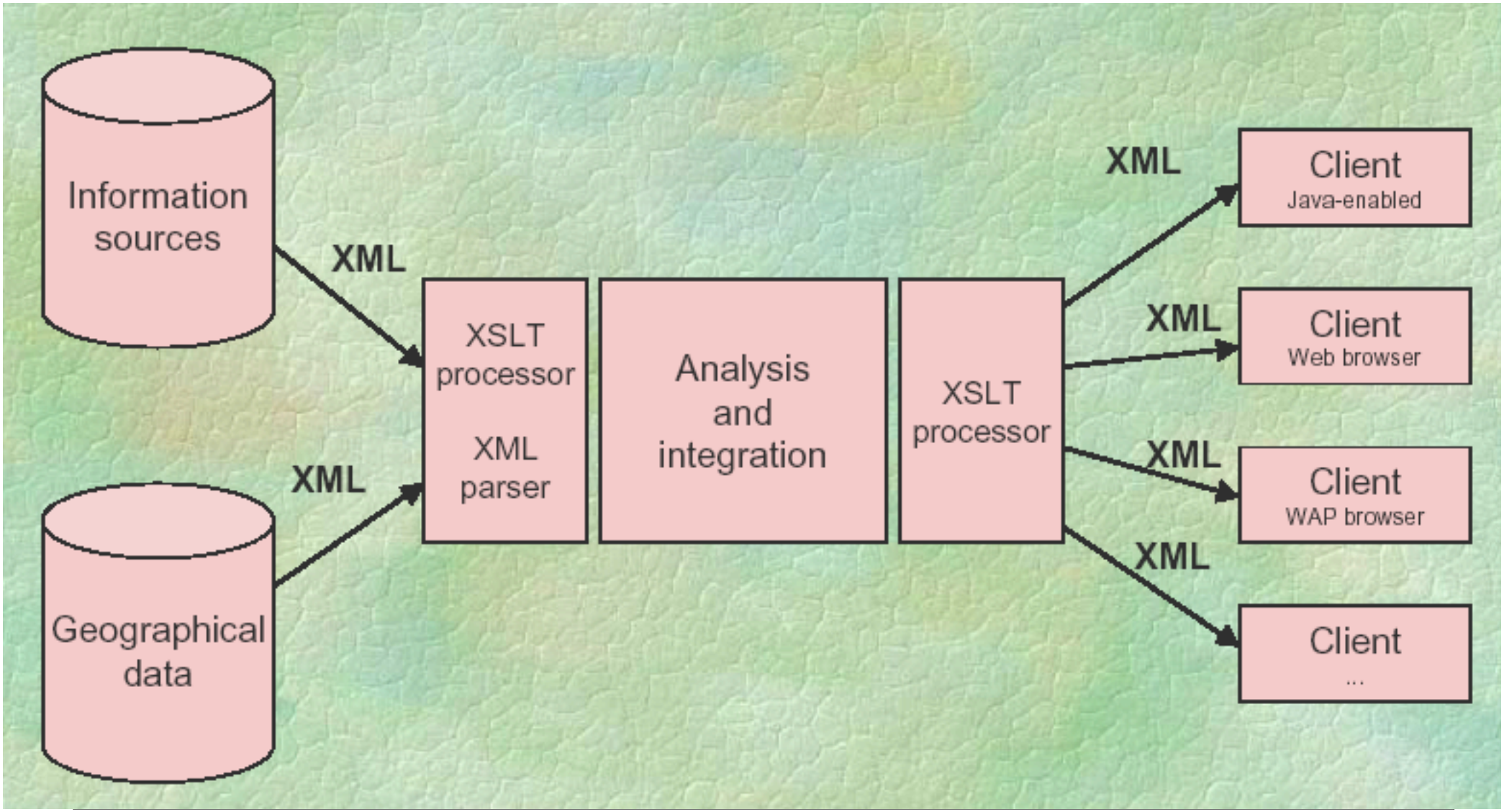
Enterprise GIS…

Promotes data sharing and integration

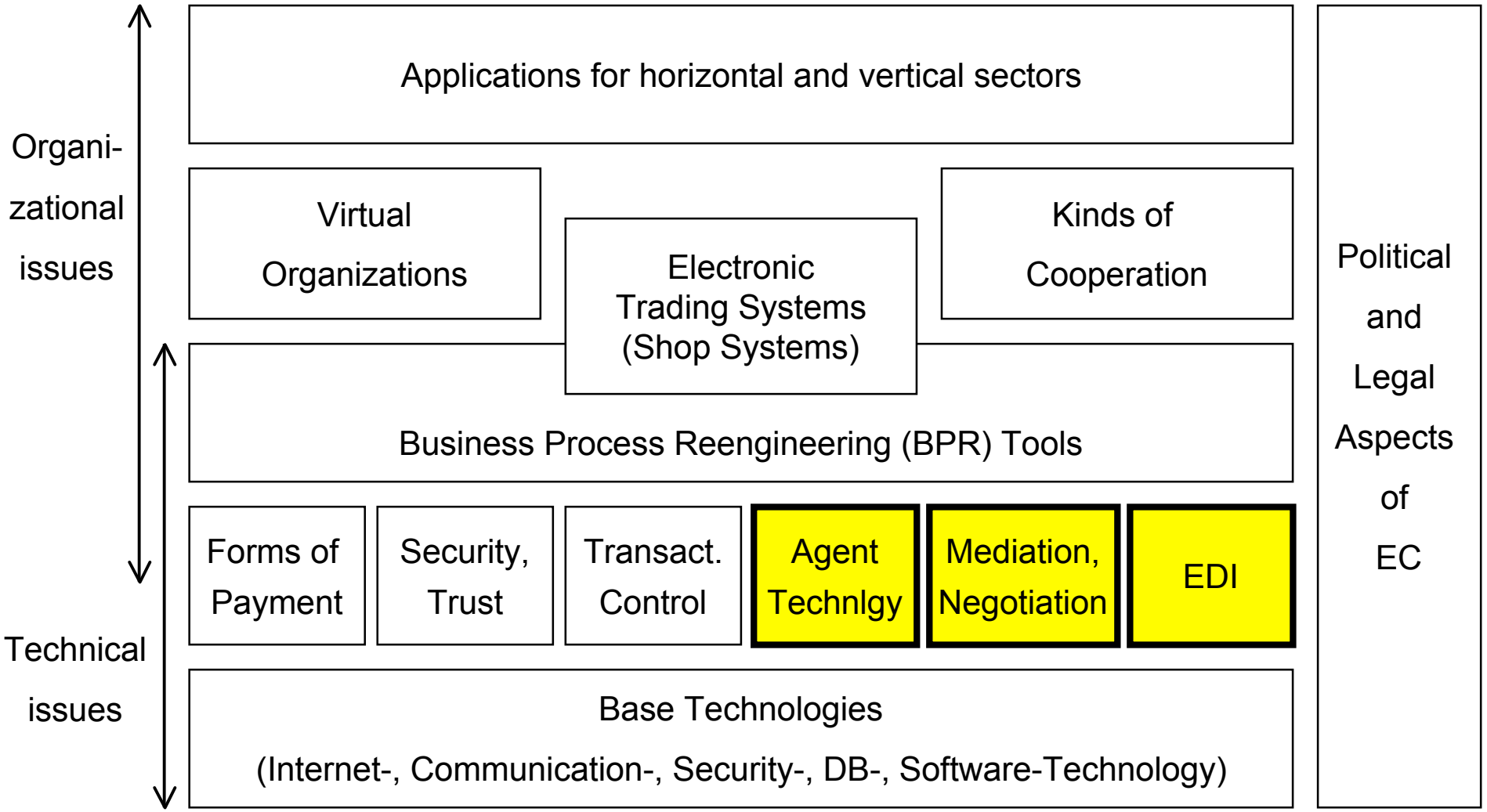
- ❏ Enterprise and local sources come together



Information Flow: The Simple Syntactic View



ECommerce Reference Model



[MeTuLa99]