Systèmes d'information diffus avec l'environnement SPREAD

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Domain

- Ambient computing vs. Mobile computing
  - Mobile Computing
    - Providing support for *existing applications* on mobile devices
  - Ubiquitous Computing / Pervasive comp.
    - Supporting / enhancing *real-life activities* with mobile / embedded computers
    - *New applications*

- Principle
  - Merging computing systems and the real world
    - Spreading computing devices with wireless communication capabilities in everyday objects
  - Disappearing computer
    - Spontaneous / seamless services

Reminder: call Laura !

New books of interest for you:
- Programming Bluetooth
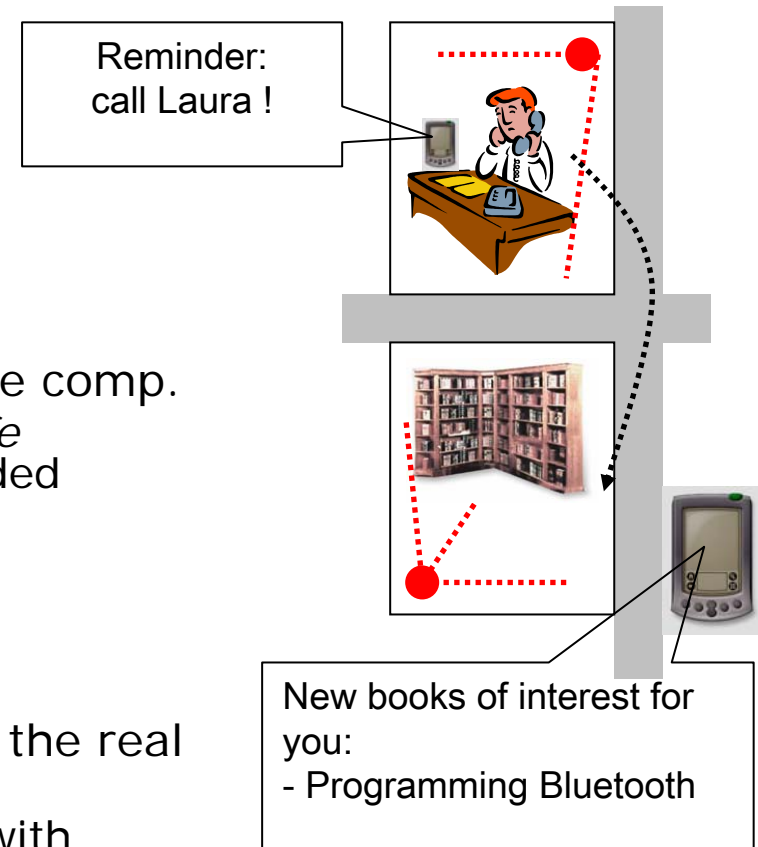
Context-Awareness

Usage profile of mobile computers is strongly different

- context is no longer focused only on the computer
  - ... but combines both real world perception and information system elements
  - Relevant information & services are often dependant on the user's activity and situation
  - user attention = scarce resource
    - Importance on spontaneous operation

Context-sensitive systems

Current practices
- Infrastruture
- Centralized context representation

Service platform
/
Information system

Communication
Infrastructure

Nearest Taxi ?

TAXI

?

Logical domain

GPS

model   processing

Perception

Physical domain

Actions

- Drawbacks
  - Complexity
  - Scalability
  - Cost
  - Privacy

Short distance Wireless

○ A natural approach to context sensitive services
  ● Short distance = proximity
  ● Auto-descriptive context dynamically composed from the nearby objects
○ Advantages
  ● Potential for lower energy requirement
  ● Reduced risks for privacy
  ● Natural scalability
  ● Simple architectures and programming
  ● Low cost

SPREAD

○ A programming model which promotes the design of spontaneous operation for the application

○ How?
- By providing programming abstractions directly related to interactions between physical objects.

○ Benefits:
- The program is structured around physical objects and their interactions
- Programming is simple because
  ○ You don't have to determine what is the context, and then take the appropriate actions:
  ○ You just have to "attach" code to already existing interactions (in the real world), reflected in the system

Spatial programming / SPREAD

○ Abstractions:
- Physical objects = data symbol (tuple)
- Physical mobility = data flow
- Physical space = associative memory
  ○ Tuple-space
  ○ Association/matching based on
    - Data properties (LINDA like)
    - Geometrical properties: the data reside inside a Shape around the object which publishes the tuple

- Synchronization: like a "token-machine", where "tokens" are represented by physical objects. An action needs a set of tokens to be proceeded.

Example

○ Stopping the bus
  in Ubi Bus…

Token: <U-STOP, Bus#16> 🔵

rd <U-STOP, 'Bus#16'> 🔵

out <S-STOP, 'Bus#16'> 🔴

Notify driver !
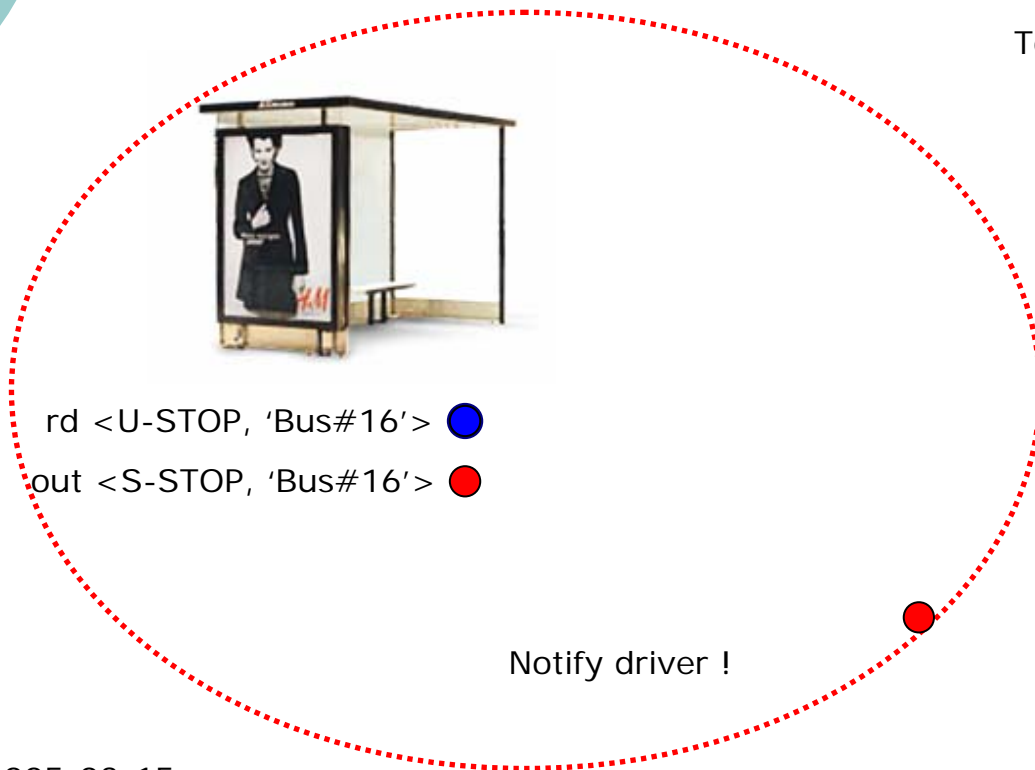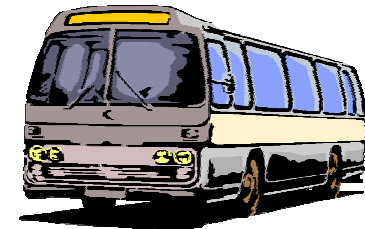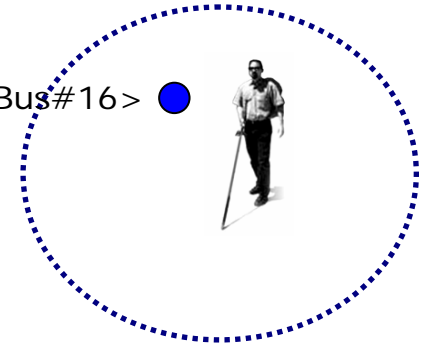
rd <S-STOP, 'Bus#16'> ⭕

SPREAD

- ○ Key points
  - • Distributed architecture, relying on autonomous nodes
  - • Targets range from smart tags / smart sensors to personal communication devices (ie PDAs, handsets)
  - • Generic support for J2ME compliant platforms
  - • C version adaptable to specific OS / architectures
  - • Air interfaces: WiFi, BT (w/ restrictions)

  - • Experimented on several applications

Applications

- Smart spaces
  - Physical objects augmented / annotated with electronic information
    - Objects augmented with URLs
    - Objects augmented with text
      - Dynamic selection of information from a set of physical objects, defining an information context.

  - Usage scenarios
    - City / Museum tours
      - Dynamic selection of a panel content according to the profiles of surrounding peoples
    - Sharing of comments about places...
      - Virtual graffiti
    - Outdoor advertisement

WebWalker

○ Principle

- Building the Web *implicitly from the physical space*.
- Supporting spontaneous (context-driven) navigation as the user move...

○ How ?

- Spreading *web context* in the physical environment.

WebWalker

- Navigator key features
  - Integrates virtual and physical mobility in the familiar interface of a Web browser
  - Support physical navigation and web searches from information collected from the surrounding objects.

WebWalker

○ Dynamic web search from the physical space

- Link words to physical objects
- A set of words located in a given geometrical area defines a textual context
- Example :
  ○ spontaneous cooking suggestion

Tomatoes, salmon

Google

cooking.com

Fisher salad,
Baltic pizza,
...

WebWalker interface

Assistance to disabled people

○ **Ambient Computing:**

- Perception enhancement (by sensing)

- Making the environment more friendly to disabled people
  - ○ Detecting their presence
  - ○ Adapting the behavior of existing services

- Ex: Ubi Bus

Ubi-Bus

- An application of ambient computing to urban transport systems
  - Services:
    - Enhance the service for visually impaired people
    - Provide useful information and/or entertainment services for standard users
    - Promotes bus shelters as digital service providers
      - Contextual information / notification
      - Advertising

Conclusion

- Ambient computing:
  - One of the major development area in computing for the next years, identified as strategic by the EC
  - Link the real-world with information systems
    - Potential for many new context dependant services
- Ambient computing services requires context-awareness
  - The short distance approach exhibits significant advantages, in particular:
    - Scalability, Cost, Reduced risk for privacy, Simplicity
  - Short term: BT, WiFi, RFID, ZigBee?
  - Future: UWB?

Related resources

- SPREAD environment
  - Ambient computing applications: an experience witht the SPREAD approach (HICSS'36 paper)
    - http://csdl.computer.org/comp/proceedings/hicss/2003/1874/09/187490291abs.htm
- Ubi Bus
  - Video:
    - http://www.inria.fr/cgi-bin/MULTIMEDIA/Afficher-La-Video-Videotheque-Entree.pl?video=501-fra.html
  - Ubi-Bus: Ubiquitous Computing to Help Blind People in Public Transport (Mobile'HCI 2004)
    - http://springerlink.metapress.com/app/home/contribution.asp?wasp=8e650c7f4e7547a9aef2f791d04f388e&referrer=parent&backto=issue,28,76;journal,256,1955;linkingpublicationresults,1:105633,1
- Context-awareness in the Web / WebWalker
  - SPREADing the Web (PWC'03 paper)
    - http://springerlink.metapress.com/app/home/contribution.asp?wasp=0f554399860f4863b4b4a403ff8e5c76&referrer=parent&backto=issue,36,79;journal,636,1955;linkingpublicationresults,1:105633,1