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Sum Ergo Computo
I am therefore I compute

MDebugger:

A model-based debugger for real-time and embedded systems

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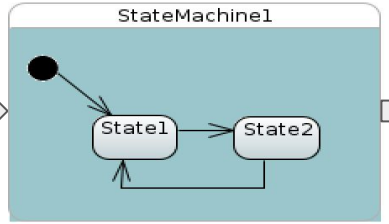
Outline

- Problem Statement
- Solution
- Concepts and Techniques
- MDebugger features
- Future Work
- Conclusion

Problem Statement

Development

Step 1: Design



Step 2: Code Generation

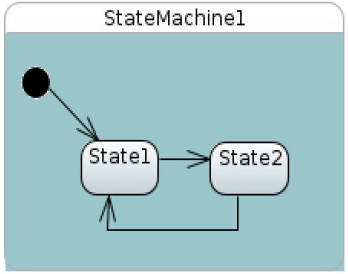
Step 2: Build & Run

Debugging

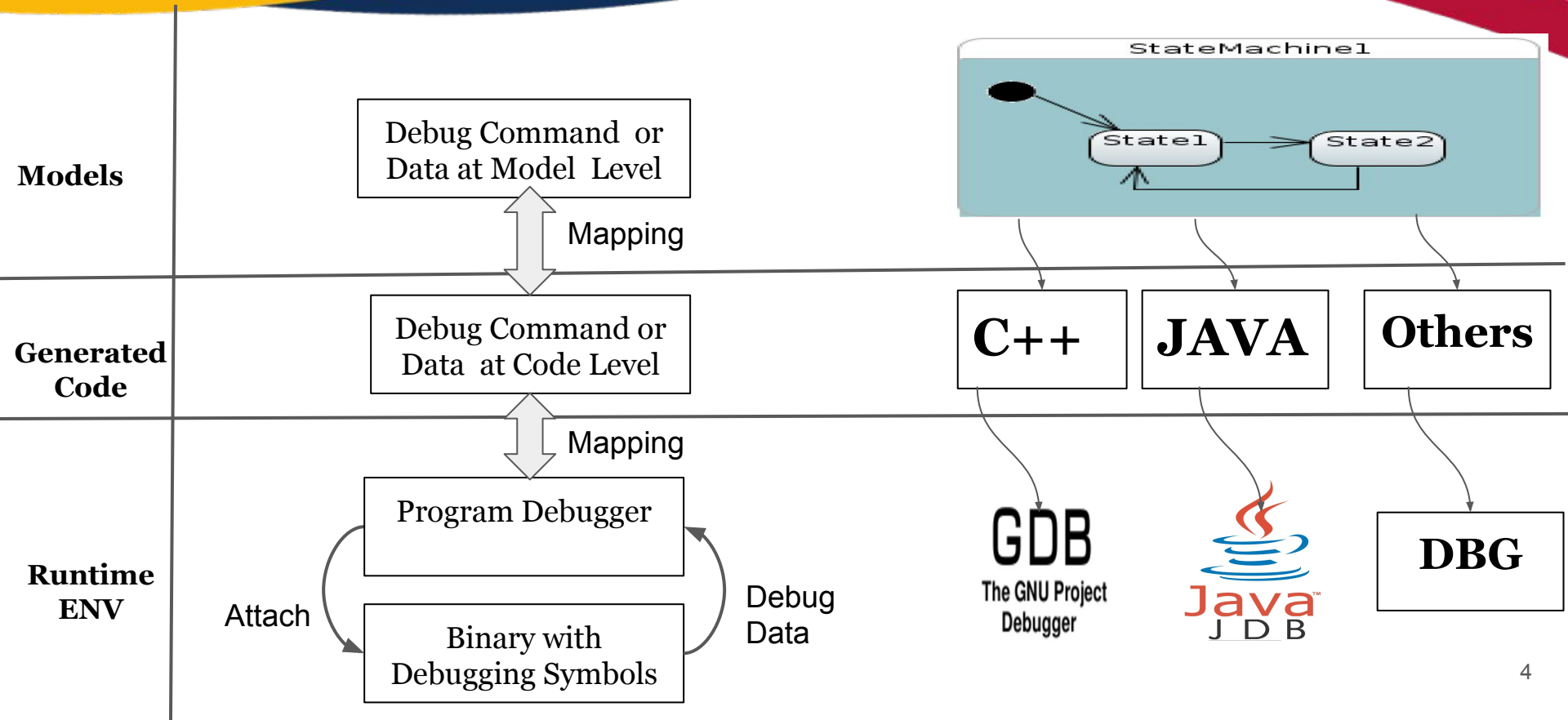
Step 1: Find Fault in Generated Code

GDB,JDB,...

Step 2: Find Fault in Model or ...



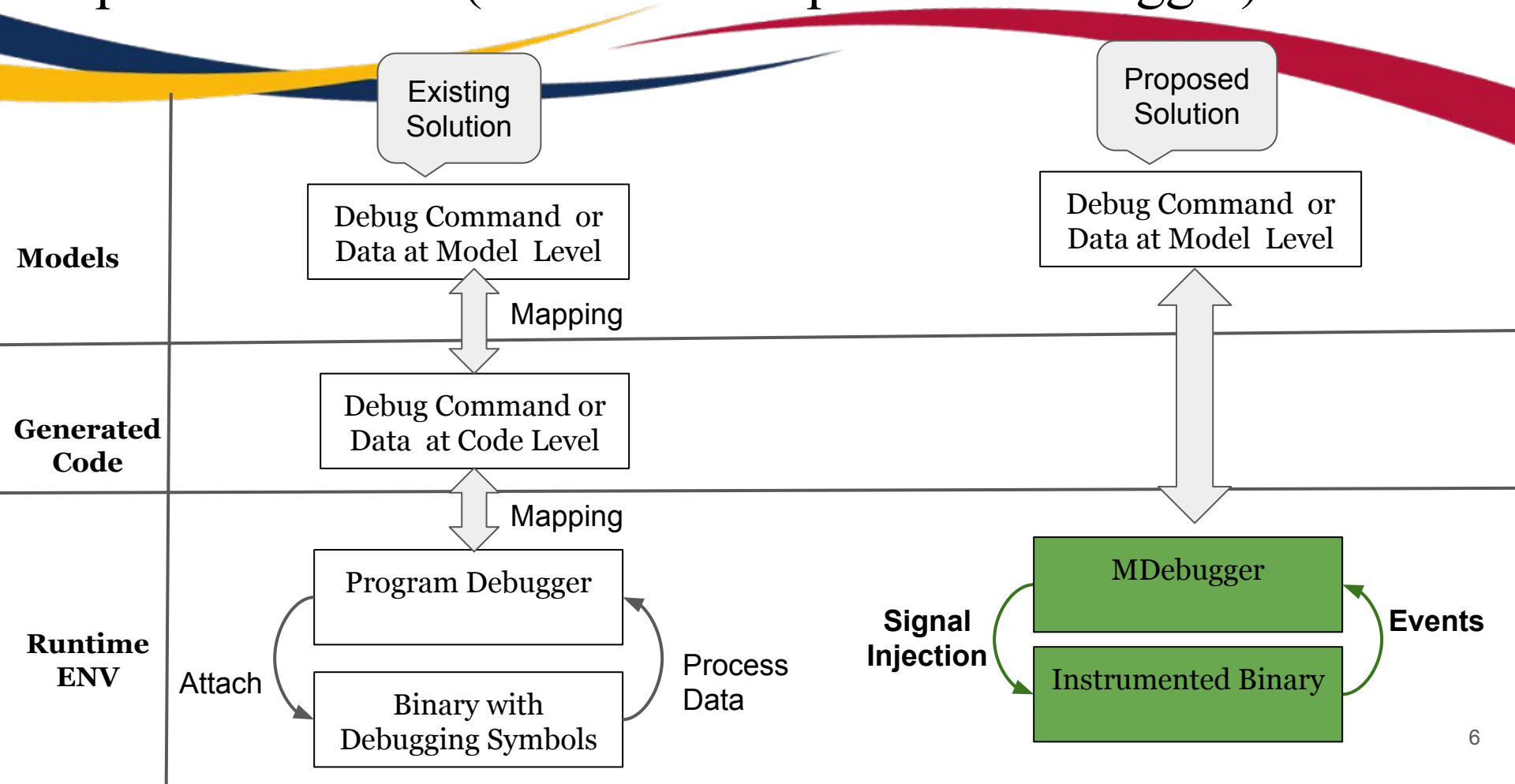
Problem Statement (Existing approaches)



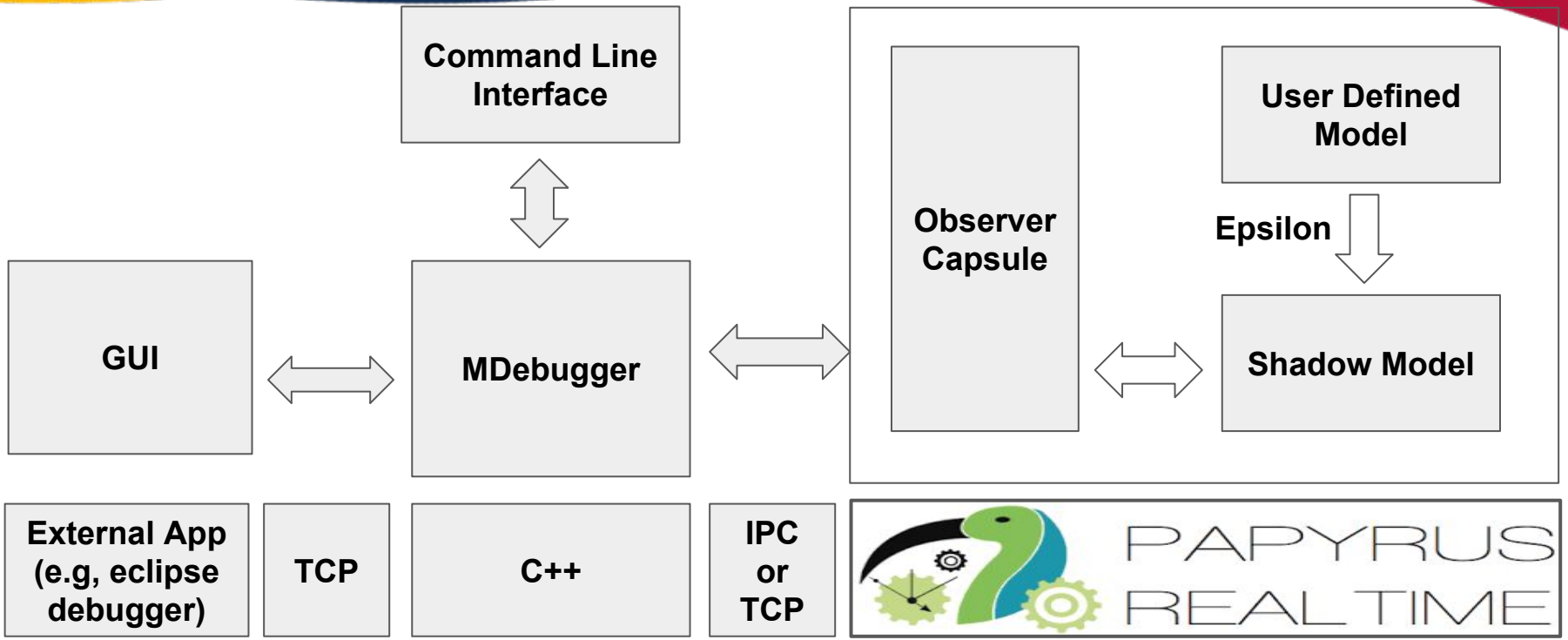
Problem Statement (Summary)

- Exiting work has tried to solve the issue by creating wrappers around the program debuggers and mapping the features.
- Extra metadata generation are required for mapping.
- Using program debugging, causes dependency and compatibility and integration issues.
- The process is time consuming and challenging process.
- Debugging issue is one of the main barriers to adoption of MDD.

Proposed Solution (Platform Independent Debugger)



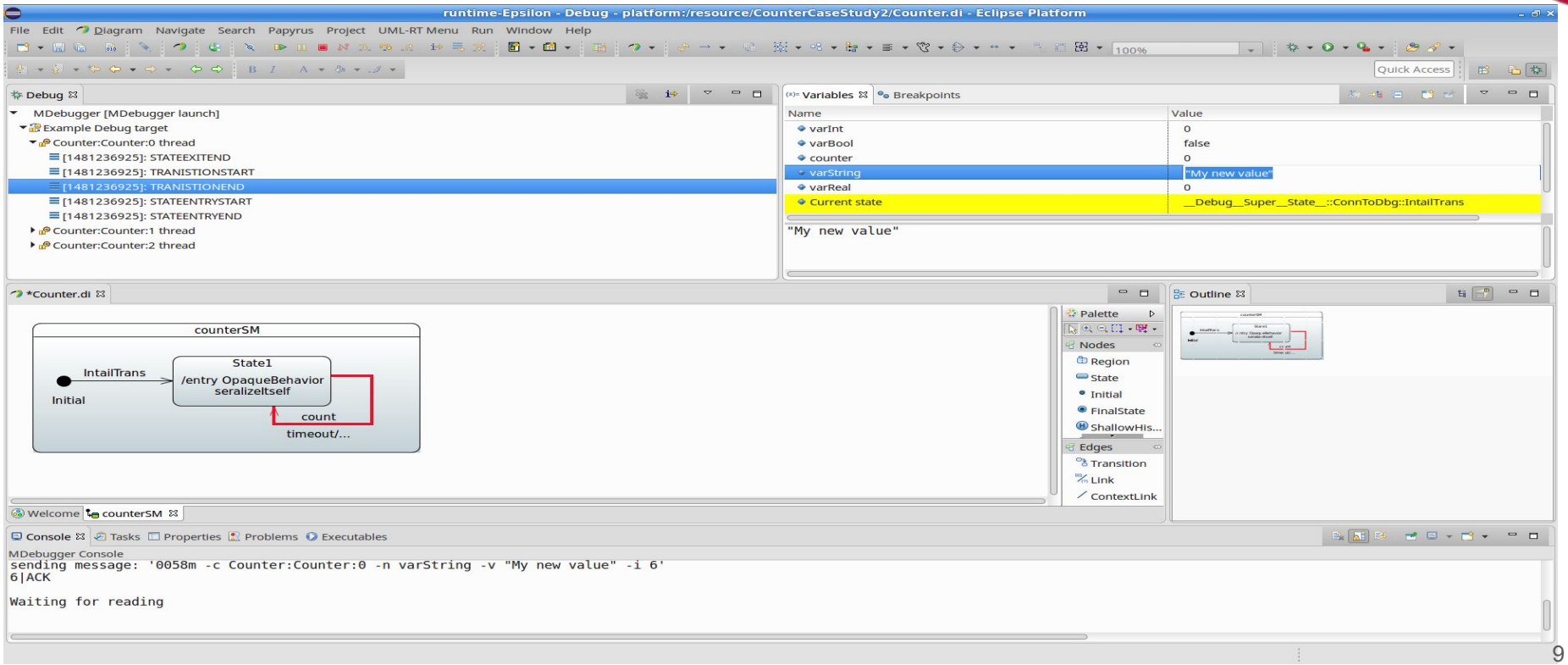
Overall Architecture



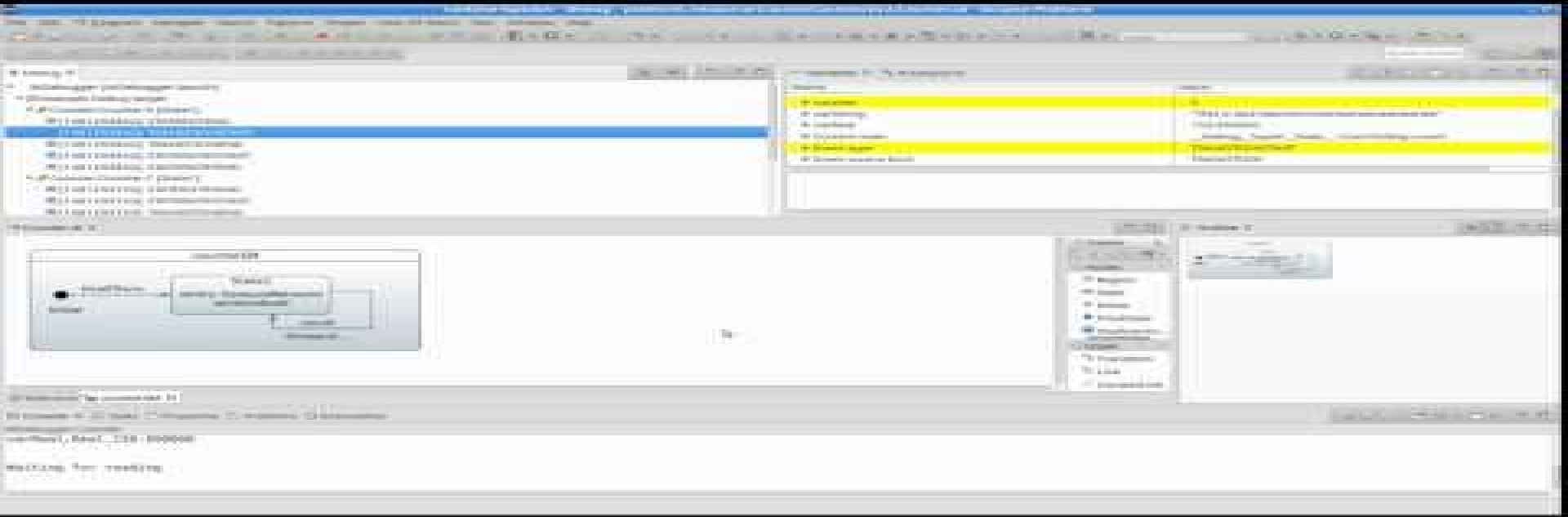
MDebugger (Command Line Interface)

```
mdebugger#help
Available Options
"help|h"                                          (Show the commands and their options)
"breakpoint|b"  -c capsuleName -t name -b  -i traceNo(Set breakpoint at start of a transition)
"breakpoint|b"  -c capsuleName -t name -e  -i traceNo(Set breakpoint at end of a transition)
"breakpoint|b"  -c capsuleName -t name -s  -r  -i traceNo(Remove breakpoint at end of a transition)
"breakpoint|b"  -c capsuleName -t name -e  -r  -i traceNo(Remove breakpoint at end of a transition)
"next|n"        -c capsuleName -i traceNo       (Execute until next step)
"continue|c"    -c capsuleName -i traceNo       (Continue execution until next breakpoint)
"run|r"         -c capsuleName -i traceNo       (Run capsule without interrupt)
"modify|m"      -c capsuleName -n name -v value -i traceNo(Modify a attribute of capsule)
"view|v"        -c capsuleName -v  -i traceNo   (View the capsule's attributes)
"view|v"        -c capsuleName -n count -e  -i traceNo(View n last action of capsule's action chain)
"list|l"        -i traceNo                      (List running capsules and their current state)
"list|l"        -c capsuleName -i traceNo       (List capsule's configuration including breakpoints and etc)
"list|l"        -c capsuleName -b  -i traceNo   (List exiting breakpoint)
"save|s"        -c capsuleName -i traceNo       (Save existing events)
"connect|con"   -h host -p port -i traceNo      (Connect to eclipse debugger)
```

MDebugger Integration with PapyrusRT



MDebugger Integration with PapyrusRT



Future Work

- Model-based instrumentation framework.
- Complete the current implementation
- Add debugging facility for action codes
- Automatic root cause analysis using program slicing on action codes
- Generate sequence diagram to present the runtime behaviour

Conclusion

- We presented a new way of providing debugging at model-level.
- Our solution is implemented at model-level using modeling concept and is not dependent on program debugger or generated code.
- Basic features such as setting breakpoints, watch and change variables are implemented.
- Graphical and command line user interface are presented.

Model Instrumentation

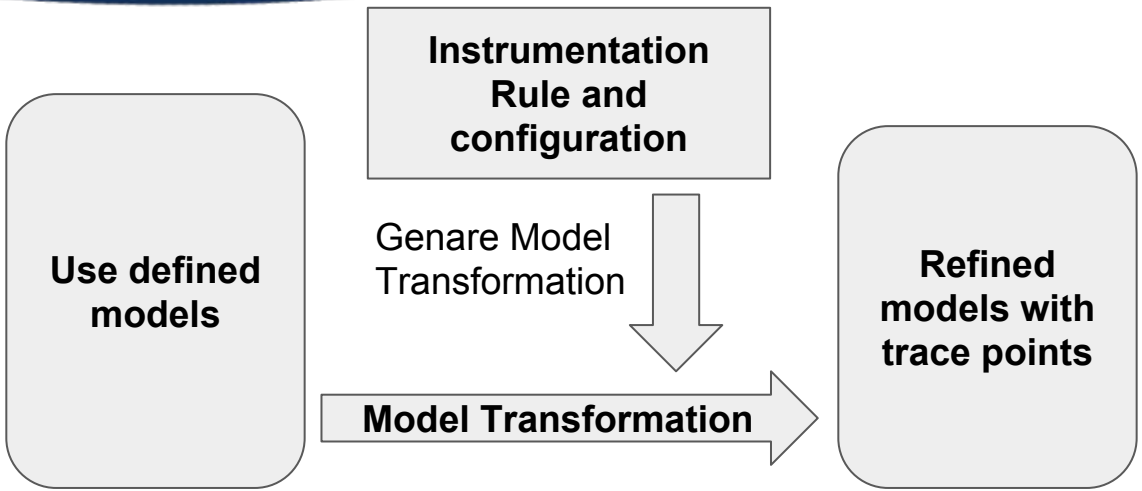
Provide instrumentation by extending the code generation:

- Is a complex task.
- Causes maintenance and compatibility issues.
- Is platform and tool dependent.
- Is hard to validate and verify.
- Is not possible to capture all instrumentation requirements by pre-defined code generation.

Vision

Create a DSL to enable users to define customized instrumentation at model level.

The Big Picture



Example of instrumentation rule:

- Trace all state changes.
- Trace all attribute changes that their type is Integer.
- Trace change of attribute x during entry of state 1.

Architecture

Instrumentation DSL

Progress till now:

- Integration between and Epsilon and PapyrusRT was done.
- Integration with LTTng and Observer as main tracing tools was done.

Thank You!