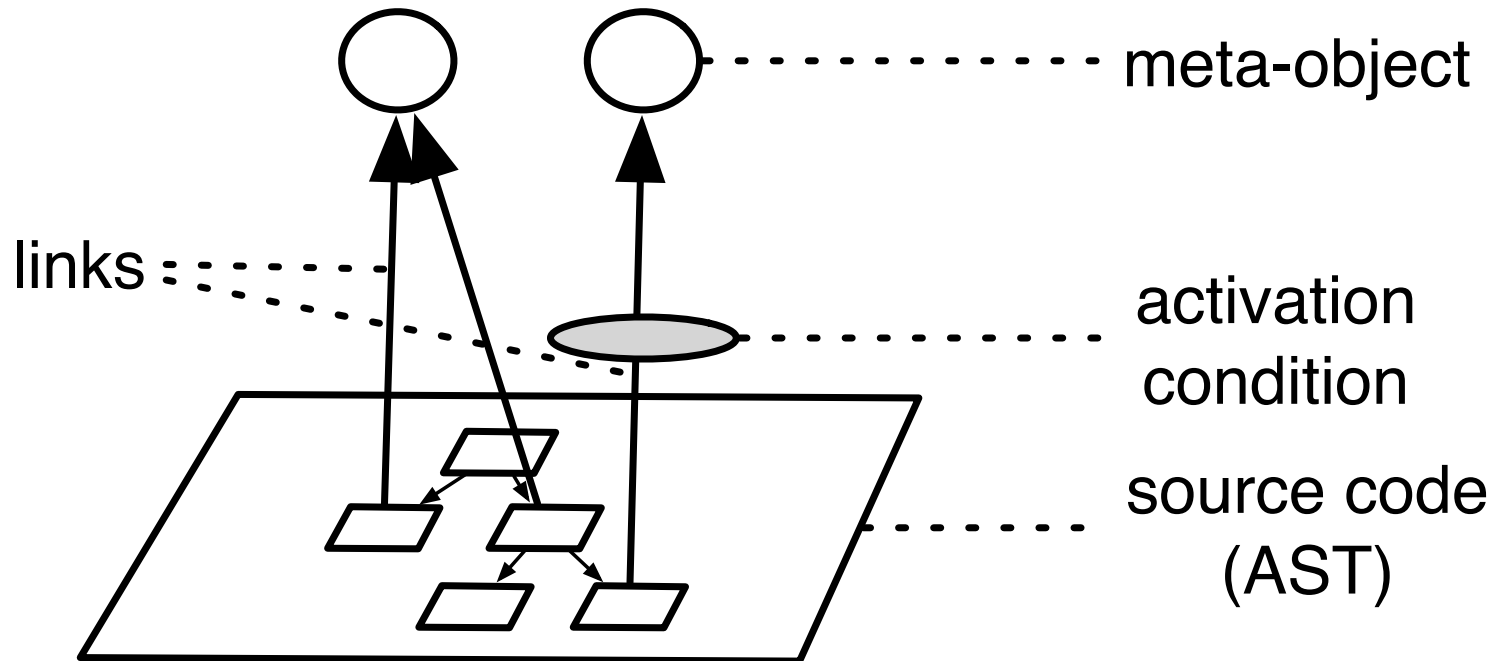


# The Meta in Meta-Object Architectures

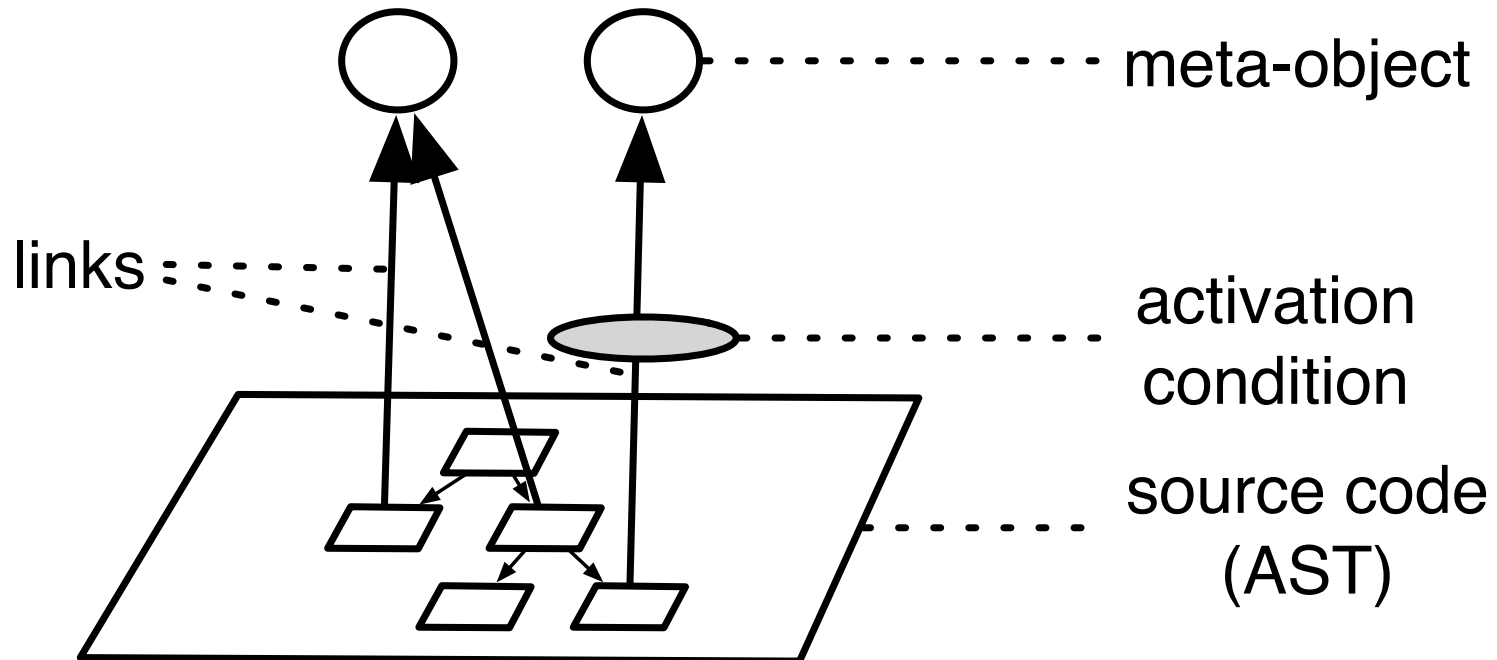
**Marcus Denker**, University of Bern  
Mathieu Suen, INRIA  
Stéphane Ducasse, INRIA

# Partial Behavioral Reflection



Tanter, OOPSLA 2003

# Partial Behavioral Reflection

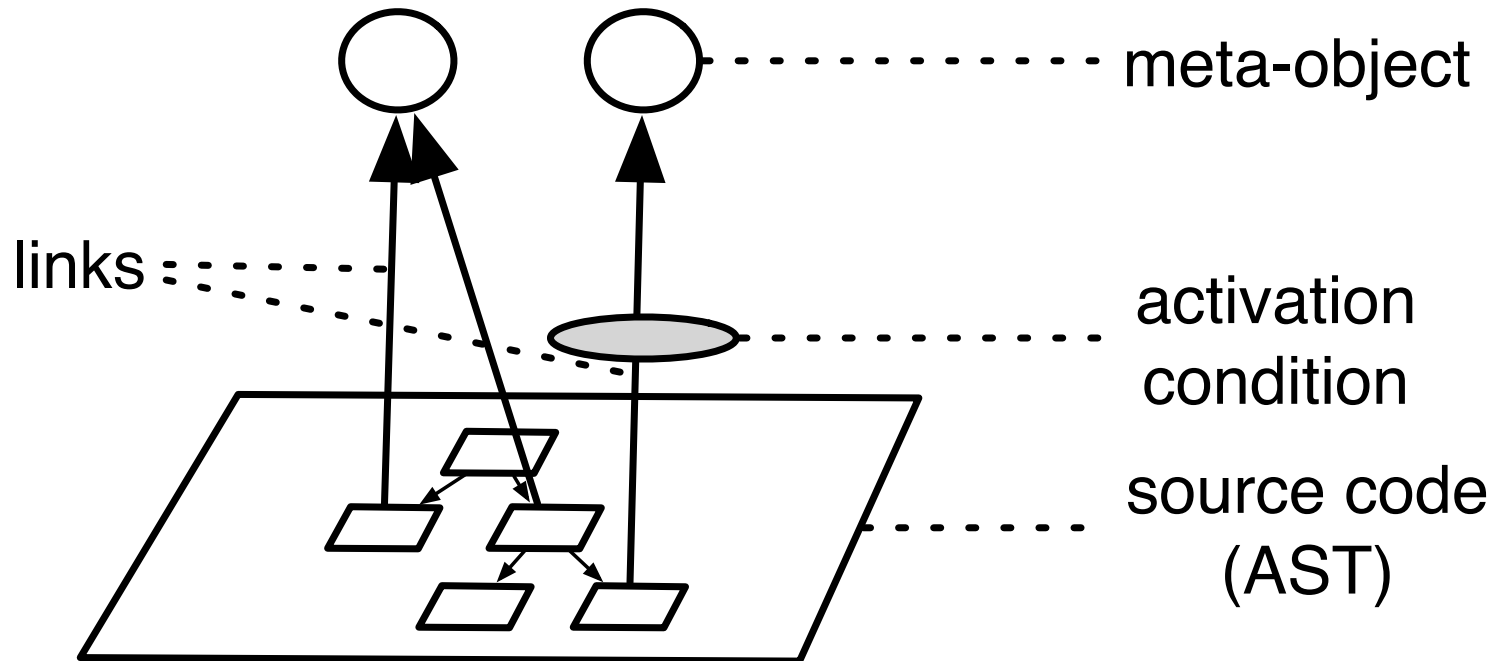


Dynamic  
(Smalltalk)

David Röthlisberger, Marcus Denker and Éric Tanter:  
**Unanticipated Partial Behavioral Reflection:  
Adapting Applications at Runtime**

Journal of Computer Languages, Systems and Structures, vol. 34, no. 2-3, July 2008, pp. 46-65.

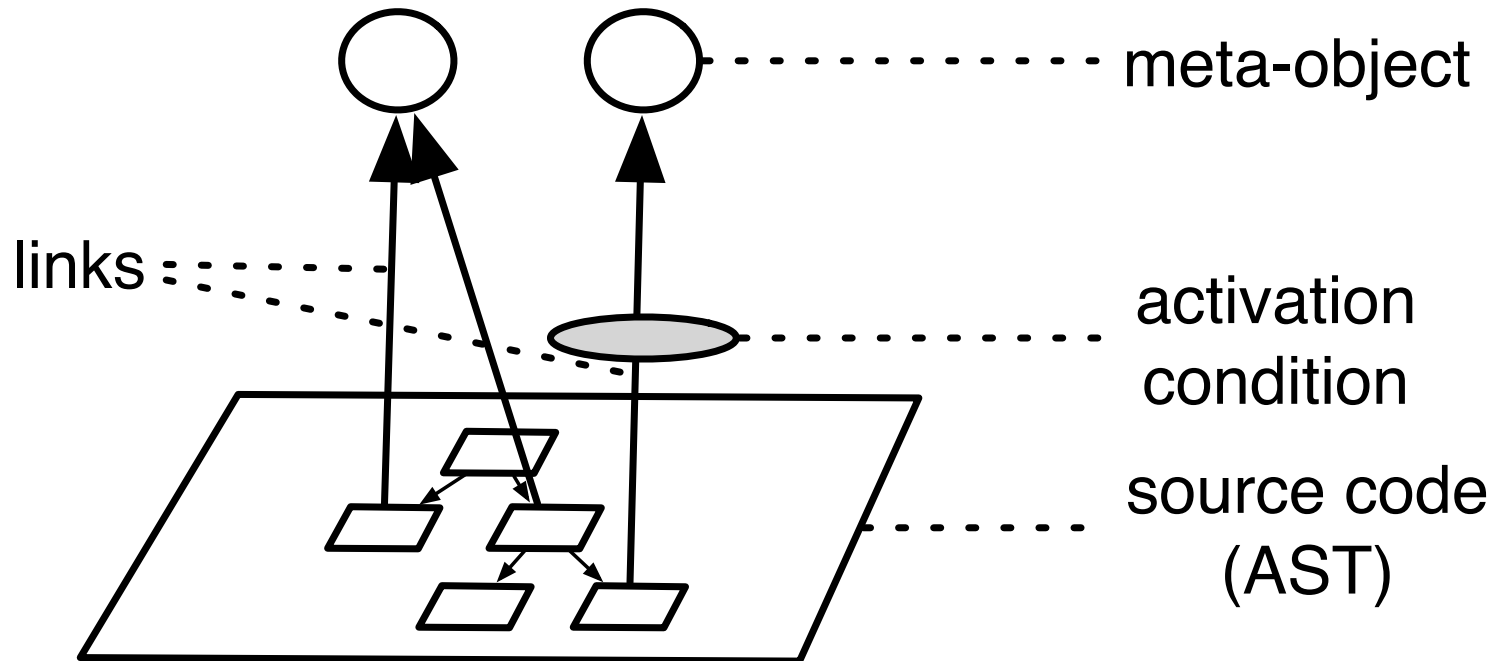
# Partial Behavioral Reflection



AST

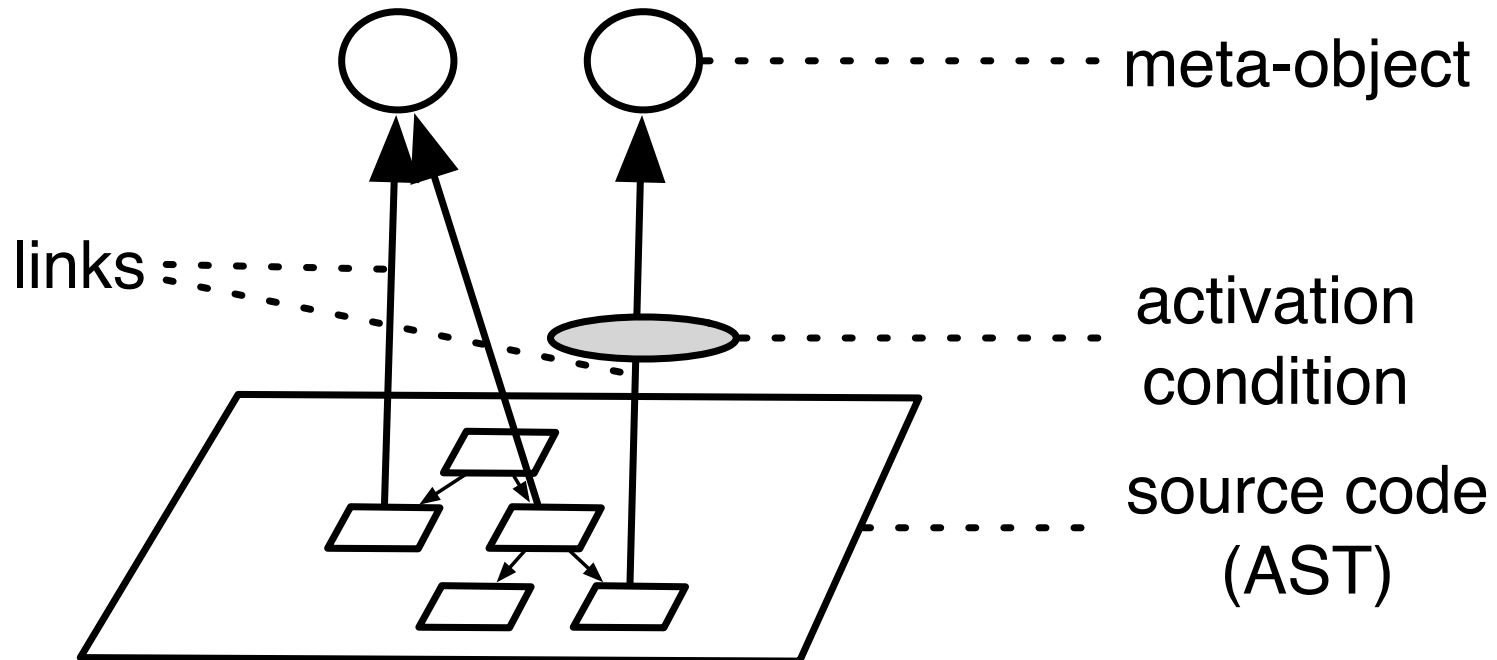
Marcus Denker, Stéphane Ducasse, Adrian Lienhard  
Philippe Marschall: **Sub-Method Reflection**  
Journal of Object Technology, vol. 6, no. 9,

# Behavioral Reflection: Flexible



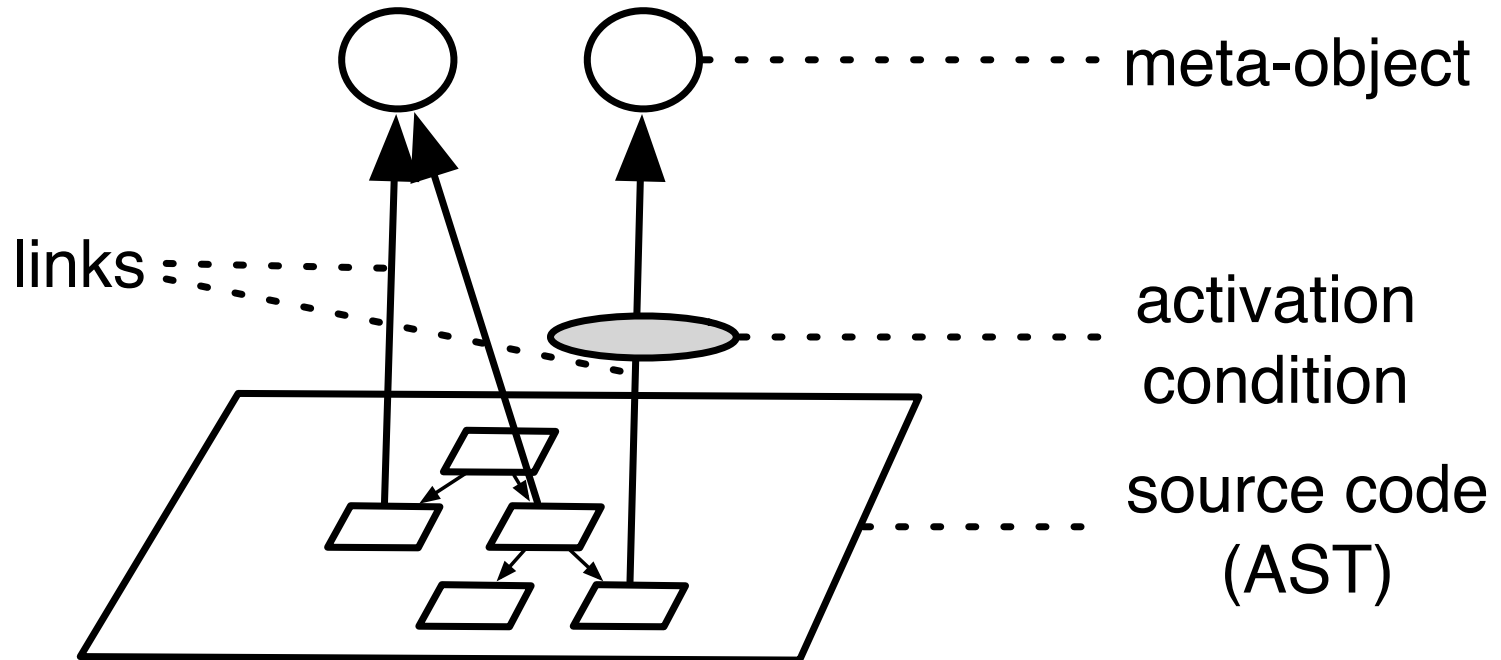
> Very Flexible

# Behavioral Reflection: CLOS



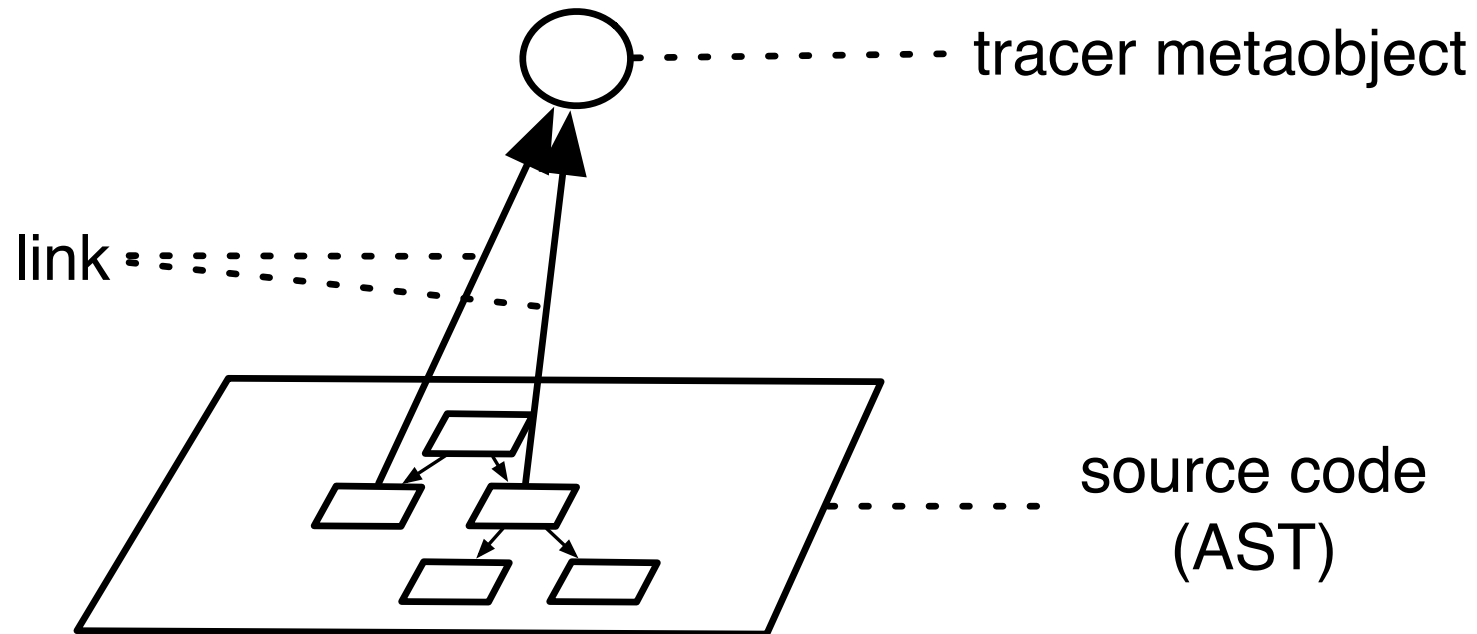
> Meta-class MOP (CLOS)

# Behavioral Reflection: AOP



> Aspects

# Behavioral Reflection: Tracer



> Tracer



# Problem: Recursion

- > Behavioral reflection cannot be applied to the whole system
  - System classes
  - Meta-objects

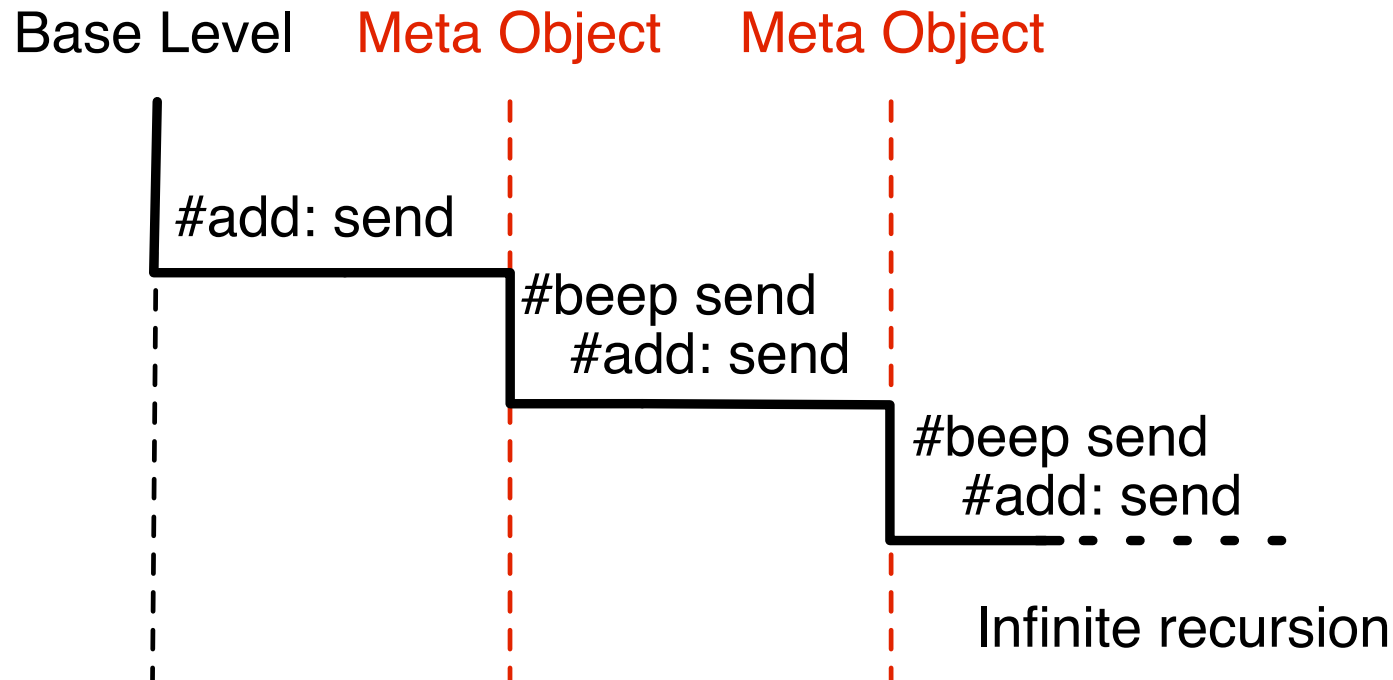
## Example: Beeper

> Call the Beeper from `OrderedCollection>>#add`

```
beepLink := Link new metaObject: Beeper.  
beepLink selector: #beep.
```

```
(OrderedCollection>>#add:) methodNode link: beepLink.
```

# Meta-object Call Recursion

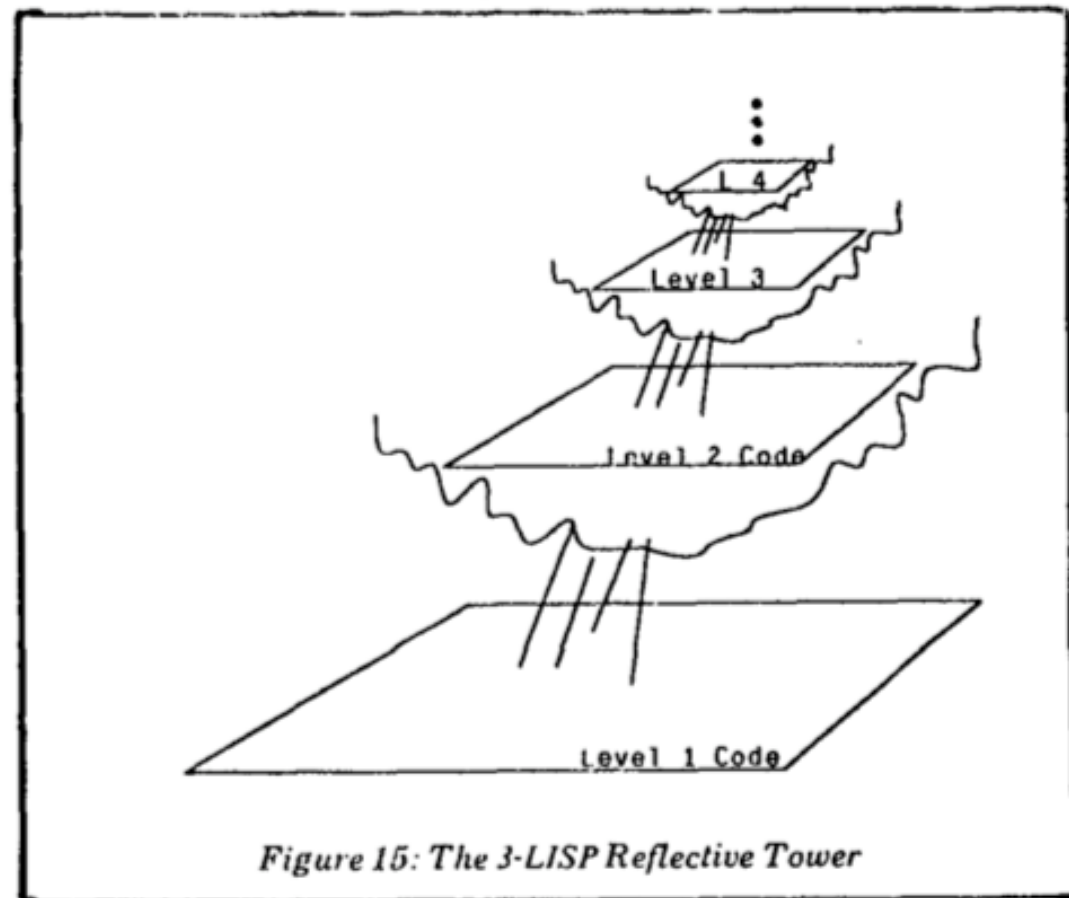


# Ad-hoc Solutions

- > Code duplication
- > Adding special tests

# Tower of Interpreters

> Smith, 1982

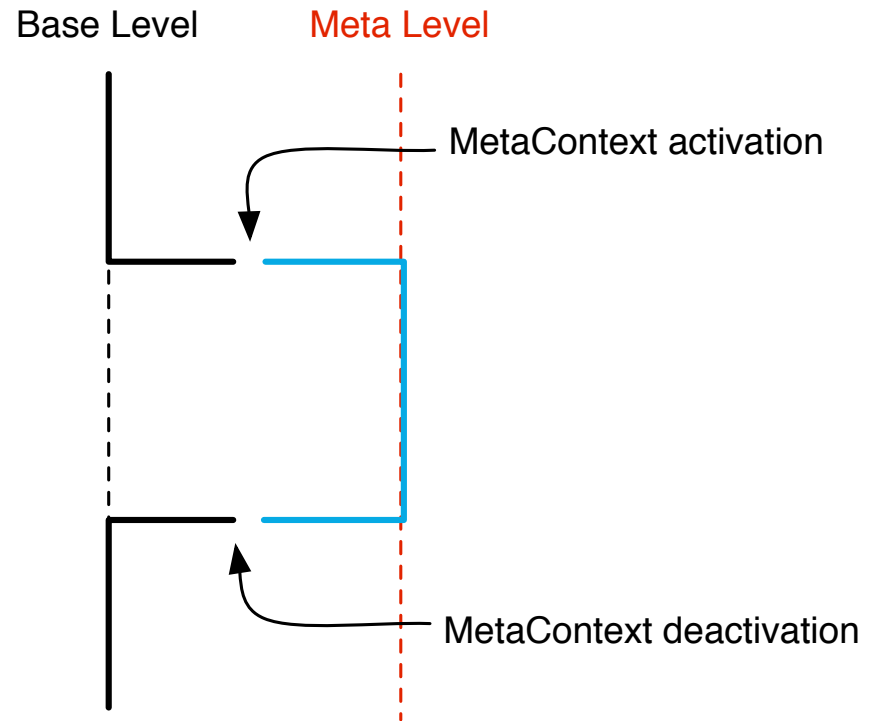


# The Real Problem

## Representing Meta-Level Execution

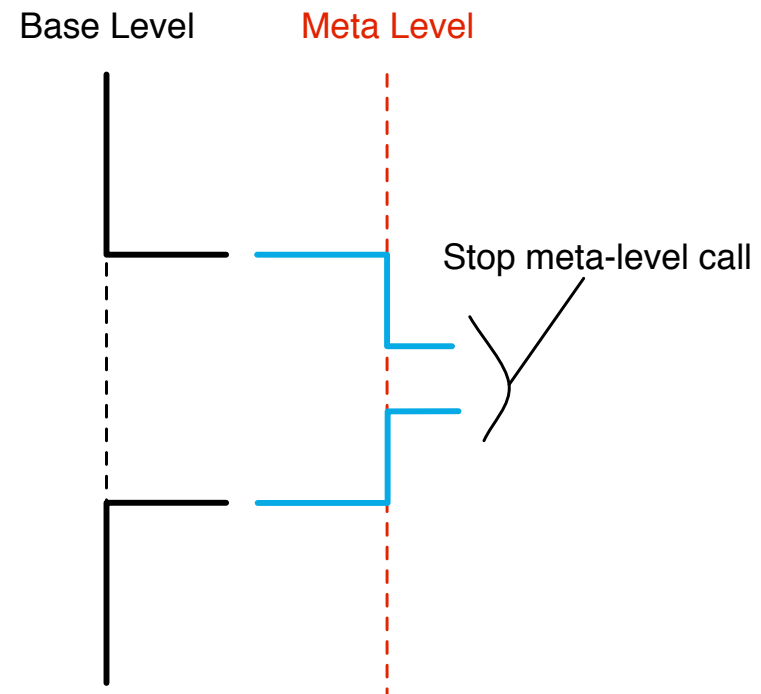
# The Meta-Context

- > Link enables **MetaContext**



# Context-aware Links

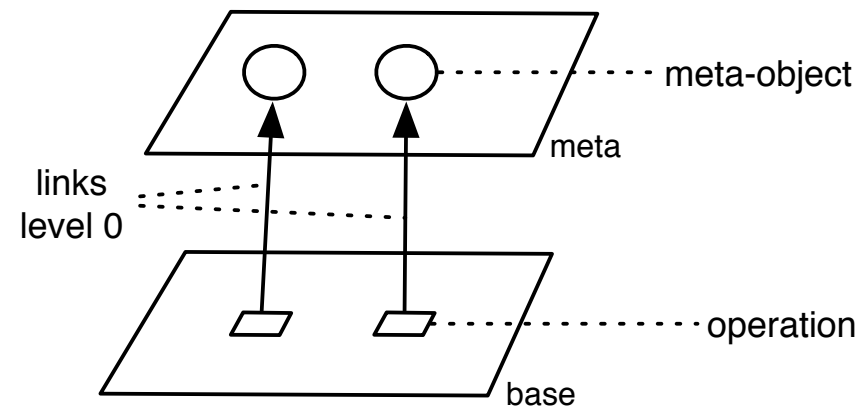
- > Disable call when already on the meta-level





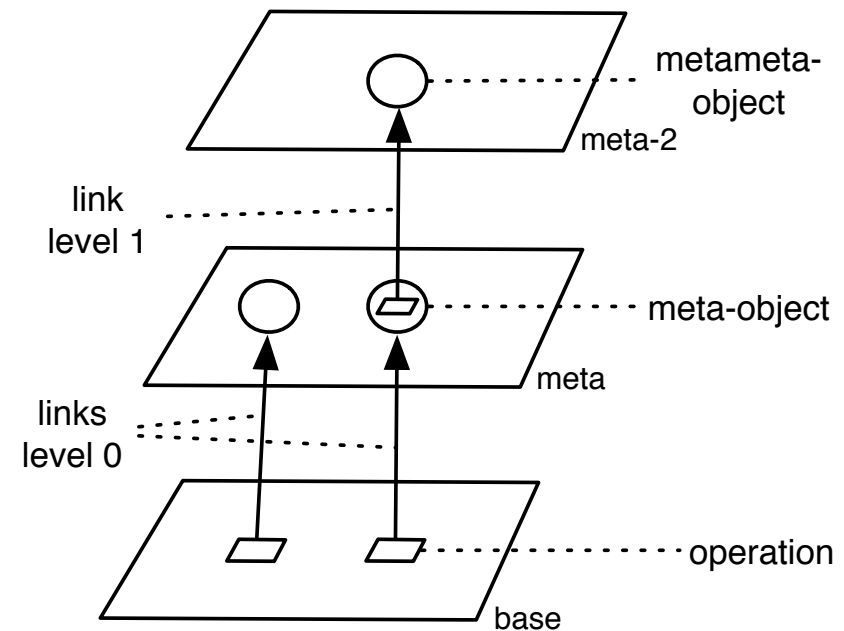
# MetaContext

> Recursion problem solved



# MetaContext

- > Meta-level analysis:
  - Trace the tracer



# Future Work

- > Generalize context model:
  - Beyond the meta-context
- > Virtual machine support
- > Context-aware language kernel

# Conclusion

- > Recursion problem
- > Missing representation of meta-level execution
- > Meta-context
  - Solves the recursion problem
  - Enables *meta-level analysis*

# Conclusion

- > Recursion problem
- > Missing representation of meta-level execution
- > Meta-context
  - Solves the recursion problem
  - Enables *meta-level analysis*

## Questions?