Mescal Architecture Model

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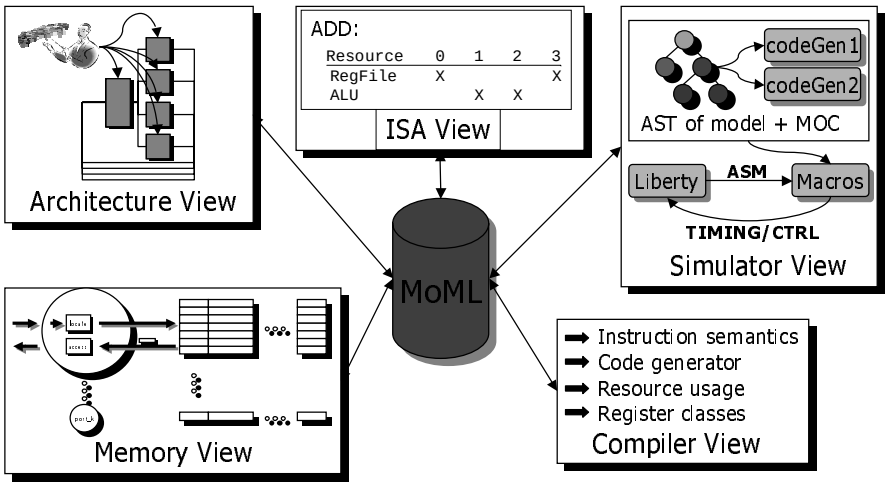
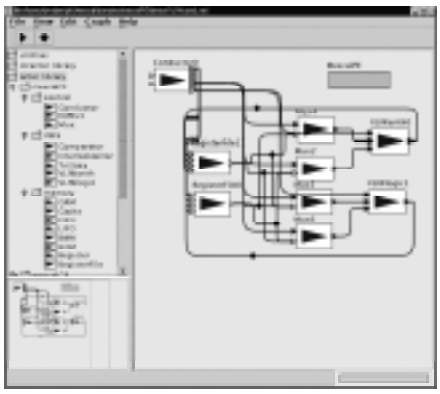
Mescal Views



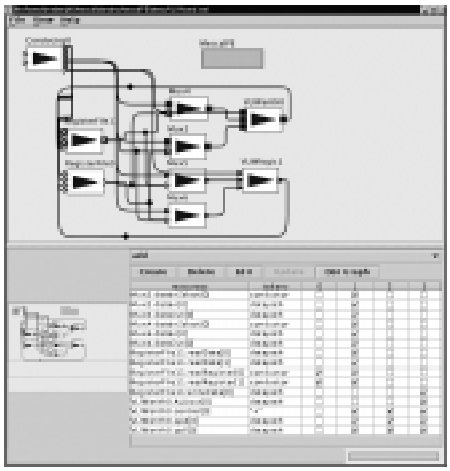
Architecture View

- PtolemyII and Vergil as the base
- Expandable library of common micro-architecture components
- Strongly-typed visual language with type and domain polymorphic actors
- Exploits bit-level and instruction-level concurrency
- Actors have cycle delays
- Conductor handles control
  - Output controls dataflow actors
  - Control implicitly synchronized

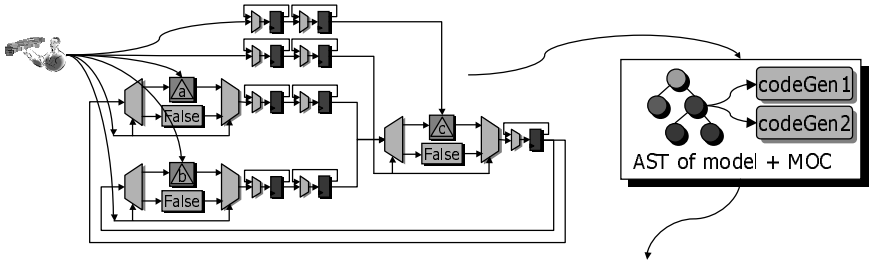


ISA View

- User defines an instruction by giving it a name and specifying the resources it uses
- Static timing analysis determines the timing
  - Instructions are synchronized from the Conductor
- Simplifies ISA development
- Correct by construction
- Information is used to create the simulator and can be used by the compiler for scheduling



Simulator View



- Generate an AST of the model
- Knowledge of the MOC and semantics of PtolemyII allows code generation from the AST
- Code generated is a compiled simulator of the model

```
while (iterations) {
    decode instruction and send tokens
    if (a enabled)
        execute a
    if (b enabled)
        execute b
    if (c enabled)
        execute c
    // move data through the pipeline
    move present state to next state
}
```

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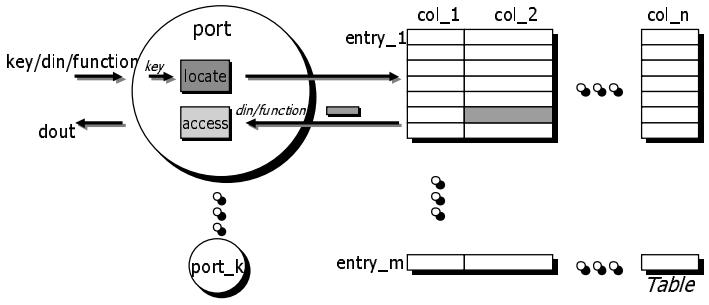
Memory View

- For memory architecture exploration
- Views memory as a table and accessing ports



- Port and read/write prioritization determine access order
- Variable delays in cycles

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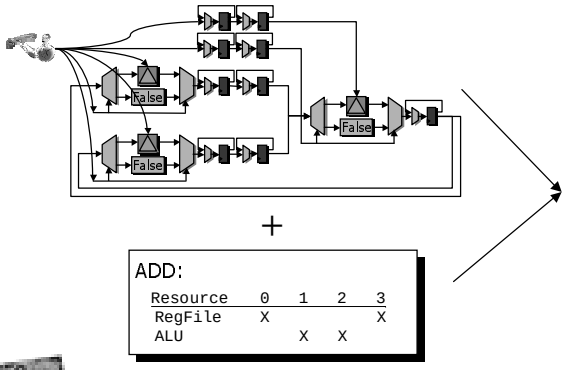
Compiler View

- Size and features of the register files
- Expose intrinsics and memory features
- Behavioral description of the instruction (like ISDL/nML)



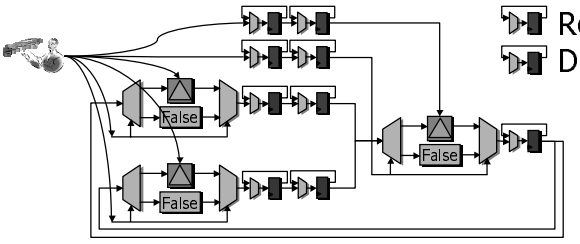
Behavioral Description

ADD Rr, Rs, Rt

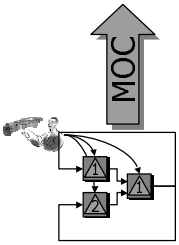
Rr ← Rs + Rt

…

Model of Computation



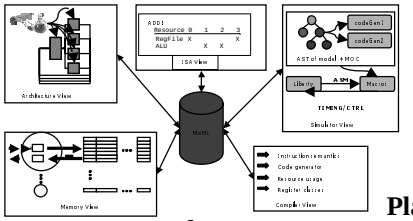
* Stall signals not shown but would come from the Conductor too



- Implicit actors added with knowledge of the MOC
- As a dataflow model, there is one token per edge
  - Static schedule except for a conditional enable
  - Centralized control through the Conductor produces the tokens including enables at the correct time
  - Token, enable, and stall set generated on each cycle by identifying the issued instruction

Mapping to the Middle

PtolemyII



Mescal Views

Platform Specification

Application Space

Application Instance

System Platform

Platform Exportation

Platform Instance

Architectural Space

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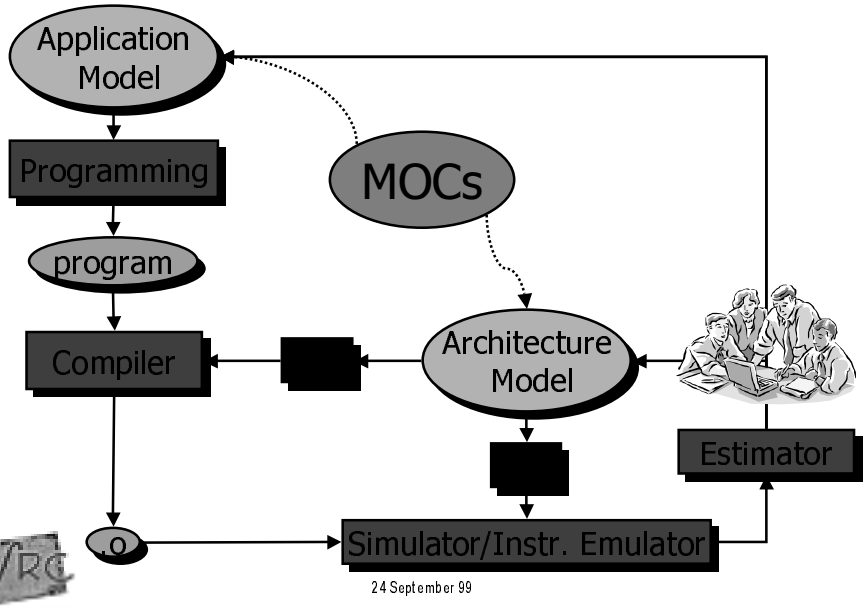
Architectural Exploration



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