# A Platform Independent Framework for Statecharts Code Generation

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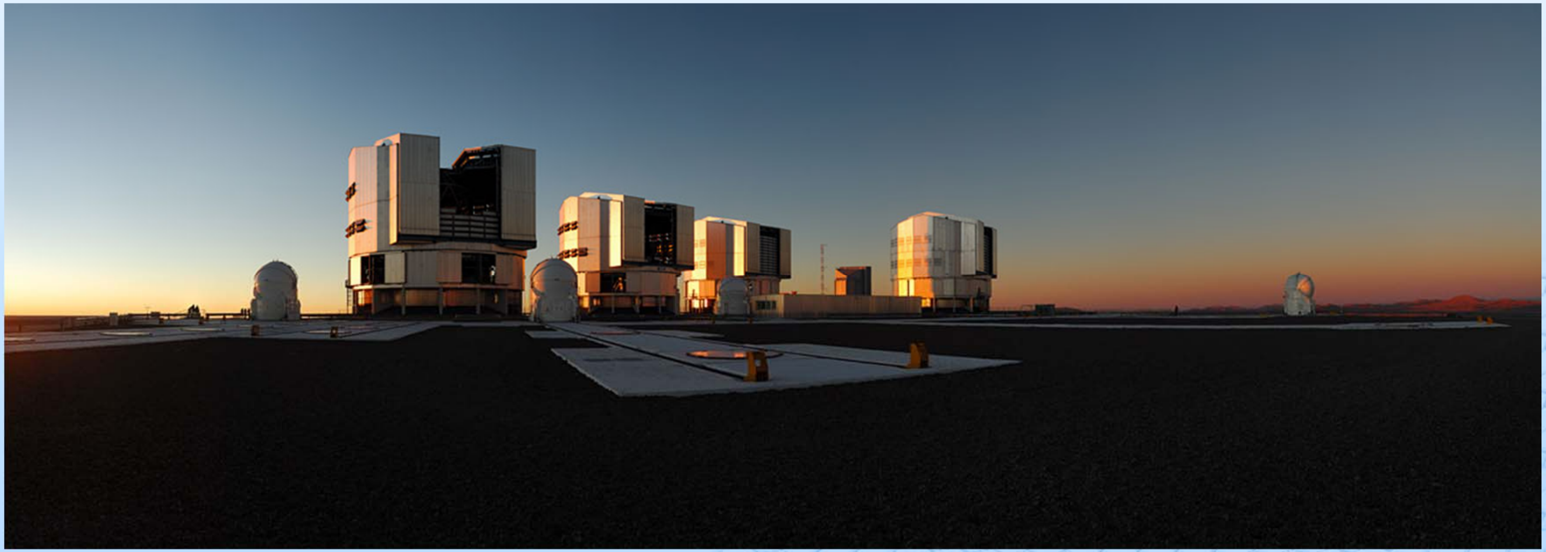
# Outline

- Motivations
  - Application Frameworks
  - Model Driven SW Development
- Architectural Concepts
  - Statecharts Semantic and the SCXML Standard
  - UML-to-SCXML Mapping
  - COMODO Profile for UML
  - Cross Platform Model2Text Transformations
- Future Plans

# Statecharts for the Very Large Telescope (VLT)

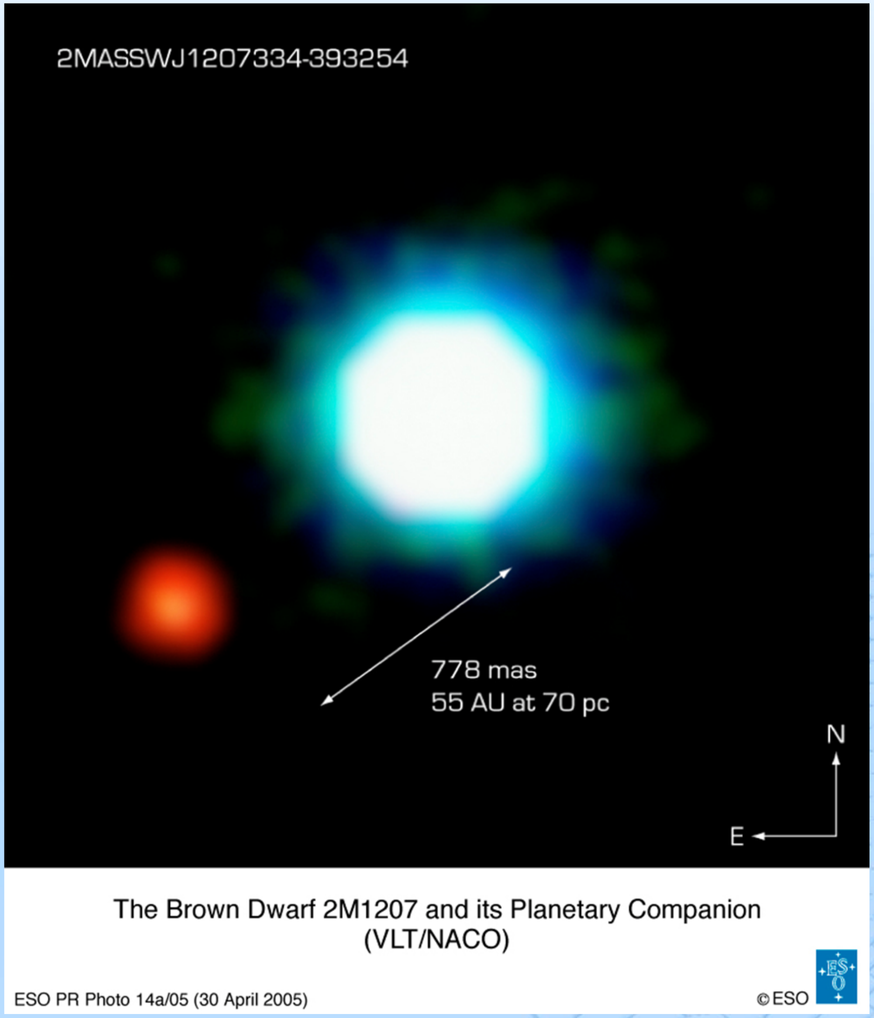


- VLT SW Platform: Linux, GNU C/C++, TCL/TK, CCS
- Workstation Software Framework: framework  for the development of control/monitor applications from Statecharts models (more than 30 applications)

# Statecharts for Alma Common Software (ACS)

- ACS SW Platform: Linux, C/C++, Java, Python, CORBA
- Code Generator tool to generate the MasterComponent application from a Statecharts model

# Statecharts for Adaptive Optics



The Brown Dwarf 2M1207 and its Planetary Companion (VLT/NACO)

ESO PR Photo 14a/05 (30 April 2005)

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- SPA SW Platform: Linux, C/C++, CORBA, DDS
- Application framework to build Statecharts based application (+ behavioural inheritance feature).

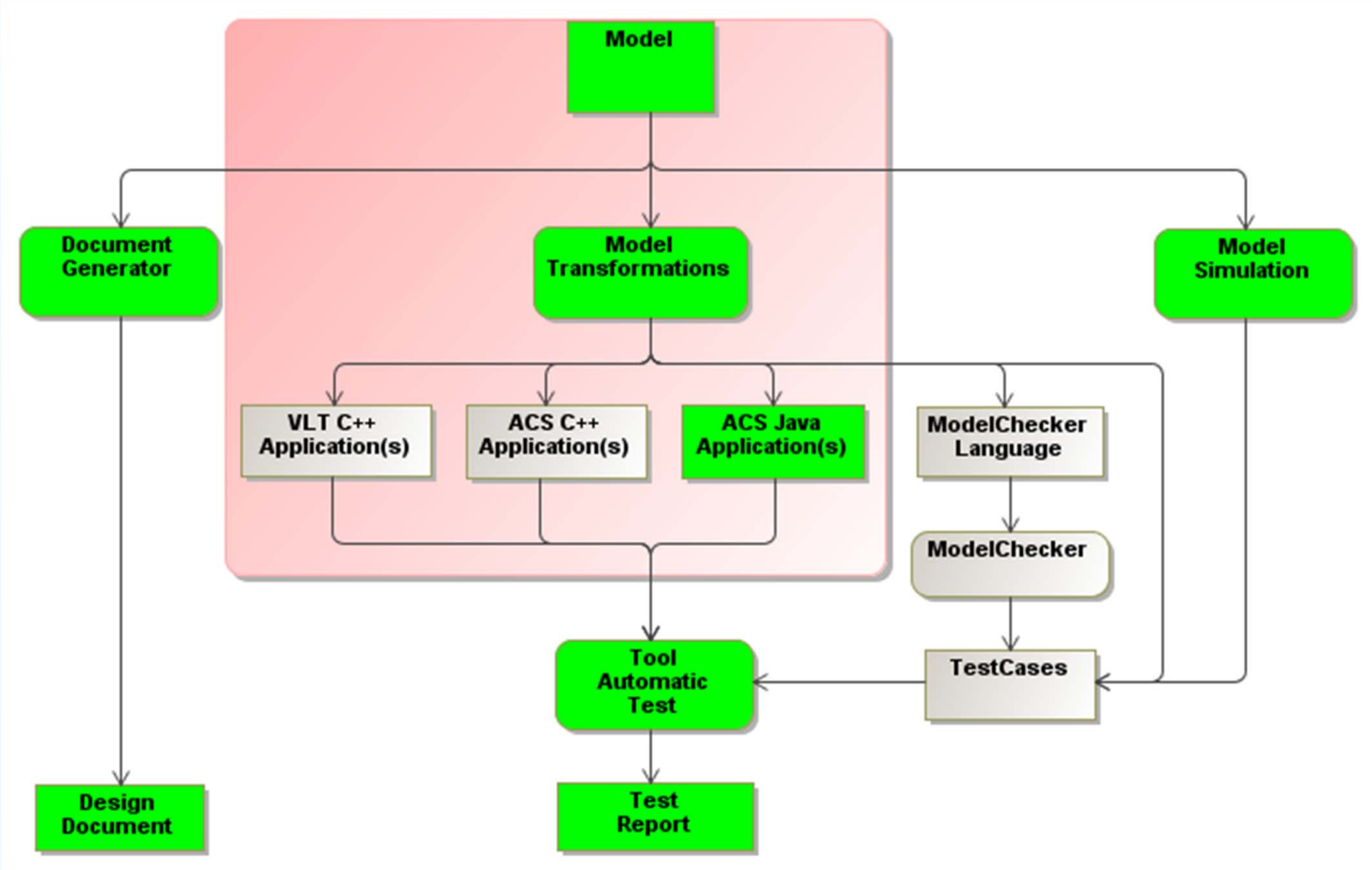
# Application Frameworks

- Concentrate on Domain Specific concepts
- Reuse and document of Domain Specific know-how

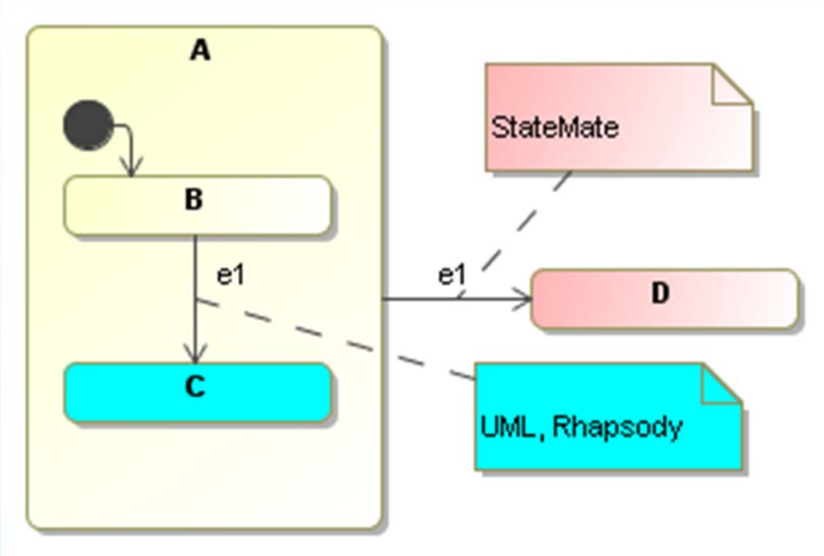
↓

- Independence of platforms and languages
- Reuse the models on different platforms:
  - Easier to migrate applications
  - Prototyping applications for future platforms

# Model Driven SW Development



# W3C SCXML Standard

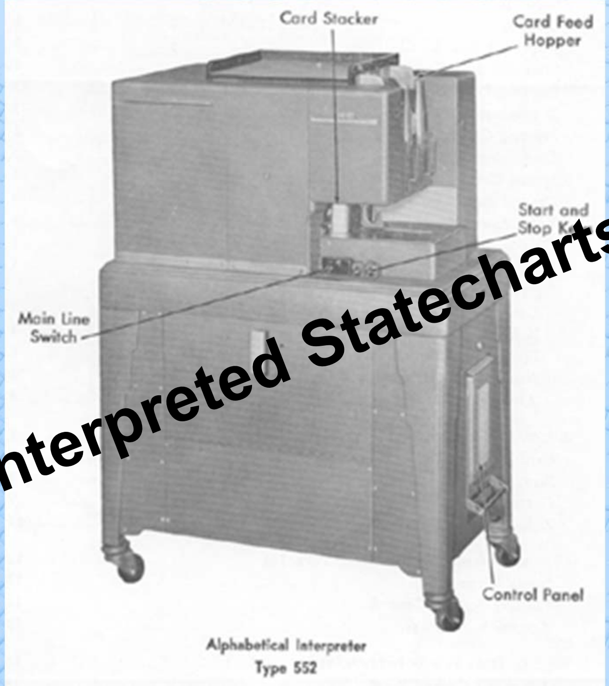


Crane & Dingel paper on differences between Statecharts syntax & semantics: “Not all models are created equal”

**State Chart XML**

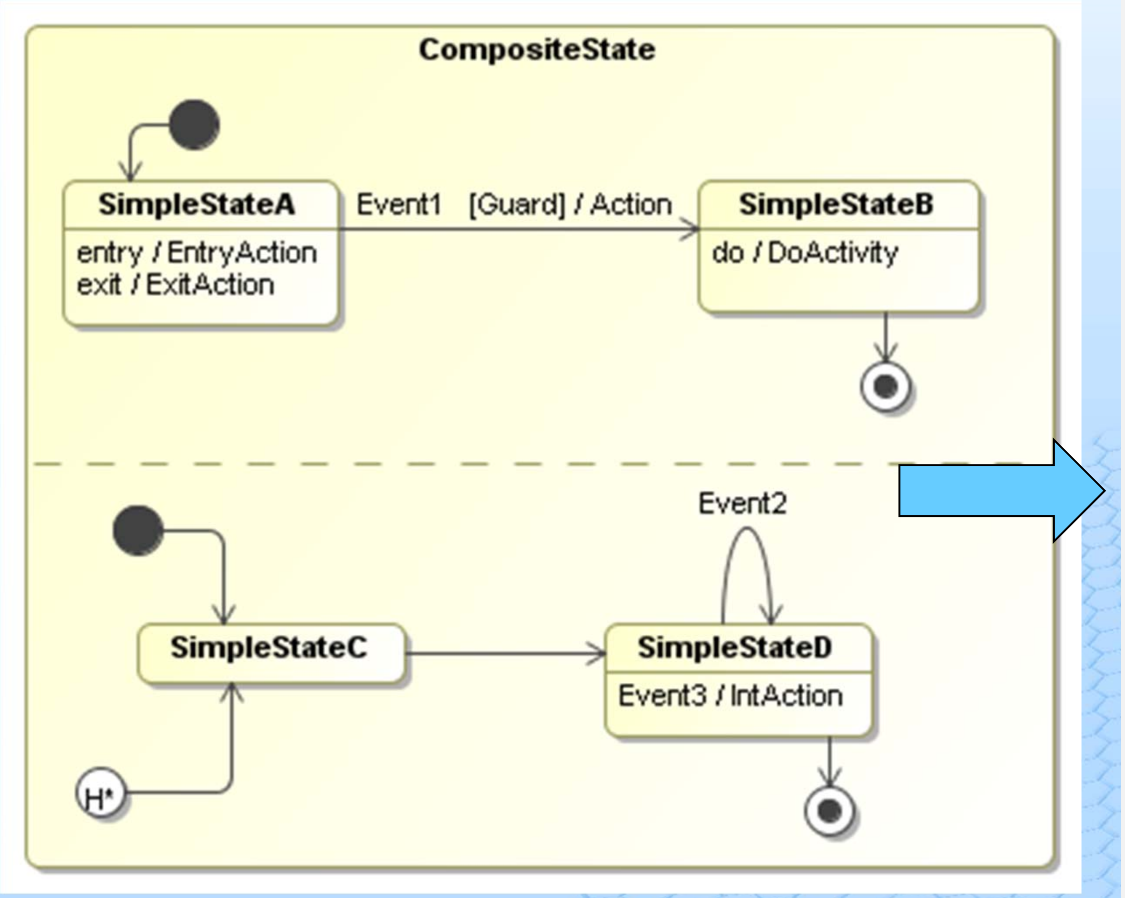
**Supported by IBM, HP, Microsoft, Nokia**

```
<state id=“A" initial=“B">
   <state id=“B">
      <transition event="e1" target=“C“/>
   </state>
   <state id=“C">
   </state>
   <transition event="e1" target=“D“/>
</state>

 <state id=“D">
 </state>
```



**Interpreted Statecharts**

# UML2SCXML Mapping



<state> id="" initial="" </state>

<parallel> </parallel>

<transition> event="" guard="" target=""
</transition>

<initial> </initial>

<final> </final>

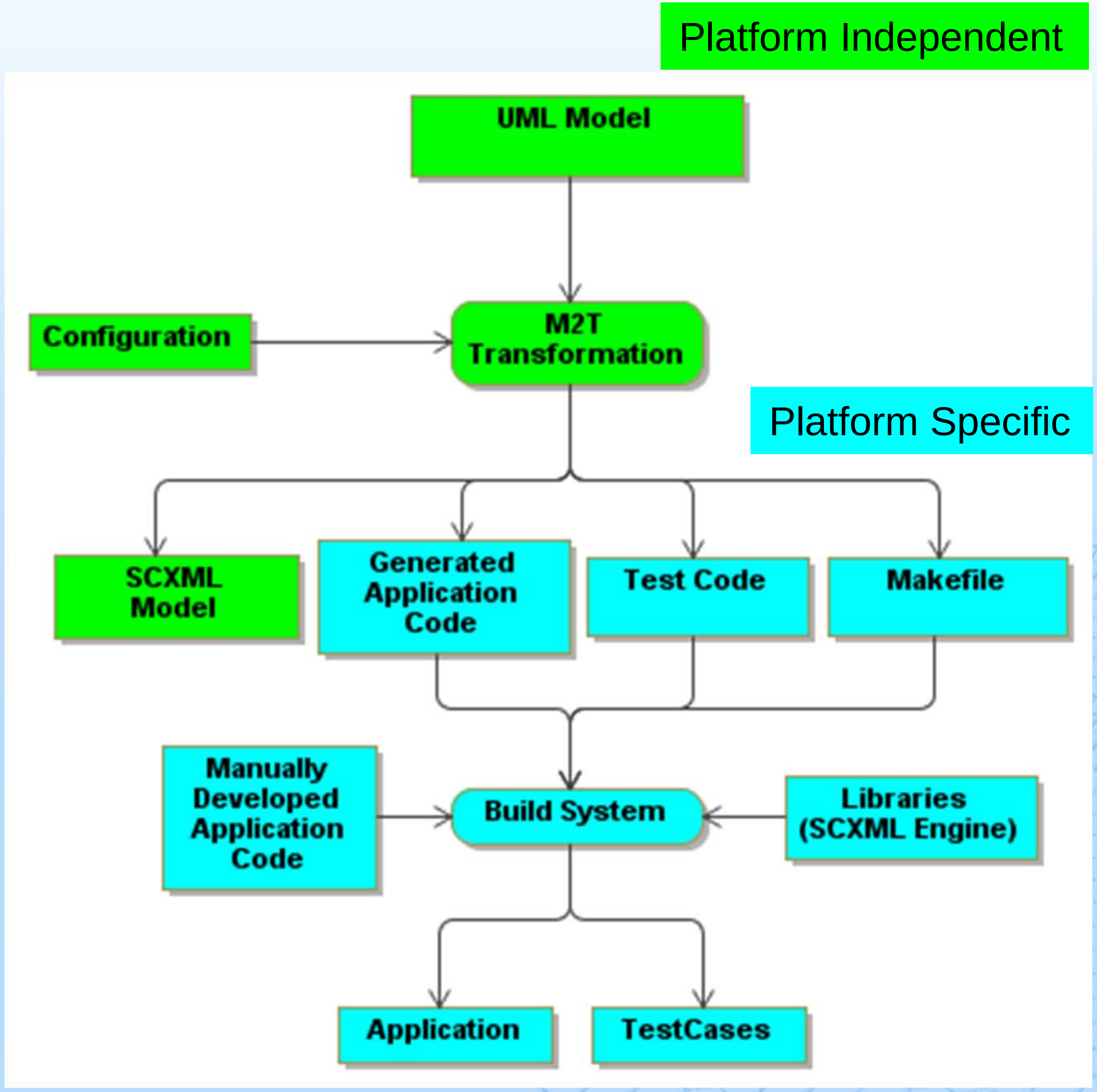
<history> type="deep|shallow" </history>

<onentry> </onentry>

<onexit> </onexit>

<invoke> </invoke>

# The Data Flow



Platform Independent

Platform Specific

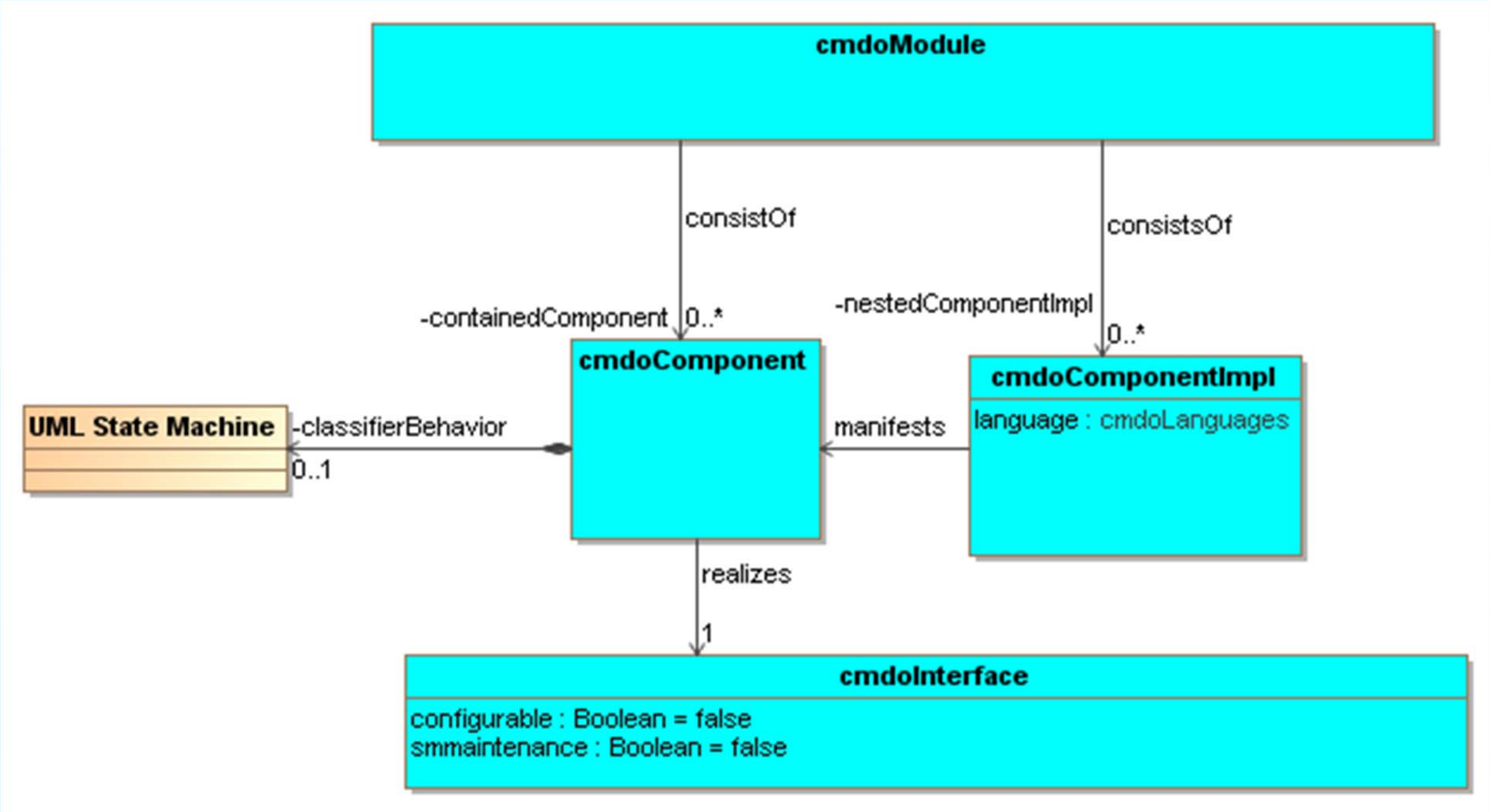
COMODO Profile and MetaModel

Cross Platform M2T Transformation (EMF + Xpand)

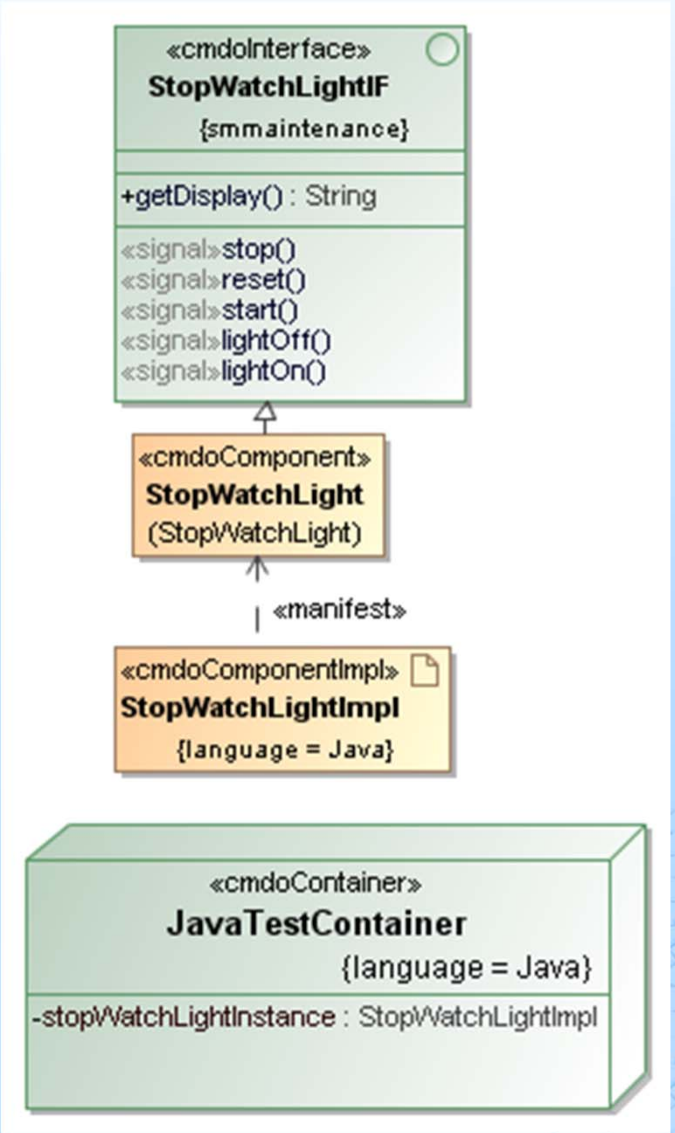
Clear separation between generated and manually developed code

Generated Application uses SCXML Model and SCXML Engine library

# COMODO Profile for UML



# StopWatch Example



«cmdoInterface»
StopWatchLightIF
{smmaintenance}

+getDisplay() : String

«signal»stop()
«signal»reset()
«signal»start()
«signal»lightOff()
«signal»lightOn()

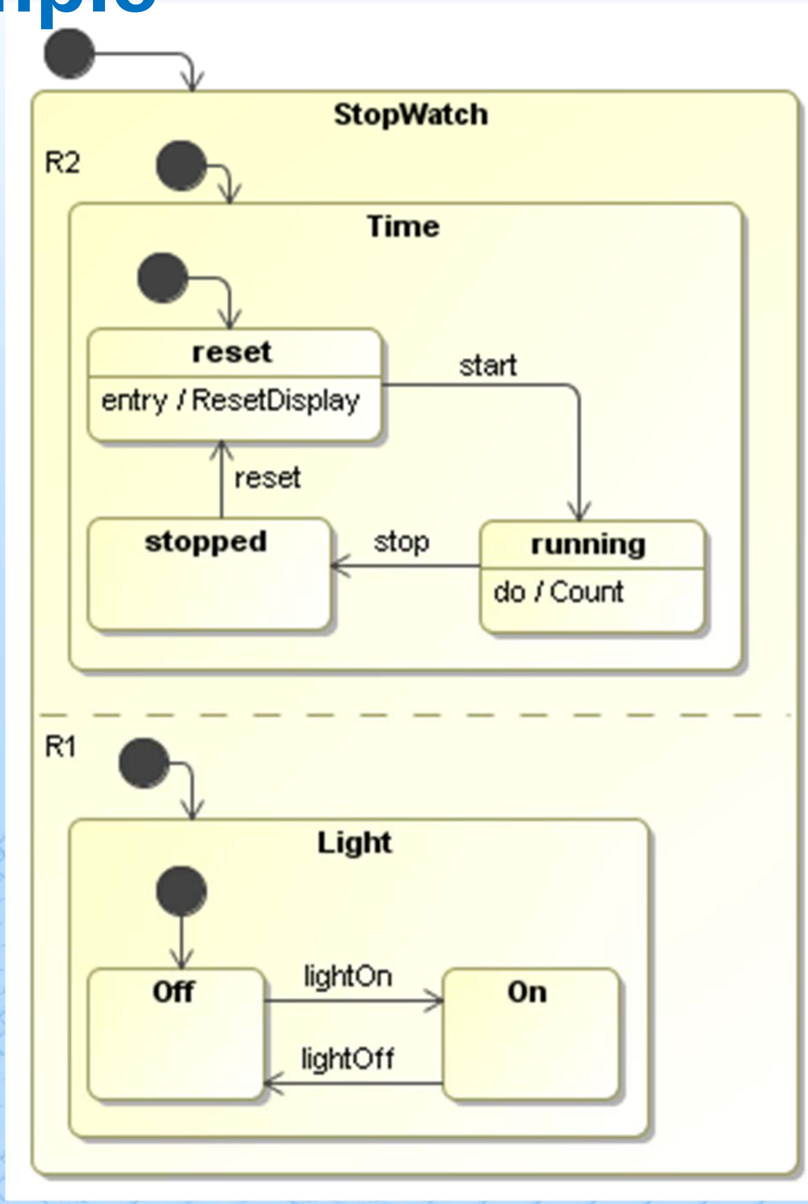
«cmdoComponent»
StopWatchLight
(StopWatchLight)

«manifest»

«cmdoComponentImpl»
StopWatchLightImpl
{language = Java}

«cmdoContainer»
JavaTestContainer
{language = Java}

-stopWatchLightInstance : StopWatchLightImpl



StopWatch

R2

Time

reset
entry / ResetDisplay

start

reset

stopped

stop

running
do / Count

R1

Light

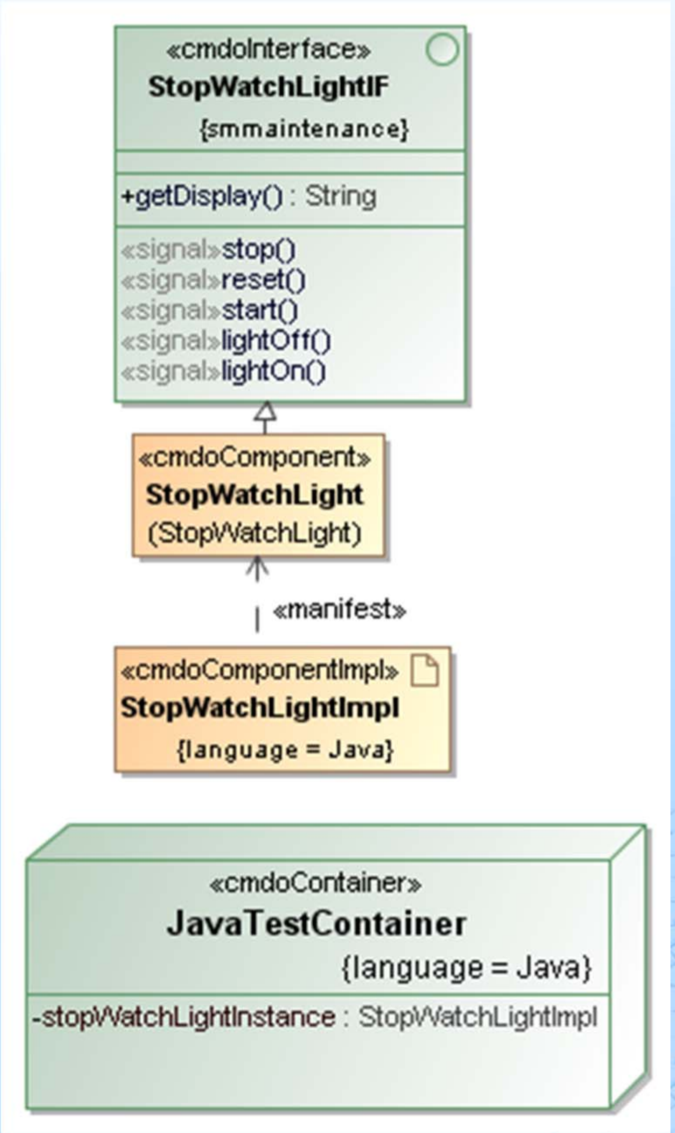
Off

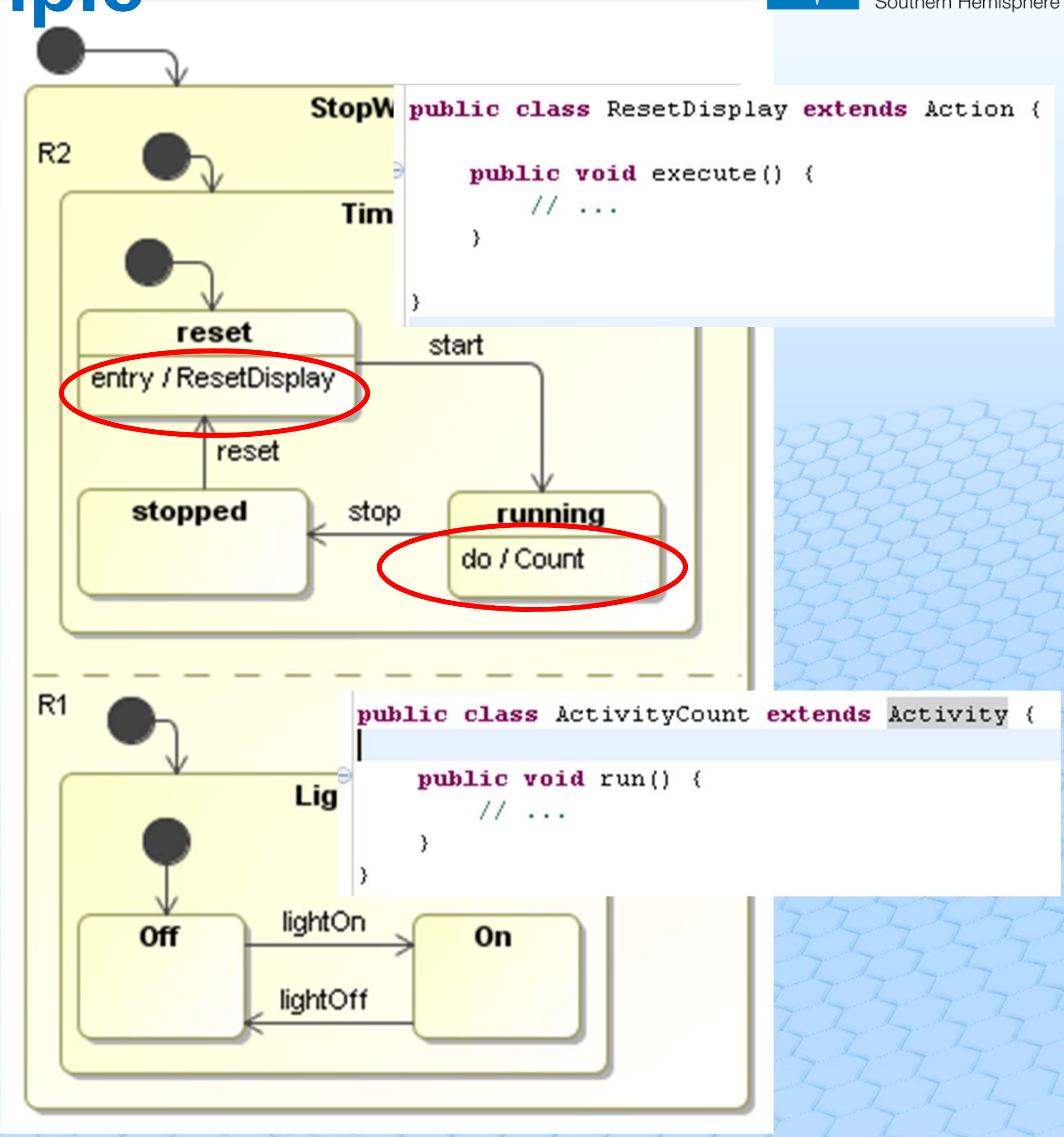
lightOn

On

lightOff

# StopWatch Example



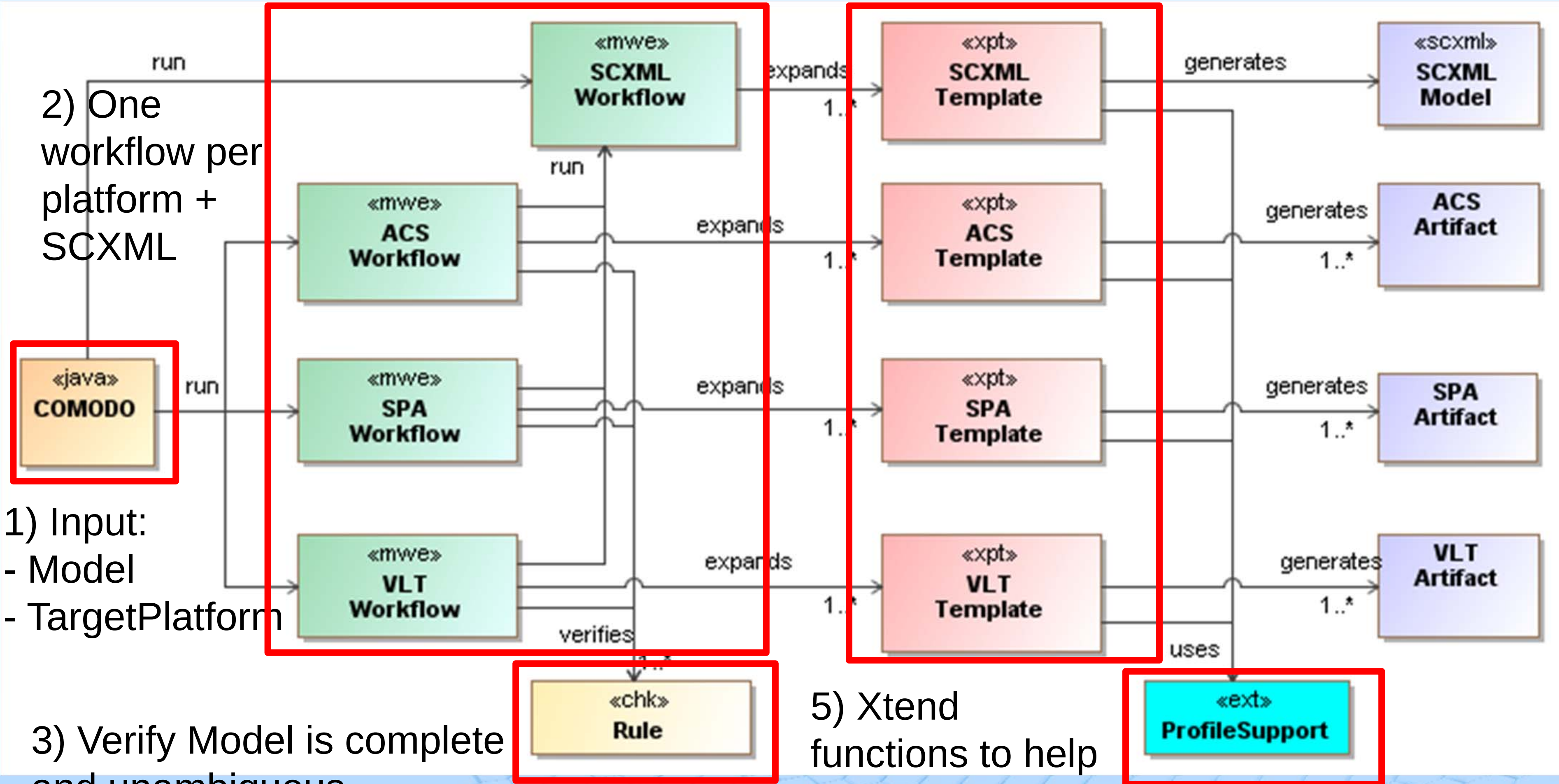


```
public class ResetDisplay extends Action {

    public void execute() {
        // ...
    }

}
```

```
public class ActivityCount extends Activity {

    public void run() {
        // ...
    }
}
```

# Cross Platform Model2Text Transformations

4) Xpand Templates generates the artifacts using Xtend functions



2) One workflow per platform + SCXML

1) Input:
- Model
- TargetPlatform

3) Verify Model is complete and unambiguous

5) Xtend functions to help navigating the model

# Future plans

- Development of the C++ SCXML Engine
- Additional Model2Text transformations
  - ESO supported platforms/languages
  - ModelChecker language (Promela/SPIN)

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