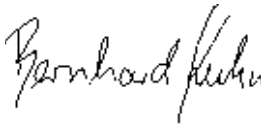
DECUS München e.V.

ToP Business AG

Welcome to „Location-Based Services“

Bonn, April 16, 2002

Presented by:



Vice President Training Wireless & Public Networks

TOP Business AG, Nuremberg / Germany

About TOP...

ToP Business AG

making know-how work

Business Interactive

WBTs: GPRS, UMTS, TCP/IP, GSM, ATM, VoIP

Training Enterprise Nw. & Information Technology	Training Wireless & Public Networks	Consultancy Mobile & Fixed Networks	Training & Consultancy Org. & Mngmt. Development	Training Proj. Mngmt. Indiv. Skills	Training & Consultancy TQM ISO / TL9000

- Since 1994, independent training institute, privately owned
- Training centers: Nuremberg, Hamburg, Neuss, Utrecht (NL)
- Total Staff in 2001: 90
- Total Sales in 2001: EUR 9.5m
- DIN EN ISO 9001 certification since 1993
- EFQM member since 1993
- www.TOPBusinessAG.com, www.business-interactive.com

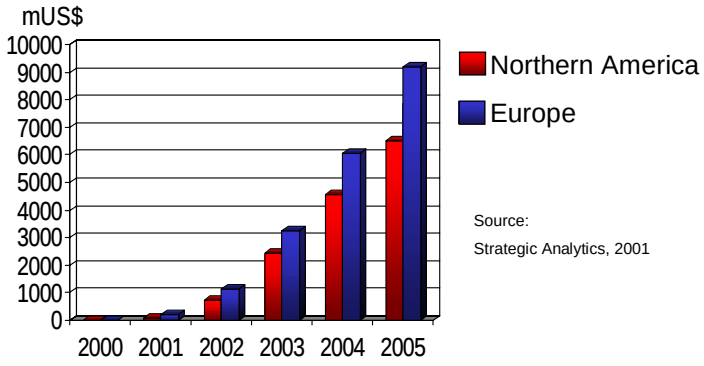
EFQM

Presentation Content

- Market Aspects
- 2G LBS Examples
- Service Aspects
- Measurement Methods
- LBS Architecture
- SoLSA

LBS Drivers

- Differentiator between Network Operators and Service Providers
- Additional revenue generator
- High market potential

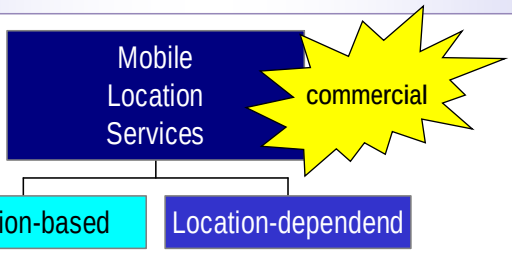


Source:
Strategic Analytics, 2001

LBS Constraints

- Current MS displays not yet suitable for graphs
- Current bearers for pictures
  - CSD at 9.6kbps
  - HSCSD at 43.2kbps
  - GPRS at ~30kbps
- Current bearers for text
  - SMS
  - WAP
- Slow transfer
- Boring (WAP)
- Still too expensive

Service Differentiators (1)



- Visible to user
- User activates service (Pull Type)
  - „Where is...“
  - Navigation
- Use restricted to dedicated area
- User activates service (Pull Type)
- Automatic delivery (Push Type)
  - Promotion

Service Differentiators (2)

Mobile Location Services

governmental

- Automatic positioning of MS for emergency purposes (E911), 125m accuracy
- Requested by FCC (government)
- Mandatory pre-requisite for license award to GSM800 / 1900 network operator
- Obligations not yet met
- Lawful interception

LBS Examples: T-Mobil

- By T-motion (JV between T-Online and T-Mobile)
- Co-operation with SIEMENS
- Local info available for
  - Weather (per country, sailing, biologicak impacts)
  - Hotels
  - Taxi
- Greeting card services
- Low price gas stations („Clever Tanken“)
- www.online.t-mobile.de

LBS Examples:

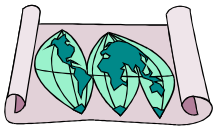
- Shopping Guide („Kompazz“)
- Traffic info PASSO
- D2 Vodafone shop finder
- Nightguide for 1,600 German cities
- Taxi service
- Friendfinder & Child watch in preparation
- www.d2vodafone.de

LBS Examples:

- First network operator to start LBS
- Zone tariffing service „Genion“
- LBS by SMS and WAP
  - Bars, restaurants
  - Hotels
  - Gas stations
  - Cash dispensers
- New PDA-like smartphone Xda with 240 x 320 pxl resolution shall push LBS
- www.viaginterkom.de, www.genion.de

LBS Examples: debitel

- Jamba!
- JV between debitel, EP & Media-Saturn
- Shopfinder
- Hotels
- Restaurants
- Taxis
- Travel planning
- www.jamba-ag.de



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LBS Examples: e-plus

- Local „Yellow Map“
- Shopfinder
- Hotels
- Restaurants
- Taxis
- Travel planning
- CeBIT 2002 showed Europe‘s first i-Mode applications in combination with LBS
- www.eplus.de, www.eplus.imode.de

NEC 21i

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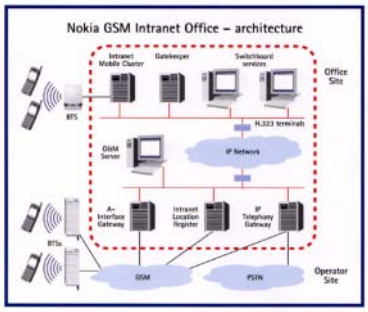
Location-based Tariffing

- May include home-, city- and office-zone applications
- Preferential charging for calls made from the particular "zone“
- Single cell or a cluster of cells
- Especially valuable to migrate traffic from fixed to mobile networks ("Fixed-Mobile Integration“)
- GSM Office Solution



Any kind of call can be made within the Nokia GSM Intranet Office, which involves the combination of a company LAN, IP network, an operator LAN and GSM network

Market aspects
2G LBS examples
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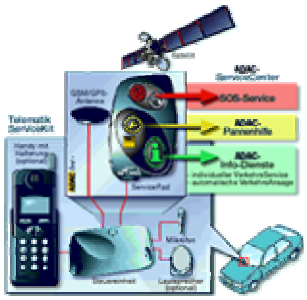
Safety, Security and Information Services

- Enable the involved authorities to locate the person calling for help very exactly
- Automated services
  - immediate breakdown assistance for cars
- Easy combination with present WAP services
  - traffic conditions
  - "where is the nearest...?“ services



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Tracking Services

- Primarily used to manage fleets of vehicles
  - Taxis
  - Trucks
  - To increase operational efficiency of those companies that depend on the rapid scheduling and dispatching of vehicles
  - New assurances services for lost or stolen cars



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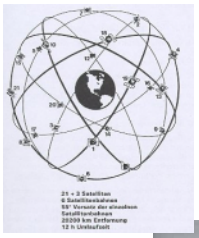
Navigation Services

- Help the car driver to reach the destination quickly and without loosing concentration on the traffic situation
- Requires the highest degree of accuracy in identifying the location

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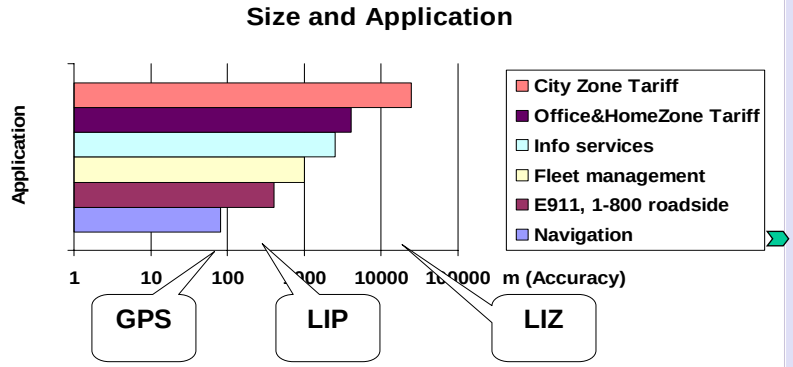
Application vs. Accuracy



GPS: Global Positioning System
LIP: Location Identification by Position
LIZ: Location Identification by Zone

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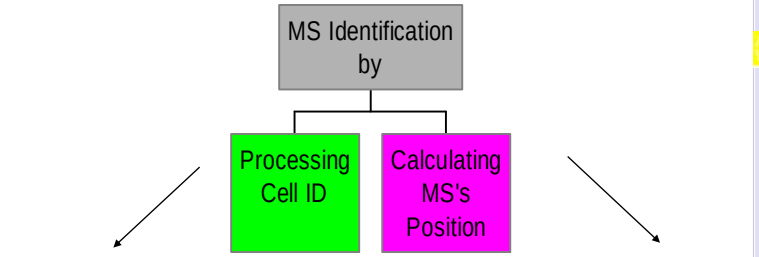
Measuring Methods



- Easiest way
- Processes CGI
- Forwards requested info into cell
- on countryside: cell sizes up to 7okm diameter

- Based on exact known BTS position (3- 4 BTSs needed)
- Measured and processed radio signal timing information
- Accuracy depends on
  - Used method
  - Cell size
  - Radio propagation conditions
  - No. of BTSs involved

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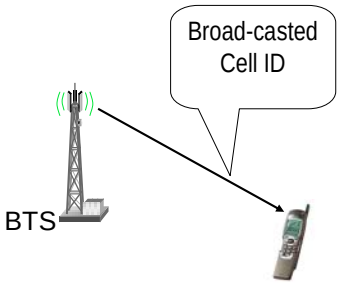
Cell ID Method (1)

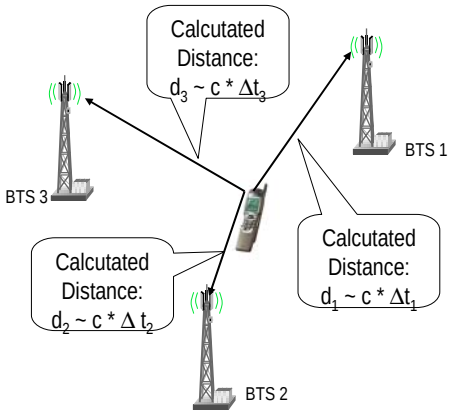


- Together with the Timing Advance value a MS positioning is possible "around" the BTS
- The smaller the cell the more precise the method
- Accuracy between n*100m ...n*1km
- Criteria:
  - Cell size
  - BTS type (omnicell, sectorized)
  - Timing advance value
  - Precision of TA measurement
  - Line-of-sight possibility

Cell ID Method (2)

- Advantage:
  - simple method
  - still works sufficiently with a single BTS
- Disadvantage:
  - Too big cell sizes even in urban coverage
  - Requires additional methods to define the zone with specialized tariffs
    - Gauss-Krueger coordinates
    - Broadcast by the BTSs suitable for ”HomeZone”
    - MS determines its presence in the HomeZone

Time of Arrival (TOA, 1)



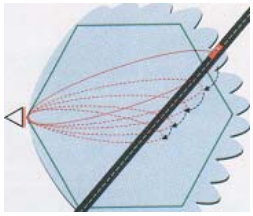
- Uses the propagation delay of Access Bursts received by the BTS
- Location Measurement Unit needed per BTS
- At least 3 BTSs needed with sub-sequent evaluation of access bursts

Time of Arrival (TOA, 2)

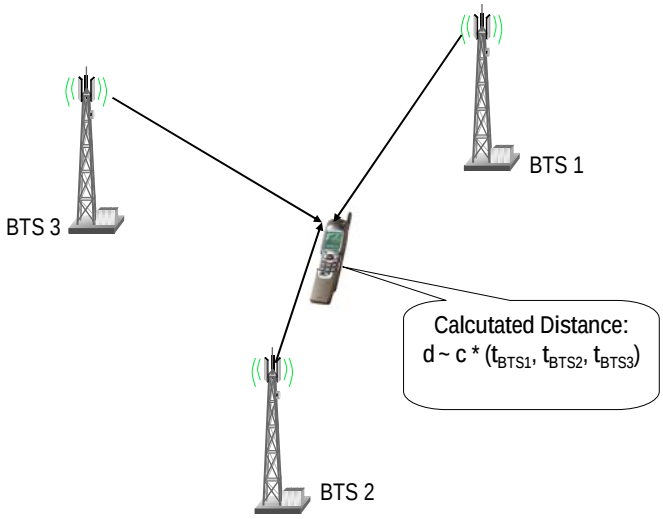
- TOA is a candidate for emergency services in phase 1 LBS
- Strength: technique does not require any support from the MS, enabling the positioning of both old and new mobiles
- Calculation capacity of the network is limited
- Significantly increases BSS's signaling load
- Can not locate any MSs in idle mode
- User has no control over the positioning procedure
- TOA is not considered to be suitable for large-scale commercial services

Angle of Arrival (AOA)

- LMUs equipped with sophisticated antenna arrays
- determine the MS signals upon arrival
- Two BTSs are required for this process
- Accuracy is degraded if clear line of sight between MS and LMUs is missing
- Not very reliable



Enhanced Observed Time Difference (E-OTD, 1)



Enhanced Observed Time Difference (E-OTD, 2)

- E-OTD measures the delay time of signals sent by at least 3 different BTSs
- MS measures the observed time differences and sends them back to the SMLC (Serving Mobile Location Center)
- No mandatory synchronization between all BTSs

  ⇨ Real Time Difference (RTD) has to be encountered by LMU prior to any further measurement procession
- 1 LMU per 5 BTSs as a minimum configuration
- Result is sent to the SMLC, combined with the E-OTD results and the positioning data of the BTSs in order to calculate the MS's position

Enhanced Observed Time Difference (E-OTD, 3)

- Precision can be increased if E-OTD is combined with the CI method
- E-OTD provides high capacity and works seamlessly also with GPRS and EDGE
- Privacy stays under control of the user
- E-OTD is a candidate for phase 2 LBS because it requires the calculation capability in the MS

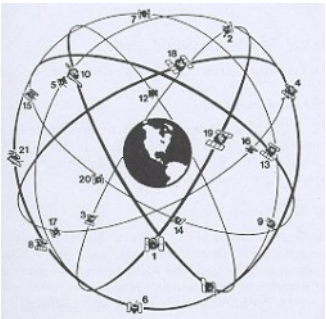
  ⇨ Older MSs can not be used for this method!
- E-OTD is currently regarded as the most suitable positioning system for commercial services and mass market applications
- Proposed for 3G mobile networks

Enhanced Observed Time Difference (E-OTD, 4)

- Criteria with impact on the E-OTD measurement method:
  - Multi-path propagation
  - No. of BTSs available for time difference to be observed
  - Line-of-sight possibilities
  - Co-channel interference
  - MS calculation performance
  - MS speed
- Resulting precision:
  - 70 to 250m in urban locations
  - 30 to 100m in sub-urban and rural areas

Assisted Global Positioning System (A-GPS, 1)

- GPS consists of 21 U.S. Government satellites encircling the earth, plus 3 'spare'
- 6 orbits with 55° offset
- 20,200km above ground
- 12h cruising time
- Transmit a constant data signal
- 'classic' GPS technology
  - personal devices fro yachting and hiking
  - in-vehicle navigation systems

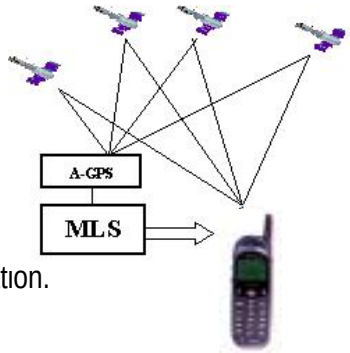


Assisted Global Positioning System (A-GPS, 2)

- Standard GPS receiver needs a 10-step process
  - Find 1st satellite, identify and lock on to
  - Find sat. No. 2, 3 and 4
  - Download information
  - Measure time differences
  - Calculate position
- Lasts 40sec. ... few min.
- Requires free line-of-sight
  - does not work indoors
  - nor in obstructed areas
  - nor with GPS receiver in pocket

Assisted Global Positioning System (A-GPS, 3)

- Assisted GPS improves GPS functionality and performance by integrating the classic GPS information with sophisticated geographic software and mobile / cellular network information.



- Server sends assisting information to the mobile phone about the satellites to look for
- Reduces number of steps to calculate the position from 10 to 3
- Reduces MS power consumption
- Get a position in areas impossible for classic GPS to do so

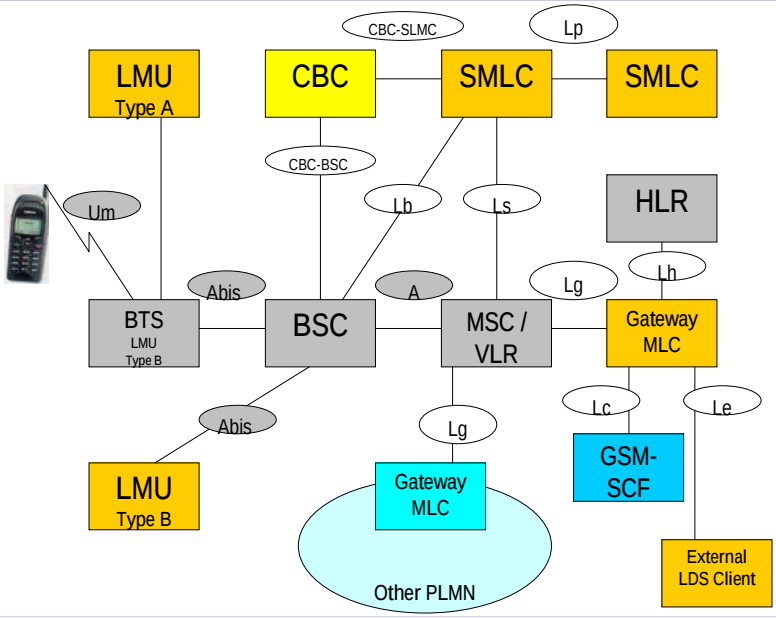
Measurement Accuracy

Technique	*Accuracy*	*User-controlled Privacy*	*Speed of Response*	*LMU Network Cost*	*MS Cost Increase*
CGI	Variable, down to 150m	○	3s	○	○
TOA	>125m*)	○	10s	●●●	○
AOA	>>125m	○	10s	●●●	○
E-OTD	125...50m	✓	5s	●	●●, ● if SW upgrade only
A-GPS	100...5m (with D-GPS)	○	<60s	○ , ● for D-GPS	●●●

○: Zero / No ✓ Yes ●: Low ●●: Medium ●●●: High

*): 125m accuracy is required in the U.S. under the FCC Enhanced 911 Emergency Calling Systems order.

LBS Architecture



Gateway Mobile Location Center (GMLC)

- Interface point for location applications
- Forwards MS positioning data to external applications on host servers
- Authenticates applications and servers
- Ciphers data traffic routed to application servers using SSL technology (Secure Socket Layer)

Serving Mobile Location Center (SMLC)

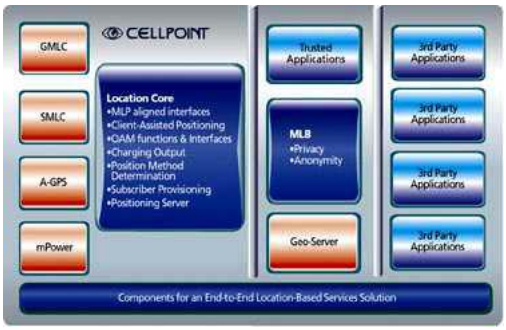
- Responsible for requesting that a mobile be positioned
- May in some cases maintain information on network topology to allow efficient positioning of the MS
- Provides RTD measurements in E-OTD mode
- Calculates MS position
- Interfaces with MSC to check MS location services abilities
- Interfaces with GMLC
- (Mostly) integrated in MSC

Location Measurement Unit (LMU)

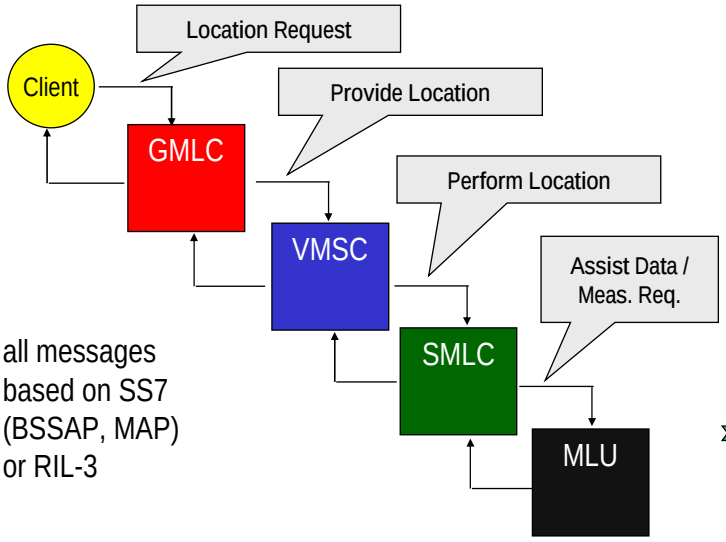
- Provides reference information that is combined with the received measurement data or broadcast to assist in the calculations
- Two types of LMUs:
  - Type A is signaled using the A_{bis} interface
  - Type B is signaled over the U_m interface

Implementation Example CELLPOINT

- One of most experienced location equipment providers
- Supports e·plus (a.o.)
- System architecture:



Basic Positioning Procedure



all messages based on SS7 (BSSAP, MAP) or RIL-3

SoLSA

- ETSI Support of Localized Service Areas (SoLSA)
  - Preference of the LSA cells in both idle and connected mode, even if a better non-LSA cell would be available
  - Different access classes for cells
    - A cell can have preferential access for LSA subscribers or even exclusive access rights for registered announcements
    - LSA subscribers may be the only ones that are allowed in this particular cell
  - A subscriber can have several LSAs with different priorities
- MS shows the used LSA on its display

LSA Creation

- Cell allocation per service zone has to be done
- For coordinate based zone services, it might be sufficient to define one center point and let the system check whether the MS is "close enough" according to the positioning accuracy of the used method
- For larger areas it might be necessary to define it by a set of more parameters.
- Two basic approaches to define service areas
  - Predefined services areas and
  - Dynamic service areas

LBS References

- Network Operators
  - www.online.t-mobile.de
  - www.d2vodafone.de
  - www.viaginterkom.de, www.genion.de
  - www.eplus.de, www.eplus.imode.de
  - www.quam.de
- Mobile Service Providers
  - www.jamba-ag.de
- LBS Developpers
  - www.daimlerchrysler.de
  - www.eyeled.de
  - www.mobileway.de

Location Interoperability Forum (LIF)

- founded in October 2000
- LI's mission:
  - *to define a simple and secure access method that allows user appliances and Internet applications to access location information from the wireless networks irrespective of their underlying air interface technologies and positioning methods*
- Definition of MLP (Mobile Location Protocol) API
  - MLP API based on existing and well-known Internet technologies (HTTP, SSL and XML)
  - Easy to use for developers of location application and services
- www.locationforum.org

Wireless Location Industry Association

- WLIA's mission:
  - *To create awareness and a positive image among the consuming public of wireless location as an industry that creates significant added value, and one that fully respects the interests and rights of its customers (in particular their privacy rights), including development and implementation of standards establishing responsible industry practices.*
  - *To be the voice for the location industry as a whole*
- www.wliaonline.com

Finally...

- More info...
  - bernhard.kuhn@TOPBusinessAG.com
  - www.TOPBusinessAG.com
  - www.business-interactive.com

Thanks a lot for Your attention...

...and further enjoy the conference!!