A Portable Debugger for Algorithmic Modelica Code

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Outline

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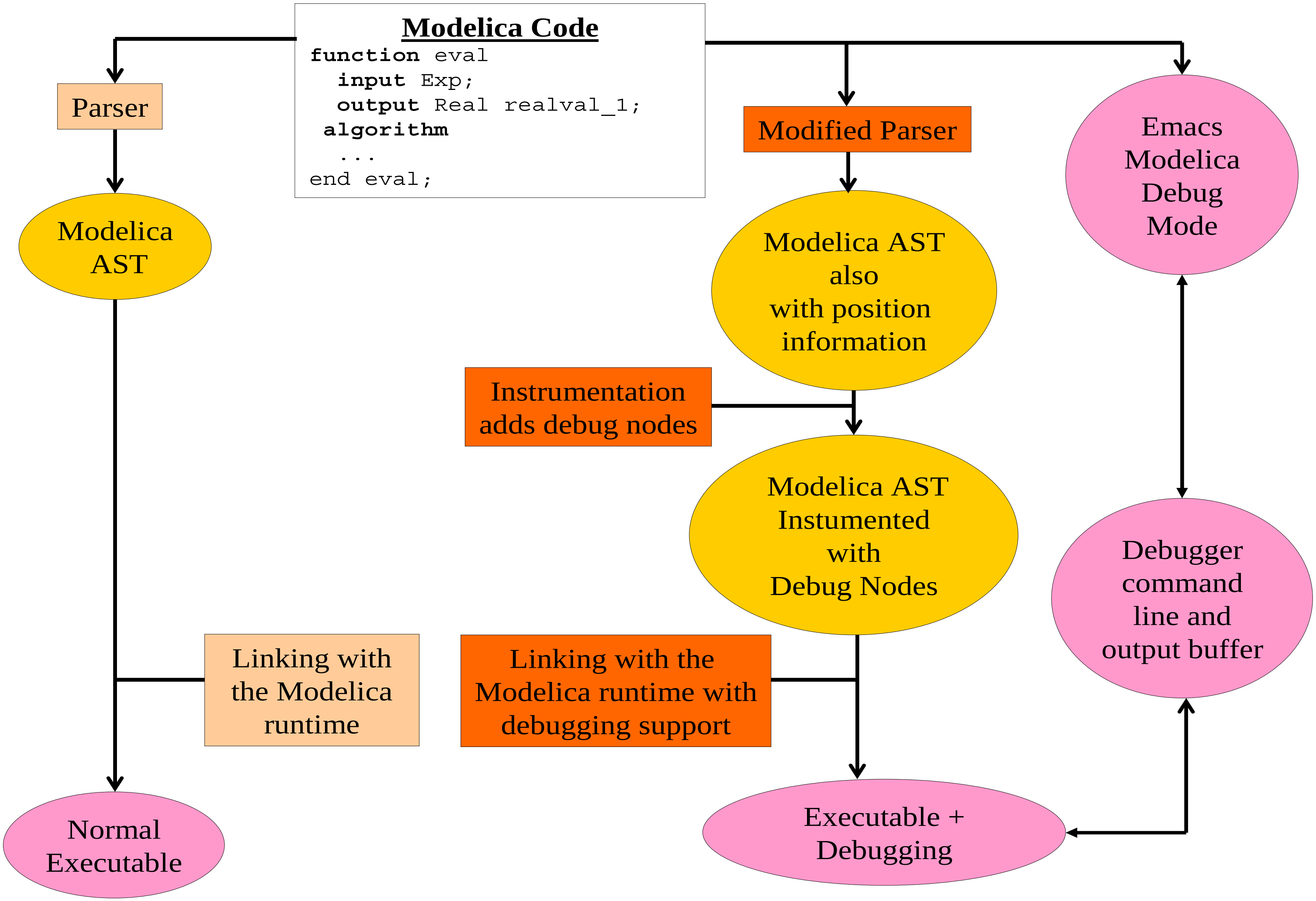
Introduction

- Why do we need such a debugger?
  - debugging of equation-sections exists
  - debugging of algorithmic code
- Modelica
  - large algorithmic sections in functions
  - scripting
- Modelica+
  - implementation of the OpenModelica compiler
  - 43 packages, 57083 lines of code, 4054 functions, 132 data structures

Debugger Implementation - Overview



Debugger Implementation - Instrumentation

```
function bubbleSort
  input Real [:] unordElem;
  output Real [size(unordElem, 1)] ordElem;
  protected
    Real tempVal;
    Boolean isOver = false;
  algorithm
    ordElem := unordElem;
    while not isOver loop
      isOver := true;
      for i in 1:size(ordElem, 1)-1 loop
       if ordElem[i] > ordElem[i+1]
       then
          tempVal      := ordElem[i];
          ordElem[i]   := ordElem[i+1];
          ordElem[i+1] := tempVal;
          isOver := false;
       end if;
      end for;
    end while;
 end bubbleSort;
```

```
function bubbleSort
  input Real [:] unordElem;
  output Real [size(unordElem, 1)] ordElem;
  protected
    Real tempVal;
    Boolean isOver = false;
  algorithm
    Debug.register_in("unordElem",unordElem);
    Debug.step(...);
    ordElem := unordElem;
    Debug.register_out("ordElem", ordElem);
    Debug.register_in("isOver", isOver);
    Debug.step(...);
    while not isOver loop
     isOver := true;
     Debug.register_out("isOver", isOver);
     Debug.register_in("ordElem",ordElem);
     Debug.step(...);
     for i in 1:size(ordElem, 1)-1 loop
       Debug.register_out("i", i);
       Debug.register_in("i", i);
       Debug.register_in("ordElem[i]",
                           ordElem[i]);
       Debug.register_in("ordElem[i+1]",
                           ordElem[i+1]);
       Debug.step(...);
   ...
end bubbleSort;
```

Debugger Implementation – Functionality (1)

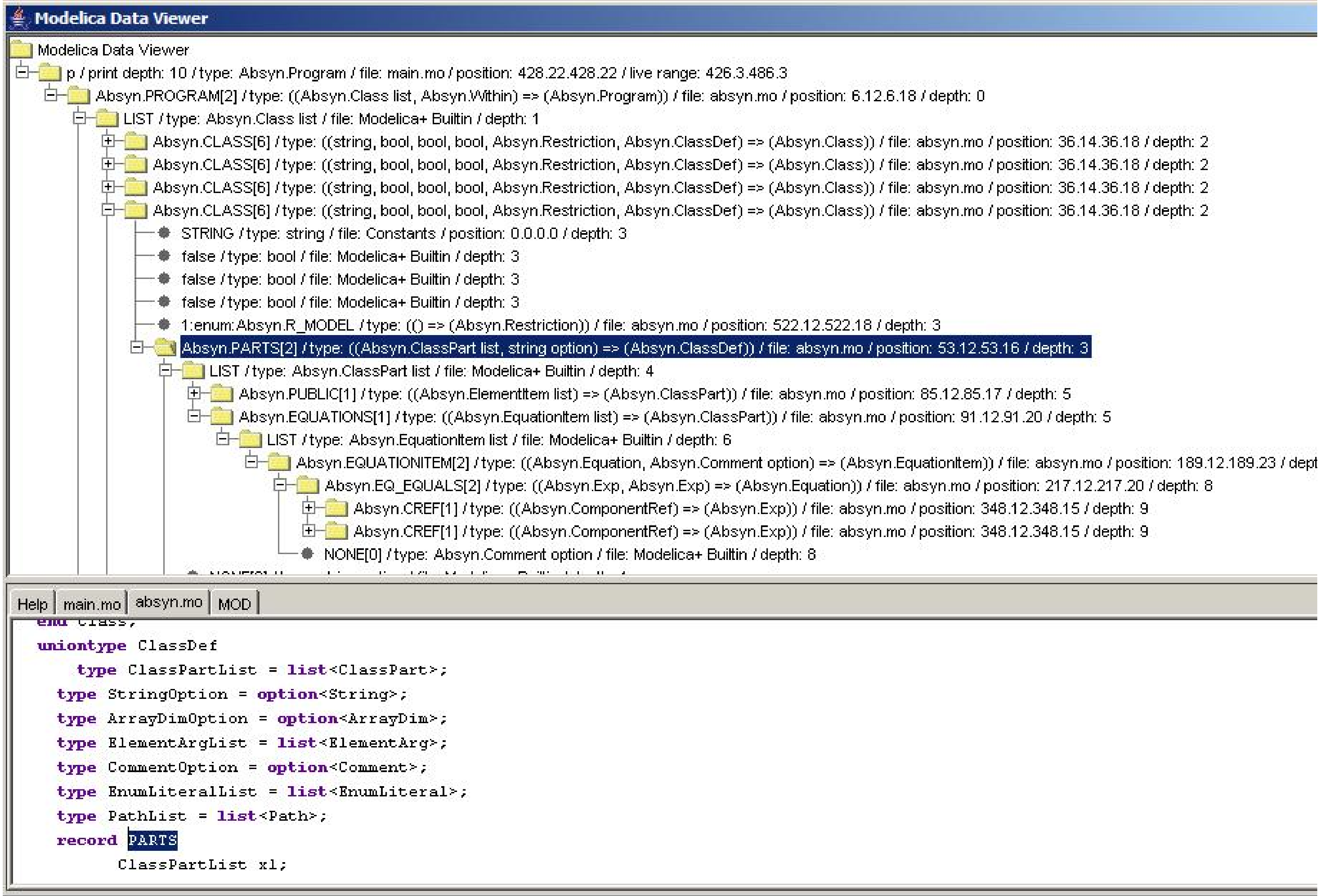
- Breakpoints
  - can be placed on lines or function/package names
  - can be deleted (selectively or all)

- Stepping and Running
  - step mode (step into) – stops before each statement
  - run mode – stops only at breakpoints
  - next mode (step over) – stops at next function call

Debugger Implementation – Functionality (2)

- Examining data
  - printing variables
  - setting the depth of printing
  - sending variables to an external browser
- Additional functionality
  - viewing status information
  - printing backtrace information (stack trace)
  - printing call chain
  - setting debugger defaults
  - getting help

Java Browser for Modelica+ Data Structures



Conclusions and Future Work

- Releasing the debugger together with OpenModelica compiler (implemented in Extended Modelica)
- Supporting all Modelica algorithmic constructs
- Better integration with other Modelica tools
  - model editor
  - equation debugger
  - Eclipse plugin for Modelica

Debugger Demo

- Debugger demo on an expression evaluator

Thank you!

Questions?