

Methods and Tools for System and Software Construction

Jean-Raymond Abrial
ETH Zürich, Switzerland

This course is an introduction to the construction of complex systems using a formalism called Event-B and a tool called the Rodin Platform.

Event-B is a mathematical formalism (based on first-order logic and set theory) used to develop formal models of discrete transition systems. These models are elaborated before effectively building these systems which are thus intended to be correct by construction.

Discrete transition system is the unifying paradigm which can be used in many different areas: sequential, distributed, concurrent, parallel. It also covers larger systems where one takes into account not only the future software but also its (fragile) environment.

Models are made of constants and variables related by possibly complex invariants. Their dynamics is defined by means of transitions (called events) made of guards (the enabling conditions) and actions (supposed to modify variables in parallel).

Models are developed by means of successive refinements steps: from quite simple and abstract to very concrete. When a model becomes too complicated, it can be decomposed into smaller ones communicating in a systematic fashion.

Proofs and model-checking are performed at each step of the development. They insure that each model is coherent and that it indeed refines its abstraction (if any).

The Rodin Platform is the tool set which has been developed (as funded by the European Project Rodin) to ensure a mechanical aid to the user of this approach. This platform is open source and implemented on Eclipse. It works on Windows, Linux and Mac-OS. It contains a database support which contains the developed models. This database is surrounded by various plugins: provers, model-checkers, animators, UML transformers, etc. New plugins can be added.

The intent of the course is to explain all this in greater details by means of various practical examples and tool demonstrations.

But the course will not be made of examples and demonstrations only: the theory behind EventB and the tool will also be exposed in details.

References

1. Jean-Raymond Abrial, *The B-book*, new edition, to appear.