AmbientTalk

Seminar presentation

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Outline

Ambient Resources

An ambient resource is

- a networked device
- dynamically (un)available
- existence not known a-priori, require discovery

Examples:

- PDAs discovering each other when in communication range
- WLAN hot-spot

Hardware phenomena

As constraints like processing power and power drain become less important to mobile computing, new constraints arise:

- Connection Volatility
- Ambient Resources
- Autonomy
- Natural Concurrency

Ambient-Oriented Programming

The following concepts have been found crucial to address the hardware phenomena:

- Classless Object Model
- Non-blocking Communication
- Reified Communication Traces
- Ambient Acquaintance Management

Outline

AmbientTalk

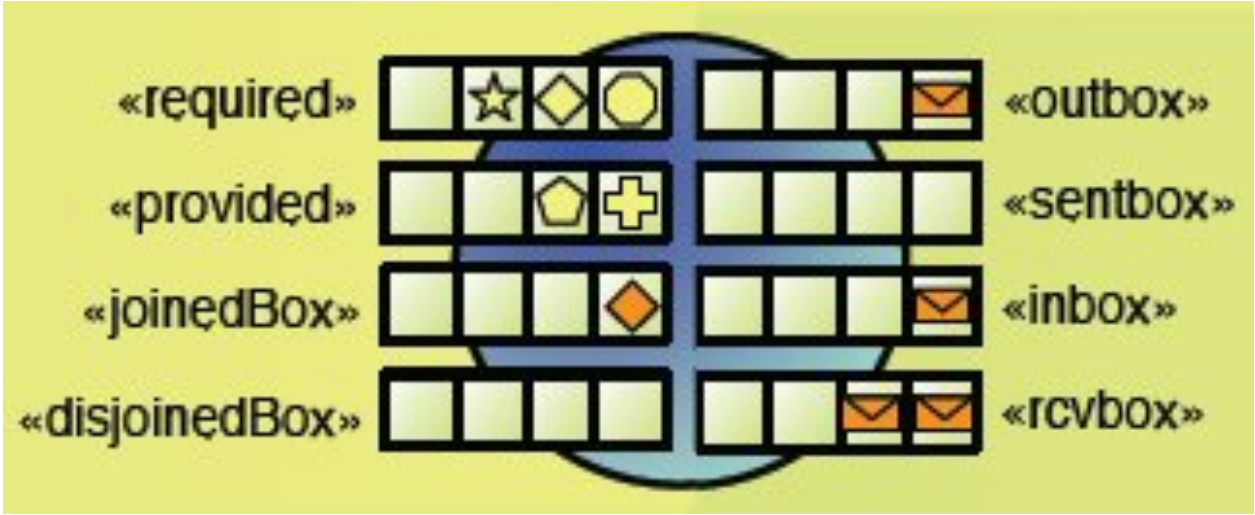
AmbientTalk is developed at the Programming Technology Lab of the Vrije Universiteit Brussel.
Used as a language laboratory to experiment with ambient-oriented programming languages.
Basic language features, explicitly designed to cover all ambient-oriented programming concepts:

- double layered object model
- first-class mailboxes
- reflectively extensible kernel

Double Layered Object Model

- active objects (*actors*)
  - single thread of execution
  - passed as reference
  - non-blocking communication
- passive (normal) objects
  - passed by copy
  - synchronous message passing

First-class Mailboxes



- reified communication (right)
- reified environment (left)
- observers can be attached to a mailbox

Reflectively Extensible Kernel

AmbientTalk is built of three layers:

- Base AmbientTalk
  interpreted by
- Metacircular AmbientTalk
  interpreted by
- Native AmbientTalk
  written in Java

Mirrors and *Mirages* (German: Illusion) are used to extend AmbientTalk's features using Metacircular AmbientTalk.

Advanced Language Features

- Stripes – annotate an object with a type
- Futures – allowing non-blocking calls to return sth.
- Symbiotic Programming with Java

and many more . . .

Outline

Example Application

Scenario:
An instant-messenger application running on hand-held mobile devices. The application will be able to handle disconnects transparently due to AmbientTalk's communication concept.

Core application consists of:

- an interface used by local application
- an interface adressed by remote messengers
- event handler code

local interface

```
1  def buddyList := jlobby.java.util.HashMap.new();
2
3  def localInterface := object: {
4   def sendTextMessage(to, string) {
5    def buddy := buddyList.get(to);
6    if: (nil == buddy) then: {
7     listener<-unknownBuddy(to);
8    } else: {
9     def msg := TextMessage.new(username, string);
10    buddy<-receiveTextMessage(msg,
11     singleCallLease: seconds(30) for: ( object: {
12      def resolve() {
13       listener<-printMessage(msg);
14      }
15    }));
16   };
17  };
18 };
```

remote interface

```
20  def remoteInterface := object: {
21   def receiveTextMessage(textMessage, future) {
22    listener<-printMessage(textMessage);
23    future<-resolve();
24   };
25   def getName(future) { future<-resolve(username) };
26  };
27
28  export: remoteInterface as: InstantMessenger;
```

event handler

```
30  whenever: InstantMessenger discovered: { |messenger|
31   messenger<-getName(singleCallLease: seconds(30) for: (object:{
32    def resolve(name) {
33     if: (nil == buddyList.get(name)) then: {
34      buddyList.put(name, messenger);
35      listener<-addBuddy(name);
36      when: messenger disconnected: {
37       listener<-buddyOffline(name);
38      };
39      when: messenger reconnected: {
40       listener<-buddyOnline(name);
41      };
42     };
43    };
44   }));
45  };
```

Outline

Conclusion

benefits:

- superior concurrency and distribution abstractions
- reflectively extensible
- java library access

drawbacks:

- frequently changing
- interpreted language
  - source code open
  - slower than compiled code

Questions?