The main concepts for object approaches and UML

Part 2:
The dynamical models

The dynamical models

- To understand and describe the behaviours of the objects and their interactions

- Three types of representations
  - State chart diagrams (*internal dynamics*)
  - Activity diagrams (*intra and inter object dynamics*)
  - Interaction diagrams (*interaction dynamics*)
    - Sequence diagrams
    - Collaboration diagrams
Content

- State chart diagrams
- Activity diagrams
- Interaction diagrams
  - Sequence diagrams
  - Collaboration diagrams
- Conclusion
State chart diagrams

Objective:
- To describe the life cycle of an object

Elements:
- State of an object
  - Values of its attributes and links
  - An object change its state over time
- Transition
  - Events (action of an object onto another)
  - Guard (conditions)
  - Actions

A transition is due to an event

Event 1 [Cond1] / Action1

State 1
do : Activity 1

State 2
faire : Activity 2

stimulus
Examples

- **Heater**
  - State: stop $T^* < 15°C$
  - State: heat

- **Life cycle**
  - active
  - hire
  - formation
  - work change
  - age limit
  - retired
  - fire
  - unemployed
  - conversion

Example: plot

- Forest
  - build
  - clear
  - plant
- Clearing
  - making crop
  - abandon
  - make crop
- Field
  - make crop
  - do nothing
- Plantation
  - plant
The actions

- For the transitions

State A -> State B
Event( arg1, ... ) || condition || link.sendEvent(arg1, ...)

- For the states

```
A state
entry / print("error")
do / do something
exit / print("I love")
```

Super states

- États d'un feu tricolore

- États d'une machine à laver
Parallelism

- T and U in parallel
- Event E1 dispatched to T and U

Content

- State chart diagrams
- Activity diagrams
- Interaction diagrams
  - Sequence diagrams
  - Collaboration diagrams
- Conclusion
**Activity diagrams**

- **Objective:**
  - To describe the activities and their ordering

- **Can be used for**
  - the internal behaviour of an object
  - the concrete functioning of a behaviour
  - the control ordering between activities spread among a set of objects

**Activity diagrams the elements**

- **Activities**

- **Order between activities**
  - En fait ces diagrammes peuvent être vus comme une forme simplifiée des diagrammes d’états - transitions

- **Initial and final pseudo activities**

- **Decision and synchronisation points**

- **Object flows (petri nets, etc.)**
Notations

- An activity is an action

![Activity diagram](image)

- A link is a sequencing of activities

![Activity diagram](image)

Activity diagram: life cycle

![Activity diagram](image)
Other notations

The swimlanes

QuickTime™ et un décompresseur TIFF (LZW) sont requis pour visionner cette image.
Example: farmer activities

- State chart diagrams
- Activity diagrams
- Interaction diagrams
  - Sequence diagrams
  - Collaboration diagrams
- Conclusion
The life line

« create »

Creation by an external object

:C1

op

Activation of an object
Receiving the event « op »

« destroy »

Deletion by an external object

Interaction types

- synchronous:
- asynchronous:
- reflexive:
- constructive:
- destructive:
- alternative:
- loops:

[X]mess.
[non X]mess.
*[X]mess.
State chart diagrams

Activity diagrams

Interaction diagrams
- Sequence diagrams
- Collaboration diagrams

Conclusion

UML: Conclusion

A tool for dialog:
- A language to represent models
- Graphical and simple
- Formal and normalized (OMG)

An open tool
- Independent of the implementation
- It is a language, not a process
- Adaptable (stereotypes)
UML books (1)

- Booch Grady, Rumbaugh James, and Jacobson Ivar, The Unified Modeling Language User Guide, 0-201-57168-4, Addison Wesley, Fall 1998,
- Jacobson Ivar, Booch Grady and Rumbaugh James, The Unified Software Development Process, 0-201-57169-2, Addison Wesley, Fall 1998,

UML books (2)

- Muller Pierre-Alain, Modélisation objet avec UML, Eyrolles, 1997
- Schmuller Joseph, Teach Yourself UML in 24 Hours, Sams Publishing, 1999
- Texel Williams, Uses cases combined with Booch/OMT/UML, Prentice Hall, 1998