Gamma Statechart Simulator

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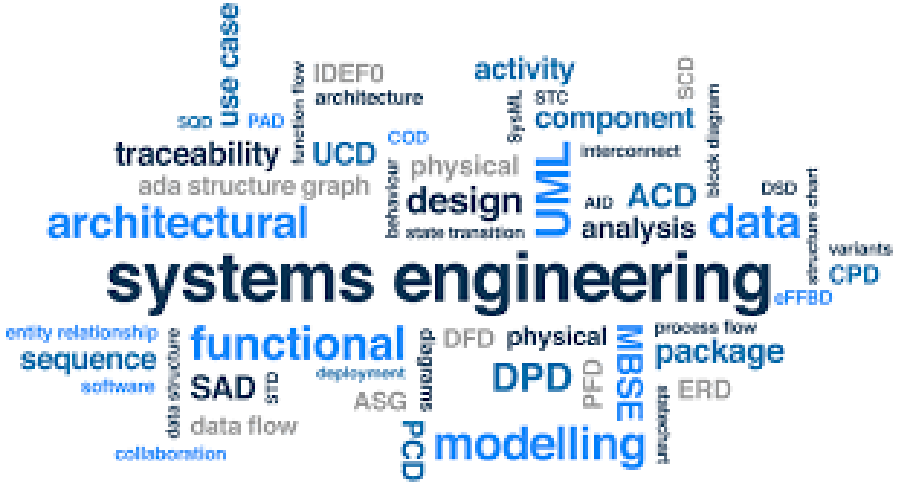
Model based systems engineering

OMG SYSTEMS MODELING LANGUAGE SysML™

MODELICA

RDF

γ



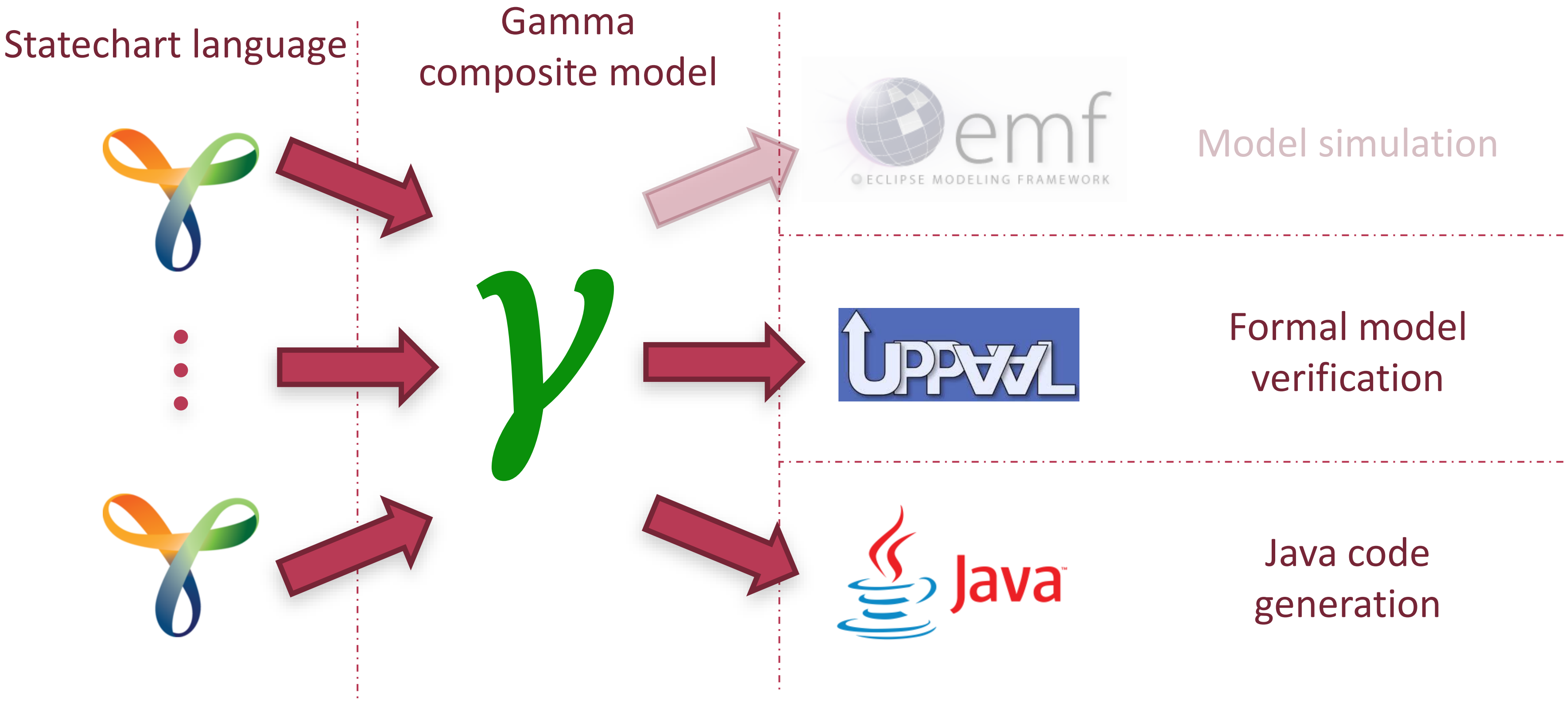
MBSE
TEST
REQUIREMENTS
ANALYSIS
DESIGN
IMPLEMENTATION
INTEGRATION
Business Process Model

theta

VIATRA

UPPAAL

Gamma


Statechart language
Gamma composite model
γ
emf
ECLIPSE MODELING FRAMEWORK
Model simulation
UPPAAL
Formal model verification
Java
Java code generation

Gamma Simulator

Why shall we make a statechart simulator?

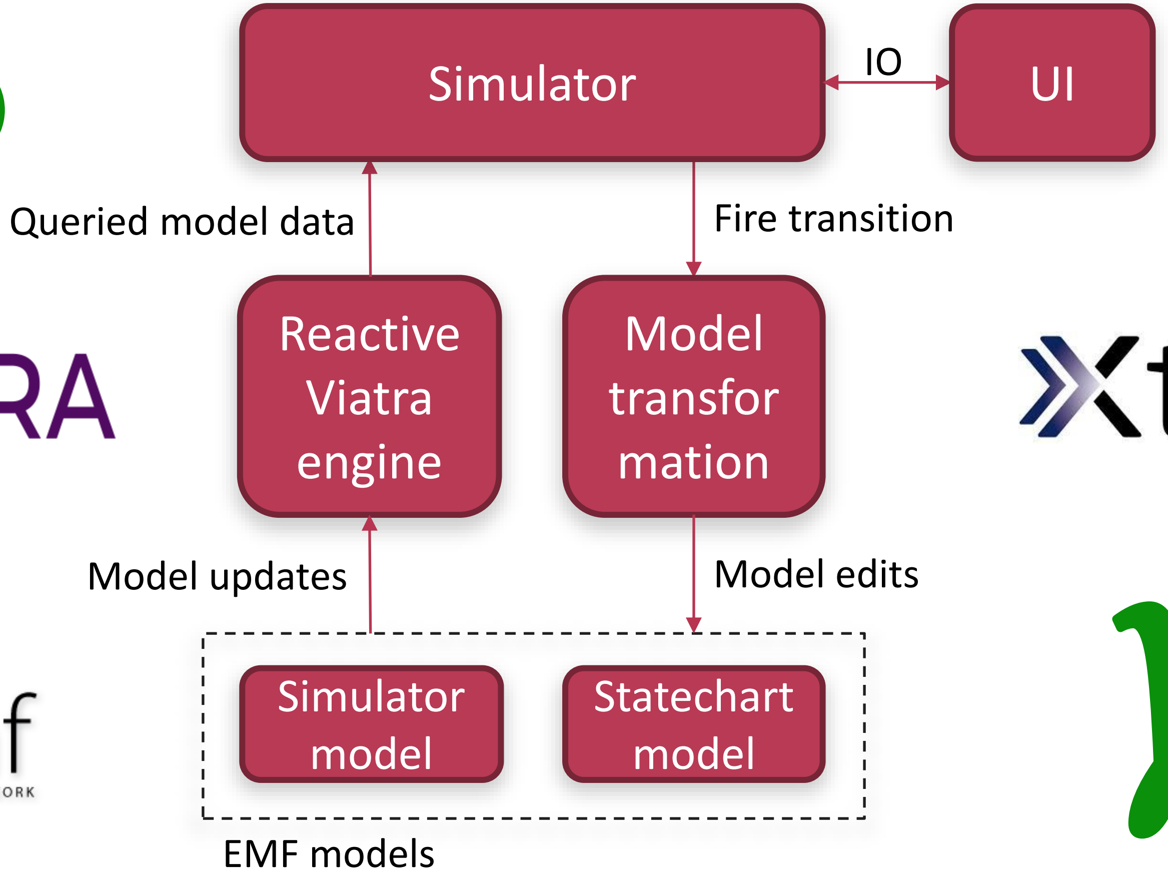
- It helps engineers (visually) test statecharts
- You can raise specific events, and set specific variables
- Edit-test-repeat
- Debug your statechart

EMF Based Gamma Simulator

Why EMF model based?

- Less dependency on the code generator
- The model can be edited during simulation
- Flexible for new features and behaviour change
- (EMF is fun ☺)
- (eclipse not so much ☹)

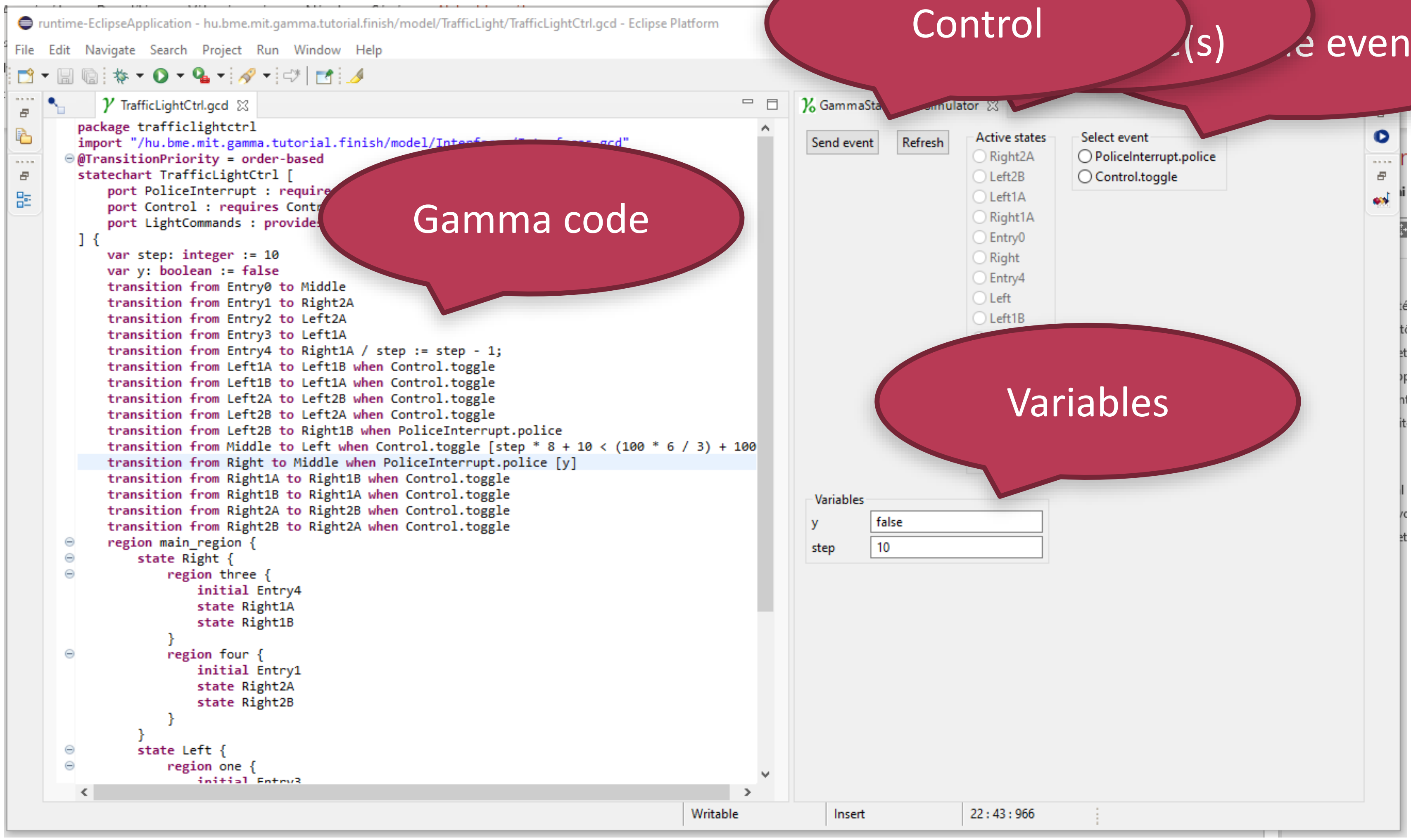
EMF Based Gamma Simulator



Already implemented features

- Simple states
- Top-down order between transitions
- Arbitrarily complex composite states with orthogonal regions
- Cross-region transitions
- Guards using integers and Booleans
- Limited actions (exit, transition, entry) (only var assignment)

Simulator UI



```
package trafficlightctrl
import "/hu.bme.mit.gamma.tutorial.finish/model/Interf
@TransitionPriority = order-based
statechart TrafficLightCtrl [
    port PoliceInterrupt : require
    port Control : requires Contr
    port LightCommands : provide
] {
    var step: integer := 10
    var y: boolean := false
    transition from Entry0 to Middle
    transition from Entry1 to Right2A
    transition from Entry2 to Left2A
    transition from Entry3 to Left1A
    transition from Entry4 to Right1A / step := step - 1;
    transition from Left1A to Left1B when Control.toggle
    transition from Left1B to Left1A when Control.toggle
    transition from Left2A to Left2B when Control.toggle
    transition from Left2B to Left2A when Control.toggle
    transition from Left2B to Right1B when PoliceInterrupt.police
    transition from Middle to Left when Control.toggle [step * 8 + 10 < (100 * 6 / 3) + 100
    transition from Right to Middle when PoliceInterrupt.police [y]
    transition from Right1A to Right1B when Control.toggle
    transition from Right1B to Right1A when Control.toggle
    transition from Right2A to Right2B when Control.toggle
    transition from Right2B to Right2A when Control.toggle
    region main_region {
        state Right {
            region three {
                initial Entry4
                state Right1A
                state Right1B
            }
            region four {
                initial Entry1
                state Right2A
                state Right2B
            }
        }
        state Left {
            region one {
                initial Entry3
```

Active states
○ Right2A
○ Left2B
○ Left1A
○ Right1A
○ Entry0
○ Right
○ Entry4
○ Left
○ Left1B

Select event
○ PoliceInterrupt.police
○ Control.toggle

Variables

y	false
step	10

Control

ly

(s)

e events

Gamma code

Variables

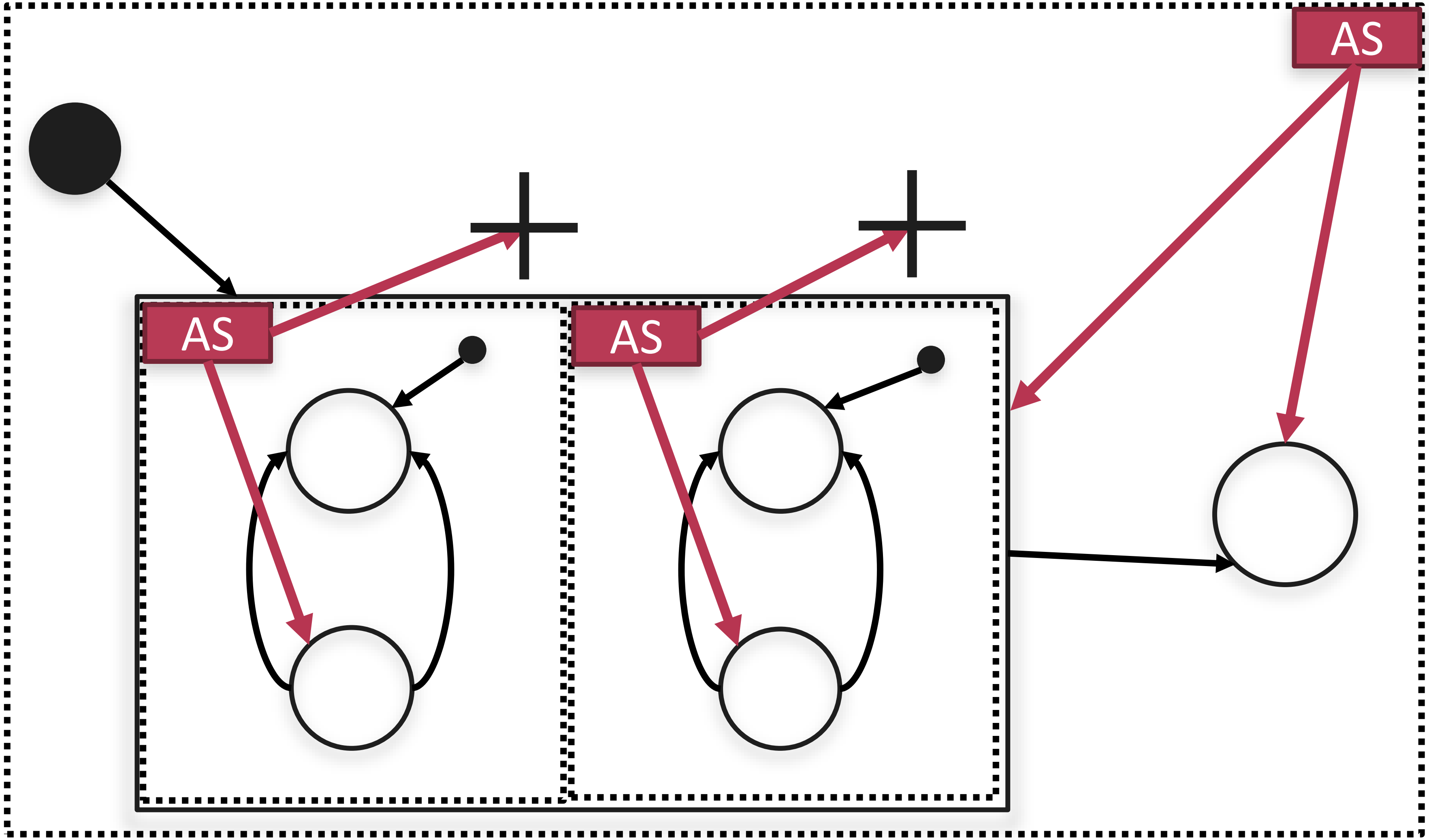
Under the hood

Some non-trivial questions (and quick answers)

- How to store active states?

Under the hood

- AS for every region
- AS has a reference to the active state
- Changes upon transition
- Prevents multiple active states in a region



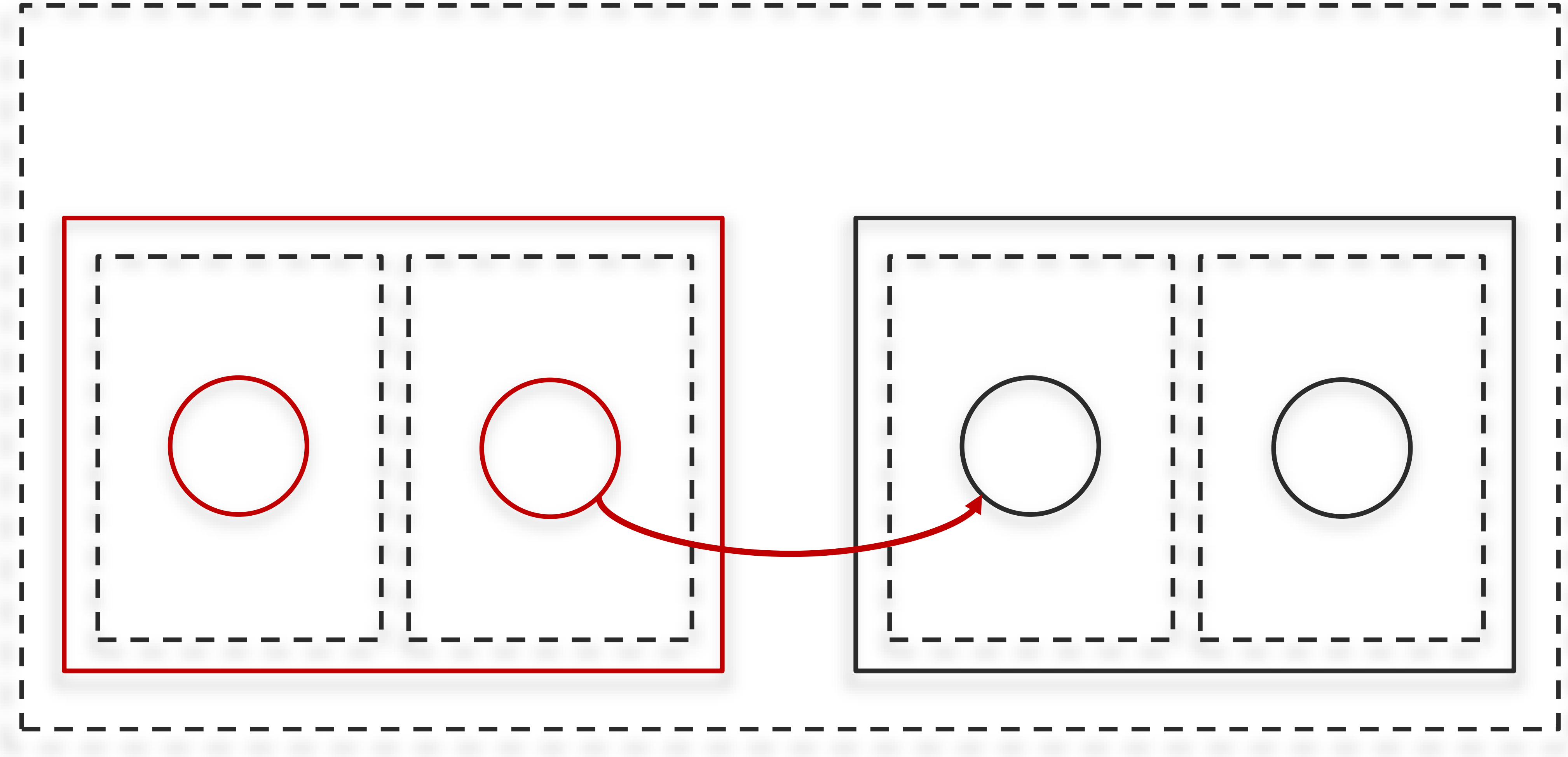
Under the hood

Some non-trivial questions (and quick answers)

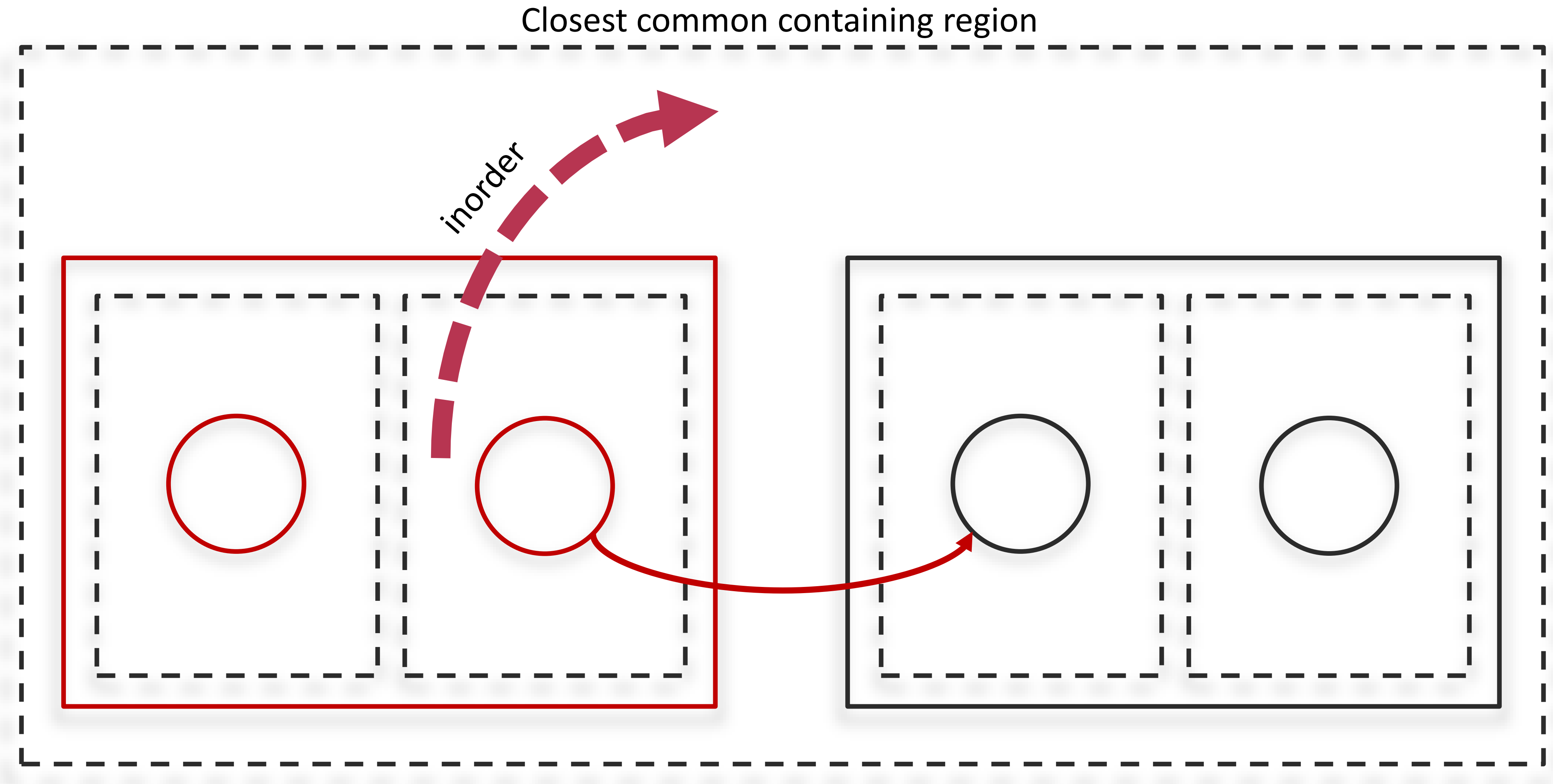
- How to store active states?
- How to execute non-trivial transitions?

Under the hood

Closest common containing region

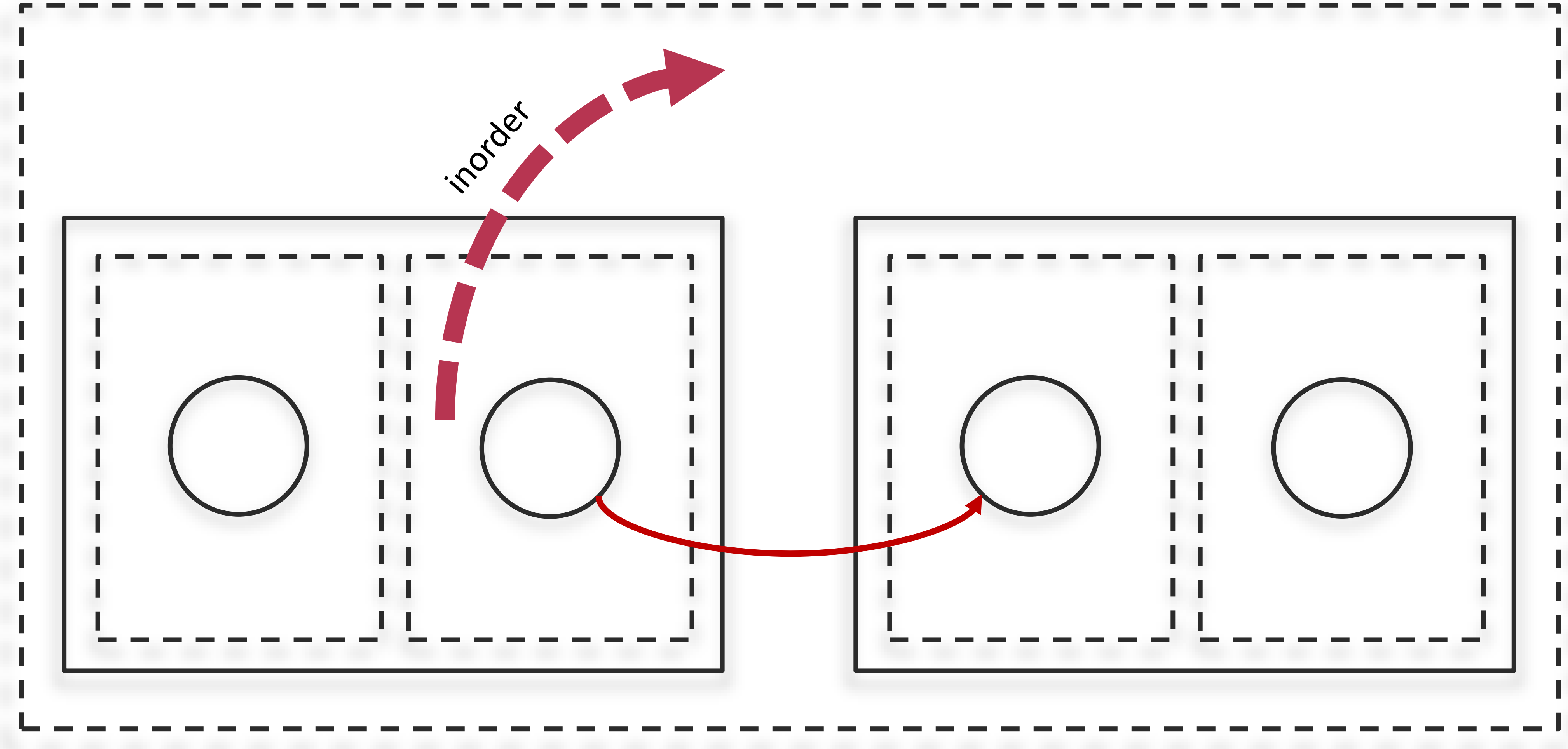


Under the hood

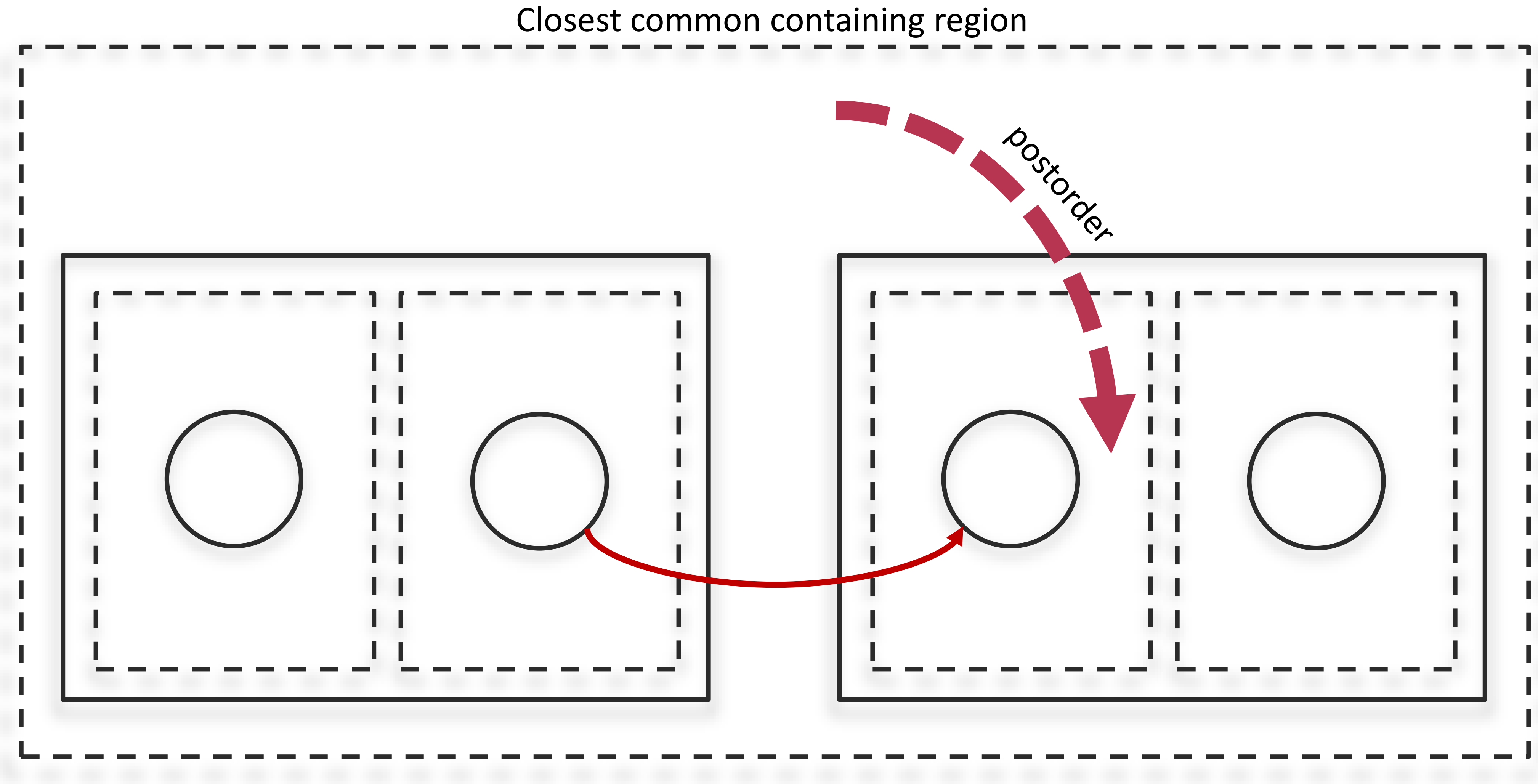


Under the hood

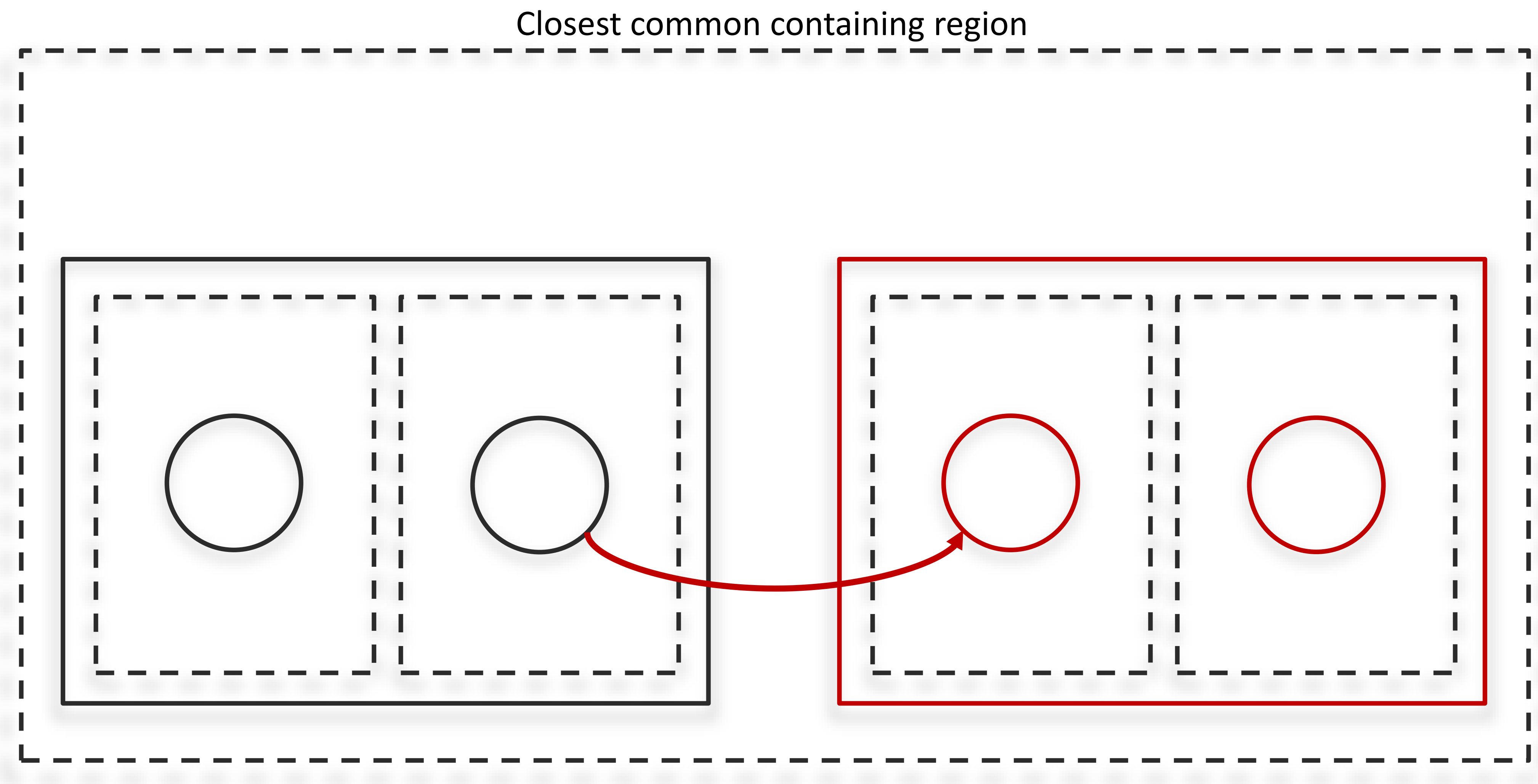
Closest common containing region



Under the hood



Under the hood



Future work

- Support all state types
- Full support for the action language
- Respect Transition Priority and Orthogonal region settings
- Time based triggers
- Break points and debug support
- Switch from Xtend to Kotlin
- Extend PlantUML visualization with active states
- Composite statechart system simulation

Questions

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