

# Advances in UML Model Execution

The screenshot displays a software development environment with a debug window and a state machine diagram. The debug window shows a thread [Thread-0] suspended at a breakpoint at line 16 in XMachine1.txtuml. The state machine diagram shows a state transition from an initial state to an 'Off' state, which then transitions to an 'On' state. The 'Off' state is highlighted in green, indicating it is the current state.

```
9 model XMachine1 {
10
11     class Machine {
12         initial Init;
13
14         state Off {
15             entry {
16                 log("\tMachine enters sta
17             }
18
```

hu.elte.txtuml.examples.machine.XMachine1...

ButtonPress/Activity: SwitchOn\_effect

Init

/Activity: Initialize\_effect

On

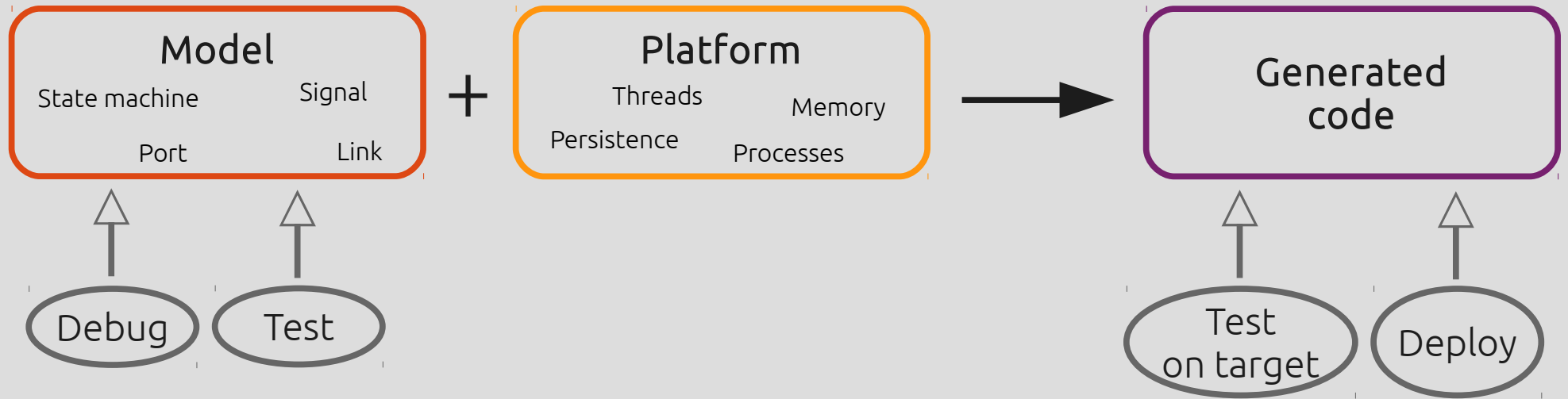
Off

Ericsson Modeling Days  
Nov 16, 2015

Gergely Dévai  
ELTE-Soft Ltd.



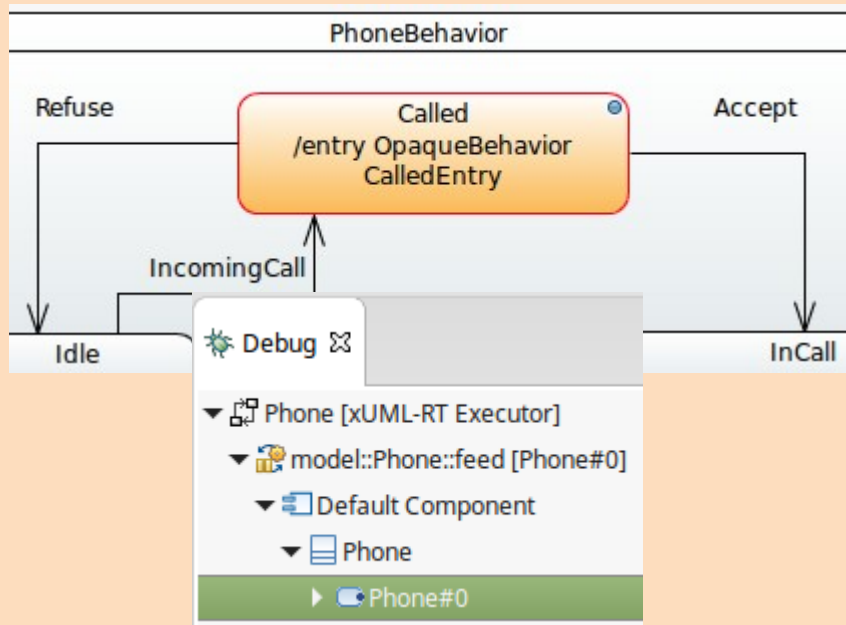
# Executable Modeling Vision



- Early verification
- Avoid model - code divergence
- Separation of business logic and platform-specifics
- Predictable code quality

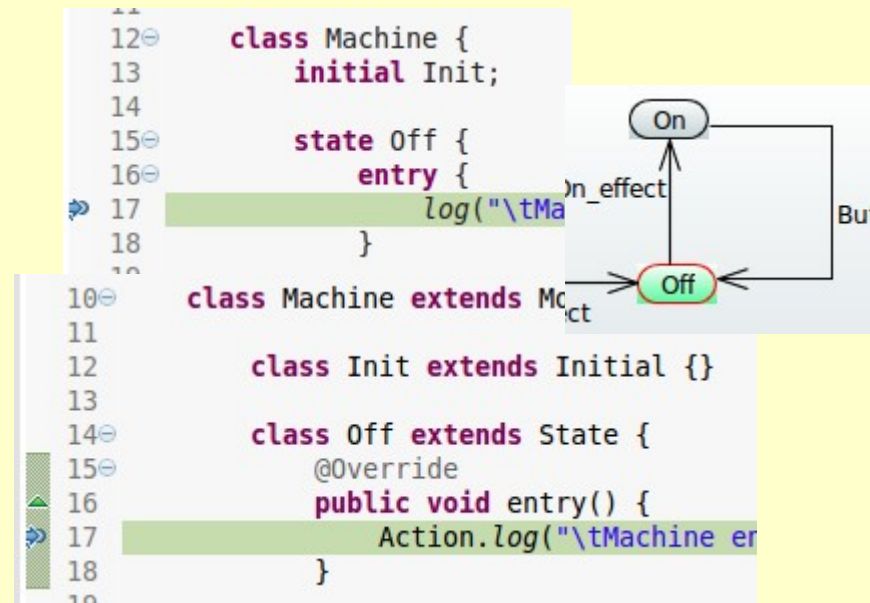
# Two Approaches

## Model execution via code generation



xUML-RT Model Executor

## Text-based model execution



txtUML Framework

# Model Execution via Code Generation

xUML-RT Model Executor

# xUML-RT Model Executor

## Project Background

### xUML-RT Language

- UML-RT + xtUML
- UML-based
- to-be-standardized

### Papyrus

- Model editor
- Customization
- Animation utilities

### Model Executor

- Debugging, animation
- Automated testing
- CI support

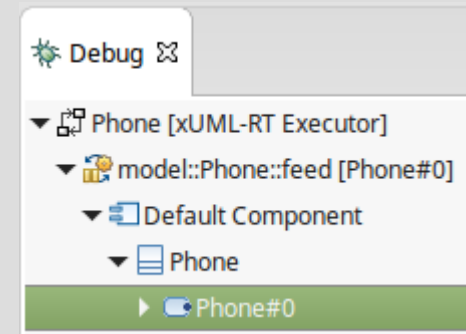
### Model Compiler

- C++
- Action code parser and analyzer

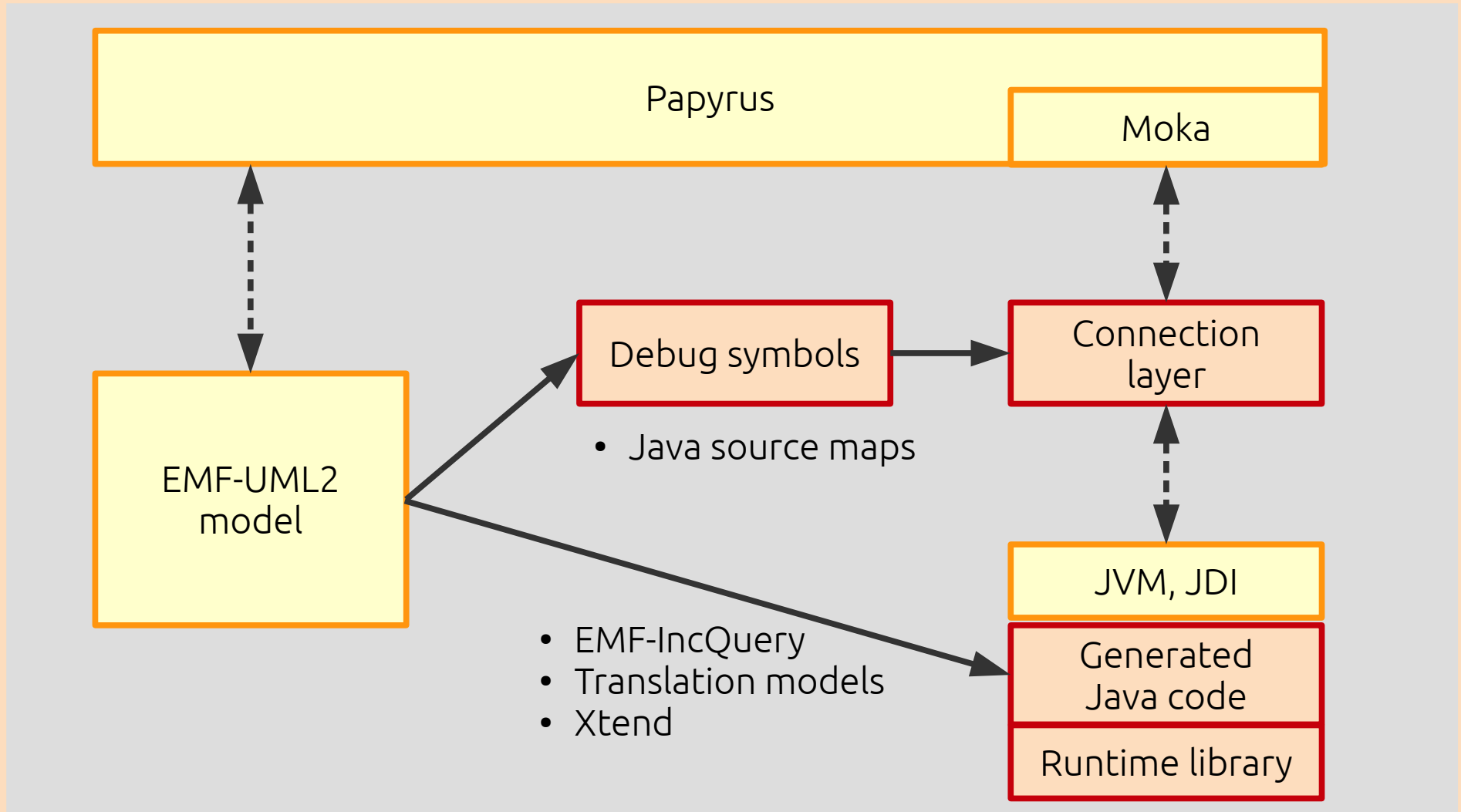
# xUML-RT Model Executor

## Goals

- Interactive model execution and debugging
  - Breakpoints in action code and on diagrams
  - Debug controls
  - Animation of state machines
  - View instances and their properties
- Mass test execution on model level
  - Runtime performance is important
  - Randomization of non-deterministic choices
  - Log-replay functionality
- Support for class and capsule modeling



# Model Execution via Code Generation



# xUML-RT Model Executor

## Demo



## xUML-RT Model Executor

# Lessons Learned

- The code generation approach works
  - Provides good performance for testing
  - Debugging and animation is possible
- Tricky parts:
  - UI programming
  - Integration of technologies
- Being part of a work-in-progress tool-chain...
  - Customized editor, Model refactoring, Search
  - Compare & merge, Model review etc.

# Text-based Model Execution

## txtUML Framework

# Motivation

- Text input is faster than graphical for many users
- Tooling for edit, search, review, compare&merge is easier for textual languages
- Tooling for mainstream languages, like Java, is mature
- Idea: *Implement the executable UML abstractions in text and reuse tooling*
- txtUML: **t**extual, **e**xecutable, **t**ranslatable **UML**

{txtUML}

textual, executable, translatable

# txtUML Framework

## Features

- Two text front-ends:

- Custom syntax
- Java API

```
class Machine {
    initial Init;

    state Off {
        entry {
            log("\tMac
        }
    }
}
```

- Validation of modeling rules

- Debugging,  
breakpoint support

- Papyrus diagram generation

- Animation of  
generated state machines

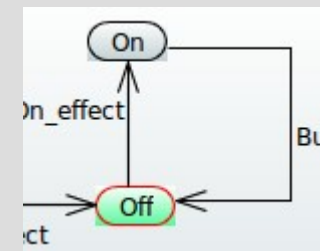
```
class Machine extends ModelClass {

    class Init extends Initial {}

    class Off extends State {
        @Override
        public void entry() {
            Action.log("\tMachine e
        }
    }
}
```

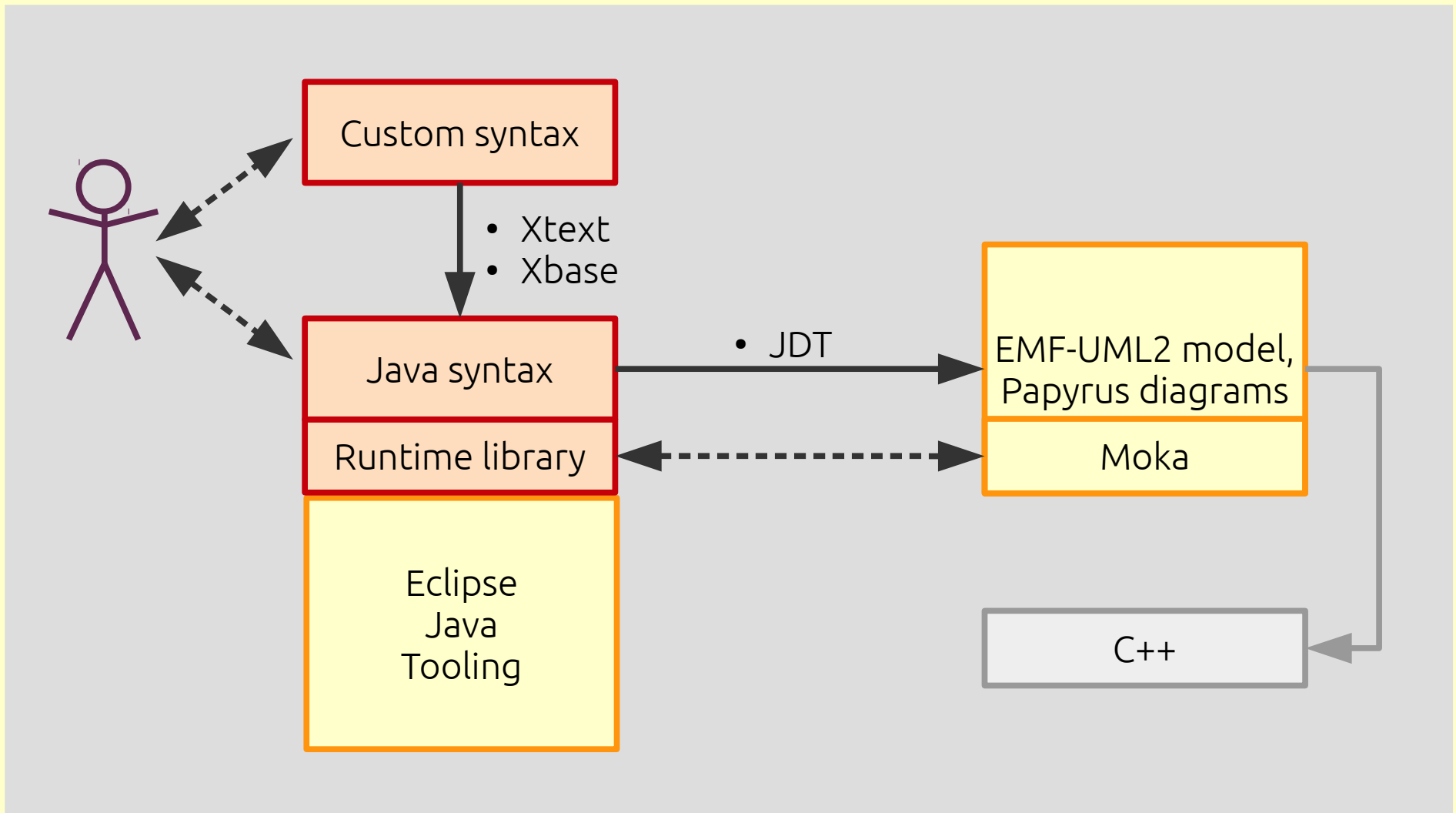
```
Vector<User> users;
```

```
12 class Machine {
13     initial Init;
14
15     state Off {
16         entry {
17             log("\tMac
18         }
19     }
```



txtUML Framework

# Text-based Model Execution



# txtUML Framework Demo

# Lessons Learned

- Lighter weight tool-chain
- Execution and debugging is (almost) for free
- Good runtime performance for testing
- Xtext, Xbase scalability:
  - Many files are handled well
  - Large files can be problematic
- Java limitations
  - Multiple inheritance

# Thank you!

xUML-RT Model Executor  
<http://modelexecution.eltesoft.hu>

txtUML Framework  
<http://txtuml.inf.elte.hu>