# The Mobius Program Verification Environment

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http://mobius.inria.fr/

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Mobius

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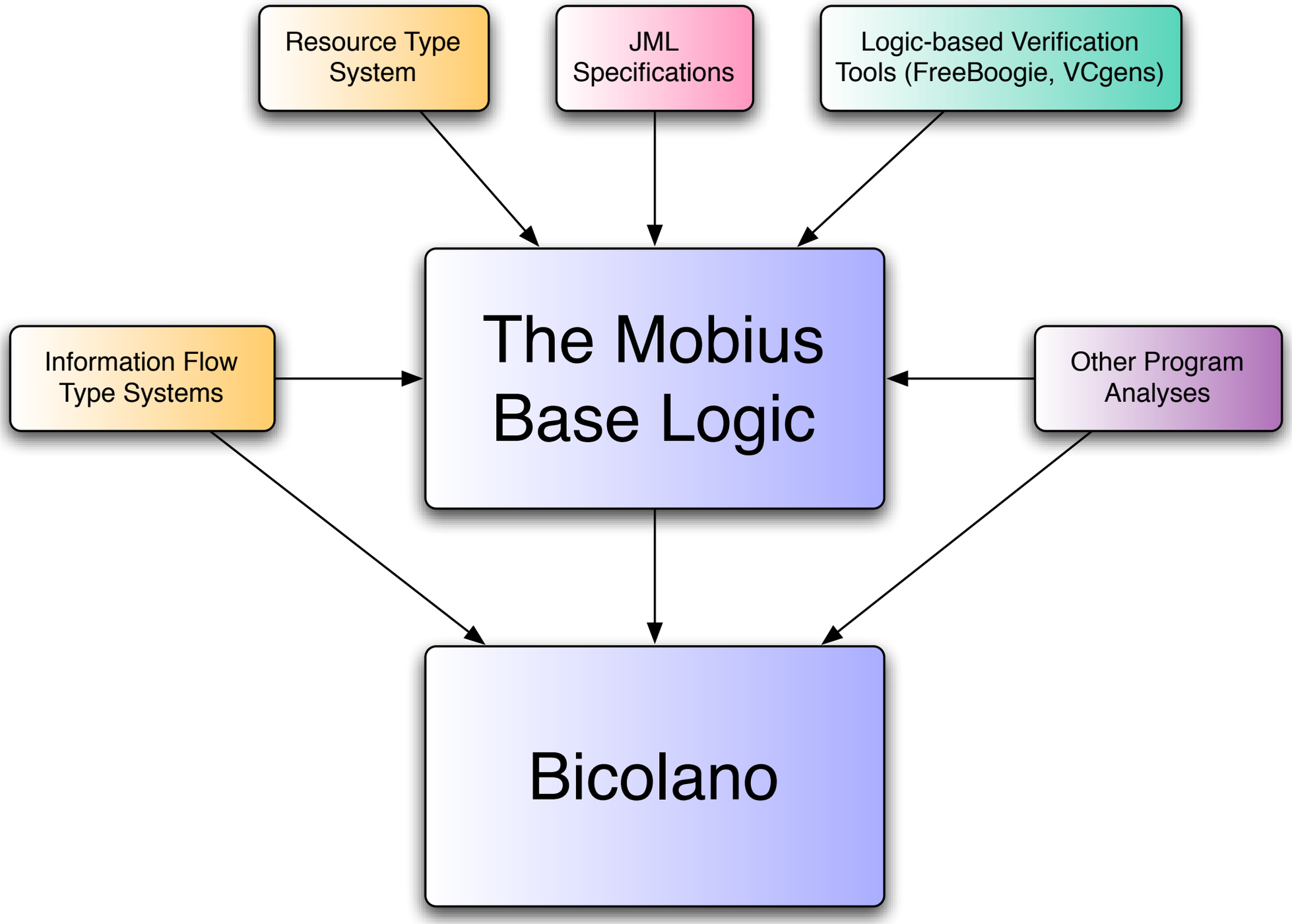
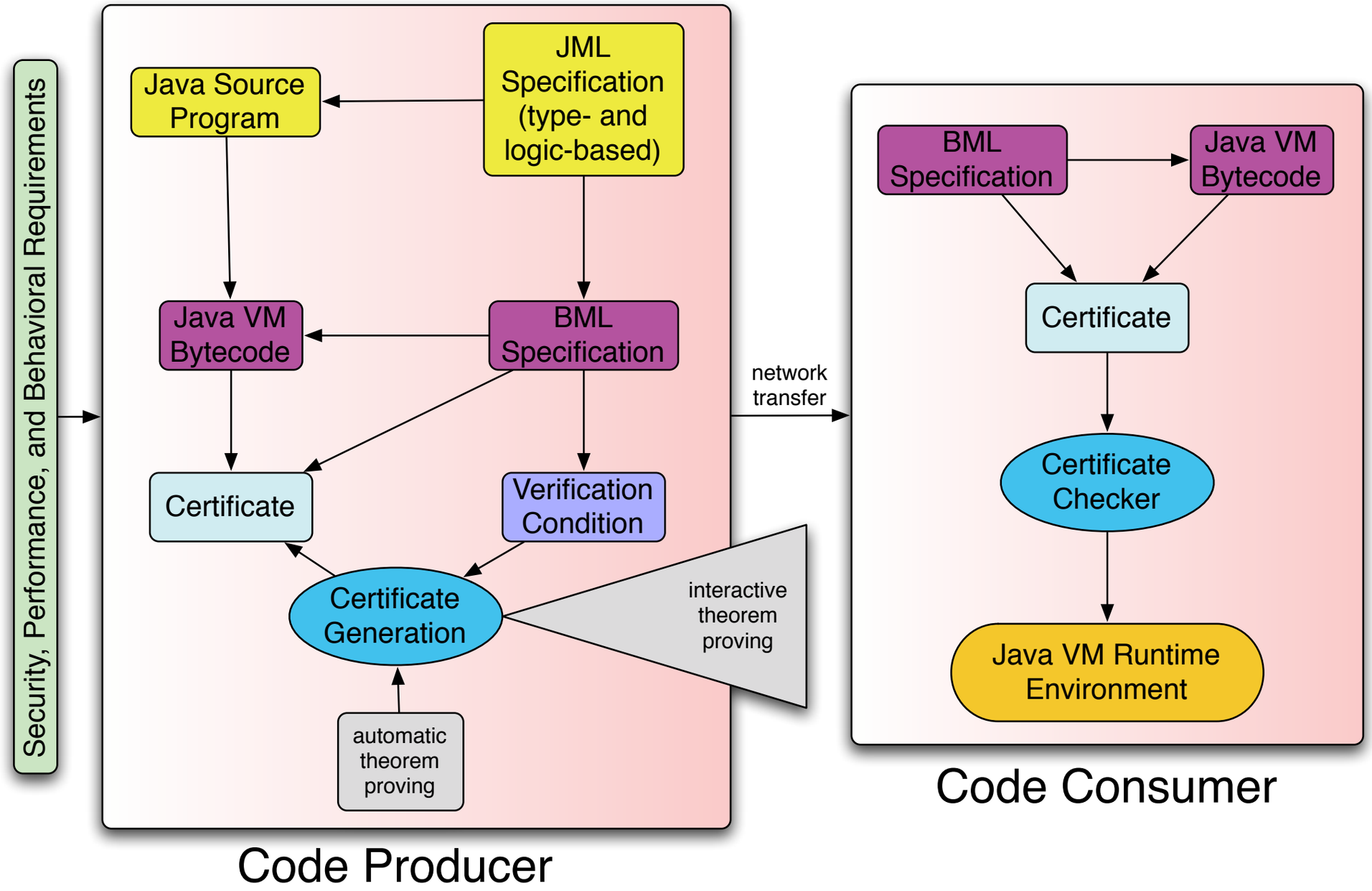
# Mobius Types and Logics



# Mobius “Big Picture”



# The Mobius PVE

- custom build of Eclipse for quality software
  - integrated set of plugins and features
- complementary set of other tools
  - integrate testing, static checking, extended static checking, theorem proving, and full verification
- “tunable” quality with concrete feedback
- growing use in education and instruction

# Context on PVE Development

- leverage existing software foundations as much as is possible and reasonable
  - primarily Eclipse, the JML tool suite, Jack, and ESC/Java2
- integrate tools developed by others
  - mainly other static checkers and rigorous software engineering subsystems
- leverage the ESC/Java2 user-base
  - large set of industrial users, academic researchers/users, and student users that are potential Mobius PVE target users

# Mobius PVE User Features

- Java program code features
  - writing new code
  - type-aware completion
  - compiling
  - debugging
  - refactoring
  - folding code
  - generate Javadoc documentation
  - *analyze code complexity*
  - *analyze coding standard conformance*
  - *detecting common programming errors*

# Mobius PVE User Features

- Java Modeling Language features
  - writing new specifications
  - compiling specifications to runtime tests
  - generate Javadoc documentation
  - *context-aware specification folding*
- Bytecode Modeling Language features
  - *compile JML to BML*
  - *display BML-annotated Java VM bytecode*
  - *edit BML*

# Mobius PVE User Features

- JML-annotated programs features
  - unit test generation
  - specification generation
    - class and *loop invariant generation*
  - translation to guarded commands
    - existing ESC/Java GC and *BoogiePL*
- theorem prover features
  - *use interactive provers in a natural way*
  - *integrate proving and programming in UI*
  - *support several automatic provers*
  - *user- and tool-customization for prover use*

# Mobius PVE *Verification Bus* Features

- Java, JML, and *BML* lexer, parser, type checker, and transformation subsystem
  - *generates, visualizes, and manipulates Java VM bytecode, JML annotations, Javadocs, BML-annotated bytecode, and DOT files*
- FreeBoogie subsystem
  - *FreeBoogiePL—FLOSS BoogiePL*
  - *FreeBoogie VC generation*
    - *targets Mobius VC back-end, thus*
    - *will support multiple theorem provers*

# Mobius PVE *Verification Bus* Features

- Mobius VC back-end
  - unsorted and *sorted VC representations*
  - *logic-aware syntax generation to several automatic and interactive theorem provers*
    - *e.g., generation of Mobius VCs in Coq, PVS, Simplify, SMT, etc.*
- Mobius ESC VC generator
  - *generation of ESC VCs in several ESC logics*
  - *extended static checking of ESC VCs with rich in-editor feedback*

# Mobius PVE *Verification Bus* Features

- Mobius Prover back-end
  - *generic interaction with a variety of automatic and interactive theorem provers*
    - *automatic provers supported*
      - *Simplify, SMT, Fx7, (CVC3, Yices)*
    - *interactive provers supported*
      - *Coq and (PVS)*
- integration of several support tools
  - e.g., CheckStyle, FindBugs, PMD, etc.
  - *the Race Condition Checker (RCC)*

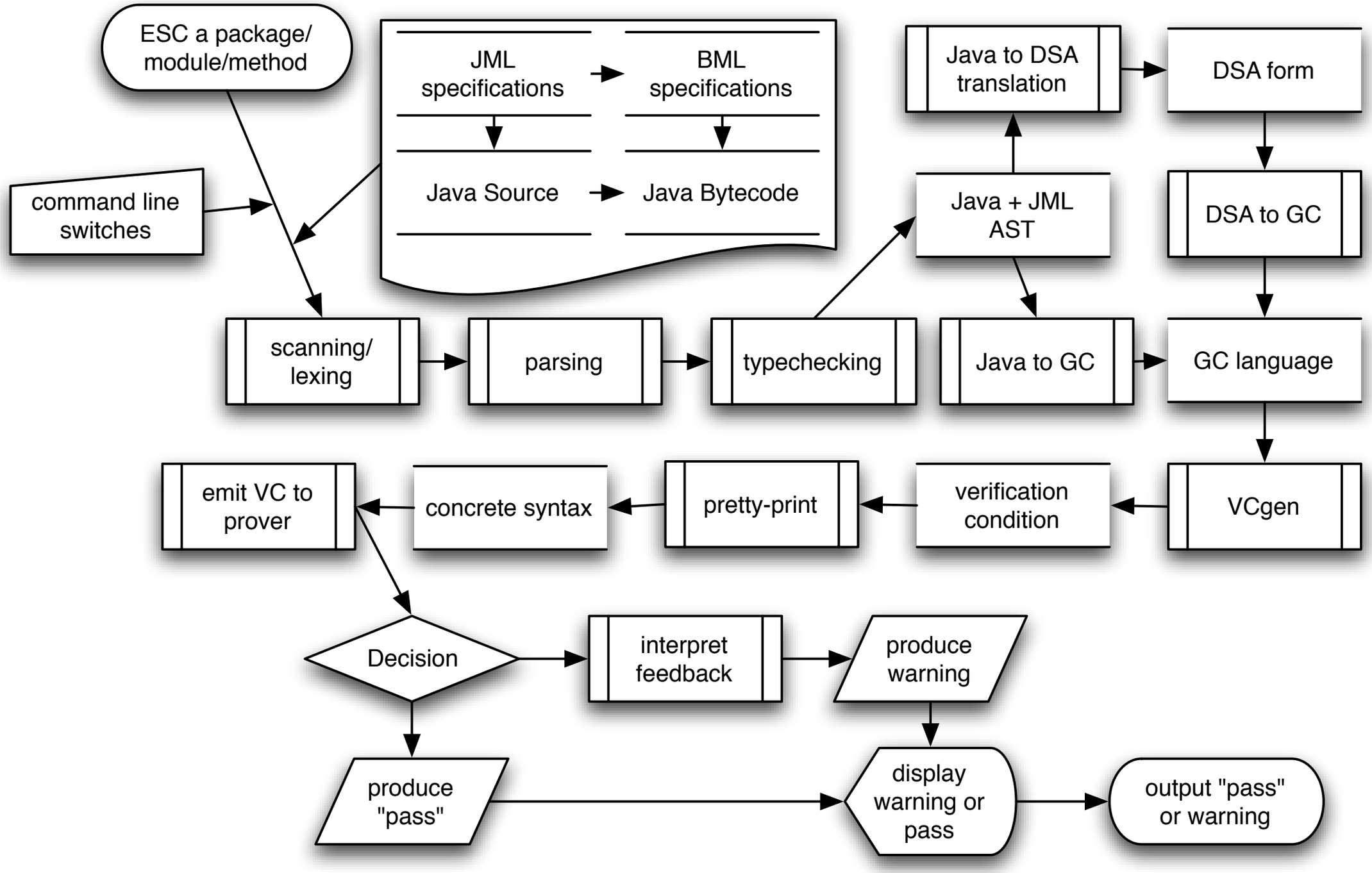
# Mobius PVE Status

- full support available for:
  - all Java and nearly all JML features
    - editing, compilation, doc generation, etc.
  - code complexity and style checking
  - partial BML support
    - no full compilation of JML to BML as of yet
- Mobius VC back-end
- advanced ESC VC generation
- Mobius Prover back-end
- interactive proof support for Coq

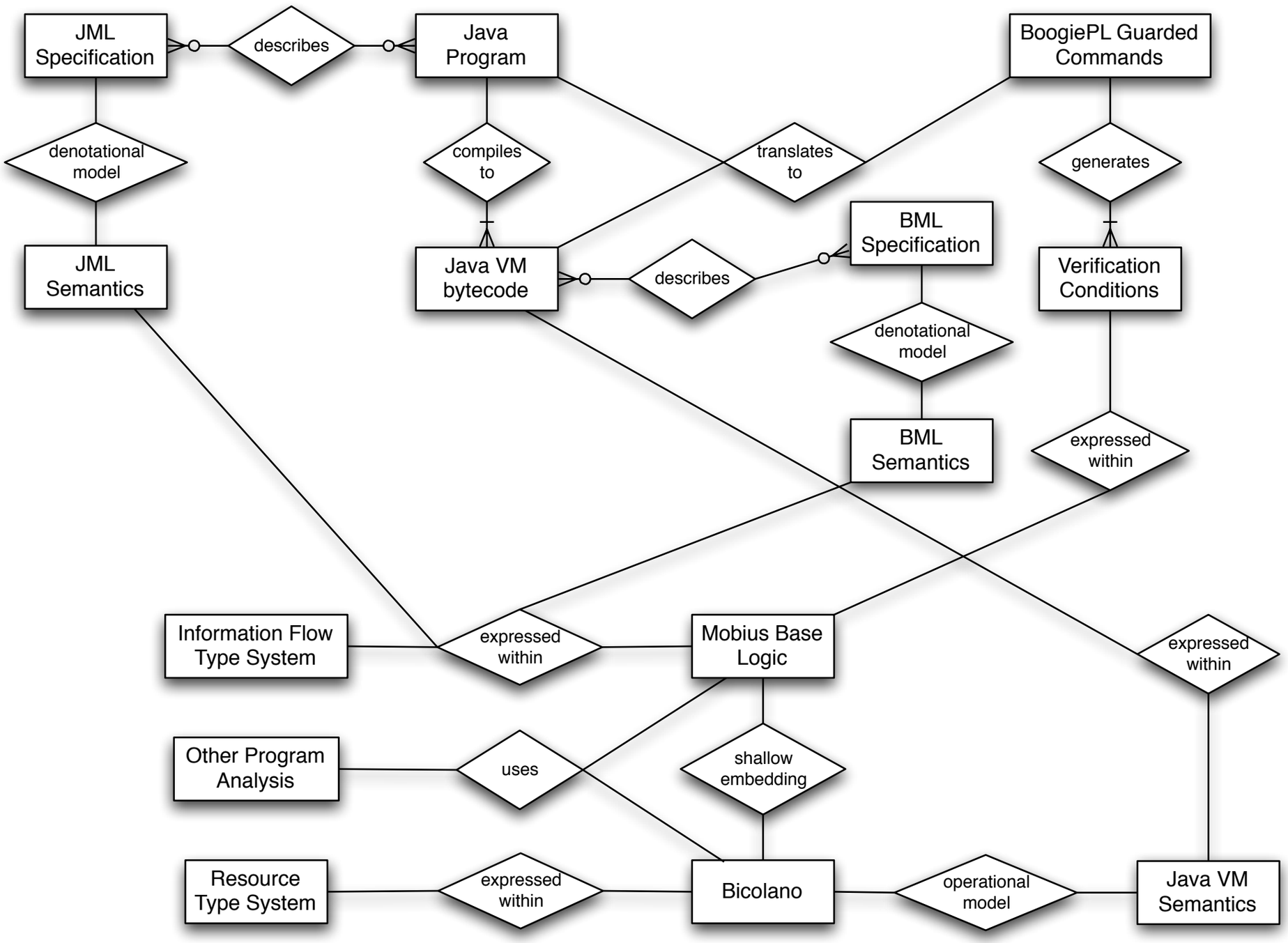
# PVE use in International Teaching and Research

- several other groups are using PVE subsystems for their own research
  - prover back-end and VC representation
  - Fx7 improvements
  - ESC experimentation (KSU, MIT, others)
- ...and teaching
  - UCD using PVE subsystems for undergraduate instruction in programming and software engineering
  - groups using static checkers for instruction include Univ. of Wash., CMU, MIT, others

# Architecture of a Static Checker



# Mobius ER Diagram



# Mobius ER Diagram with Ownership