States and State Diagrams

Object-Oriented Analysis and Design

CSCI 6448 - Fall 1998

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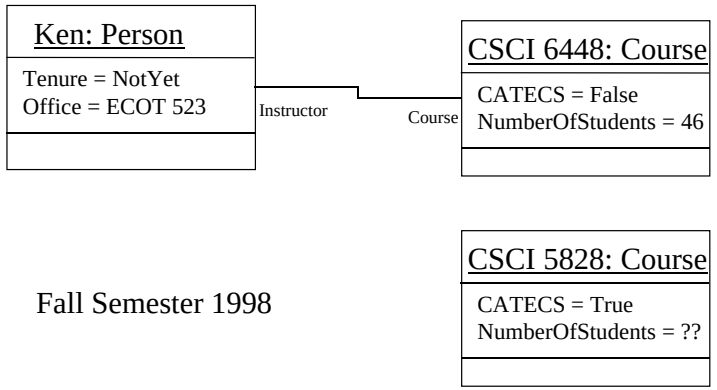
Goals of this Lecture

- Present the foundational concept of state and how it relates to objects
- Present State diagrams
- Discuss your comments on the critiques and evaluations
- Discuss next critique and next assignment

Object State

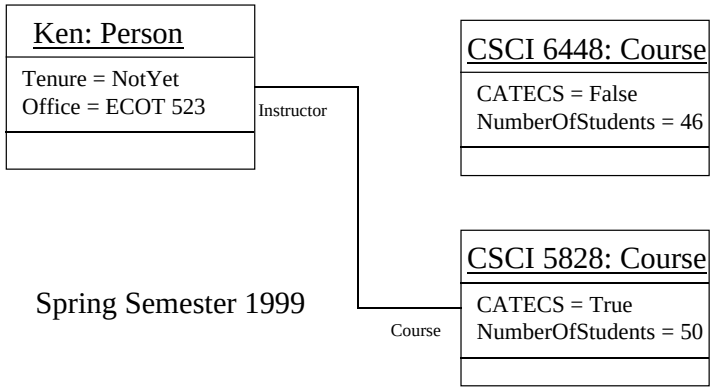
- Definition
  - Object state is a collection of attributes and relationships
  - Change an attribute, the object's state is changed
  - Change a relationship, again, the state is changed

Example



Fall Semester 1998

Example, continued



Spring Semester 1999

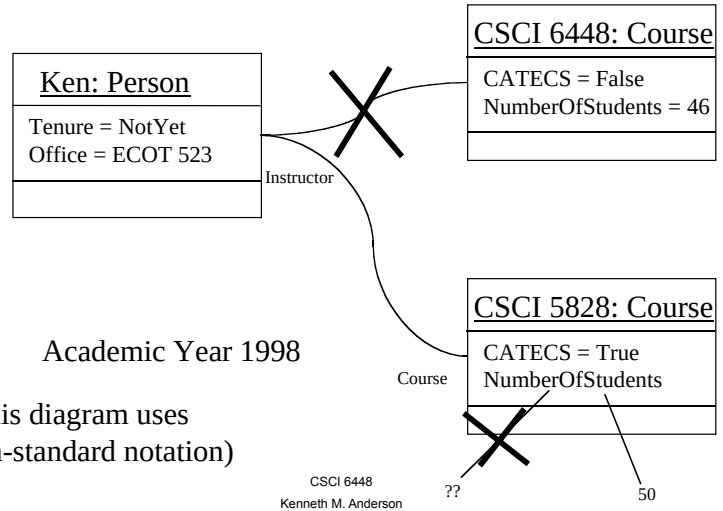
Comments on Example

- Three object states were shown
  - Ken
  - CSCI 6448
  - CSCI 5828
- All three changed state during the time period of the current academic year
  - One relationship was deleted; another created. One attribute changed value

Additional Definitions

- Point States
  - An object state at a particular point in time
    - E.G. Fall Semester, 1998
    - (The granularity depends on the object)
- Period States
  - A state with a particular duration
    - E.G. Academic Year 1998

Example, period state



Academic Year 1998

(This diagram uses non-standard notation)

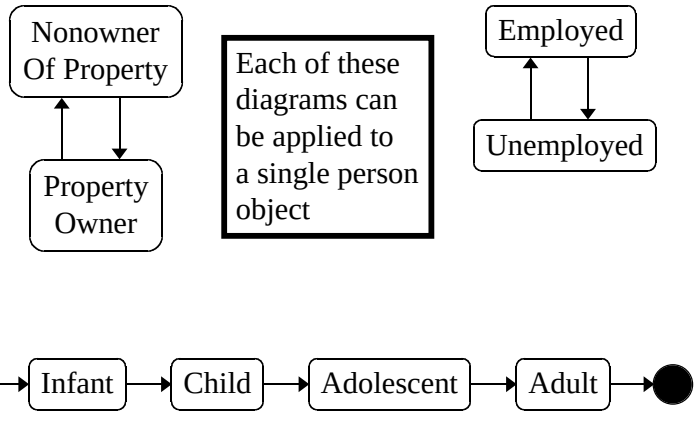
Complete State

- Definition
  - A complete state of an object is the set of relationships that existed over an object's entire lifetime
- This state can contain quite a bit of information since each delta occurs when an attribute or relationship changes

State Changes

- An object state change is the transition of an object from one state to another
- These transitions can be captured in a state transition diagram
- Multiple state diagrams can be applied to a single object to capture state changes that are orthogonal to one another

Example



More on State Diagrams

- They describe the state for a *single* object
- Actions cause state transitions; they occur quickly and are not interruptible
- Activities are associated with states; they have an unspecified duration and can be interrupted by events

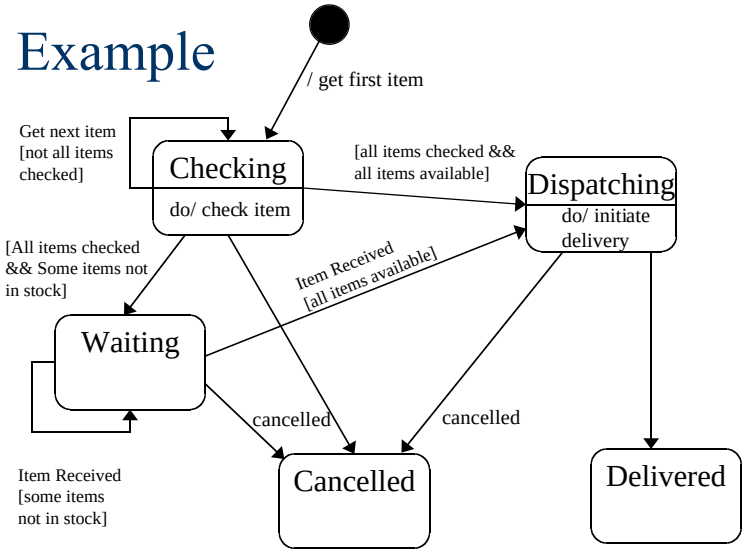
Additional Information

- Transitions are labeled in the following format
  - Event [Guard] / Action
  - Each of these parts are optional
- Examples
  - Graduation [person.isGraduated] / throw mortar board
  - / get first element
  - [object.isValid]

State Diagrams, continued

- A state has an entry action, an activity, and an exit action
- The entry action occurs whenever an object arrives at that state
- The activity then occurs until it is completed or interrupted
- If there is an exit action, then it is executed before a transition is taken

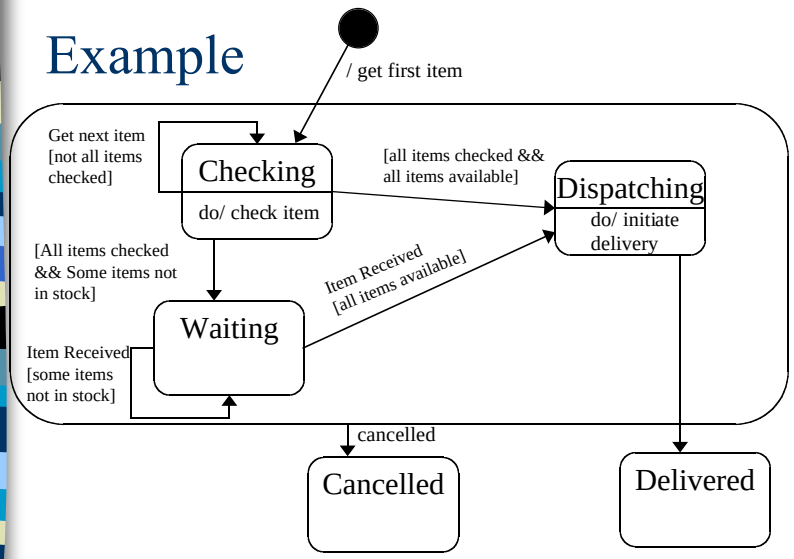
Example



Superstates and Substates

- State diagrams can be nested within other states
- This is a form of abstraction; it allows a designer to logically group related states
- This can also reduce clutter in the diagrams

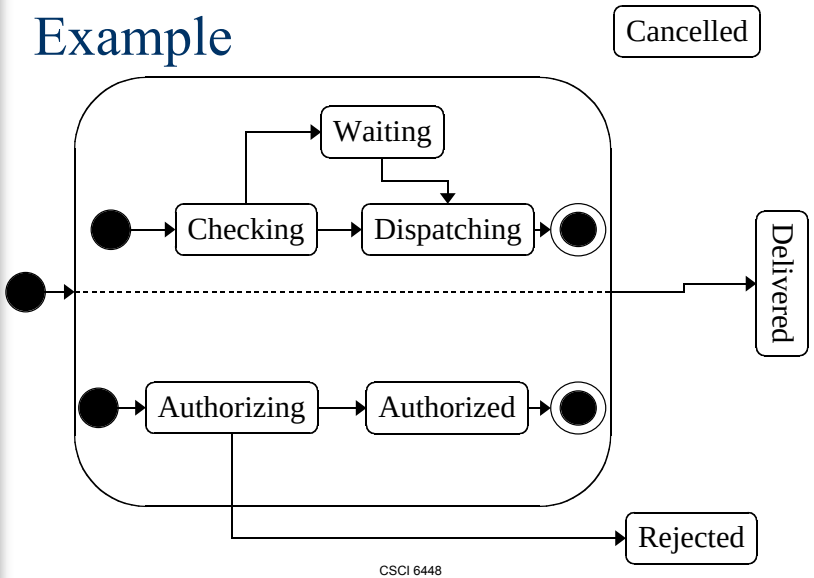
Example



Concurrent State Diagrams

- A concurrent state diagram specifies how an object's orthogonal states relate to one another
- Each thread has its own start and end states
- Both threads execute independently until one of the final states is reached

Example



When to use State Diagrams

- State diagrams are good for describing the behavior of an object across several use cases
  - Or for describing an object's lifecycle
- Do not try to create a state diagram for every class in your system; identify the objects with interesting state behavior and capture their behavior