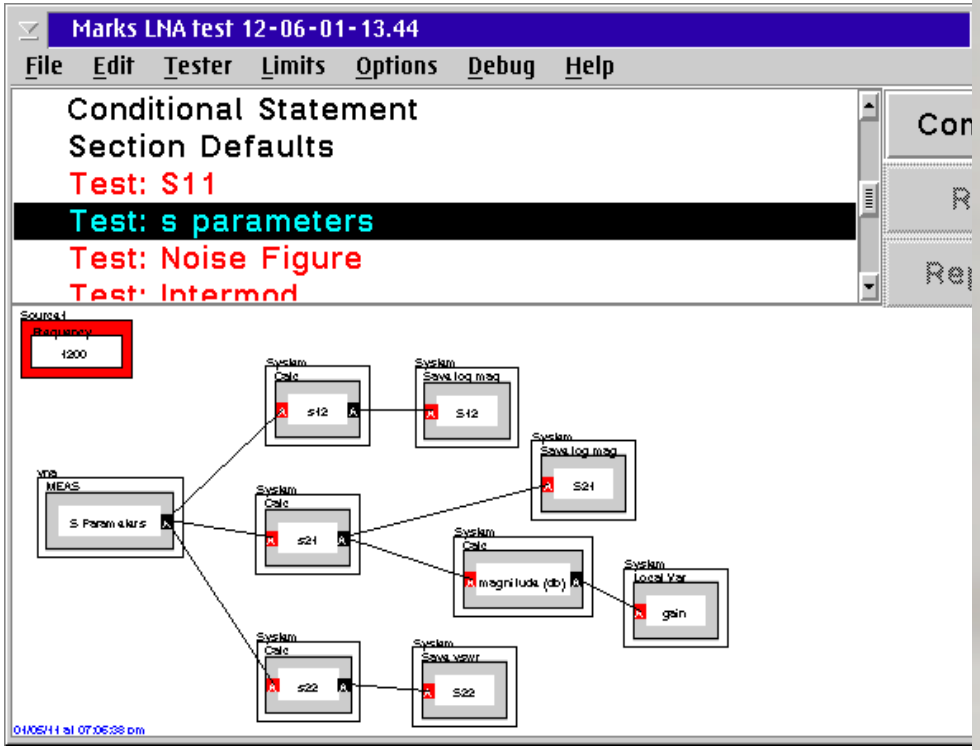
Roos Instruments, Inc.

RTALK -
A Smalltalk 'Live' Environment
Built on the JVM

Roos Instruments, Inc.

HARDWARE AND SOFTWARE FOR IC TEST



SMALLTALK AT RI

- Since 1989
- Efficiency - 3 to 9x Java
- Low errors - 1/3 Java
- 500K lines of code vs 2.5M
- But we now have Obsolete Platforms
  - OS/2
  - Digitalk STV
  - Heisenbug

Rtalk is a Fork of Smalltalk

- Not sure the JVM would support a full implementation
- Commercial distribution focus
  - Code repo based not image based
- Freedom to change
- Not in the spirit ST > Language

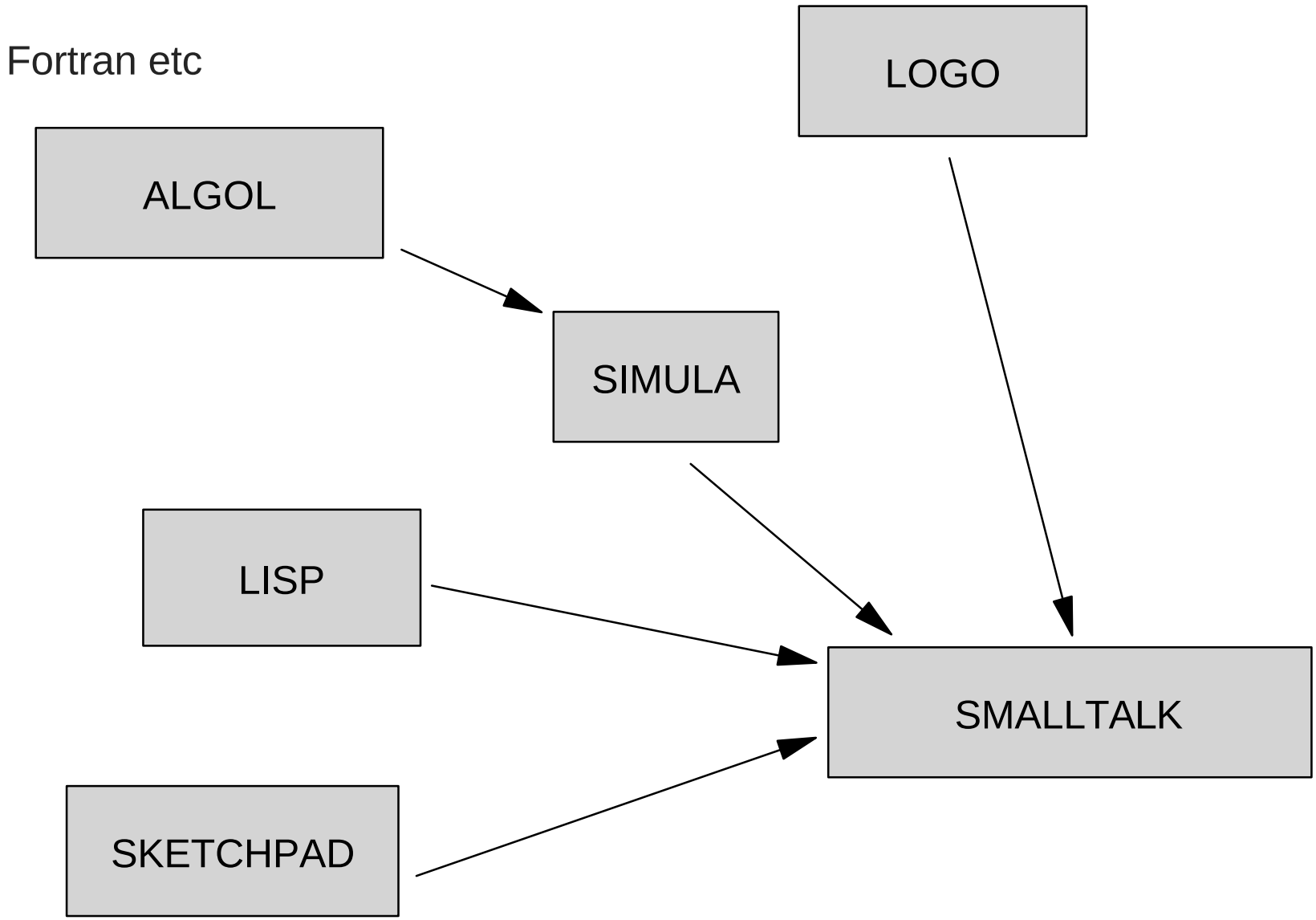
Why look at Smalltalk

- A Language should make you think (Perlis)
- It was an interesting time for computing
- Smalltalk was the start of a paradigm
- Maybe the current approaches are just fads

The real romance is out ahead and yet to come... Don't be misled by the enormous flow of money into... poor adaptations of incomplete ideas

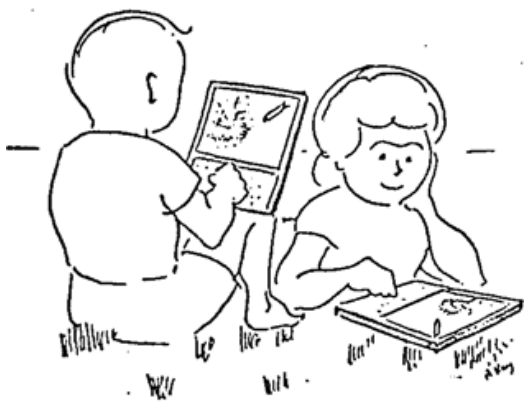
Alan Kay

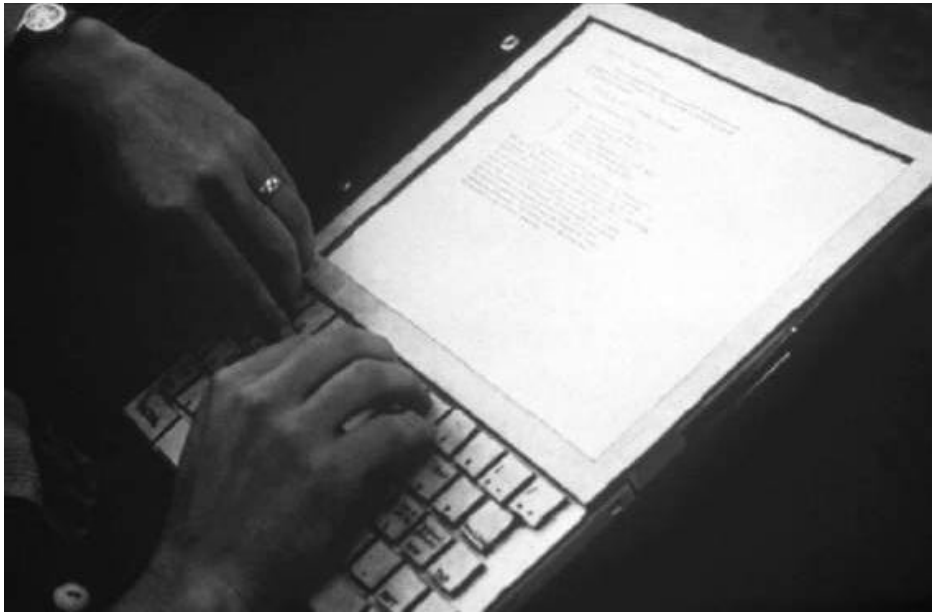
Languages at the time of Smalltalk



Dynabook

Goal to give users full flexibility for the creation and manipulation of knowledge especially for children





Smalltalk Philosophy

- Simpler but no simpler
- Support complex problems
- All about communication

Smalltalk Basics

- Everything is an Object
- Message Based not procedures
  - each Object is responsible to handle
- Class holds common behavior
  - shared message support
- Its all about communication

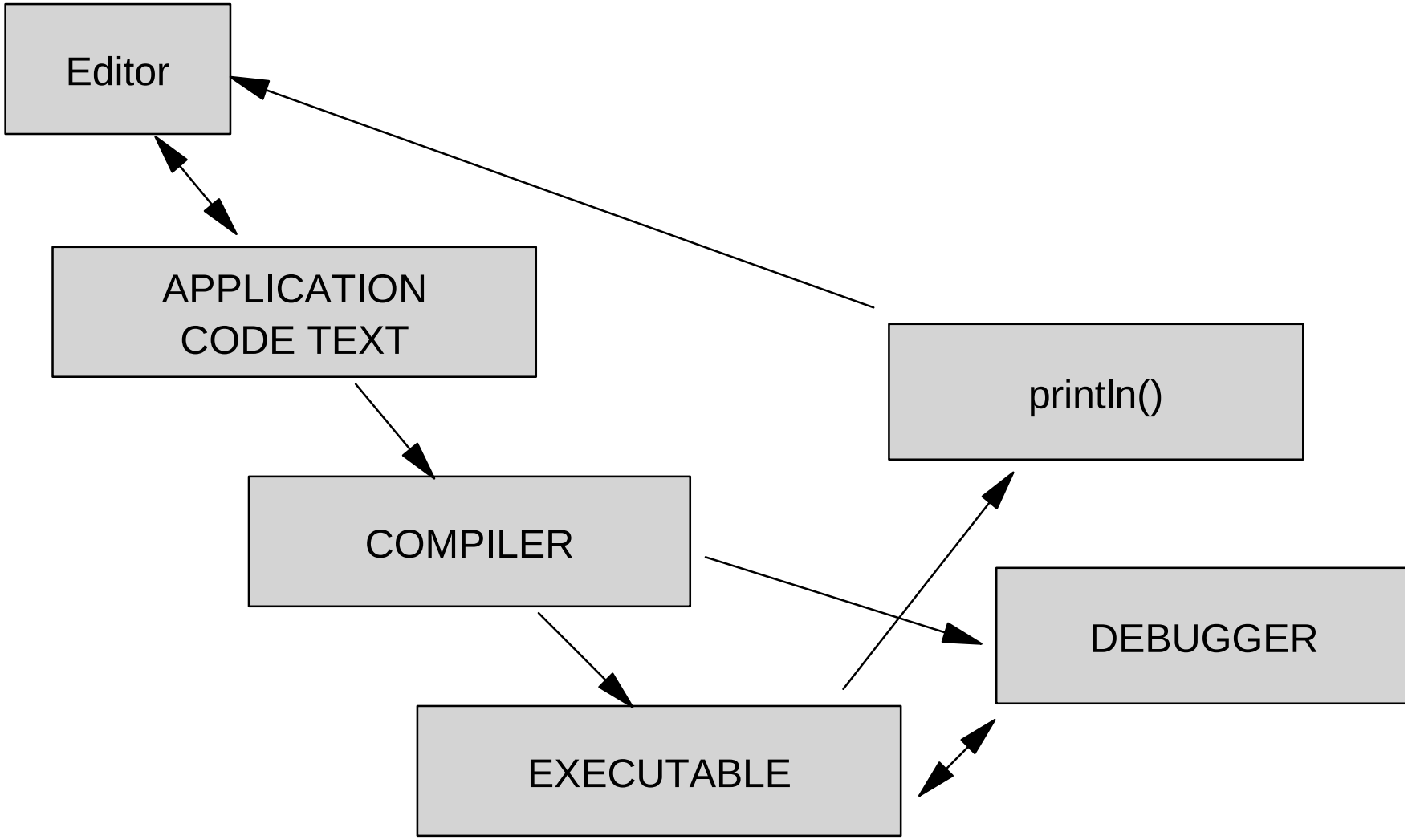
Impact of message sending

```
receiver perform:#foo with:args
```

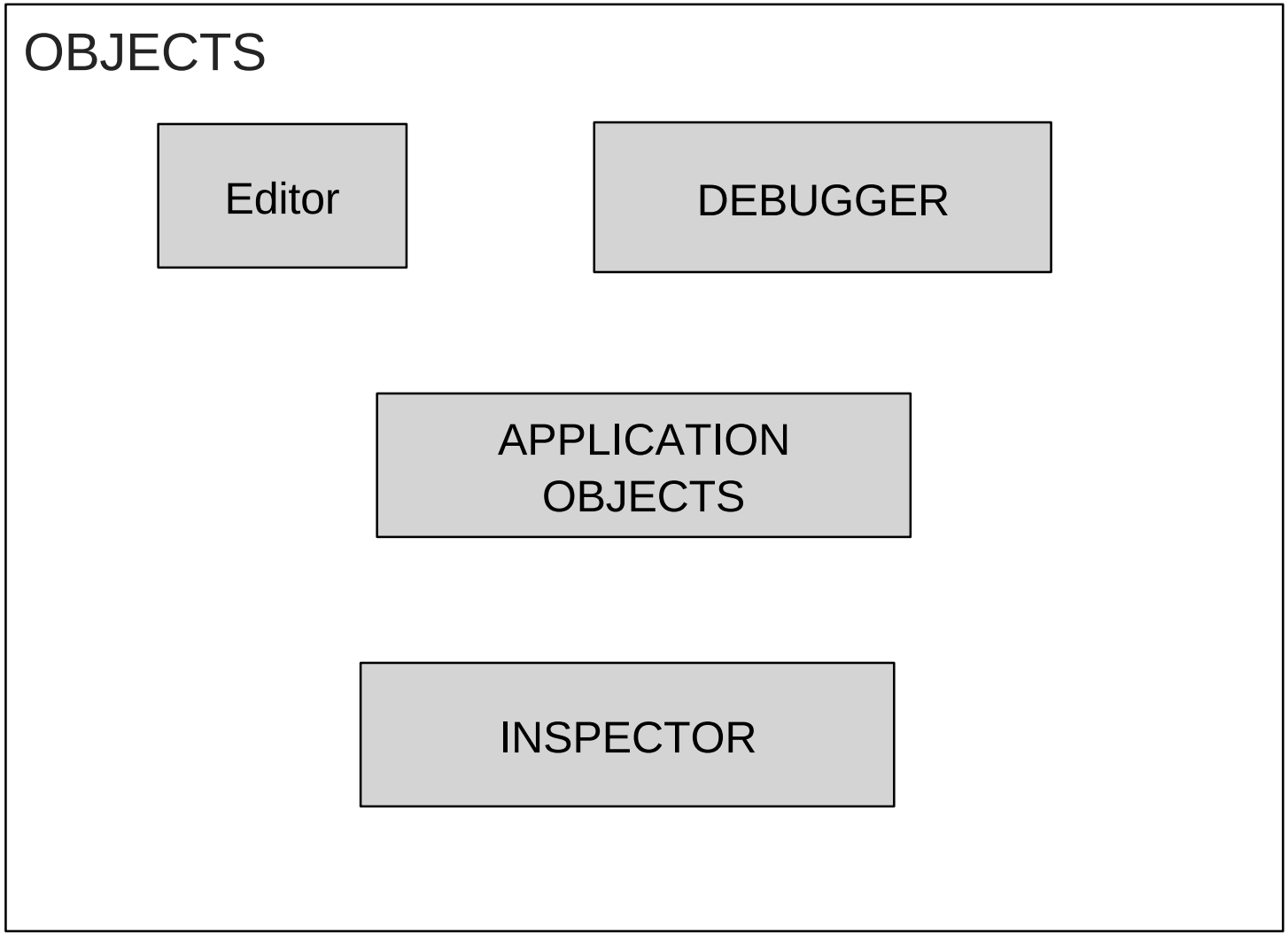
```
anArray detect:[ :a | a name = 'foo']
```

2 + 3 * 5 = ?

Existing Coding Flow



Smalltalk Coding Flow



'Live'?

Live means an instance based environment

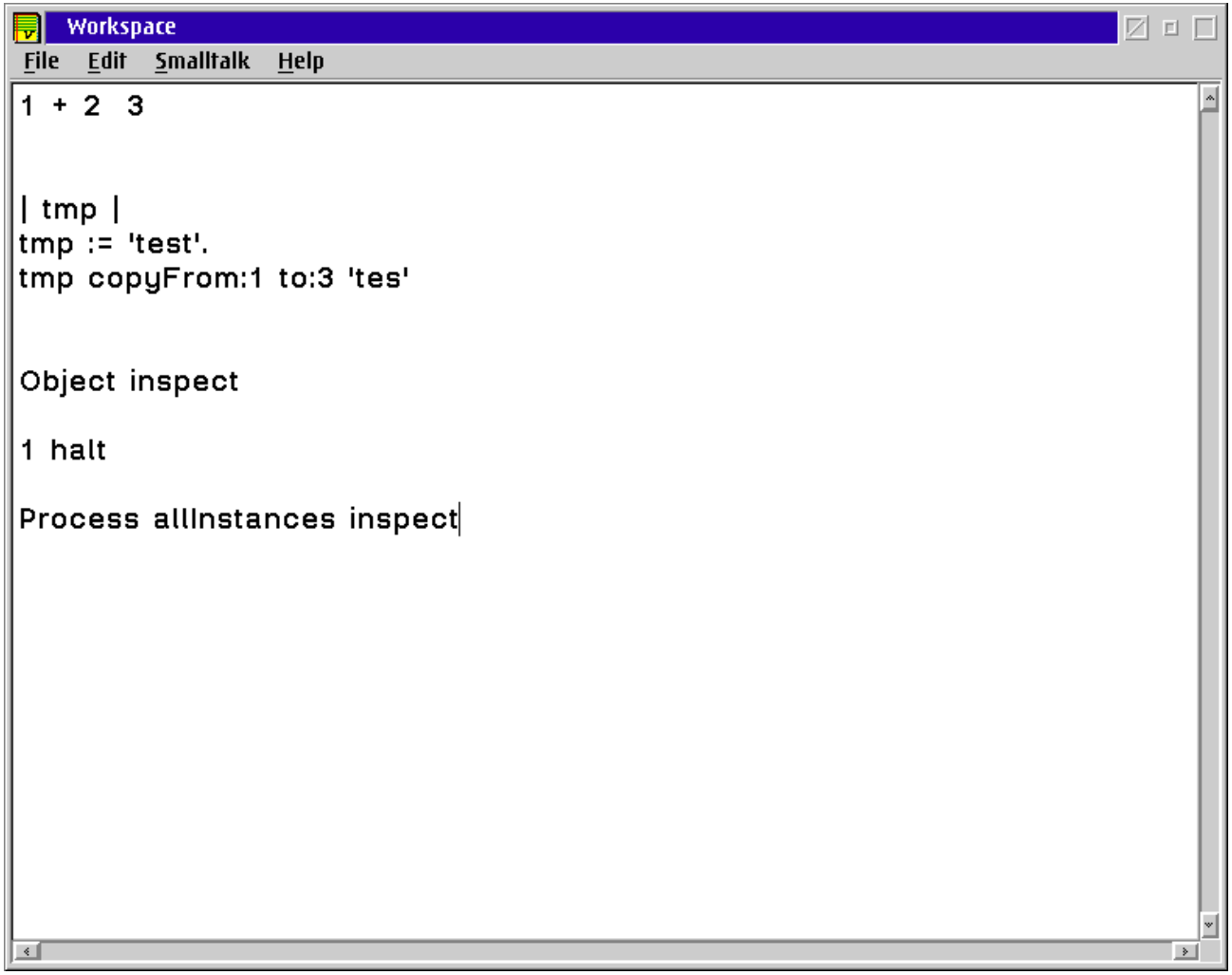
Fully Reflective

Fully Manipulative

What do we need to go 'LIVE'?

- Full Access to all Objects
- Run time code replacement
  - Code editing
- Access to all objects on heap
  - instance manipulation
- Access to stack slots
  - Debugger
- Thread Control (stop/step/run)

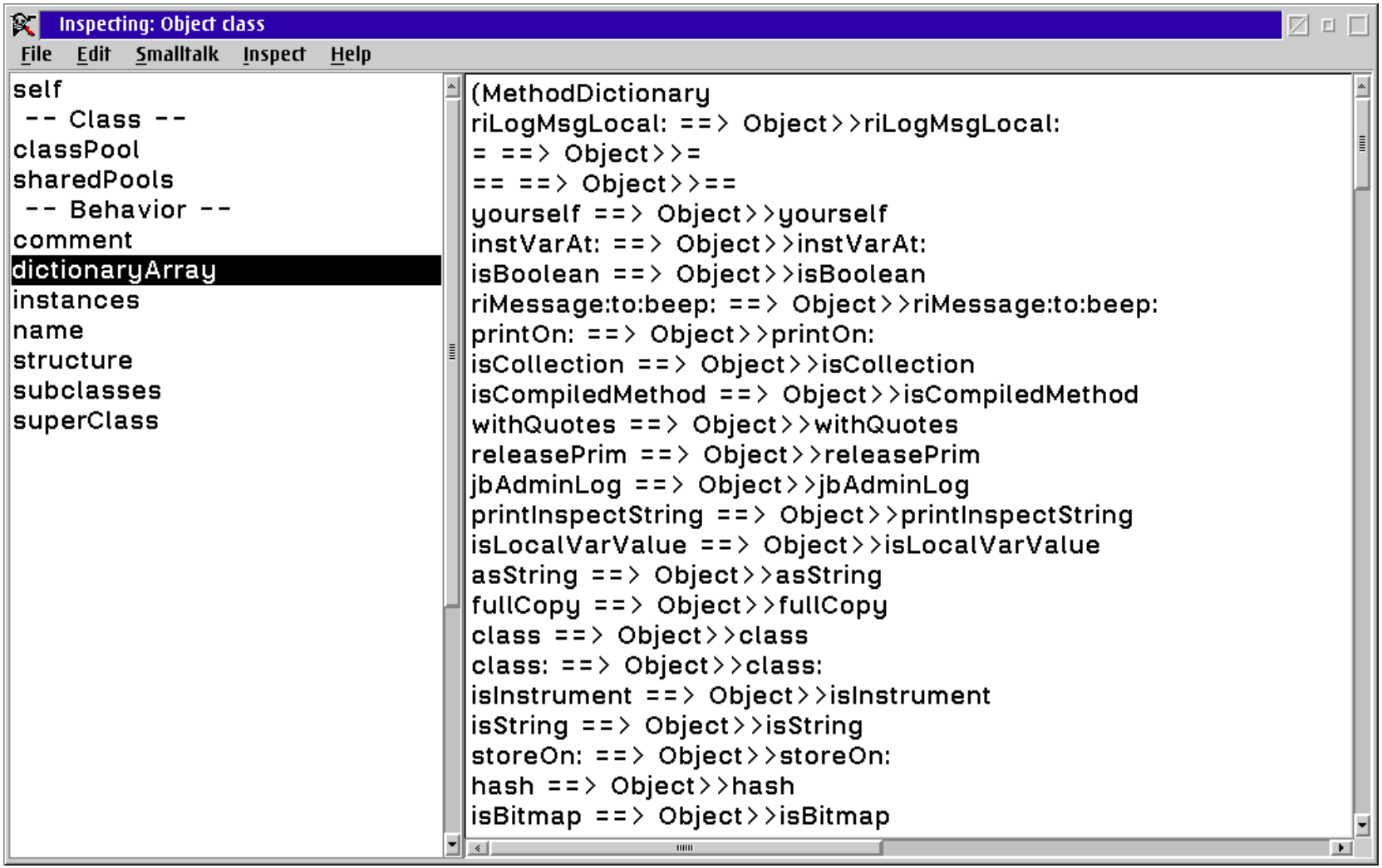
Smalltalk Workspace



WORKSPACE

- Text Pane
- All text panes are REPLs

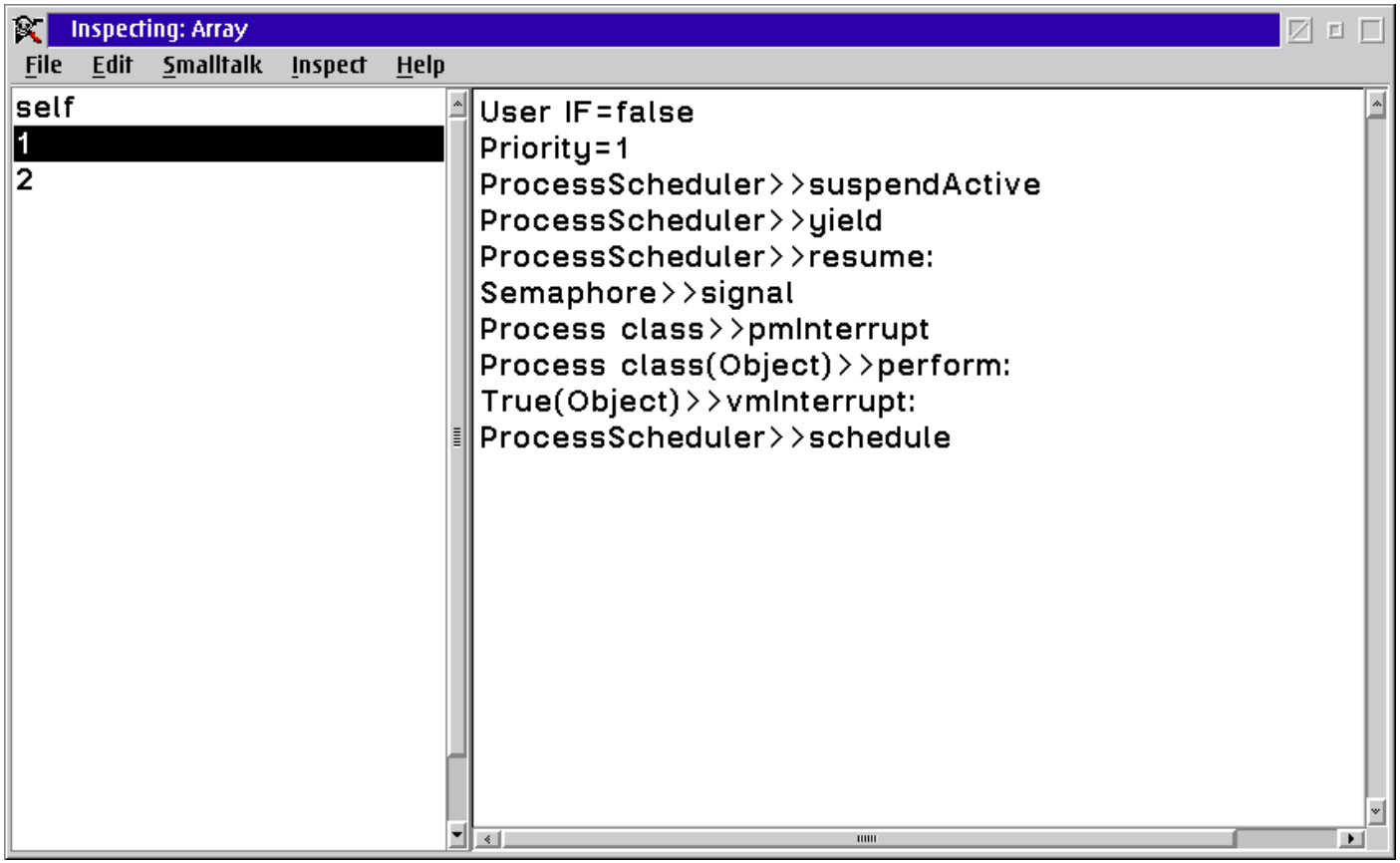
Smalltalk Inspector



INSPECTOR

- Goal Analyze all Objects
- Heap
  - instances
  - References
- Used JNI wrapping JVMTI

Smalltalk Inspector



Smalltalk Editor

GF10RC2A.148 modified alpha:Adds database as an option for local vars 04/05/12 04:06:56 pm

File Edit Smalltalk Classes Variables Methods Help Library

RiData...
RiDatabase
RiDataCache...
RiDataFFT
RiDataFlowMathCode
RiDataGenerator...
RiDataPointer
RiDataSingle...
RiDbTable
RiDependentConfig
RiDeviceTestPlan
RiDibPath

instance
class

attributes
description
guruAttributes
tables
-- Object class --
Dependents
RecursionInError
RecursiveSet

readDescFrom:
readFromCff:
readInfoFrom:
readTableFrom:
saveToGuru
table:

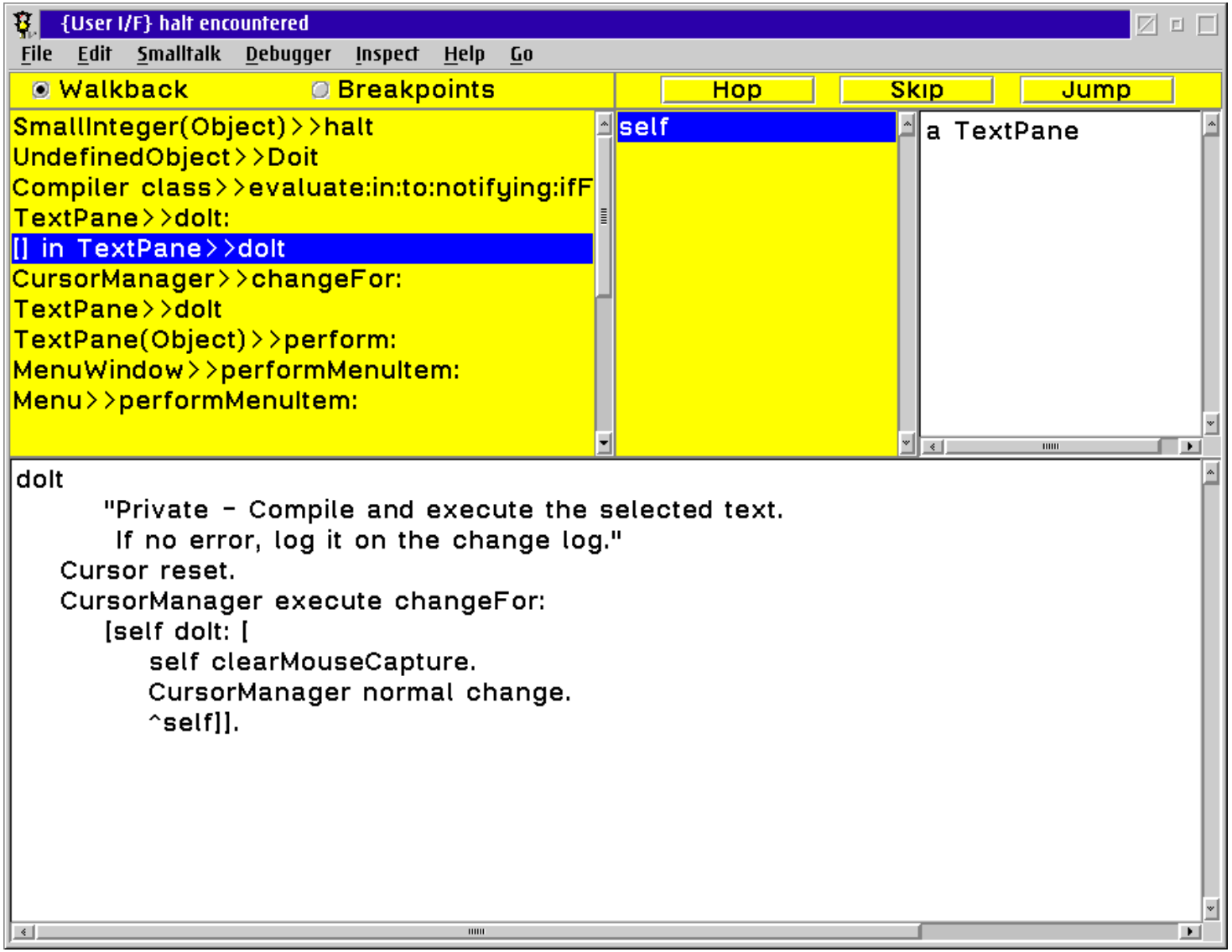
```
readInfoFrom:aFile
  "<modified:sys=G9TQQ5YA,time=10/25/11 at 07:41:07 pm>  "
  "<modified:sys=G9TQQ5YA,time=10/25/11 at 06:59:23 pm>  "
      "parse the info section"
   | tmp tmp1|

   [ aFile atEnd or:[aFile peek =$:]] whileFalse:[
      tmp := (aFile nextLine) riPair.
      tmp isEmpty ifFalse:[
          attributes at:(tmp at:1) put:(tmp at:2).
          ].
      ]
```

EDITOR

- Open (inspect) a root class
- All displays are reflective
- Text Pane compile context is list selection

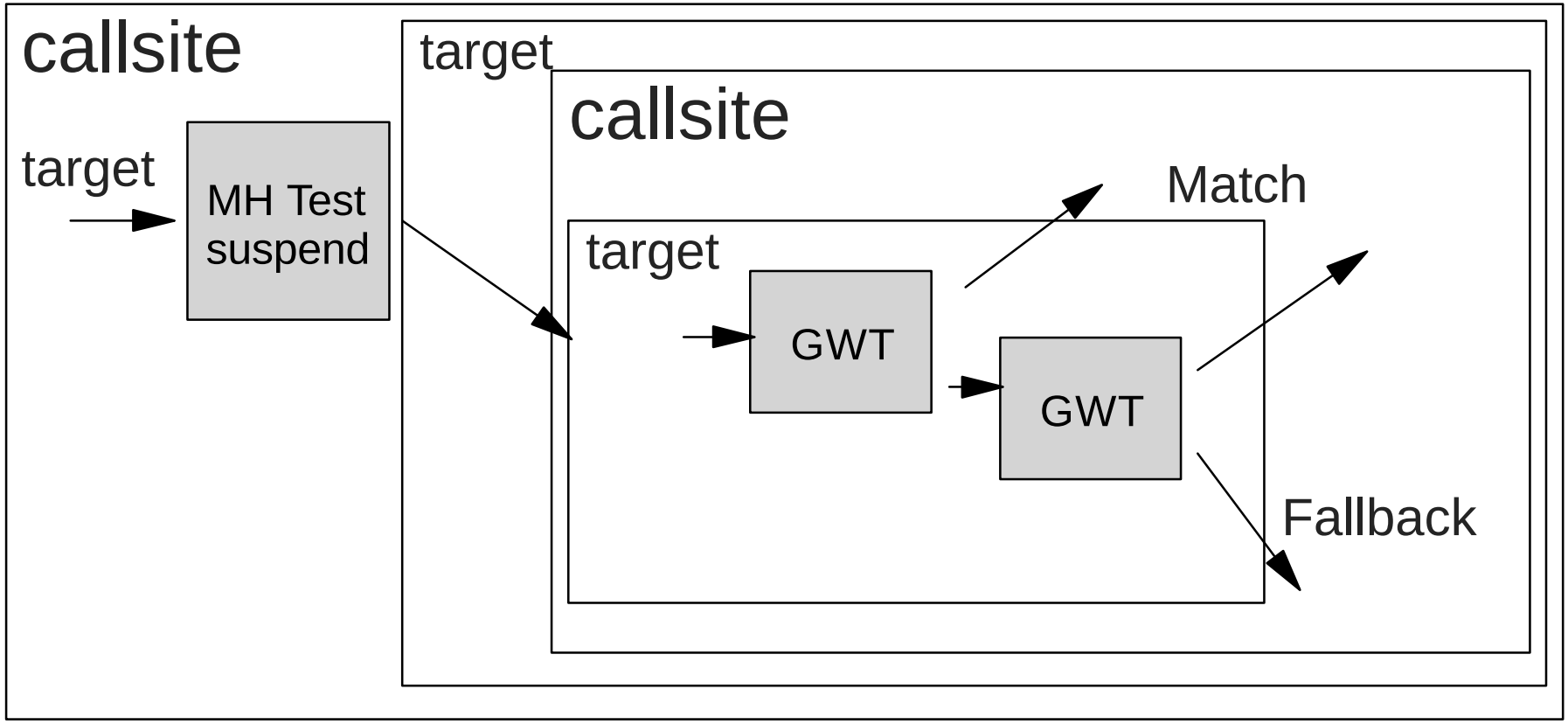
Smalltalk Debugger



Debugger

- Stack var inspection
- Hop step jump (thread control)
- Done with MethodHandles
- JVM stacks as well
- Convert all jvm errors to rtalk halts

MH Chain for debugger



Profiling

- CallSites on JVM side collect
- represented as Rtalk Objects
- Inspector just opens objects
- Done with MethodHandles

Performance for Hanoi 25

- java prims 151 ms
- smalltalk 350 ms
- java boxed 310 ms
- RtObject 425 ms
- Rtalk 960 ms Indy

Performance for RI software

- smalltalk 95 s
- Rtalk 35.881 s

FUTURE WORK

- Use and Share
- Async Messages (Linda)
- Actor base large scale concurrency
- Performance
- UI on Browser
- Objects in cloud
- coroutines

What I want from the jvm

- Visibility and access from the app
  - Hotspot
  - Heap
  - stack (coroutines?)
- Objects everywhere
- And at xmas a PIC methodHandle

References

- Viewpoints: http://vpri.org/
- dynabook: http://tkbr.ccsp.sfu.ca/dynabook/
- L. Peter Deutsch: www.ifs.uni-linz.ac.at/~ecoop/cd/papers/ec89/ec890073.pdf
- Free Smalltalk books: stephane.ducasse.free.fr/FreeBooks.html
- sample code (DropBox link on jvm summit wiki)
- mlvm mailing list http://mail.openjdk.java.net/mailman/listinfo/mlvm-dev
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