Compiler Practical 2013

Context Analysis

Berthold Hoffmann (B. Gersdorf, T. Röfer)
hof@informatik.uni-bremen.de
Cartesium 2.48

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Forschungszentrum
für Künstliche
Intelligenz GmbH

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Structure

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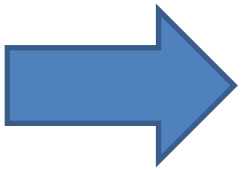
1. Context Analysis
2. Administration of Declarations
3. Extensions of the Syntax Tree
4. Task: Allowing Several Classes in a Program

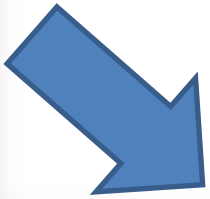
Context Analysis (1)

```
CLASS Main
  METHODS
    METHOD main
      VARIABLES
        c : Integer
      BEGIN
        READ
          c
        WHILE
          NEQ
            c
            MINUS
              1 : _Integer
          DO
            WRITE
              c
            READ
              c
```

LOOPc -s

LOOPc -c





LOOPc -i

```
CLASS Main
  METHODS
    METHOD main
      VARIABLES
        c (1) : Integer
      BEGIN
        READ
          c : REF Integer
        WHILE
          NEQ : _Boolean
            UNBOX : _Integer
              DEREF : Integer
                c : REF Integer
            MINUS : _Integer
              1 : _Integer
          DO
            WRITE
              UNBOX : _Integer
                DEREF : Integer
                  c : REF Integer
            READ
              c : REF Integer
```

```
Line4, Column 13: Integer is predefined
Line6, Column 14: c ist defined in Line 4, Column 9
Line7, Column 15: c ist defined in Line 4, Column 9
Line8, Column 19: c ist defined in Line 4, Column 9
Line9, Column 18: c ist defined in Line 4, Column 9
```

Context Analysis (2)

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- Identification
  - Where has the identifier been declared?
  - Which type does it have?
  - Visibility (simultaneous, local, global, hiding)
- Type analysis
  - Which type do the operands in expressions have?
  - Are expressions type-correct?

Context Analysis (3)

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- Extensing the syntax tree
  - (Un)boxing and de-referencing variables
  - *Insert SELF*
  - Simplifies code generation (later)
- Determining (relative) addresses
  - Local variables relative to stack frame
  - Attributes relative to start address of the object

Declarations: *ClassDeclaration*

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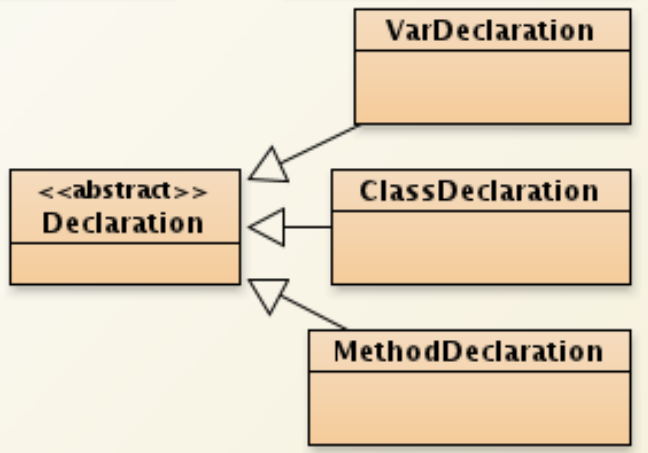
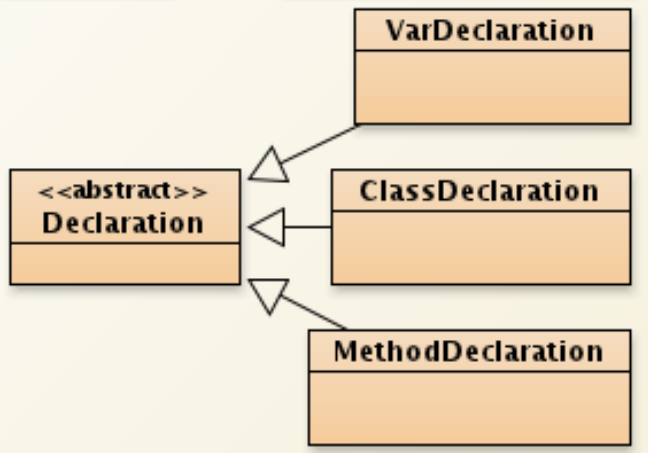
- *ClassDeclaration* contains *MethodDeclarations* and *VarDeclarations*
- Stores the *declarations valid in a class*



- Knows the size of the objects of a class (*objectSize*)
- Contains methods for type comparison
- Contains every predefined type as a class attribute

Method-, VarDeclaration

- *MethodDeclaration*
  - Contains *VarDeclarations* and *Statements*
  - Declares *SELF*



- *VarDeclaration*
  - Can distinguish attributes and local variables (*isAttribute*)
  - Contains the type of the attribute and local variable, resp.
  - Contains the relative address of the attribute and local variable, resp.
  - Does not generate code

Name Spaces(LOOP)

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- LOOP has a common name space for classes, variables, attributes, and methods
- Visibility levels in LOOP
  - Classes
  - Methods and attributes of the actual class
    - This level can also be entered with the dot operator
  - Local variables of the actual method

Example for Declaration Levels

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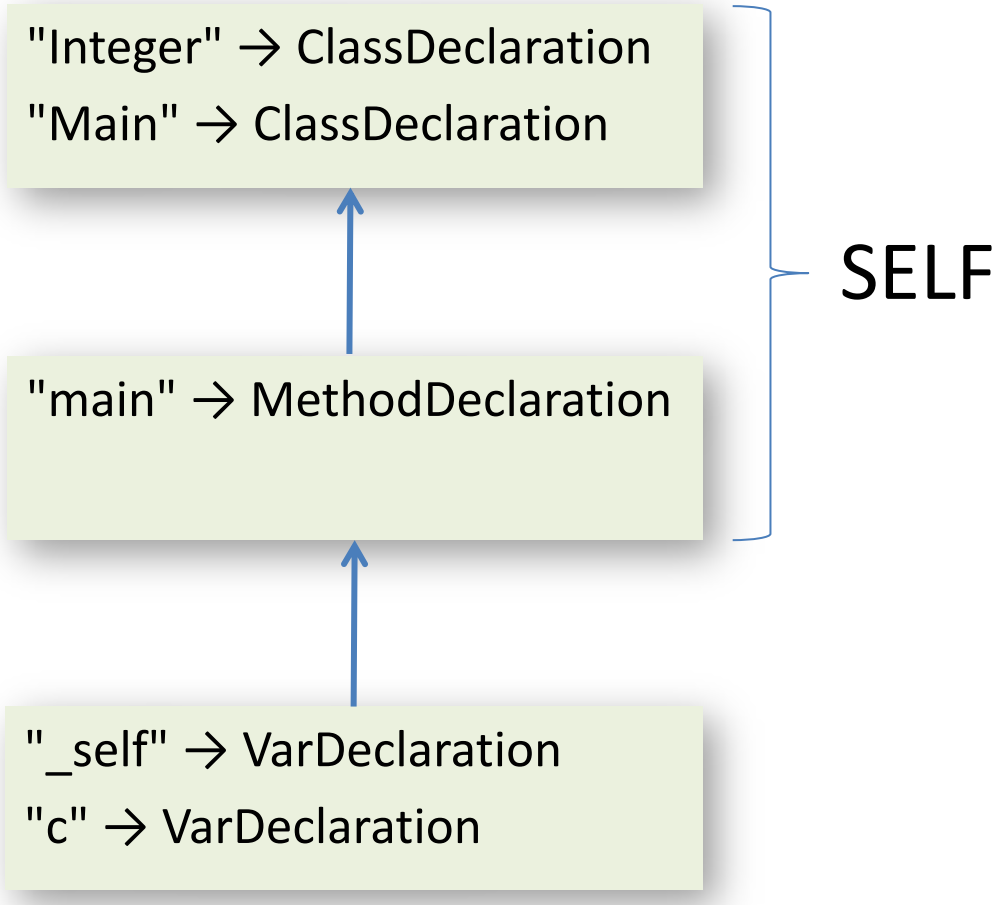
```
CLASS Main IS
   METHOD main IS
      c : Integer;
   BEGIN
      READ c;
      WHILE c # -1 DO
         WRITE c;
         READ c;
      END WHILE
   END METHOD
END CLASS
```



Declaration Sequences: *Declarations*

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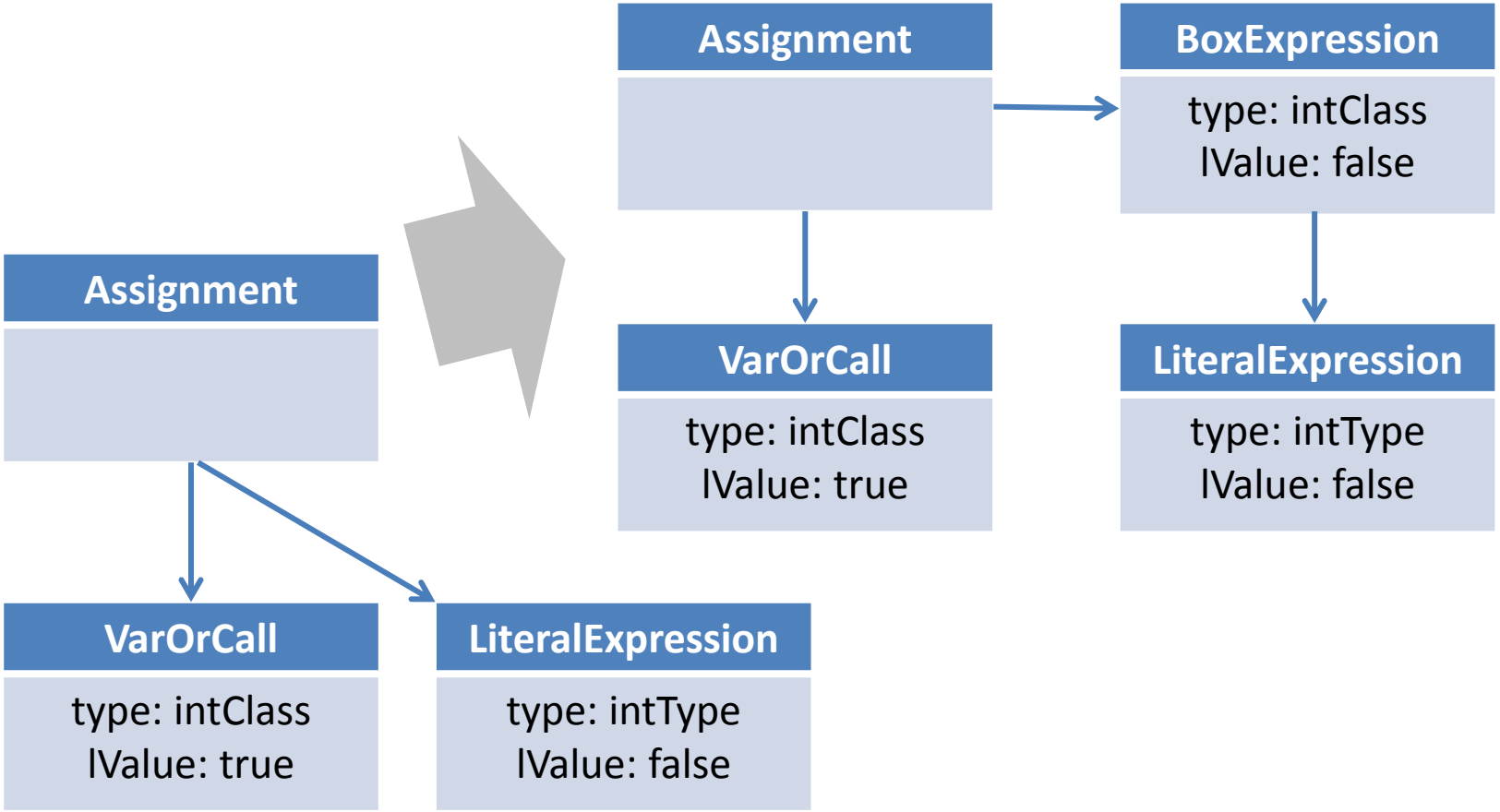
- Layers of Hashtables, which associate identifiers with declarations
- *enter*() generates a new level, *leave*() removes it
- *add*(...) inserts a declaration on top level
  - If the identifier has already been declared on top level, an error is signalled
- *resolve*(...) delivers the declaration of an identifier
  - *resolveType*(...) and *resolveVarOrMethod*(...) check the kind of the declaration
- Contains a reference to the actual class as well

Extending the Syntax Tree: Boxing

- a:=1;

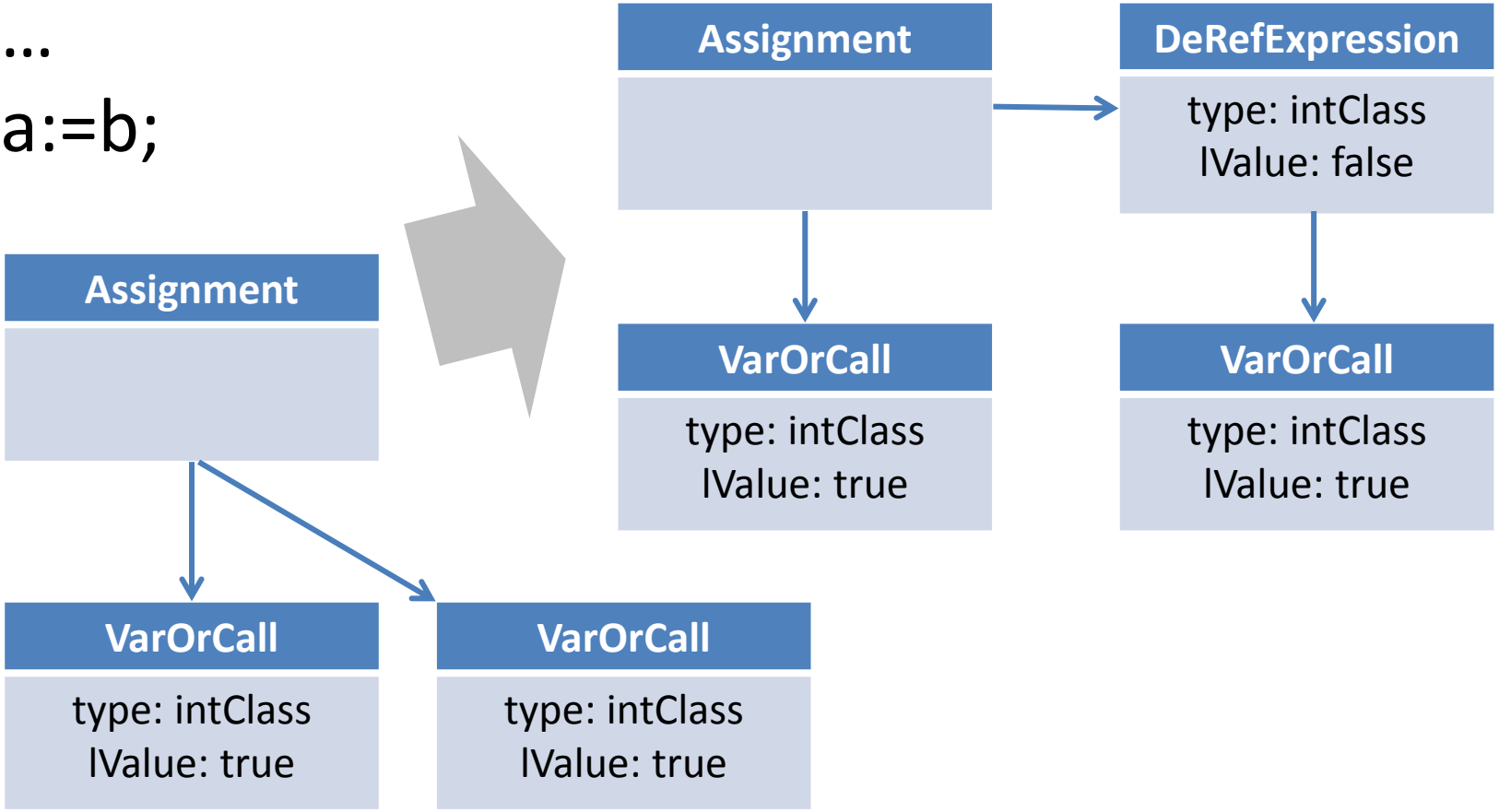


Dereferencing

- b: Integer;

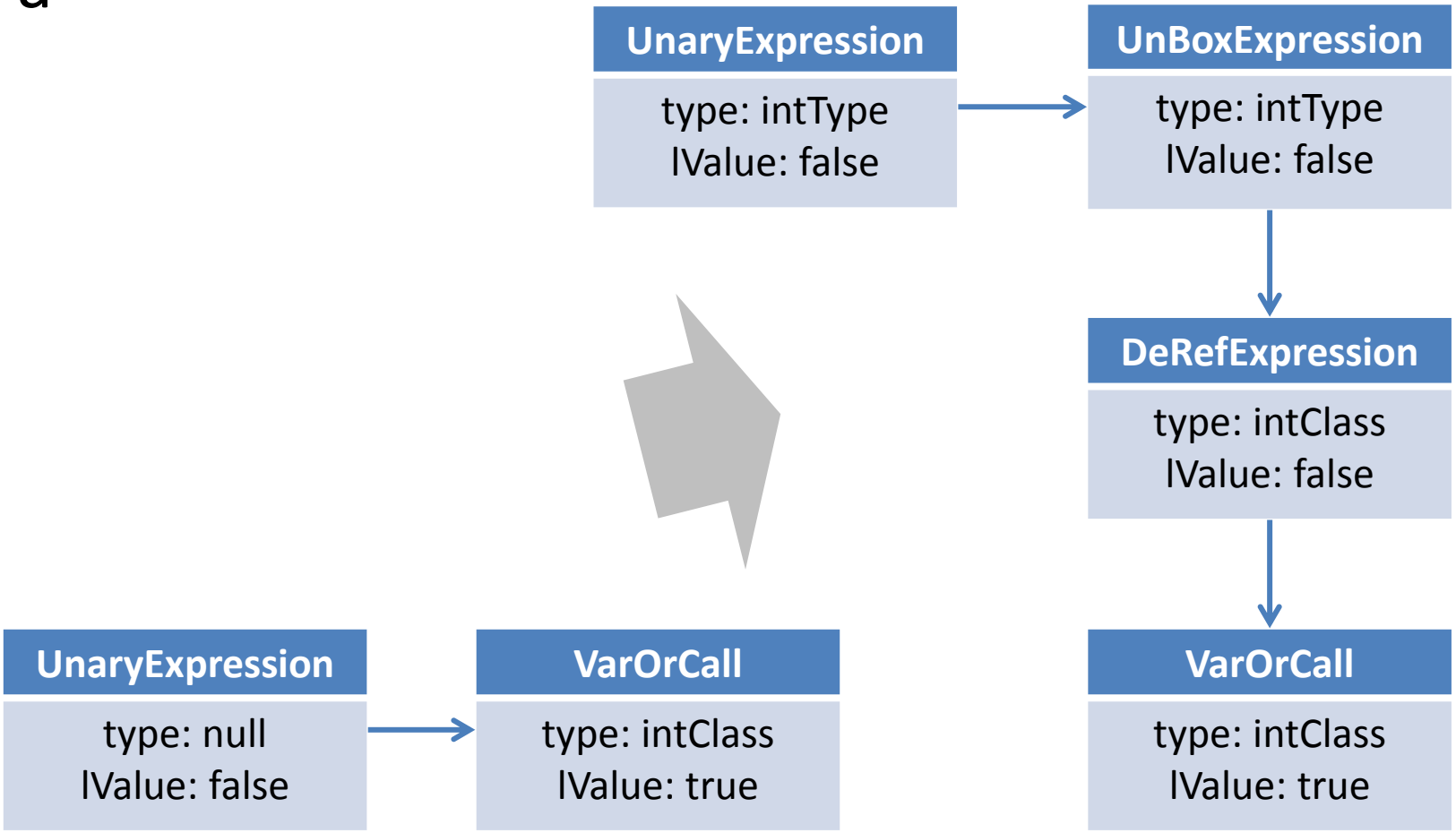
  …

  a:=b;



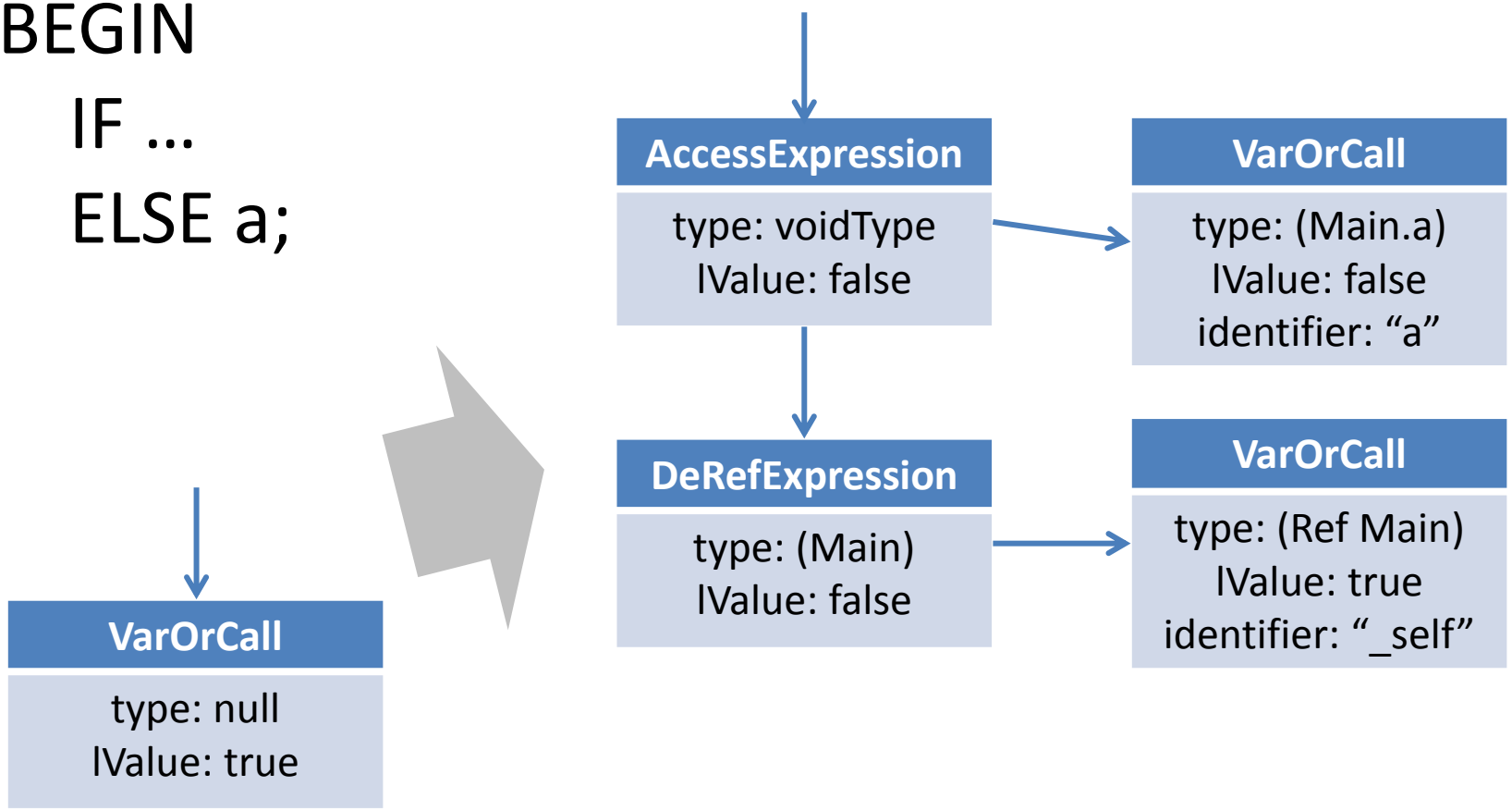
Unboxing and Dereferencing

- -a



Insert SELF

- METHOD a IS
  BEGIN
    IF …
    ELSE a;



Inserting SELF

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- *VarOrCall.contextAnalysis(...)* is not called for the right-hand side of an *AccessExpression*
  - Thus a *SELF*. Is inserted here, if the identifier is an attribute or method
- For the right-hand side of an *AccessExpression*, *VarOrCall.contextAnalysisForMember(...)* is called instead
  - Also for the left-hand side (in *VarOrCall.contextAnalysis(...)*)

Task: Programs with Several Classes

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- *Program.classes* replaces *Program.theClass*
- Simultaneous visibility *program* ::= { *classdecl* }
  - Methods may access attributes and methods of other classes
  - These classes have to be known before method bodies are checked

program ::= { *classdecl* }

- Enter*Integer* und *Boolean* in *Program.classes*
  - Then inheritance can be easier introduced, later
  - Add an attribute *_value* : *_Integer* oder *_value* : *_Boolean* instead of setting *ClassDeclaration*.(*int*|*bool*)*Class.objectSize* manually

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