State Machines V

Contents & Goals

Last Lecture:
• RTC-Rules: Discard, Dispatch, Commence.

This Lecture:
• Educational Objectives:
  - Capabilities for following tasks/questions.
  - What does this State Machine mean? What happens if I inject this event?
  - Can you please model the following behaviour.
  - What is: initial state.
  - What does this hierarchical State Machine mean? What may happen if I inject this event?
  - What is: AND-State, OR-State, pseudo-state, entry/exit/do, final state, ...

Content:
• Step, RTC, Divergence
• Putting It All Together
• Rhapsody Demo
• Hierarchical State Machines Syntax
Divergence

Wesay, object u can diverge on reception cons from (local) configuration σ₀(u) if and only if there is an infinite, consecutive sequence ((σ₀,ε₀), ..., (σ₁,ε₁)) − − − − − − − −→ ((σ₂,ε₂), ..., (σₙ,εₙ)) − − − − − − − −→ . . . such that u doesn't become stable again.

Note: disappearance of object not considered in the definitions. By the current definitions, it's neither divergence nor an RTC-step.

Run-to-Completion Step: Discussion.

What people may dislike on our definition of RTC-step is that it takes a global and non-compositional view. That is:

• In the projection onto a single object we still see the effect of interaction with other objects.
• Adding classes (or even objects) may change the divergence behavior of existing ones.
• Compositional would be: the behavior of a set of objects is determined by the behavior of each object "in isolation". Our semantics and notion of RTC-step doesn't have this (often desired) property.

Can we give (syntactical) criteria such that any global run-to-completion step is an interleaving of local ones? Maybe:

Strict interfaces. (Proof left as exercise...)

• (A): Referto private features only via "self". (Recall that other objects of the same class can modify private attributes.)
• (B): Let objects only communicate by events, i.e. don't let them modify each other's local state via links at all.

Putting It All Together

The Missing Piece: Initial States

Recall: a labeled transition system is (S, →, S₀). We have

• S: system configurations ((σ,ε)) • →: labeled transition relation ((σ,ε)) − − − − − − −→ u(σ',ε')

Wanted: initial states S₀.

Proposal: Require a (finite) set of object diagrams OD as part of a UML model (/BV/BW, /CB/C5, /C7/BW). And set S₀ = {((σ,ε)) | σ ∈ G⁻¹(OD), OD ∈ /C7/BW, ε empty}.

Other Approach: (used by Rhapsody tool) multiplicity of classes. We can read that as an abbreviation for an object diagram.

SemanticsofUMLModel—SoFar

The semantics of the UML model M = (/BV/BW, /CB/C5, /C7/BW) where

• some classes in /BV/BW are stereotyped as 'signal' (standard), some signals and attributes are stereotyped as 'external' (non-standard),
• there is a 1-to-1 relation between classes and state machines,
• /C7/BW is a set of object diagrams over /BV/BW, is the transition system (S, →, S₀) constructed on the previous slide.

The computations of M are the computations of (S, →, S₀).
References


