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An LBS for public transport

a novel event-driven design and feasibility study of GSM-based positioning

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Overview

What?

Position?

How to use?

Future?

- Location Based Services
- GSM-based positioning
  - *Overview*
  - *Implementation*
- Public Transport application
  - *Principles/design*
  - *Feasibility study*
- Conclusions

Location Based Services

- Definition
  - **Information services**, accessible … through the **mobile network** … utilising the **location of the mobile device**[1]
  - **Adaptive** to situation context
    - E.g. to location, usage mode, …
- Example: *RestaurantFinder, BuddyFinder, …*

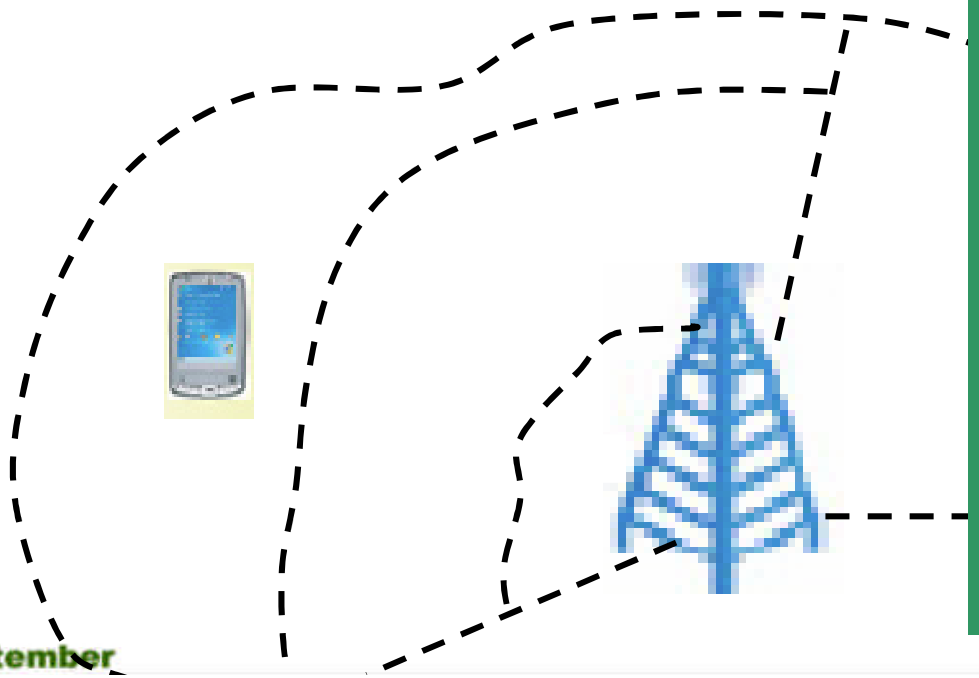
- Two scenarios
  - *Revolution: killer application*
  - ***Evolution**: many small comfort increases*

[1] K. Virrantaus et Al., "*Developing GIS-Supported Location-Based Services*" in Proc. of WGIS'2001, Kyoto, Japan, pp 423-432

GPS / NA GPS

- Precision
- Delay
- Problems
  - >
  - >

Cell-ID/Enhanced Cell-ID



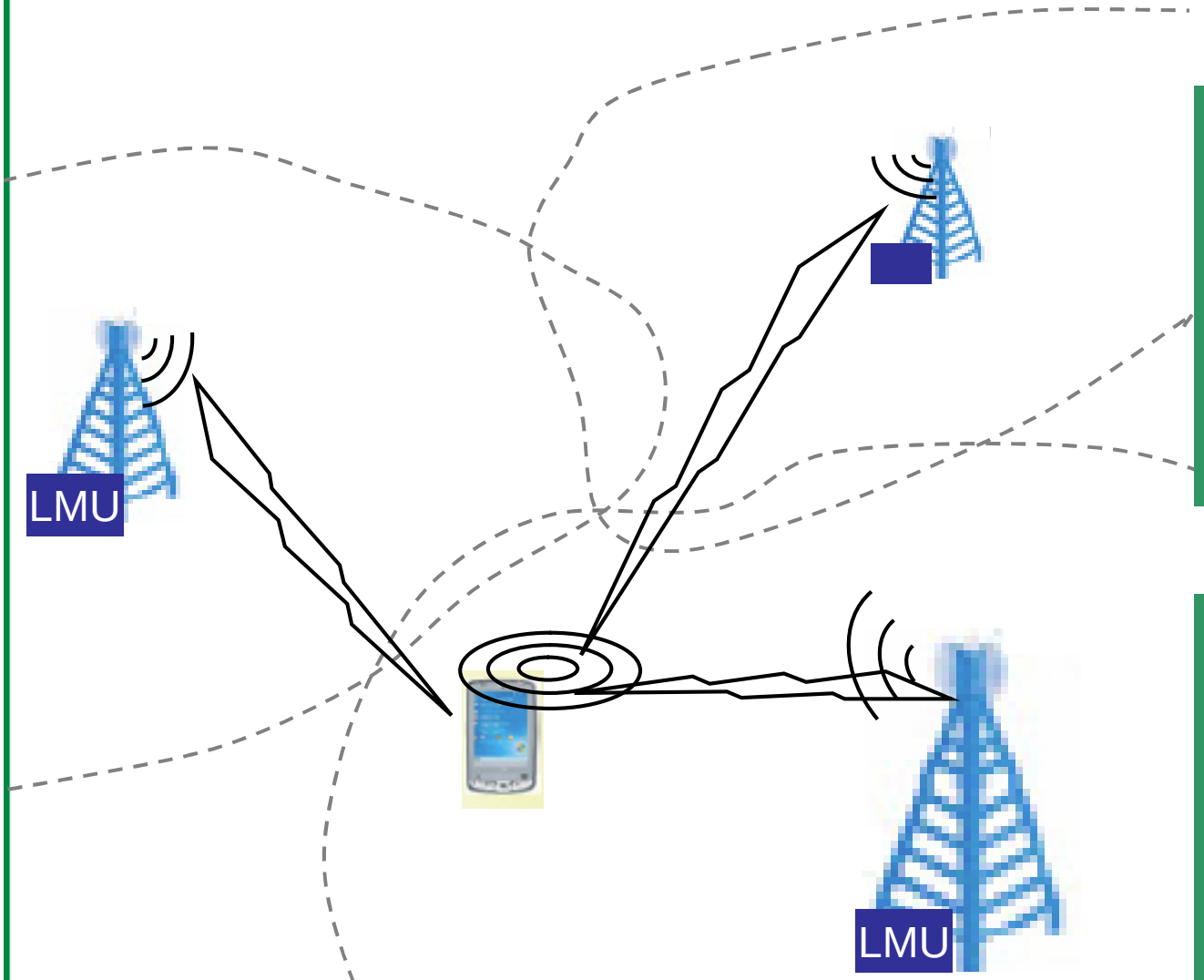
Precision
500m - 3km

Delay
1s

Problems
Resolution

Signaling

Other solutions



EOTD / TDOA

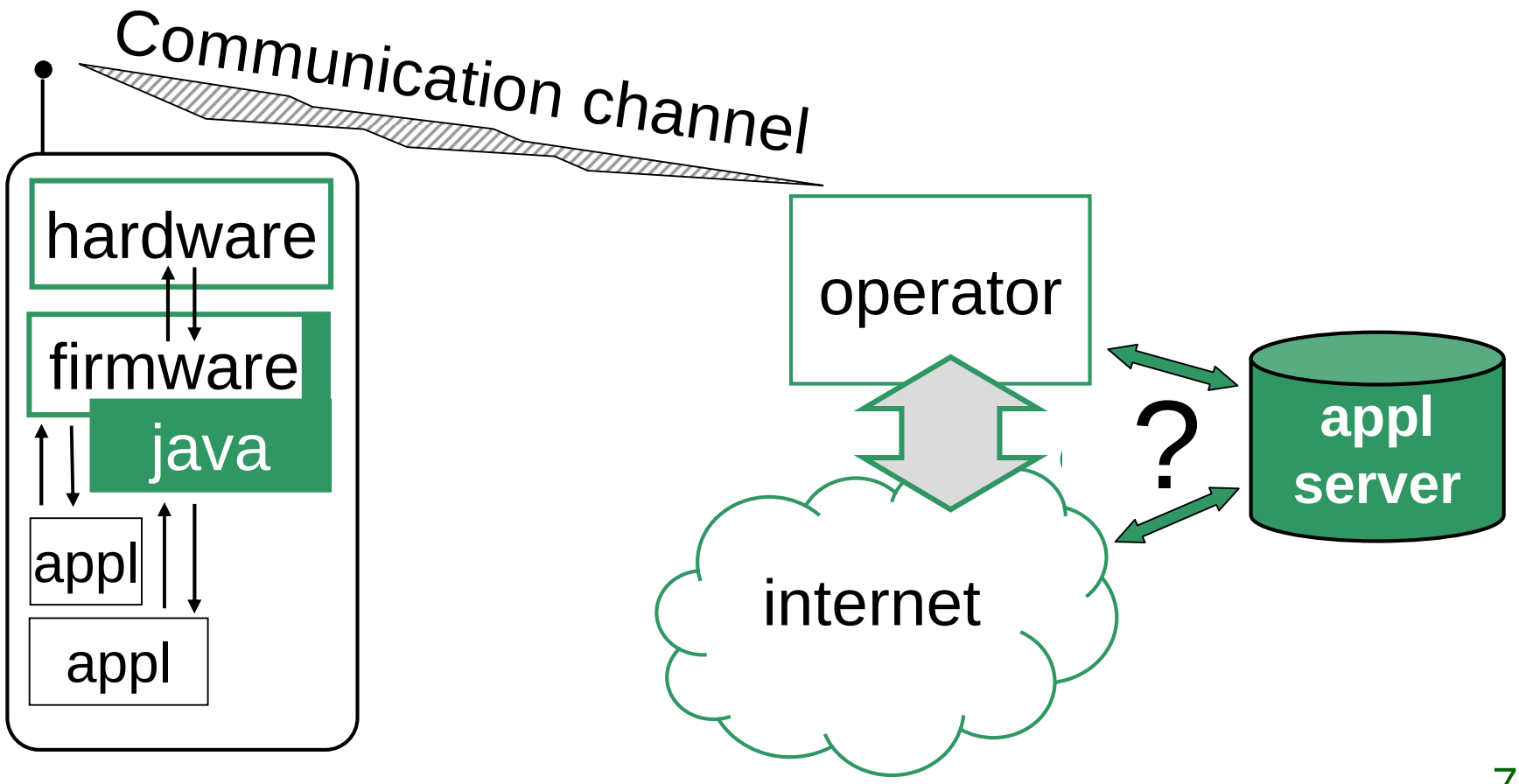
Resolution
50m - 100m
Delay
± 5s
Problem
Expensive

Signal strength

Resolution
100m - 150m
Delay
± 3s
Problem
Tracking

Implementing it

- Network side vs. **terminal side**



GSM-based positioning

- Devices are ready
  - *New generation: small computers*
- Technology almost ready
  - *GSM-based: resolution problem*
  - *GPS: coverage problem*
- Market starts slowly
  - *Find out where is the profit*

Public transport application
resolution case study
example

Mobility services

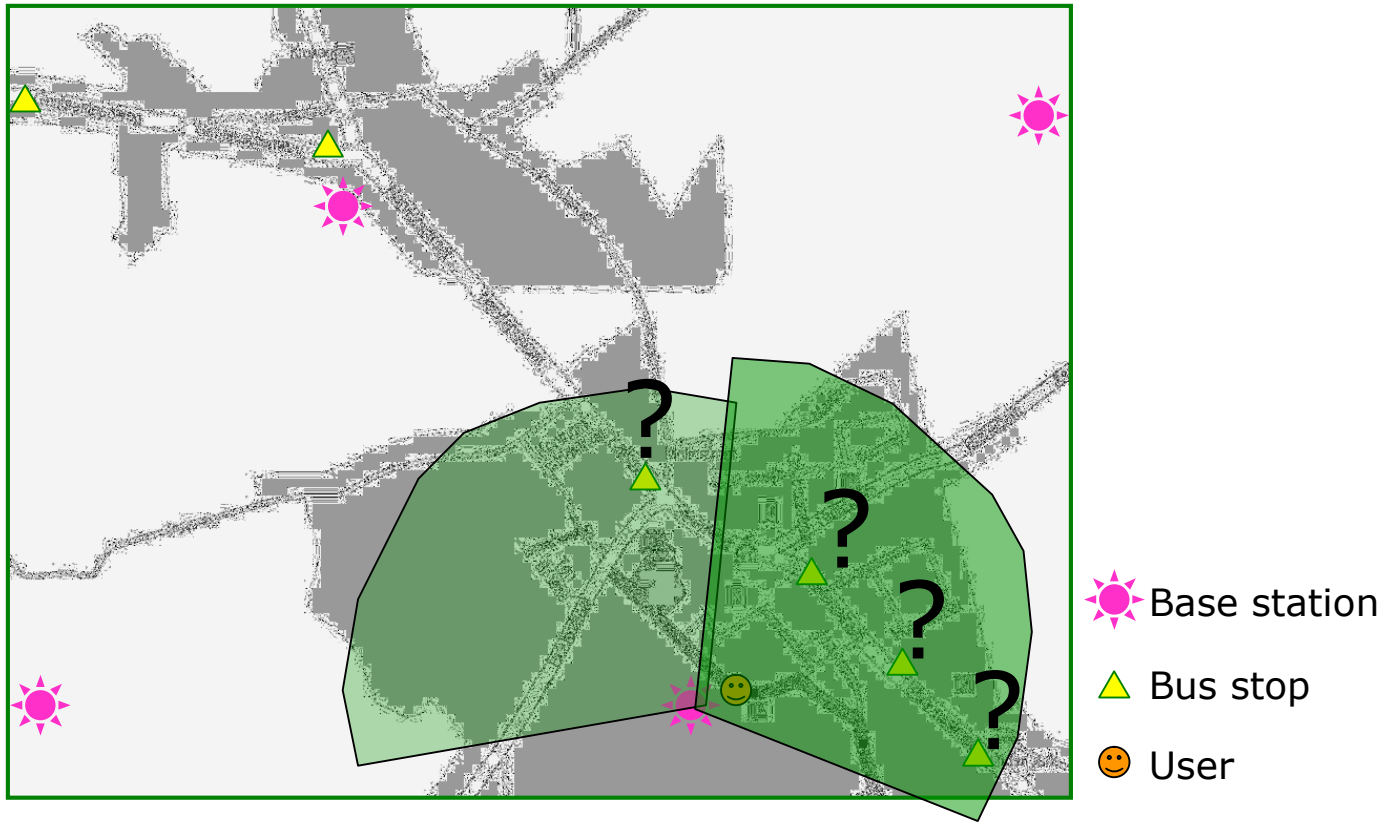
- Informing
  - ***Provide*** *position and/or time related* ***info*** *to user*
  - *User may be distant (tracking) or on the move*
- Routing
  - ***Generate optimal route*** *between two points*
  - *Optimal: duration, distance, price, …*
- Navigation
  - ***Instructions*** *for following selected route*

Mobility LBS: {info+routing+navigation}@mobile

Public transport mobility LBS (1/3)

Static operation: nearest starting point discovery

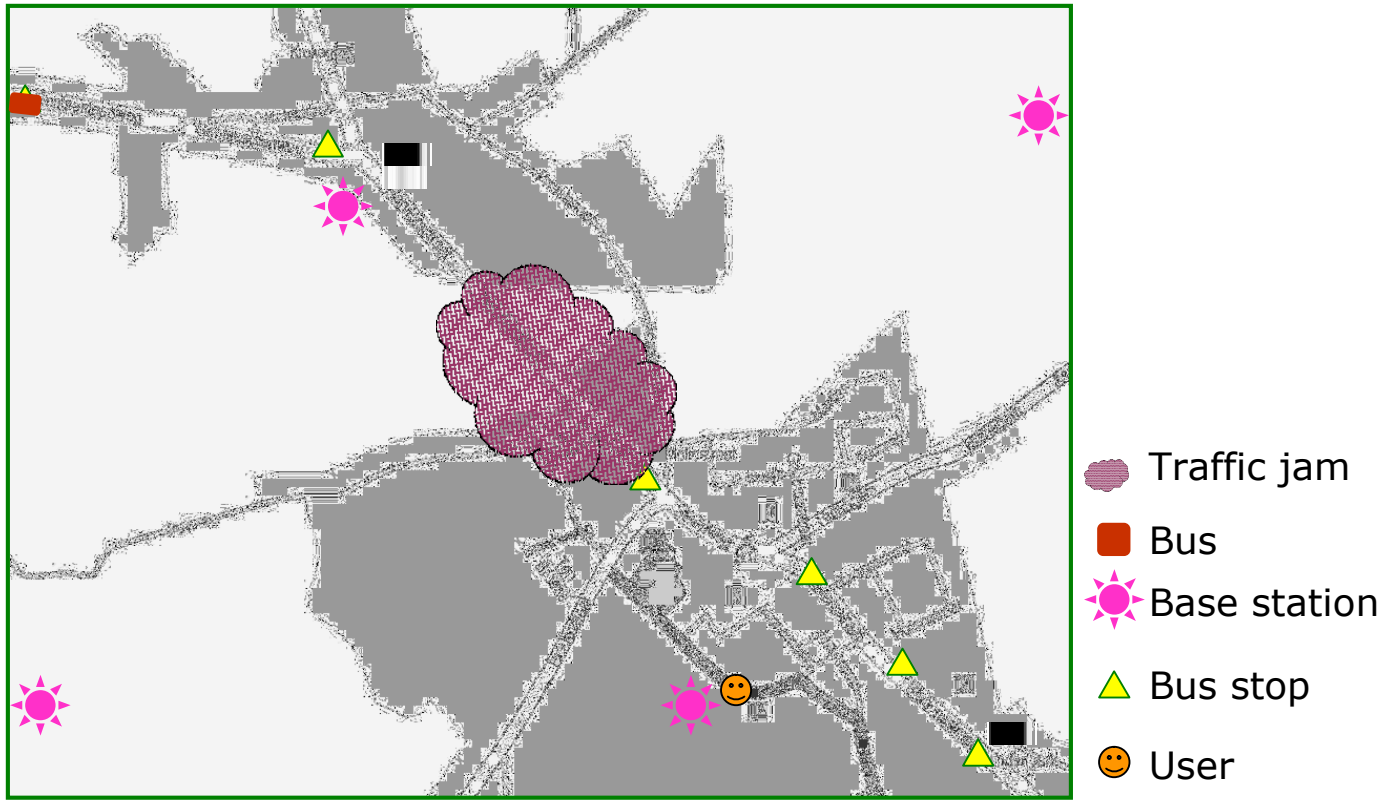
- *Reduce displacement problem to 'destination only'*



Public transport mobility LBS (2/3)

Dynamic operation: real-time routing

- *Have optimal displacement (e.g. avoid/plan in traffic jams)*



Public transport mobility LBS (3/3)

Real-time navigation

- *Alerts when needed or wanted (push/pull approach)*

2 design concepts

Split computing

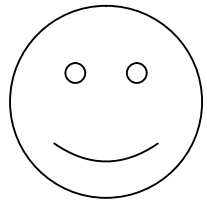
- **Device**: make use of
  - *increased computing power*
  - *intermediate location measurements (increase reliability)*
- **Server** : refer to already existing situation

Event-driven

- **Limit communication** to minimum
- **Synchronise agents**
- Across segment borders

Implications on privacy

- Customise seamlessly
  - *Depends as well on device*
  - *E.g. two extreme scenario's*



	Power conservation	Privacy maximization
Mobile	"intelligent display"	computer
Calculations	on server	on device
Position	centrally tracked	only known at device
Power use	minimal	high
Communication	moderate	moderate to high

  - *And broad range in between*

Feasibility study

Two resolution questions

- 1. static user
  - *Is user referred to nearest bus stop?*
- 2. dynamic user
  - *Can the upcoming bus stop be determined?*

Testing environment

- case study 1: urban *(Brussels Capital Region)*
- case study 2: mixed *(connection suburbs-Brussels)*

Results: static

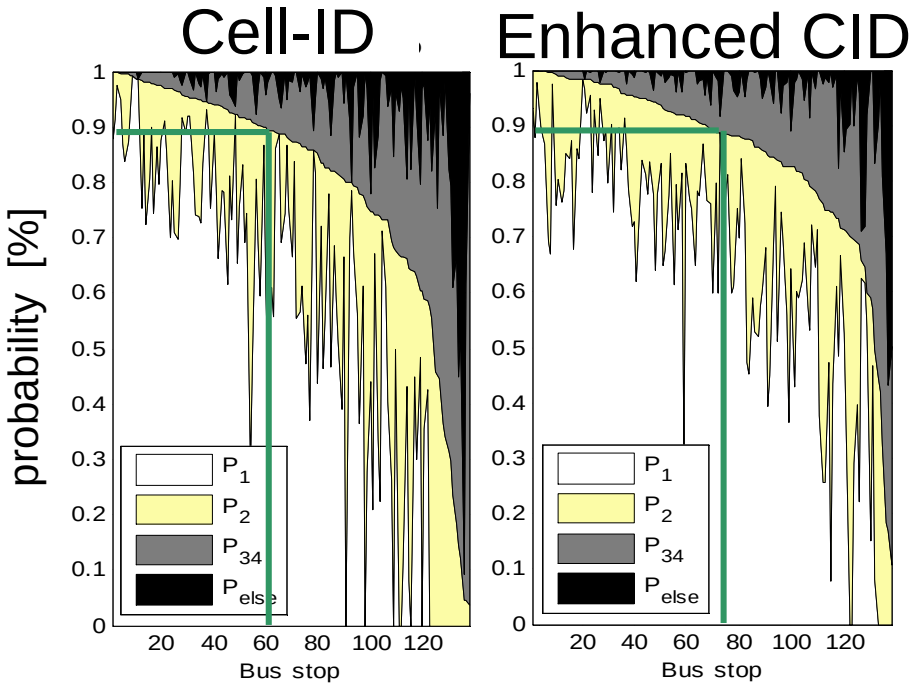
Urban environment

Nearest or 2nd nearest

- CID: 40%
- ECI: 50%

Acceptable

- CID: 80%
- ECI: >95%



P_1: nearest stop is selected
P_2: ok stop is selected
P_{34}: acceptable stop is selected

Results: dynamic

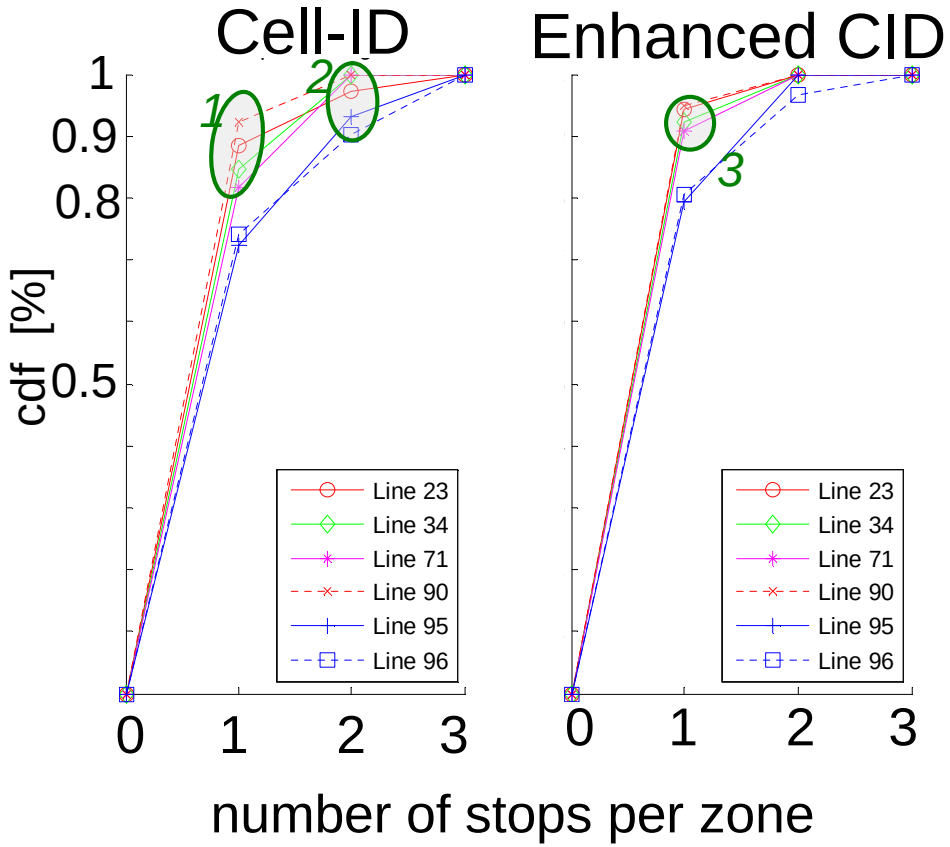
Urban environment

Sufficient

- CID: 85%
- ECI: >90%

Acceptable

- CID: 90%
- ECI: >95%



Conclusion

Location Based Services

- **1G:** network based, position + application
- **2G:** terminal based, design methodology

Then: **current technology is often sufficient**

Main research issues

- privacy
- handover *(pos. techn.)*

Big questions

- user
- business model

The end

Thank you for your attention

If you have questions, feel free

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