



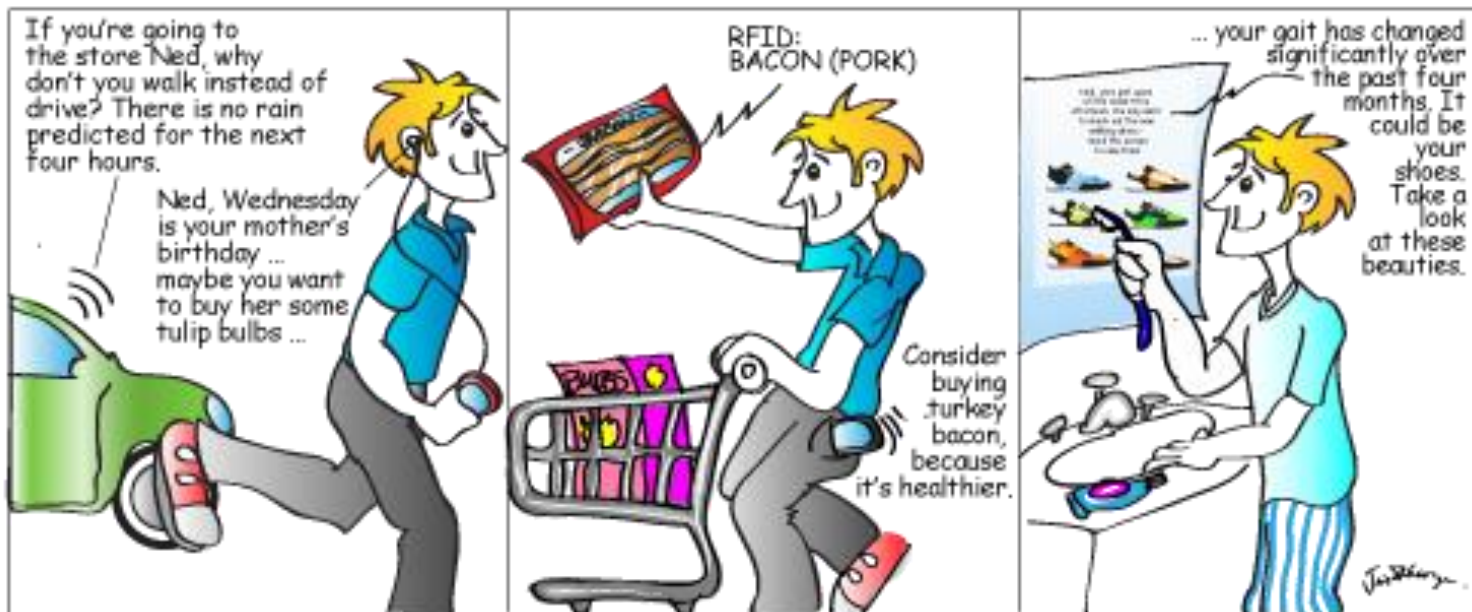
Context-Aware Computing

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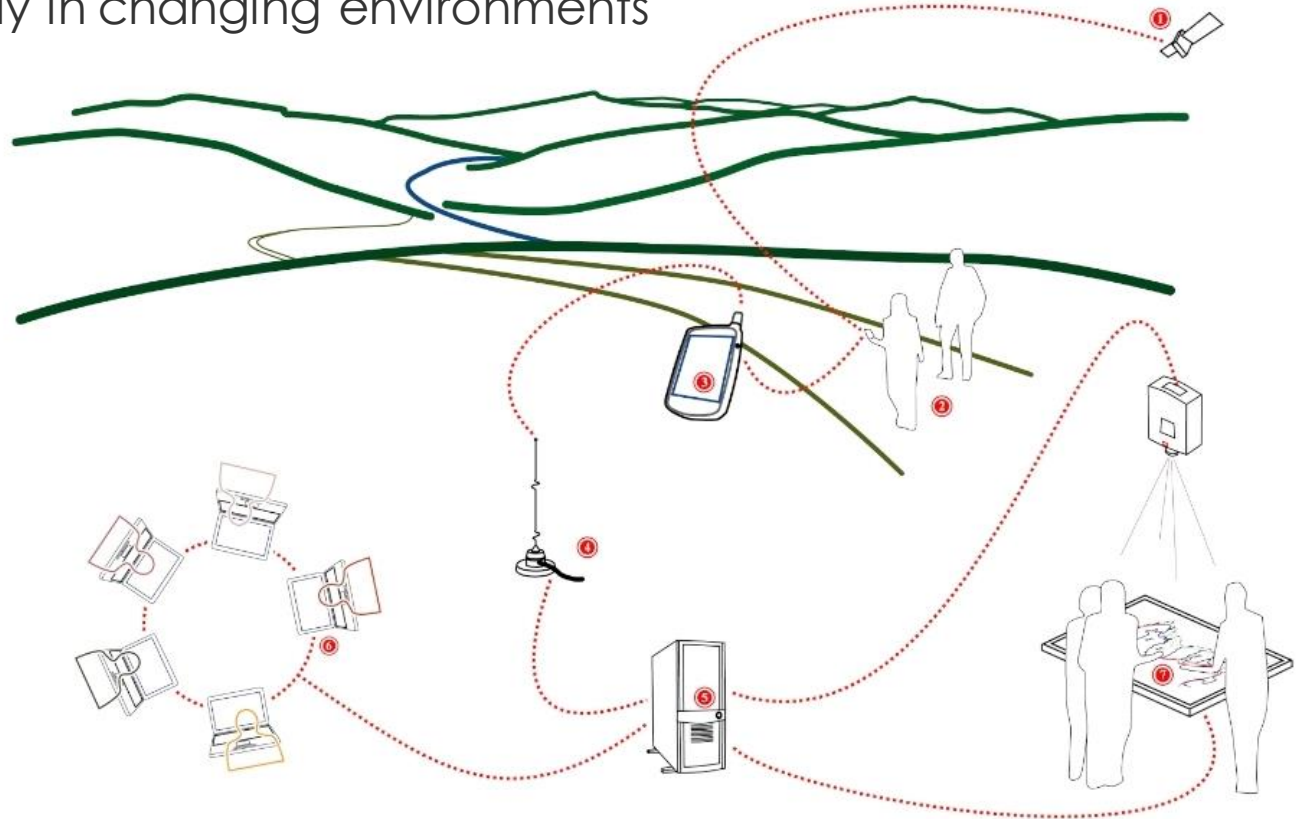
Pervasive Computing

- Pervasive computing is **computing**
 - Everywhere and anywhere and anytime
 - Any device, any location, any format



Pervasive Computing system

- is characterized by:
 - Physical integration: integration between computing nodes and the physical world
 - Instantaneous interoperation: devices interoperate spontaneously in changing environments

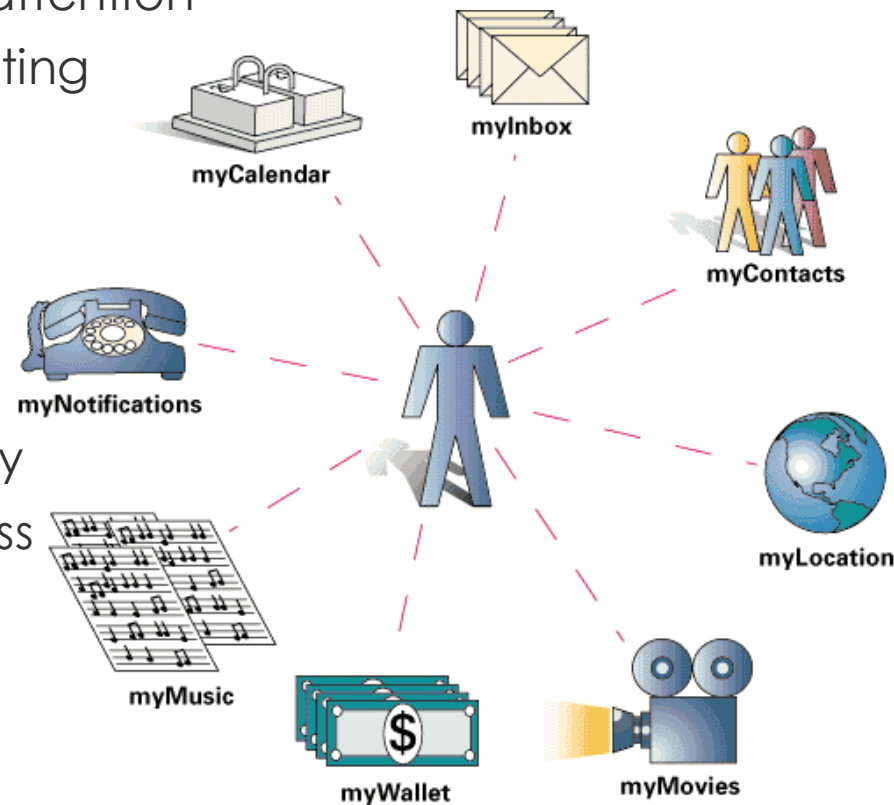


Specification:

- Pervasive computing demands applications:
 - Capable of operating in high dynamic environment
 - Placing minimal demands on user attention
 - Flexible, adaptable, capable of acting autonomously on behalf of users.

- Challenges:

- Privacy
- Usability
- Imperfect understanding of the truly compelling uses of context awareness



Different types of context information



- Sensed (highly dynamic and prone to noise and sensing errors)
- Static(DOB)
- User-supplied (very reliable, become out of date soon)
- Derived information(relative location)

Imperfect context information



- Solved by addressing
 - Quality metadata
 - Certainty
 - Freshness estimate
- Unsolved
 - Ambiguous information
 - It does not allow the information that an aspect of the context is completely unknown to be explicitly represented



Complexity

- Complexity of context-aware applications substantially can be reduced using the infrastructure:
 - Gathering information
 - Managing data
 - Dissemination of context information

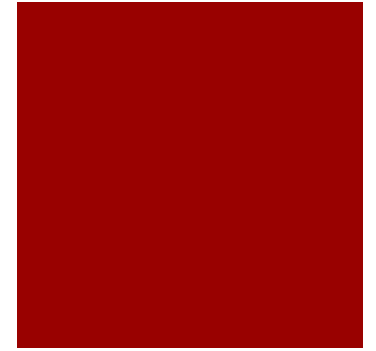


Solution

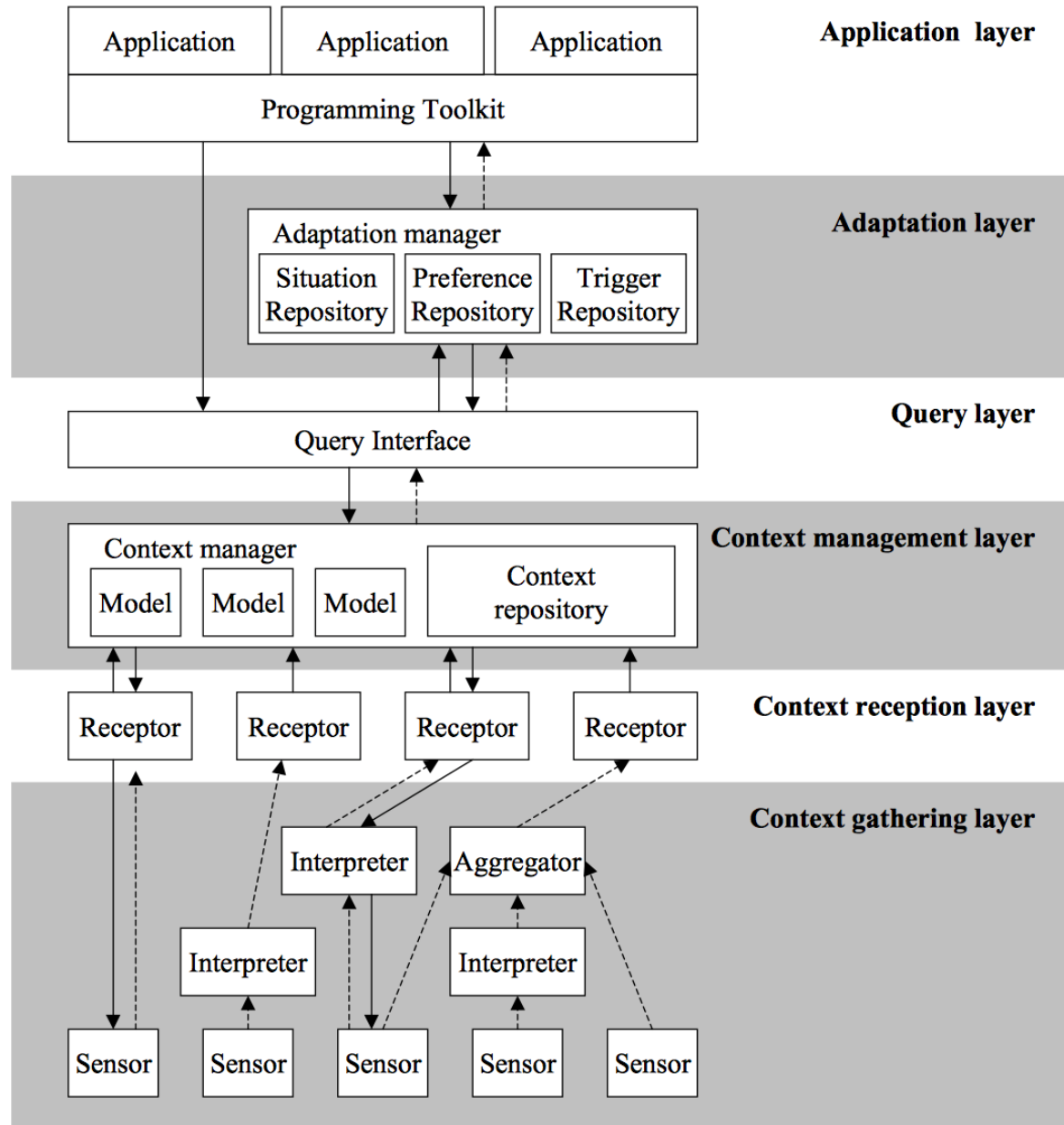
- three separate yet closely integrated modeling approach developed:
 - Exploration and specification of an applications requirements
 - Management of context information stored in a context repository
 - Specification of abstract classes of context close to the way of programmer and human user view



Context modeling technique



- Graphical modeling approach
 - types of information (in terms of *fact types*),
 - their classifications (sensed, static, profiled or derived),
 - relevant quality metadata, and dependencies between different types of information.
- Relational representation
 - R is the set of relations belonging to a context model,
 - I is an instantiation of the model,
 - $I(r)$ represents the set of tuples in I belonging to a relation $r \in R$,
 - dom is the set of constant values permitted within any instantiation of the model.
- The situation abstraction



Mobile Distributed Computing System

- Extended form of mobile computing
- Users employ many different mobile, stationary and embedded computers
- Does not occur in a single context
- Might access from different networks



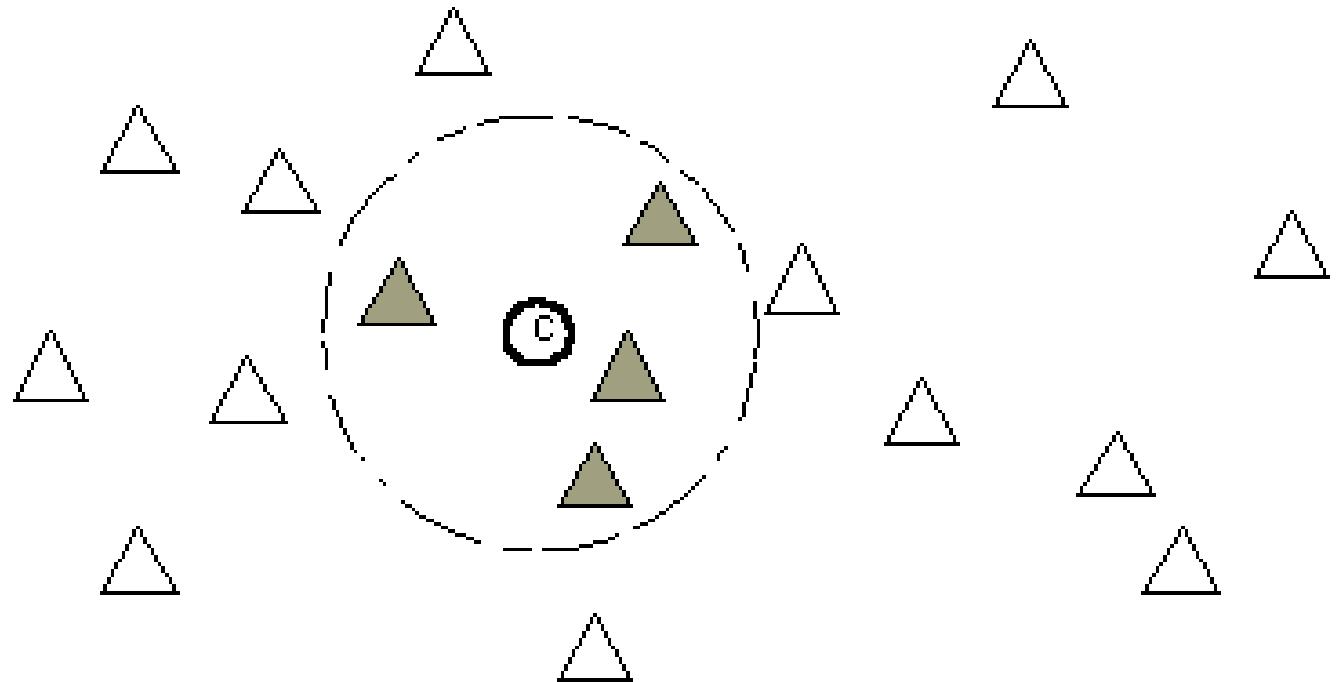
Different types of context-aware applications

- Proximate selection
- Automatic contextual reconfiguration
- Contextual information and commands
- Command-triggered actions



Proximate Selection

- A user interface technique where nearby located-objects are emphasized or otherwise made it easier to choose
- Involves entering :
 - Locus
 - Selection



Types of located-objects

- Computer input and output devices that require co-location for use
 - Printers, Displays, Speakers, Video cameras
- Objects already interacting with and need to be addressed by a software
 - Include people in a room you'd like to "beam" a document
- Set of places one wants to find out about
 - Restaurants, night clubs, gas stations, stores, exits, entrances



Automatic Contextual Reconfiguration

- Reconfiguration is the process of:
 - Adding new components
 - Removing existing components
 - Altering the connections between components



Contextual Information and Commands

- Certain task are done in certain positions.
 - Library, kitchen, office
 - Location browsers:
 - Directories are named after locations and contain files, program, links.
 - Run different program depending on context of use
 - Using some predefined context-keys facilitating future retrieval.



Contextual information and commands pros and cons

- Profitable for businesses and government agencies, since they inexpensively engage large number of potential costumer
- People interacting with third parties need to ensure security and authenticity of information
- Personal customization must coordinate with those provided by third parties.

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"I deplore the lack of internet privacy and so do my 5,000 Facebook friends!"

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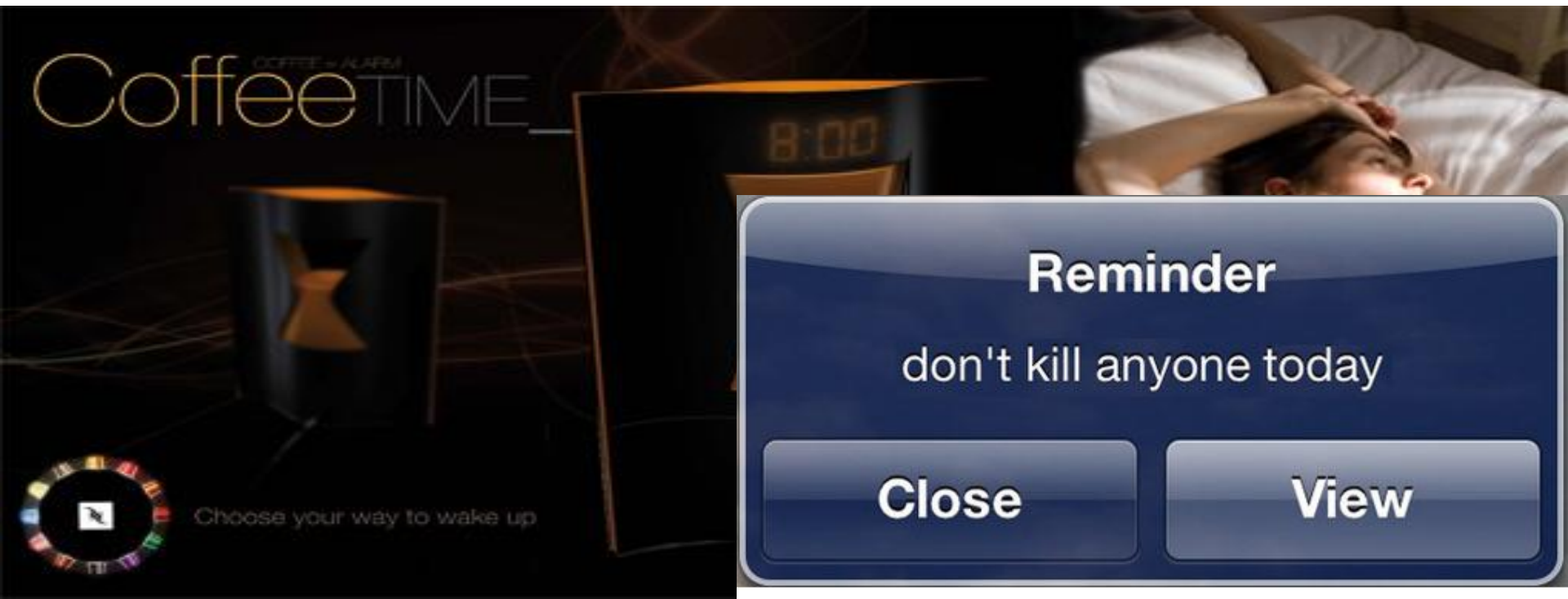
Context-Triggered Actions

- IF-THEN rules used to specify how context-aware systems should adapt.
- Living in a rule-based expert system!
- The same category as contextual information and commands except that the triggered actions are invoked automatically according to the rules



Types of context-triggered applications

- Active Badge based (Watchdog)
- Tab based (Contextual Reminders)



Problems of building actions:



- Expressiveness of the predictable language
- Accuracy and timeliness of the underlying context information
- How to balance the requirement of timely execution with the need for predictable behavior
 - Transition between states.

whereAware



- Indoor
 - Wi-Fi
- Outdoor
 - Global Positioning System
 - Cellular networks
- Concerns:
 - Privacy
 - Power consumption and price with accuracy
 - Change of technology going from indoor to outdoor