

Object-Oriented Software Analysis and Design

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UML Activity Diagrams and Modeling

- ▶ A UML activity diagram shows **sequential and parallel activities** in a process.
- ▶ They are **useful** for modeling
 - ▶ business processes,
 - ▶ workflows,
 - ▶ data flows, and
 - ▶ complex algorithms.

Basic UML Activity Diagram: Notation

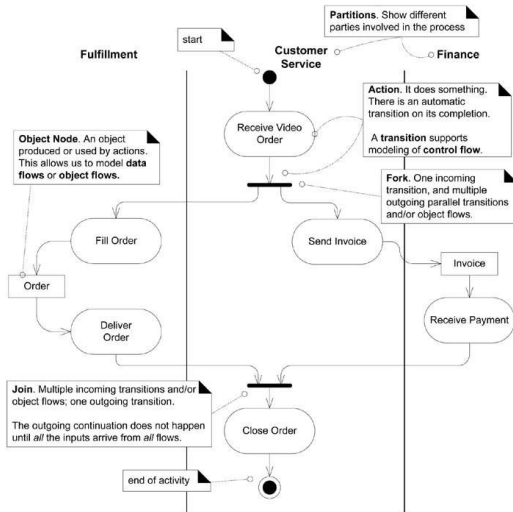


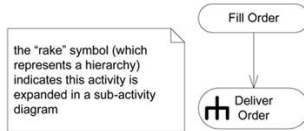
Figure: Basic UML activity diagram notation.

Basic UML Activity Diagram: Notation (contd.)

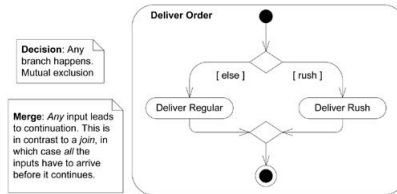
- ▶ Figure illustrating an **action**, **partition**, **fork**, **join**, and **object node**.
- ▶ In essence, this diagram shows a sequence of actions, some of which may be parallel.
- ▶ Most of the notation is self-explanatory; two subtle points:
 - ▶ once an action is finished, there is an automatic outgoing transition
 - ▶ the diagram can show both **control flow** and **data flow**

UML Activity Diagram: Notation (contd.)

- How to show that an activity is expanded in another activity diagram?



(a) An activity will be expanded in another diagram.



(b) The expansion of an activity.

- How to show conditional branches? See how the **decision** symbol used. The related **merge** symbol shows how flows can come back together.

UML Activity Diagram: Notation (contd.)

- **Signals** are shown in Figure. They are useful, for example, when you need to model events such as time triggering an action, or a cancellation request.

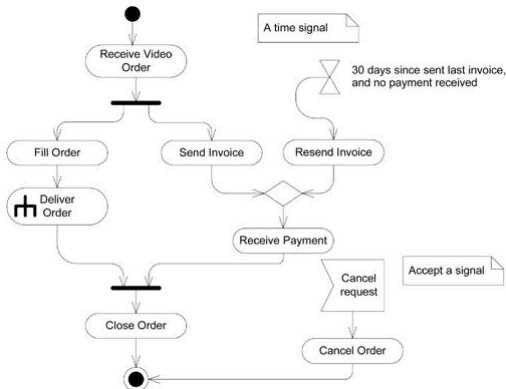


Figure: *Signals.*

How to Apply Activity Diagrams?

1. Business Process Modeling
2. Data Flow Modeling
3. Concurrent Programming and Parallel Algorithm Modeling

How to Apply Activity Diagrams? Business Process Modeling

- ▶ Although Business process can be captured in text (in use case text), in this case activity diagrams are a great example of pictures being worth a thousand words.

How to Apply Activity Diagrams? Data Flow Modeling

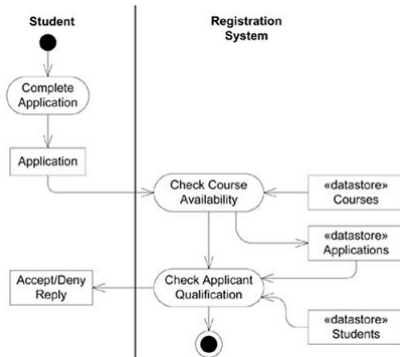


Figure: Applying activity diagram notation to show a data flow model.

How to Apply Activity Diagrams?

Concurrent Programming and Parallel Algorithm Modeling

- ▶ The UML activity diagram **partitions** can be used to represent different operating system threads or processes.
- ▶ The **object nodes** can be used to model the shared objects and data.
- ▶ And of course, **forking** can be used to model the creation and parallel execution of multiple threads or processes, one per partition.

UML Activity Diagram: Guidelines

- ▶ This technique proves most valuable for very complex processes, usually involving many parties. Use-case text suffices for simple processes.
- ▶ If modeling a business process, take advantage of the “rake” notation and sub-activity diagrams.
 - ▶ On the first overview “level 0” diagram, keep all the actions at a very high level of abstraction, so that the diagram is short and sweet.
 - ▶ Expand the details in sub-diagrams at the “level 1” level, and perhaps even more at the “level 2” level, and so forth.

UML Activity Diagram: NextGen Example

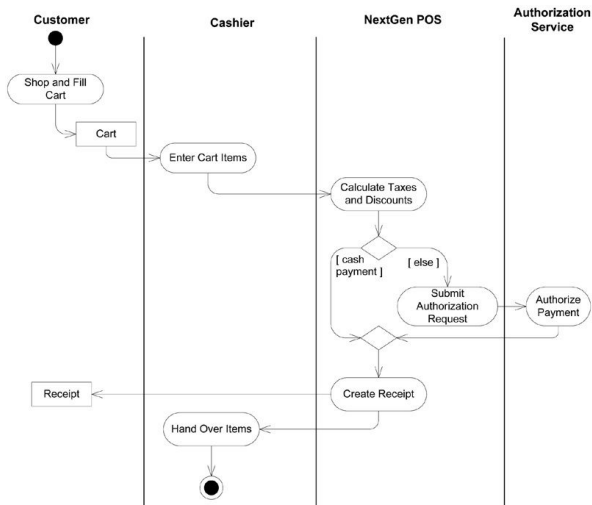


Figure: Modeling the Process Sale use case with an activity diagram.

Process: Activity Diagrams in the UP

- ▶ One of the UP disciplines is Business Modeling; its purpose is to understand and communicate “the structure and the dynamics of the organization in which a system is to be deployed”.
- ▶ A key artifact of the Business Modeling discipline is the Business Object Model (a superset of the UP Domain Model), which essentially visualizes how a business works, using UML class, sequence, and activity diagrams.
- ▶ Thus, activity diagrams are especially applicable within the Business Modeling discipline of the UP.

Activity Diagrams: An Example

Consider that you are analyzing requirements for a housing system run by the campus housing service.

The campus housing service helps students find apartments. Apartment owners complete information forms about the available rental units (e.g., location, number of bedrooms, monthly rent), which are then entered into a database. Students can search this database via the Web to find apartments that meet their needs (e.g., a two-bedroom apartment for \$400 or less per month within a half mile of campus) and contact the apartment owners directly to see the apartment and possibly rent it. Apartment owners call the service to delete their listing when they have rented their apartment(s).

- Create an activity diagram based on the above scenario

It's Quiz Time

1. UML activity diagrams are useful for modeling business processes, workflows, data flows, and complex algorithms. (True or False)
2. A UML offers rich notation to show a sequence of activities, including parallel activities.
 - 2.1 Activity diagram
 - 2.2 Sequence diagram
 - 2.3 Class diagram
 - 2.4 Use case diagram
3. In UML activity diagram, the object nodes can be used to model the shared objects and data. (True or False)