Software System Engineering

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Lesson 02-D:
Activity Diagrams
Lesson Objectives

- Discuss and understand activity diagrams
- Understand the elements of activity diagrams
  - Activity
  - Transition
  - Synch. Bar
  - Decision Diamond
  - Start & Stop Markers
Activity Diagram

- Describes how activities are coordinated.

- Is particularly useful when you know that an operation has to achieve a number of different things, and you want to model what the essential dependencies between them are, before you decide in what order to do them.

- Records the dependencies between activities, such as which things can happen in parallel and what must be finished before something else can start.

- Represents the workflow of the process.
Notation

1. Activities

2. Transition

Activity1() \rightarrow Activity2()
Notation - 2

3. Decision Diamond

Activity1()c

[x>0]  [x=0]  [x<0]

[x>0]  [x=0]  [x<0]
Notation - 3

4.1 Synch. Bar (Join)

4.2 Splitting Bar (Fork)

{AND}

{OR}

{XOR}
5. Start & Stop Markers

Start Marker

Stop Marker
Notation - 4

Application/Department/Group/Role Boundaries
Example: Business Level Activity Diagram of the Library

member
[borrower]

Find book on shelf

Wait in queue

[returner]

Librarian

[returning]

[borrowing]

Record return
Put book back of shelf

Record borrowing

Prepare for next member

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L02-d-S10 Activity Diagrams
Activity Diagrams (1)

- To model the dynamic aspects of a system
- It is essentially a flowchart
  - Showing flow of control from *activity* to *activity*

**Purpose**

- Model business workflows
- Model operations
Activity Diagrams (2)

- Activity diagrams commonly contain
  - Activity states and action states
  - Transitions
  - Objects
Action States and Activity States

- Action states are atomic and cannot be decomposed
  - Work of the action state is not interrupted

- Activity states can be further decomposed
  - Their activity being represented by other activity diagrams
  - They may be interrupted
Transitions (1)

- When the action or activity of a state completes, flow of control passes immediately to the next action or activity state.
- A flow of control has to start and end someplace:
  - initial state -- a solid ball
  - stop state -- a solid ball inside a circle
Transitions (2)
FIGURE 12–24
Activity diagram for processing a deposit to a savings account.

Deposit Savings button is pressed in the BankUI window

Display Deposit Savings window

Account::deposit

Account::deposit (anAmount)
Branching (1)

- A branch specifies alternate paths taken based on some Boolean expression
- A branch may have one incoming transition and two or more outgoing ones
Branching (2)

Diagram:
- Release work order
- Guard expression (branch)
- Materials not ready
- Reschedule
- Materials ready
- Assign tasks
- Guard expression
Activity Diagram: Example (2)

FIGURE 6–8
Activities involved in an ATM transaction.
Forking and Joining

- Use a synchronization bar to specify the forking and joining of parallel flows of control
- A synchronization bar is rendered as a thick horizontal or vertical line
Fork

- A fork may have one incoming transitions and two or more outgoing transitions
  - each transition represents an independent flow of control
  - conceptually, the activities of each of outgoing transitions are concurrent
    - either truly concurrent (multiple nodes)
    - or sequential yet interleaved (one node)
简要

- A join may have two or more incoming transitions and one outgoing transition
  - above the join, the activities associated with each of these paths continues in parallel
  - at the join, the concurrent flows synchronize
    • each waits until all incoming flows have reached the join, at which point one flow of control continues on below the join
Fork

- Prepare for speech
- Decompress
- Gesture()
- Synch mouth()
- Stream audio()
- Cleanup

fork
join
Activity Diagram: Example (3)

1. Prepare incoming documents
   - Index documents
     - Make electronic file
     - Complete request
       - Check data for life insurance
       - Calculate data for construction mortgage
       - Draw up contract mortgage-deed
       - Pay provision to insurance agent
       - Draw up insurance policy

**FIGURE 5-20**
An activity diagram for processing mortgage requests (Loan: Processing Mortgage Request).

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Activity Diagram: Example (4)
Activity Diagram: Example (6)
Activity Diagram: Example (7)

FIGURE A-21
Activity diagram for the MainUI.

- Button is pressed
  - Deposit Checking button is pressed
    - Display SavingsAccountUI
  - Deposit Savings button is pressed
    - Display SavingsAccountUI
  - Withdraw Checking button is pressed
    - Display CheckingAccountUI
  - Withdraw Savings button is pressed
    - Display CheckingAccountUI
  - Balance Inquiry button is pressed
    - Display CheckingAccountUI
  - Done button is pressed
Swimlanes (1)

- A swimlane specifies a locus of activities
- To partition the activity states on an activity diagram into groups
  - each group representing the business organization responsible for those activities
  - each group is called a swimlane
- Each swimlane is divided from its neighbor by a vertical solid line
Swimlanes (2)

- Each swimlane has a name unique within its diagram
- Each swimlane may represent some real-world entity
- Each swimlane may be implemented by one or more classes
- Every activity belongs to exactly one swimlane, but transitions may cross lanes
Activity Diagram: Example (8)
Activity Diagram: Example (9)
Discussion Questions

- What are the element of activity diagrams?

- T/F
  - Activity diagram is a behavior model.
  - Activity diagram is a control model.

- Define:
  - Activity diagram