Object Oriented Analysis and Design with Java

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Advanced state Modelling

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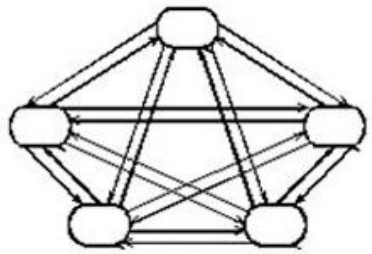
Advanced State Models

- Conventional state diagrams are **sufficient for describing simple systems but need additional power to handle large problems**.

- You can more richly model complex systems by using nest- ed state diagrams, nested states, signal generalization, and concurrency.

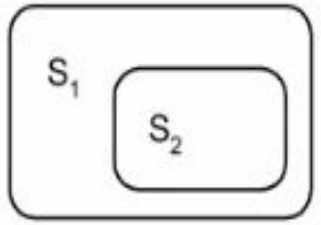
Problems with Flat State Models

- State diagrams have been often criticized because they allegedly are impractical for large problems.
- Unstructured state diagrams
- N independent boolean attributes that affect control. Representing such an object a single flat state diagram would require 2^n States. By partitioning the state into n independent state diagrams, however, only 2n states are required.
- State diagram in Figure in which n^2 transitions are needed to connect every state to every other state. It can be reduced as low as n transitions.

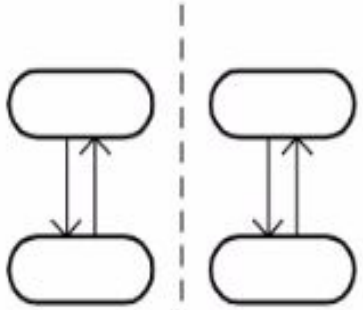


Features of Advanced state Diagram

- Two major features are introduced for controlling complexity and combinatorial explosion in state diagrams
  - **Nested** state diagrams
  - **Concurrent** state diagrams
- Many other features are also added
  - propagated transitions
  - broadcast messages
  - actions on state entry, exit
  - …



Nested State Diagrams



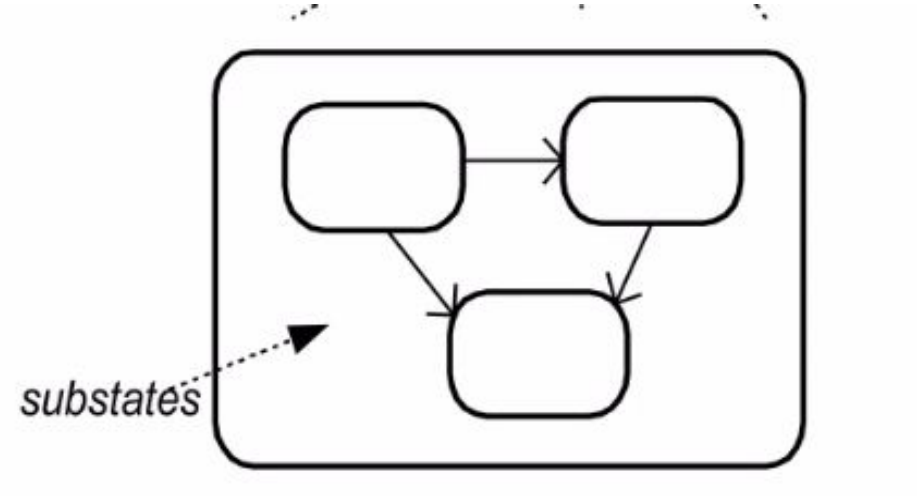
Concurrent State Diagrams

Nested State Diagram

- Activities in states are composite items denoting other lower-level state diagrams
- A lower-level state diagram corresponds to a sequence of lower-level states and events that are invisible in the higher-level diagram.

Super or Substate

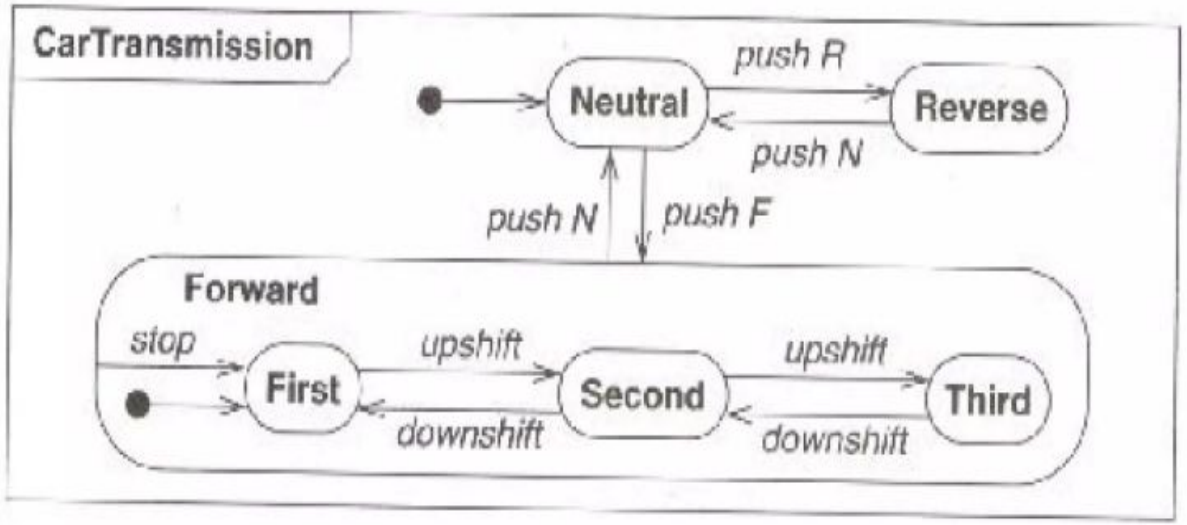
- When one state is complex, you can include substates in it.
  - drawn as nested rounded rectangles within the larger state



Nested state example

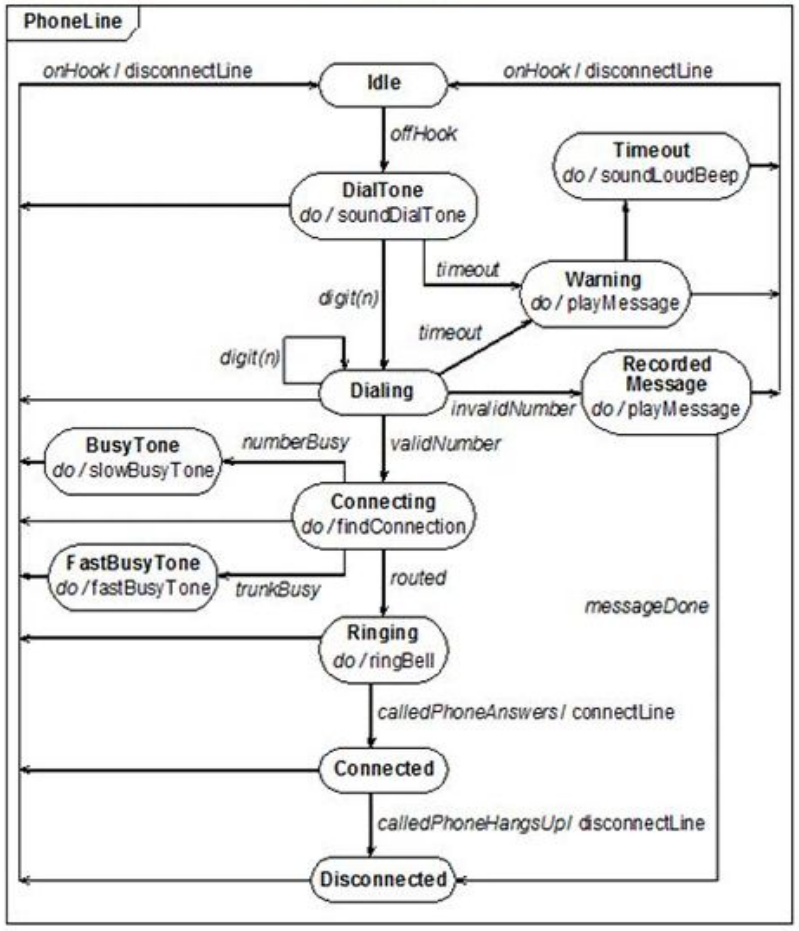
A state may be represented as nested substates.

- In UML, substates are shown by nesting them in a superstate box.
- A substate inherits the transitions of its superstate.

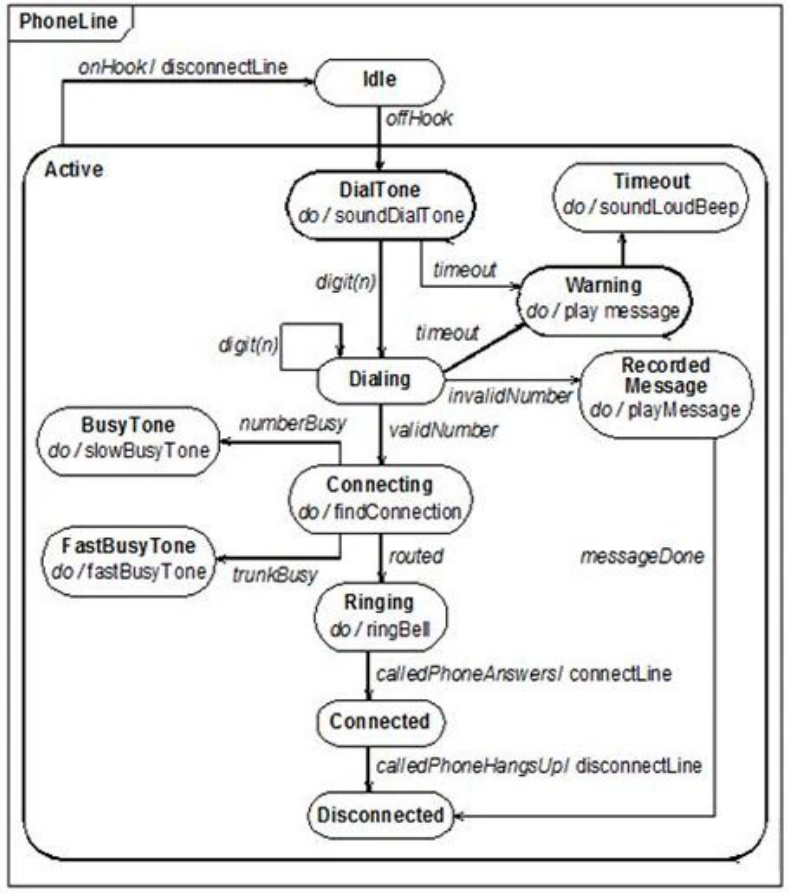


Simple state v/s Nested state

State Diagram for phone line with Activities

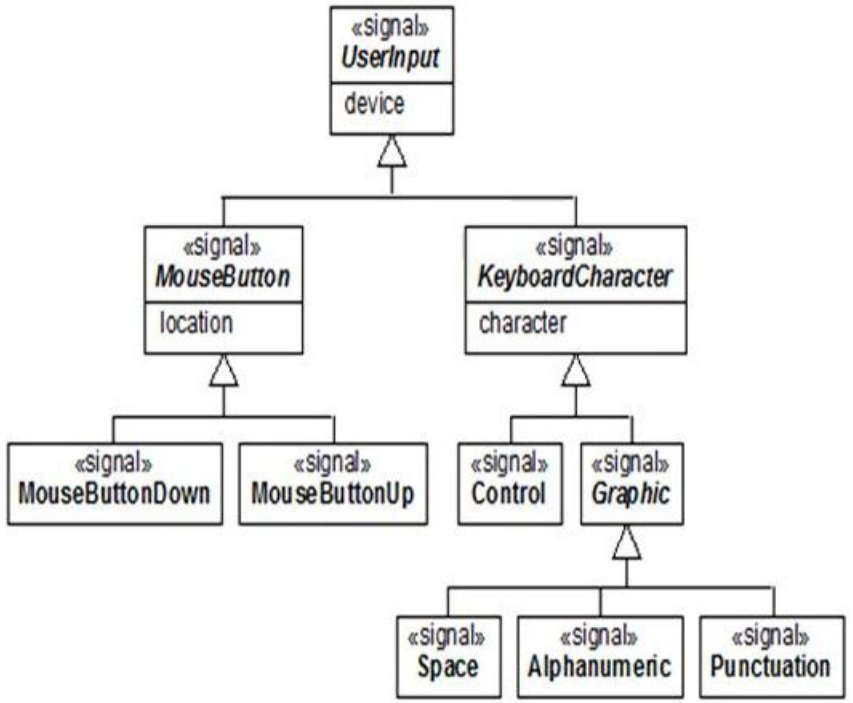


Nested states for a phone line



Signal Concurrency

- Organize signals into a generalization hierarchy with inheritance of signal attributes.



Concurrency

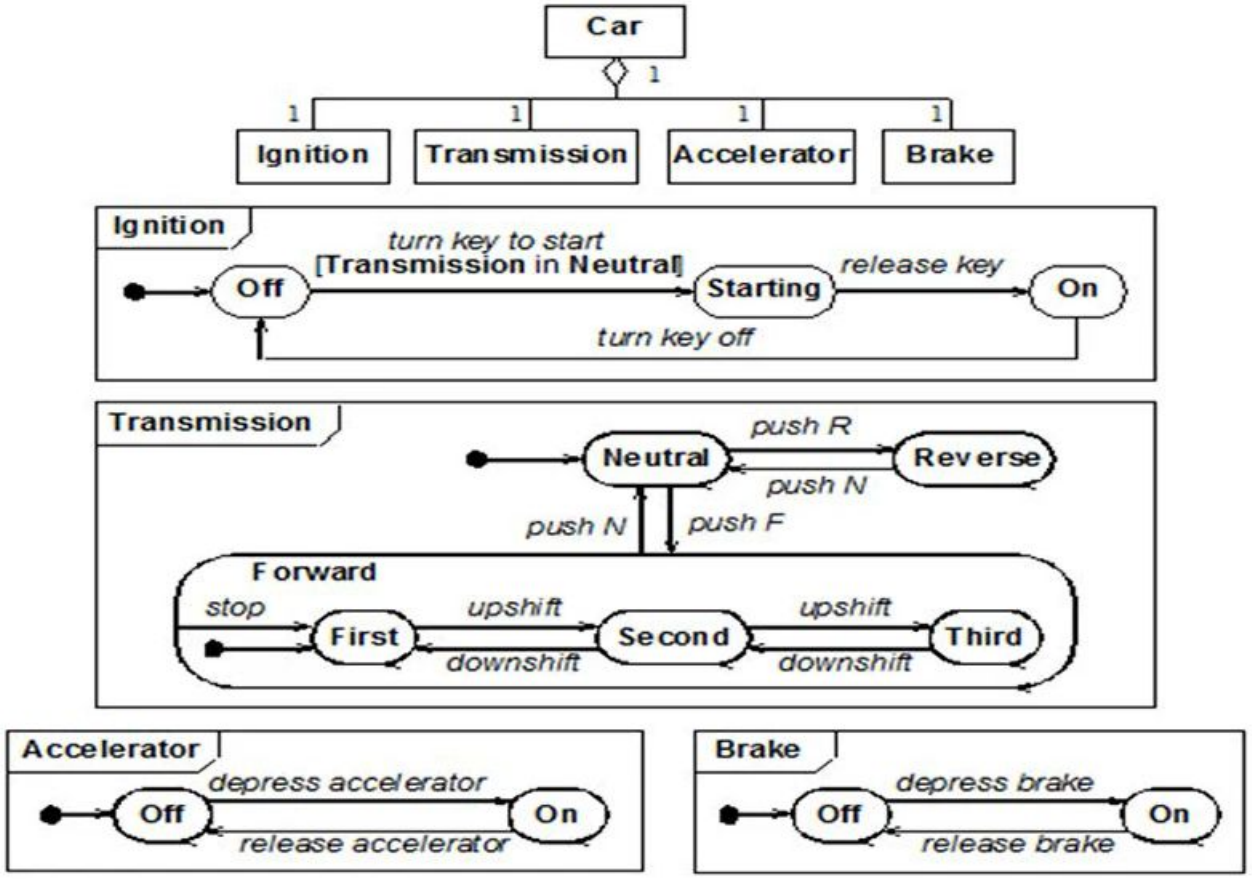
- State Models also Supports concurrency among objects. It supports two types of concurrency-

    1. Aggregation Concurrency
    2. Concurrency within an object

Aggregation Concurrency

- A state diagram for an assembly is a collection of state diagram, one for each part. The aggregate state corresponds to the combined states of all the parts.
- Aggregation is "**and-relationship**".
- Aggregate state is one state from the first diagram, and a state from second diagram and a state from each other diagram. In the more interesting cases, the part states interact.

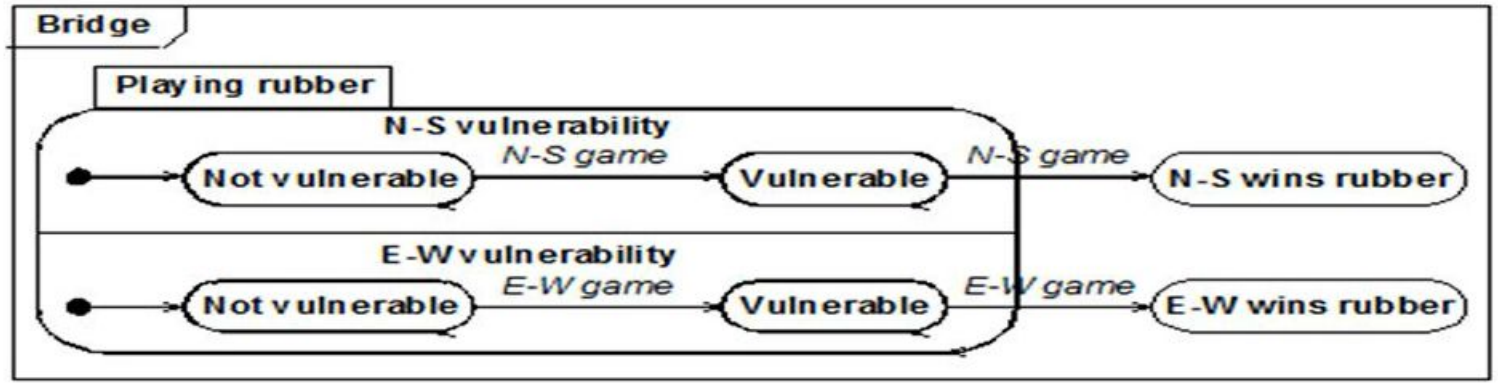
Aggregation Concurrency(Cont'd)



Concurrency within an object

- **The state model implicitly supports concurrency among objects**. In general, objects are autonomous entities that can act and change state independent of one another.

- Objects need not be completely independent and may be subject to shared constraints that cause some correspondence among their state changes.



THANK YOU

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