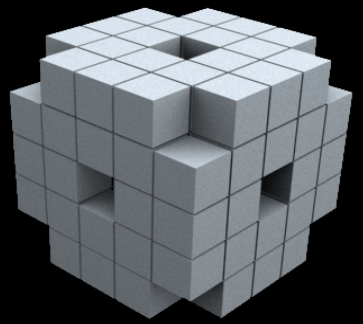

Tihamér Levendovszky

Code generation with the model transformation of Visual Behavior models

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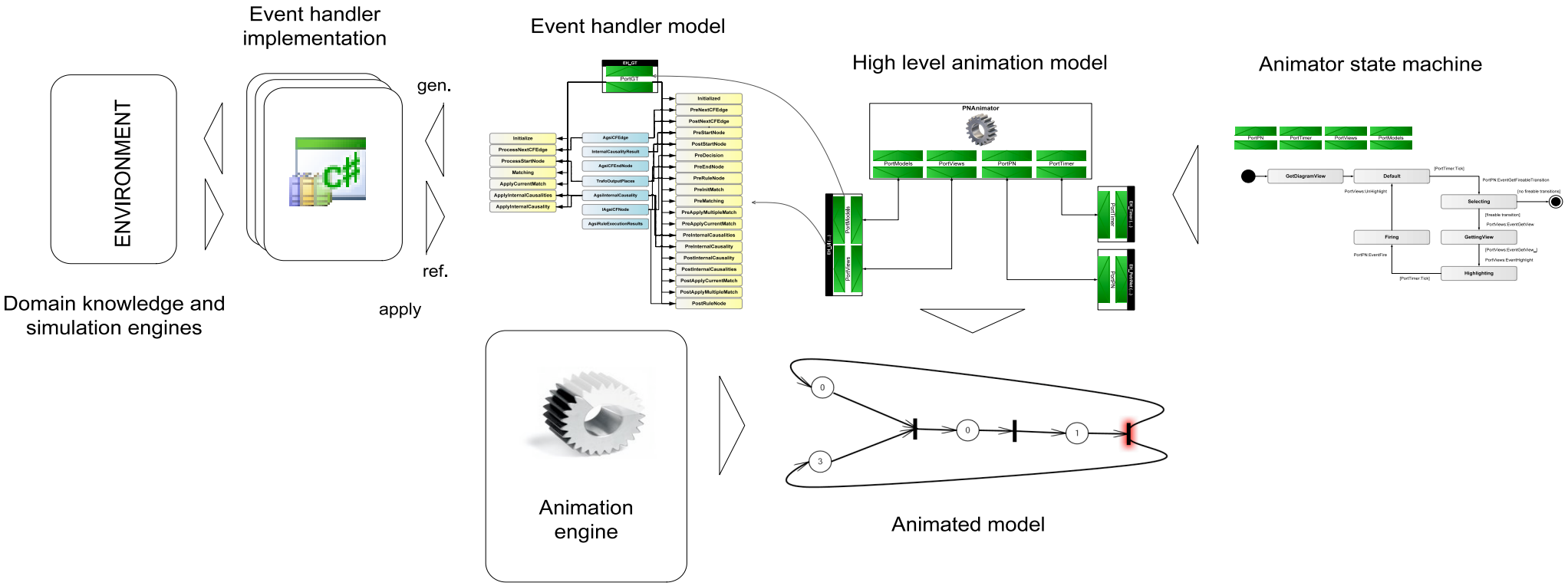
Overview

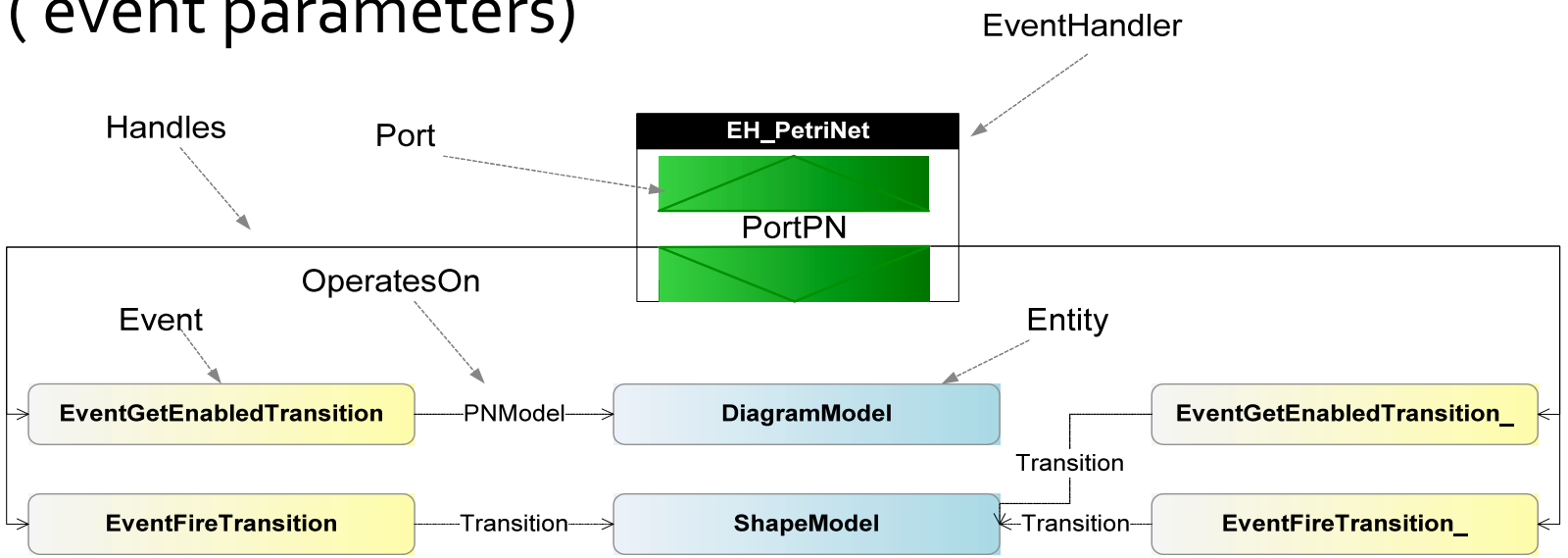
- Defining the Dynamic Behavior of Graphical DSLs
  - VMTS Animation Framework
- Transformation to C# DOM
  - (MS CodeDOM-like)

Animation Framework Overview



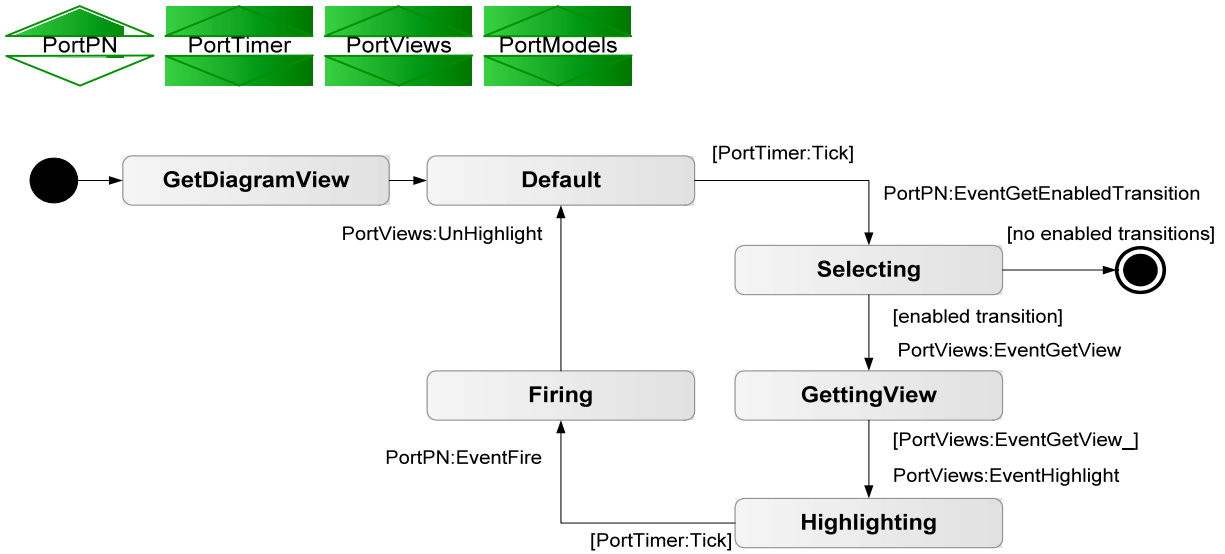
VMTS Animation Framework

- Event handler model
  - Event-driven interface for external components
  - Elements
    - Events
    - Entities (event parameters)
    - Ports



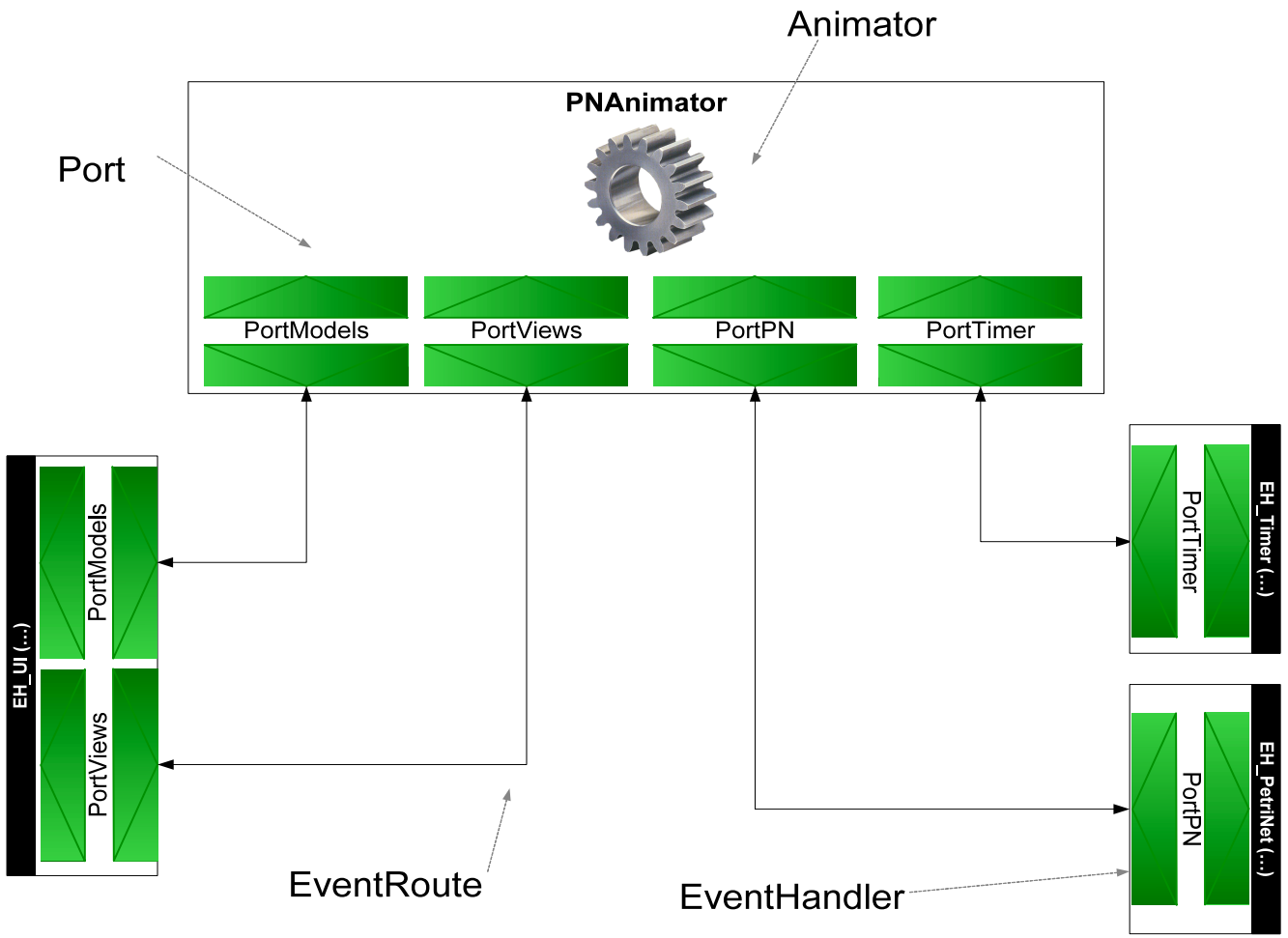
VMTS Animation Framework

- Animator
  - Event-driven state machine
  - Port-based interface
  - States
  - Transitions
    - Guard expression
    - Action expression



VMTS Animation Framework

- High Level Animation Model
  - Event handler
  - Animator
  - Port
  - Event route



VMTS Animation Framework

- Separating animation from model simulation
  - The domain knowledge is considered black-box
  - Animation logic is described with an event-driven state machine
  - Integration with an event-driven approach
- The integration is supported with visual modeling techniques
- Processing animation models
  - Generating skeleton for the event handlers
    - Automated wrapping of third-party components
  - **Generating executable application from animator models**
    - Applies a DEVS-based simulation framework

Generated files – *State machines*

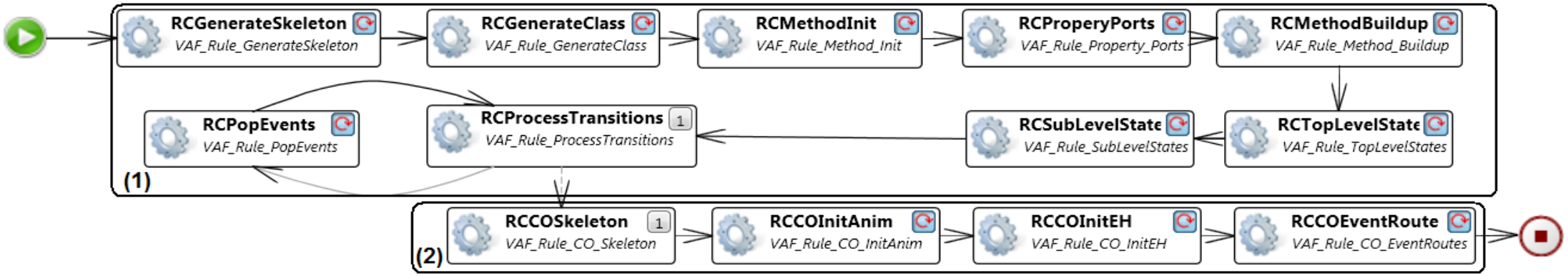
```
namespace VMTS.VAF {
  public class <AnimatorName> : Simulator {
    public Port <PortName> {get; private set;} ...
    public <AnimatorName>(Coordinator c) : base(c) { }
    <Variables of the animator>

    public override void Init() {
      //initialization of the ports
      <portName> = new Port(this);...
      <portName>.Capacity = <capacity>; ...
    }
    public override void BuildUp() {
      startState = new State(this,null,null);
      currentState = startState;
      State <stateName> = new State(this,
        <action>,<container state>); ...
      <fromState>.AddTransition( new Transition(
        this,<toState>, <guard>, <action> ),<isInternal>); ...
}}}
```

Generated files - *Configuration*

```
namespace VMTS.VAF {
  class Configuration {
    public Configuration() {
      coordinator = new Coordinator(); Init();
    }
    public Configuration( Coordinator _coordinator) {
      coordinator = _coordinator; Init();
    }
    private void Init() {
      <animator field> = new <animator type>(coordinator);...
      coordinator.Simulators.Add(<animator field>);...
      <event handler field> = new <eh type>(coordinator);
      coordinator.EventHandlers.Add(<event handler field>);...
      <setting event handler parameters>
      coordinator.AddMapping(<from>.<fromPort>, <to>.<toPort>);...
    }
    <Animator field declarations>
    <Event handler field declarations>
}}
```

Transformation

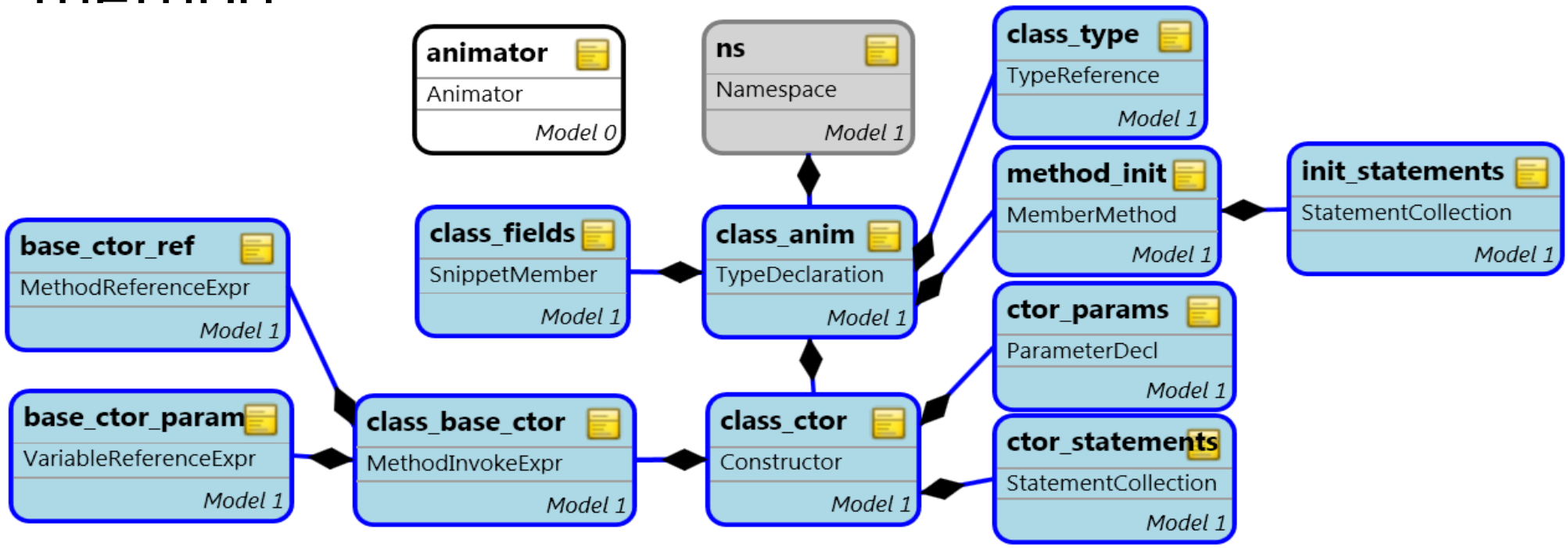
- Transforming animation models to C# DOM
- Transformation control flow



  - (1) Generating Animator classes
  - (2) Generating Configuration class which glues the components together

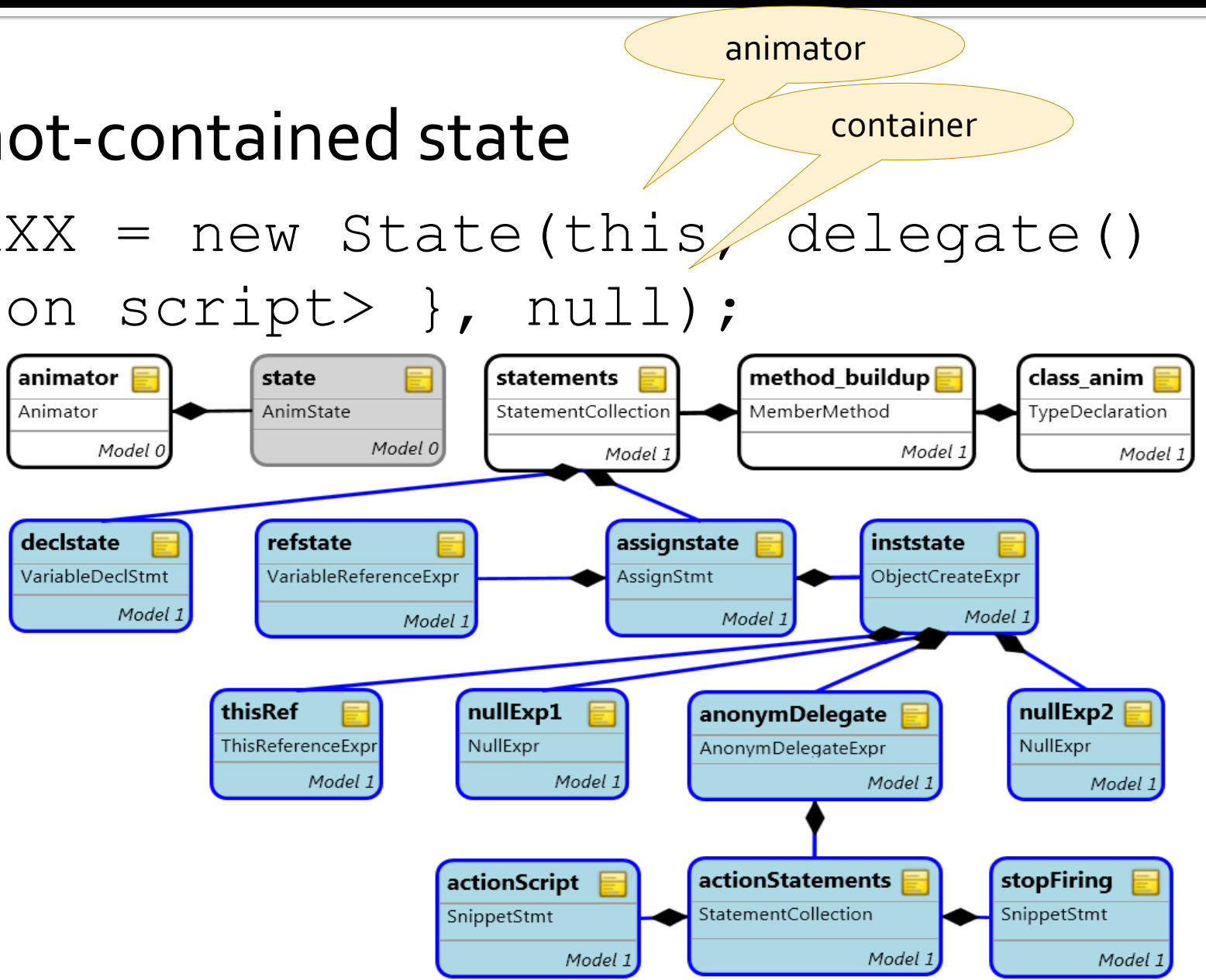
Animator classes - *GenerateClass*

- Executed for each *Animator* node
  - Exhaustive – flagging already processed ones
- Creates class declaration, constructor, *Init* method



Processing states - *TopLevelStates*

- For each not-contained state
  - `stateXXXX = new State(this, delegate() { <action script> }, null);`

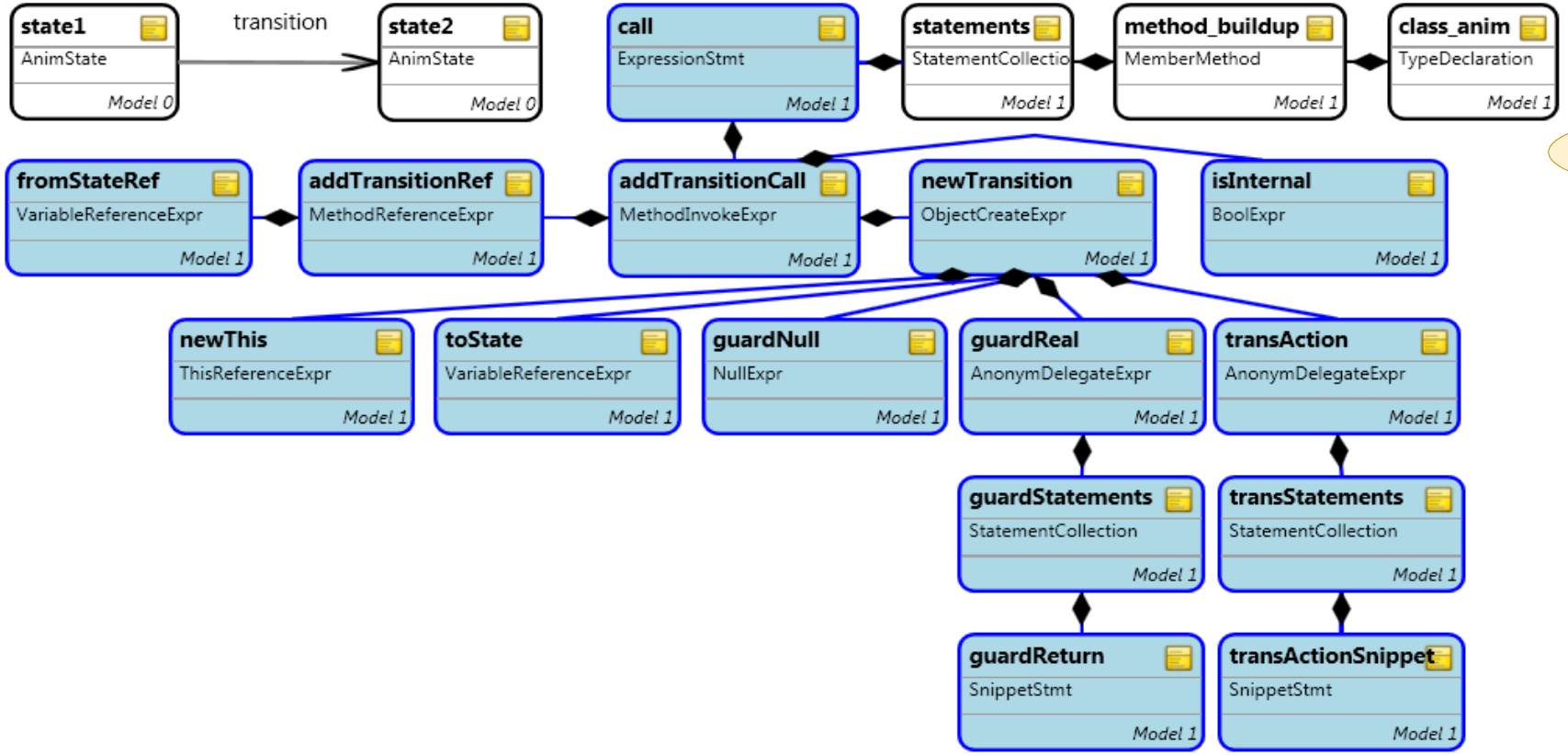


Processing transitions

- For each not-contained state
  - `<from>.AddTransition(new Transition(this, <to>, delegate(){ return <guard condition>;}, delegate(){ <action script> }), false);`

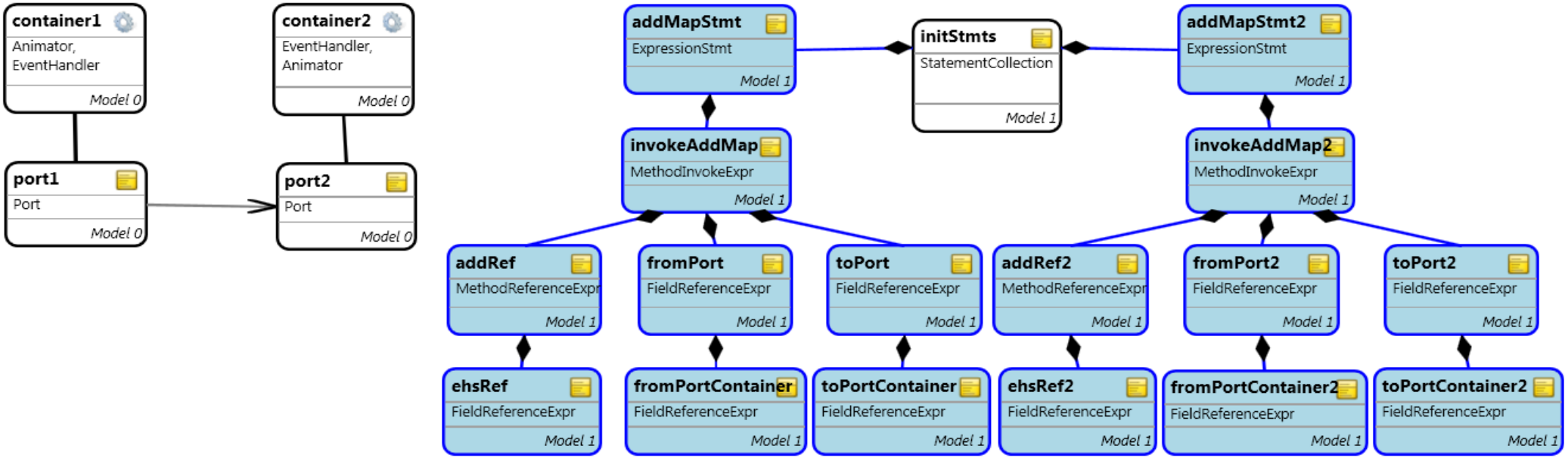
animator

not internal



Generating the Configuration class

- Connecting components (*EventRoute* rule)
  - `coordinator.AddMapping(<from>.<fromPort>, <to>.<toPort>)`
- Matching each port-pair => extending the Init method
- Conditional creation of a second *AddMapping* call
  - Direction of the event route (or bidirectional)



Conclusion

- Generating executable source code from animation models
  - Graph rewriting-based processing
- Easy to modify, formal verification possible
  - using graph and category theorem methods
  - Termination and complexity analysis, topological verification of the input
- Future work
  - Improvement of the modeling language
    - Using modeling instead of manual coding (firing of events, conditions on ports) : less error-prone, faster developement

Thank you for your attention!

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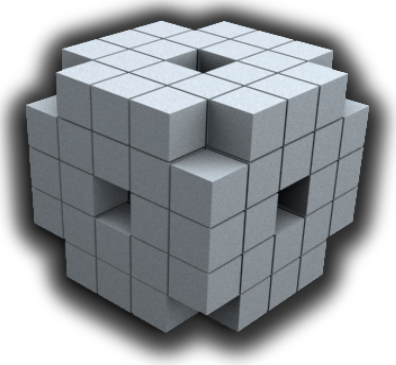

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