

UML-B

Colin Snook

Michael Butler

Mar Yah Said

Motivation

- Provide a more approachable interface to Event-B especially for newcomers
- Provide diagrams to help visualise models
- Provide extra features to Event-B
- N.b. not trying to formalise UML

What is UML-B?

- A graphical front end to Event-B
- Based on UML style
 - ‘UML-like’ - not an extension of UML
- Designed for translation to Event-B
- Close integration with Event-B tools
 - Immediate translation on save
 - Event-B errors appear on UML-B diagrams

State machines

- UML-B approach:
- State-space partitioned into one or more conceptual regions.
 - Each region can be visualised as a state machine
 - ... and modelled by explicit state variable(s)
- Other ancilliary variables
 - May vary independently of the explicit state machine *state* variables
 - Or may be used in guards and actions
 - So regions may interact

Class-oriented problems

- In B specs, often find
 - Instances I (some set - carrier, constant or variable)
 - Variables, $v \in I \rightarrow T$
 - Events depend on a modify $v(i)$

- No promotion in Event-B (c.f. Z)

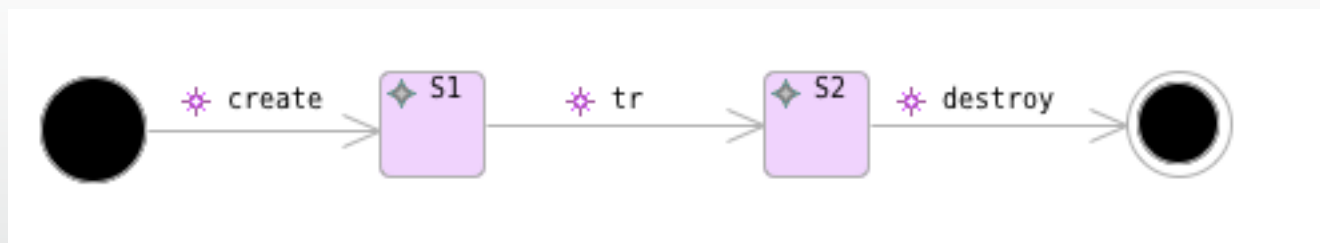
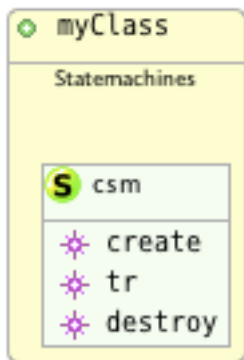
So, UML-B gives Event-B...

- A class-oriented 'lifting' mechanism,
 - And a visualisation of it

- A state machine visualisation of regions of state space

Classes and State machines

- State machine can be owned by a Class
 - i.e. *families* of state machines

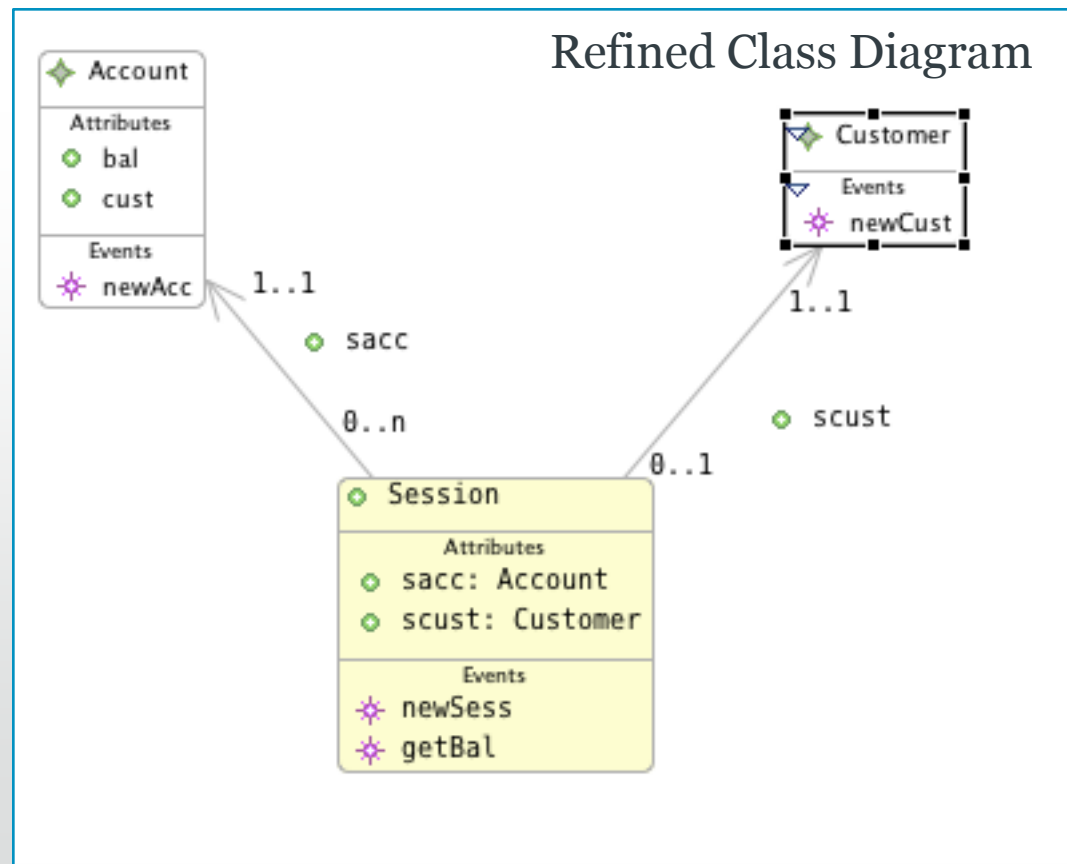


Support for Refinement in UML-B

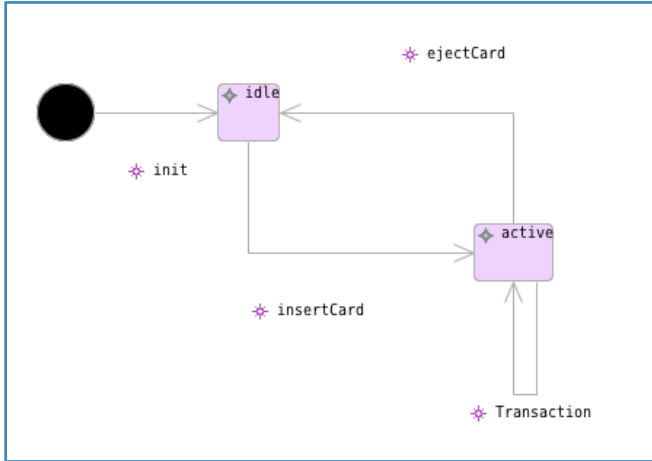
- Class Refinement - may want to:
 - Add new attributes,
 - Keep old ones (or not)
 - Add/refine/split/merge class events
 - Add new invariants and theorems
- Statemachine Refinement –
 - Add nested statemachines to states
 - Elaborate transitions with details from nested statemachines

Support for Refinement

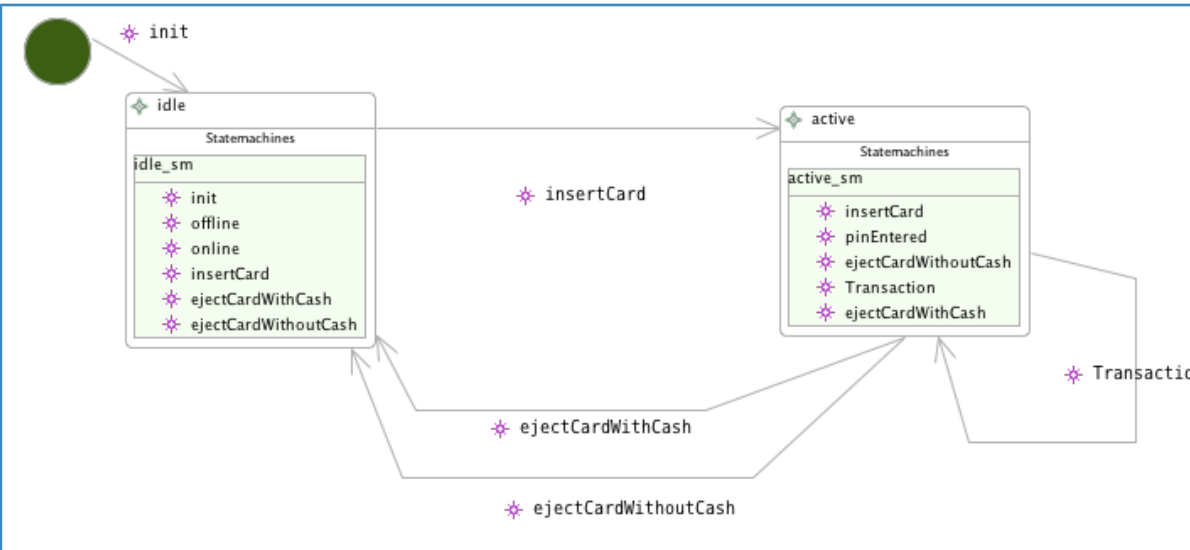
- Problem: Where to make changes to a class
 - If we draw the class again it will generate new class variables
 - User will be able to change class properties
- Solution: Introduce *RefinedClass*
 - An image of the original Class, not a new element
 - A placeholder for adding details
 - Cannot change properties such as name
- Similarly, *RefinedStatemachine*, *RefinedState*



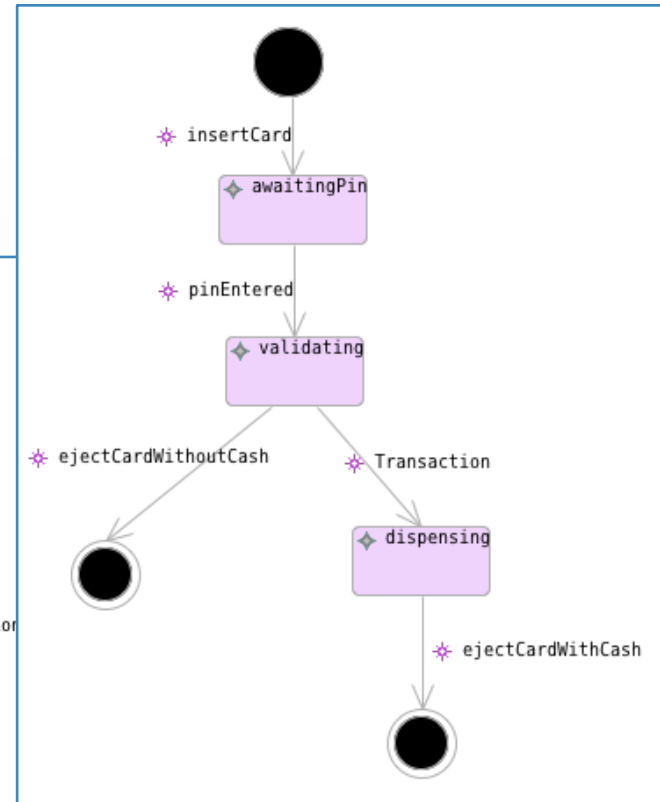
Abstract State Machine



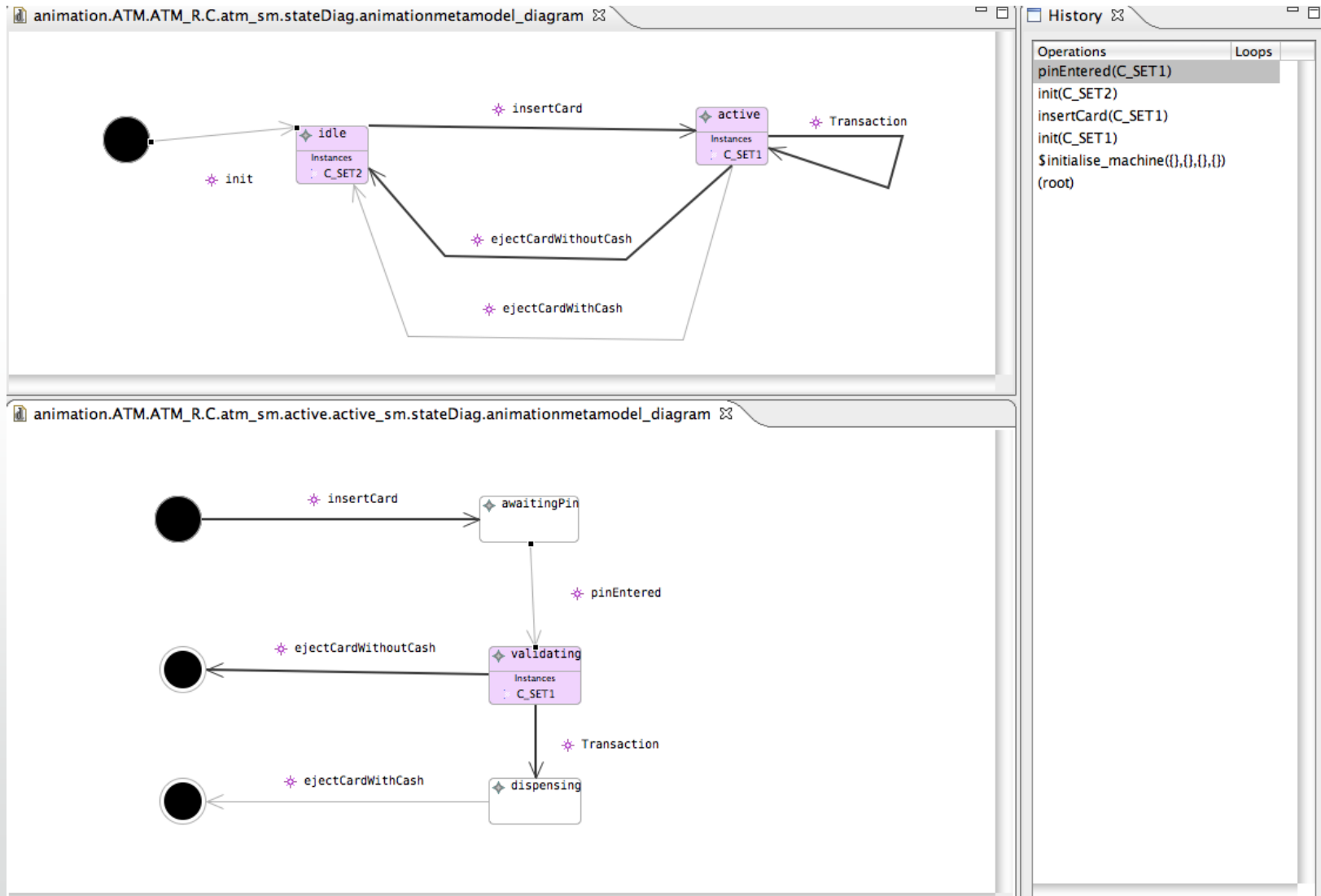
Refined State Machine



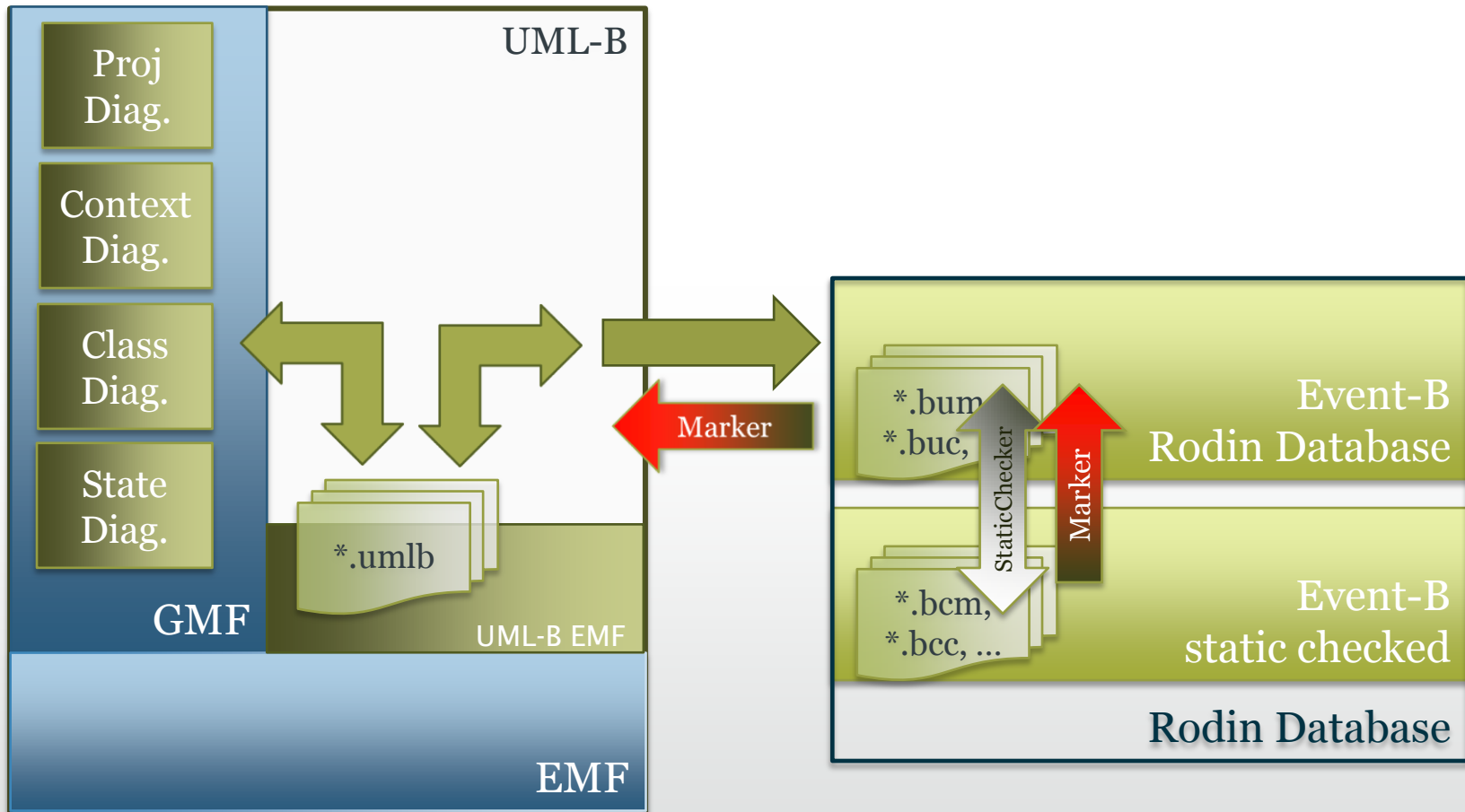
Nested State Machine



Animated State Machines



Rodin/UML-B Architecture



Summary

- Visual front-end for a systems modelling tool
- Adds class-lifting concept to Event-B
- Visual Statemachines
- Support for refinement
 - seems to fit well with Event-B refinement
- Strong integration of tools
- Open-source tools (built on EMF/GMF)