Business from technology

Real-time context recognition on different mobile platforms: lessons learned

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Outline

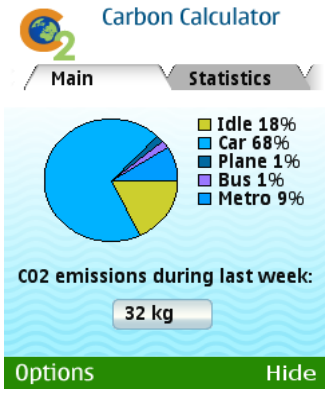
- Context recognition at VTT
- Context recognition on mobile phones
- Major requirements for context recognition
- How different platforms meet the requirements

Context recognition at VTT

- Over 10 years of experience on context awareness: hardware development, algorithm development, data collection
- 1 spin-off, solutions utilized in several commercial products
- Team:
  - Jani Mäntyjärvi, Principal Scientist
  - Ville Könönen, Senior Scientist, Team Leader
  - 5 M.Sc. level researchers
  - 1 trainee
  - 1 Graphics designer

What have we done?

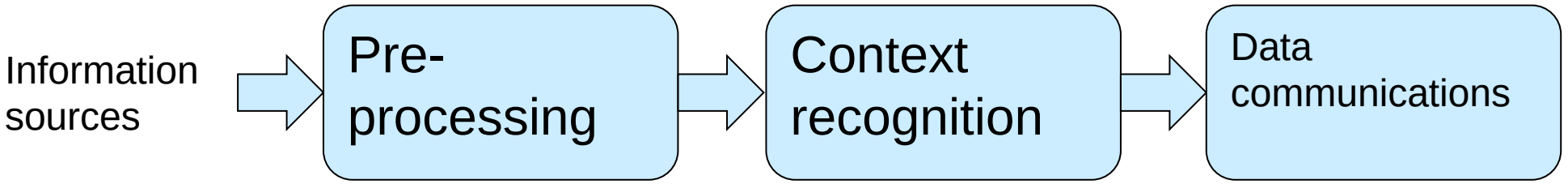
- Over 100 publications on context-awareness
- Three patents
- Ongoing research projects: SmarcoS, SmartProducts, Enlight
- Commercial work for Nokia and Siemens
- Example commercial results:
  - Nokia Carbon Calculator
  - Nokia Battery Monitor, several millions downloads from OVI-store



Context recognition in mobile phones (1/2)

- Need for context recognition in several business fields:
  - Retail, security, marketing, gaming,...
- A lot of potential, in many fields, only a weak clue of the potential applications
- Non-technical problems: novel kind of information; end-users are not familiar with the context-awarenes; legal matters
- Enablers in smartphones:
  - Sufficient capabilities: CPU, memory
  - A lot of information sources available
  - Efficient methodology available for context recognition

Context recognition in mobile phones (2/2)



- Two major challenges:
  - Power consumption, especially context recognition and data communications
  - Stability of the operating system

Context awareness is already here. Continuous real-time context awareness is still a challenge for the current mobile platforms

Requirements (1/3)
Information availability

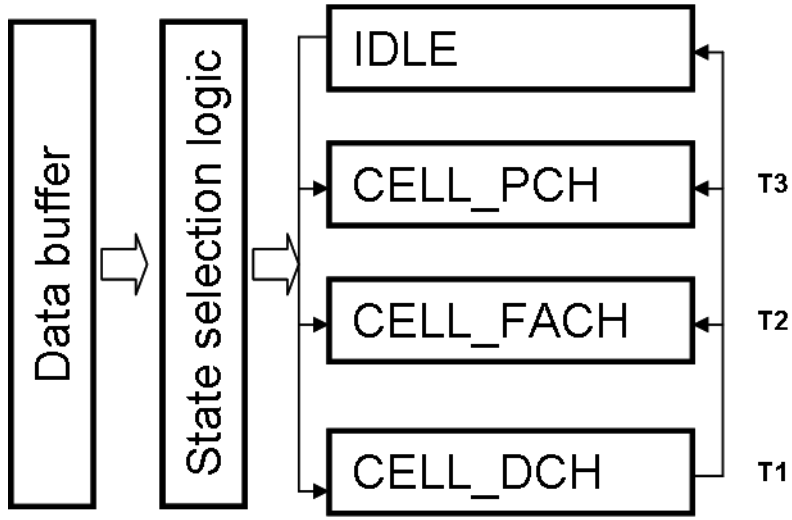
- Real-time context recognition requires continuous reading of different information sources, e.g.: accelerometer, location, user activity, calendar, etc.
- Two main requirements for the information flows:
  1. Control over information flows, i.e. sampling frequencies,
  2. Activity events
- **Potential bottlenecks in the mobile platform design**
  - **Nasty, unpredictable power saving features**
  - **No detailed specifications for the API functionality implementation**

Requirements (2/3)
Background processing

- One of the most important phases from the power-consumption viewpoint
- Two basic functionality needed for real-time context recognition:
  1. Periodic preprocessing of the raw-information
  2. Light-weight context recognition process running in background
- **Potential bottlenecks in the mobile platform design:**
  - **Nasty, unpredictable power saving features**
  - **Automatic killing of the processes**

Requirements (3/3)
Efficient data communications

- Modern smartphones send small amount of data periodically to the network, e.g. Skype status updates, Email clients, etc.
- Context-recognition is similar, usually only context class information is communicated between a terminal and a server
- Unpredictable power consumption, different states of RRC
- Requirement: system level timer register and timer alignment API
- **Potential bottlenecks in the mobile platform design**
  - **No data communications optimizations**



Symbian

- Information availability: Common information sources available: GPS, CellID, acc, ambient light sensor, compass, gyroscope, orientation, magnetometer, proximity, NFC.
- Background processing: Fully functional background processing, full control over power management
- Data communications: No timer alignment

iOS

- Information availability: Common information sources available: GPS, CellID, acc, compass, gyroscope, orientation, magnetometer, proximity.
- Background processing: Only special cases available
- Data communications: No timer alignment

Android

- Information availability: Common information sources available: GPC, CellID, acc, ambient light sensor, gyroscope, orientation sensor, magnetometer, temperature sensor, proximity sensor, NFC.
- Background processing: background processing functional, some power saving tricks present (depends on the vendor)
- Data communications: No timer alignment

MeeGo

- Information availability: Common information sources available: GPC, CellID, acc, ambient light sensor, gyroscope, orientation sensor, magnetometer, proximity sensor.
- Background processing: background processing fully functional
- Data communications: No timer alignment

Lessons learned

1. Power consumption is a major challenge in real-time context recognition
2. Data communications is the biggest power consumer and practically not optimized for real-time context recognition
3. Some stability problems in continuous context recognition

Thank You!
Questions & comments?

VTT creates business from technology