MDD in Practice

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Lukas Renggli

- **Software Engineer at Google**
  YouTube Video Analytics
- **SCG Alumni**
  Bachelor, Master and PhD
- **Open-Source Communities**
  Core-developer of Seaside
  Author of Magritte and Pier

Any sufficiently complicated program contains at least one meta-model.

Roadmap

1. **Protocol Buffers**
   Meta-data model for serialization
2. **OmniBrowser**
   Meta-model for tool building
3. **Google Web Toolkit**
   Model-driven web architecture
4. **Magritte**
   Generic meta-model

protobuf

Google's data interchange format

Protocol Buffers

Meta-data model for serialization

Describe your data format,
to share and evolve it.

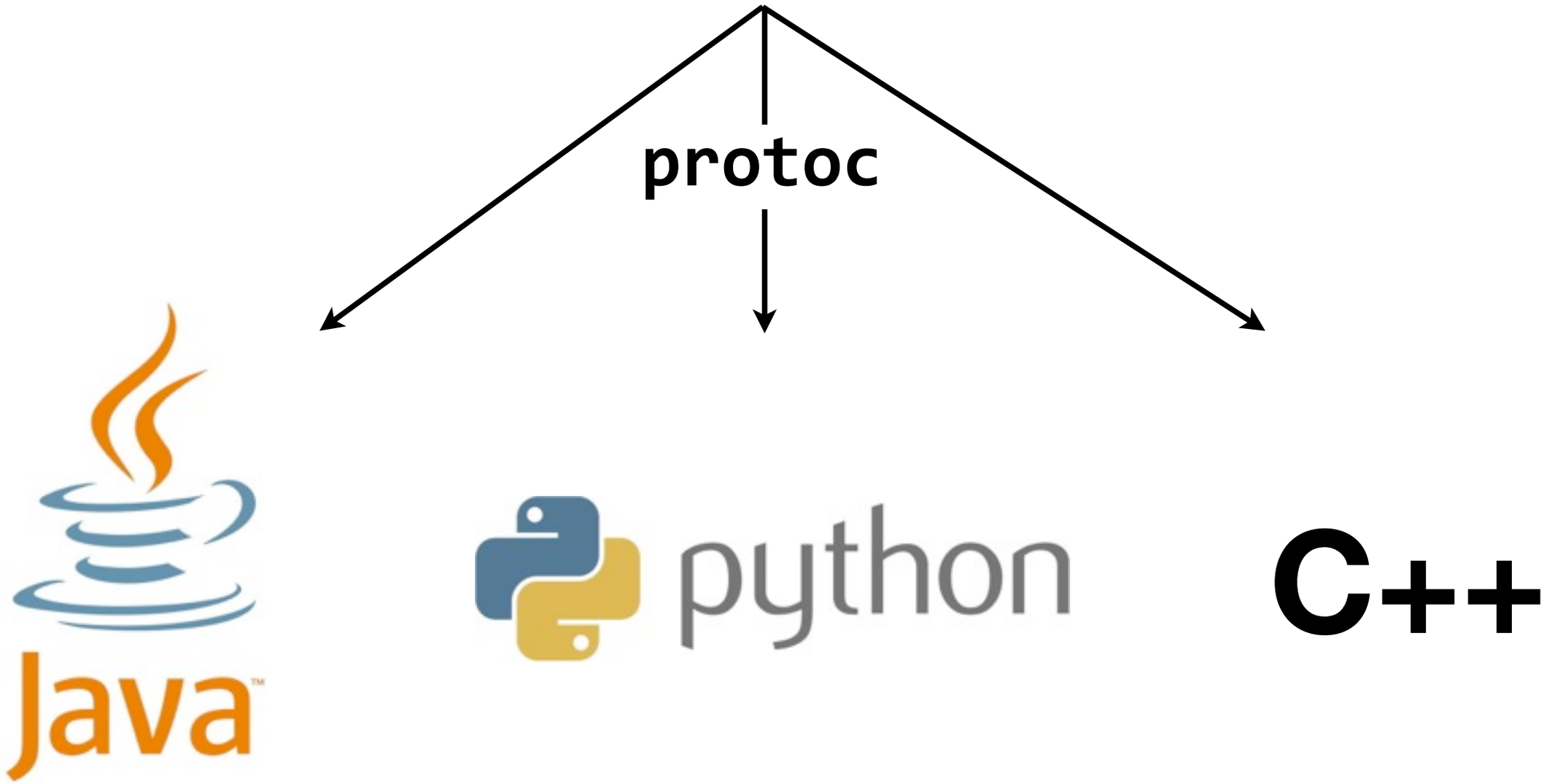
Protocol Buffers

- Encode structured data
- Language-neutral
- Platform-neutral
- Extensible
- Efficient

Protocol Buffer IDL

```
message Person {
    required int32 id = 1;
    required string name = 2;
    optional string email = 3;
}
```

```
message Person {
  required int32 id = 1;
  required string name = 2;
  optional string email = 3;
}
```



Serialize in C++

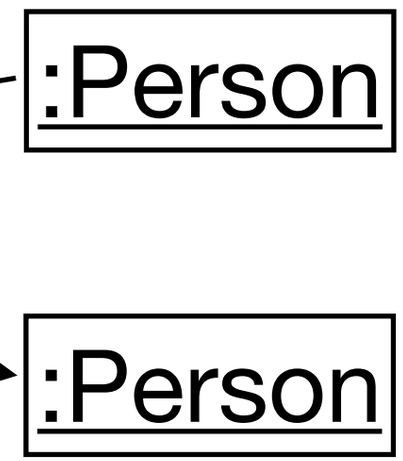
```
Person person;
person.set_name("John Doe");
person.set_id(1234);
person.set_email("jdoe@example.com");
fstream output("myfile", ios::out | ios::binary);
person.SerializeToOstream(&output);
```

Deserialize in Python

```
file = open("myfile", "rb")
person = Person()
person.ParseFromString(file.read())
file.close
print "Name: ", person.name
print "E-mail: ", person.email
```

```
message Person {
  required int32 id = 1;
  required string name = 2;
  optional string email = 3;
}
```


```
message Person {
  required int32 id = 1;
  required string name = 2;
  repeated string email = 3;
  repeated Phone phone = 4;
}
```



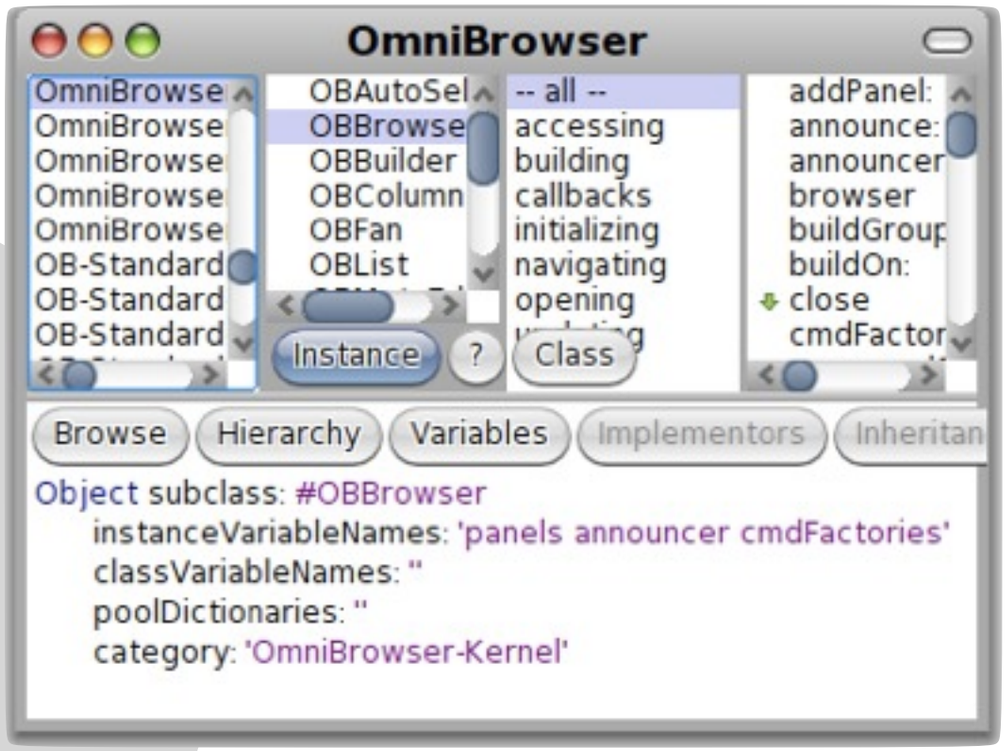
DEMO

Why not XML/JSON?

- Protocol Buffers are
  - 3—10 times smaller
  - 20—100 times faster
  - consistent code generators
  - less ambiguous
  - evolvable

Discussion

- Describe your data once, and use it across platforms and languages
- Evolution supported by design
- Used at Google for almost all
  - file formats (data storage)
  - remote procedure protocols (RPC)



OmniBrowser

Meta-model for tool building

Create a first-class description of the domain.


OBBrowser Hierarchy
ProtoObject
Object
OBBrowser
OBCodeBrowser
OBHierarchyBrowser
OBInheritanceBrowser
OBListBrowser
OBImplementorsBrowser
OBHierarchyImplementor
OBMethodStringsBrowser
OBReferencesBrowser
OBSendersBrowser
OBHierarchySendersBro
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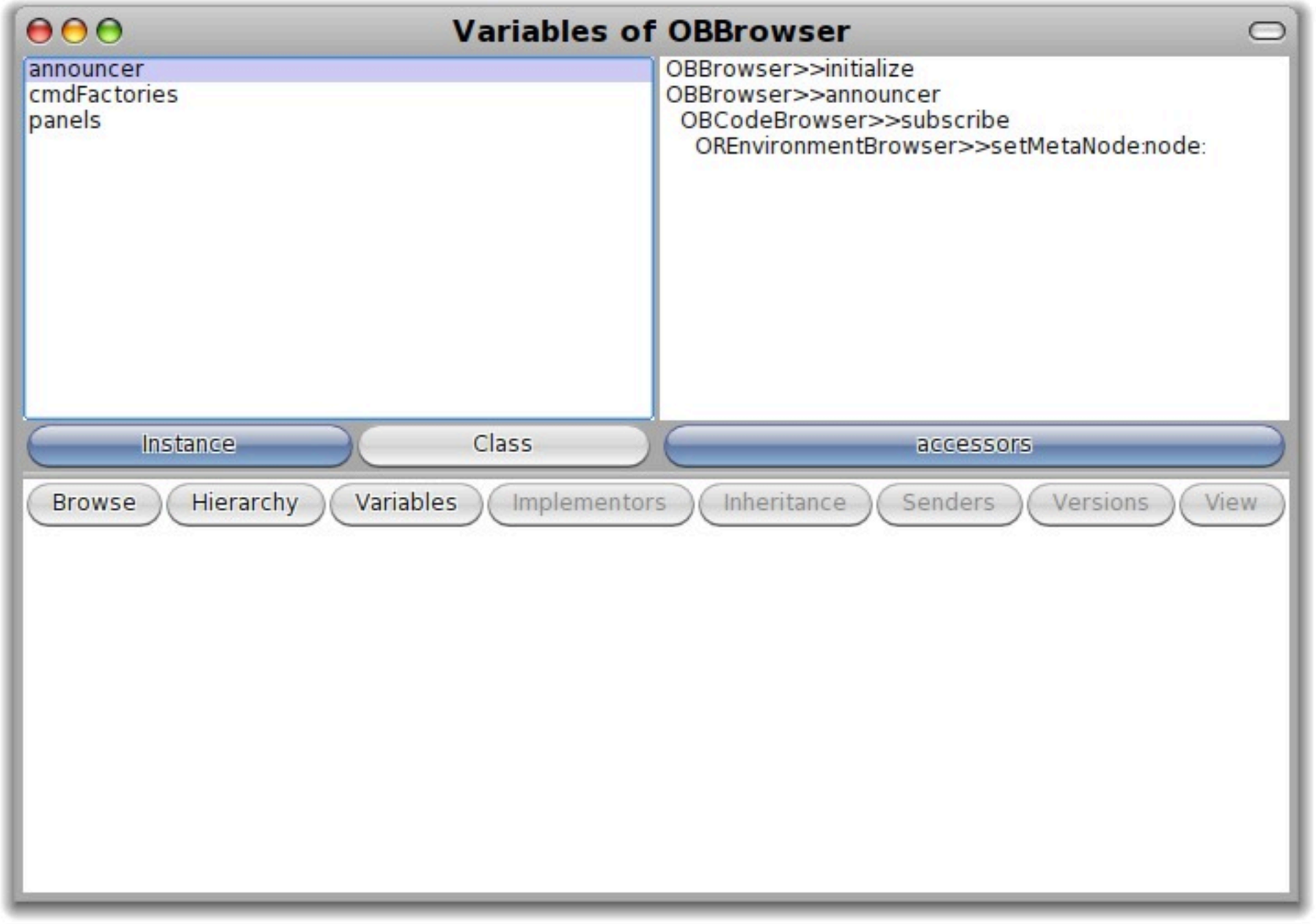
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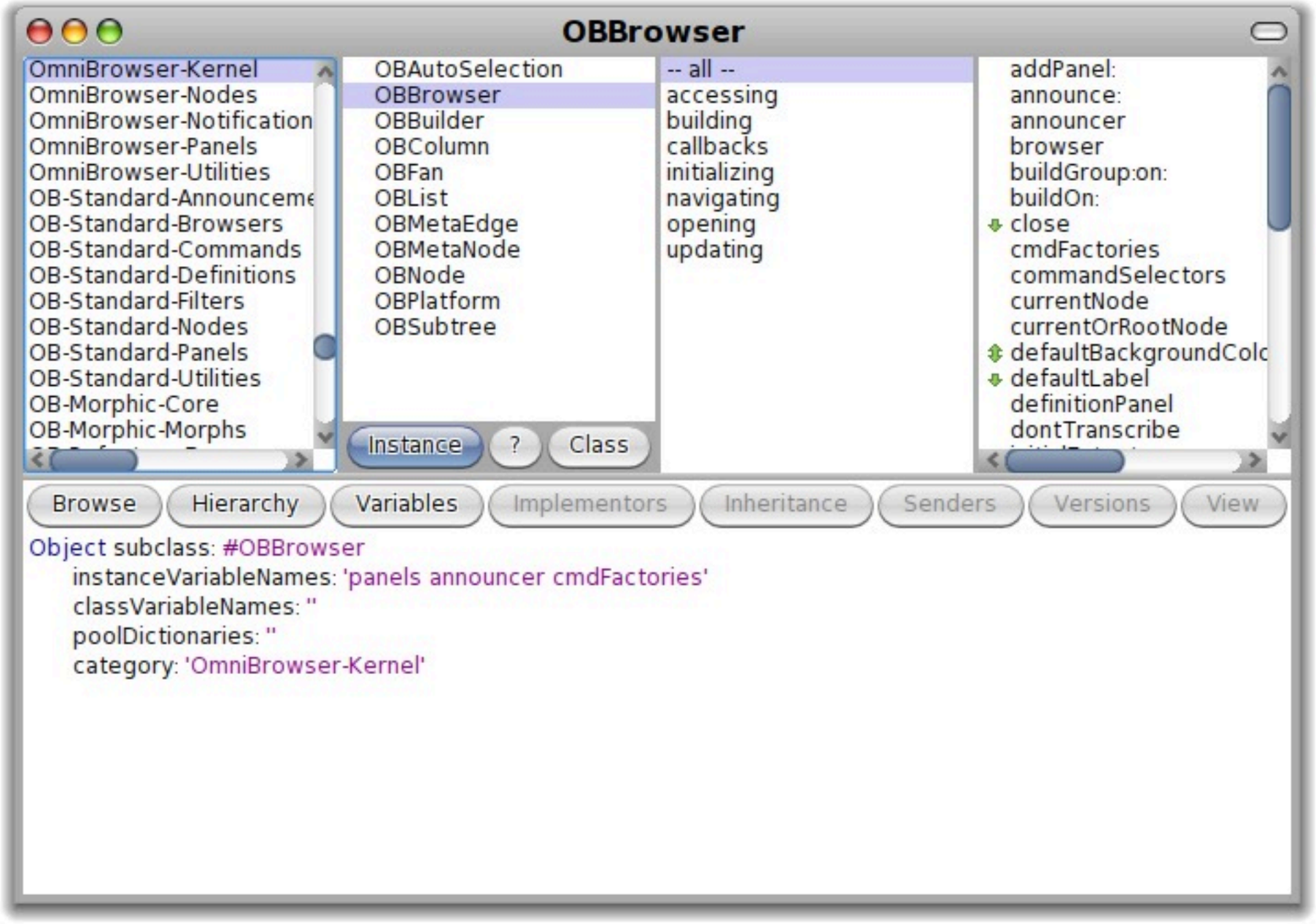
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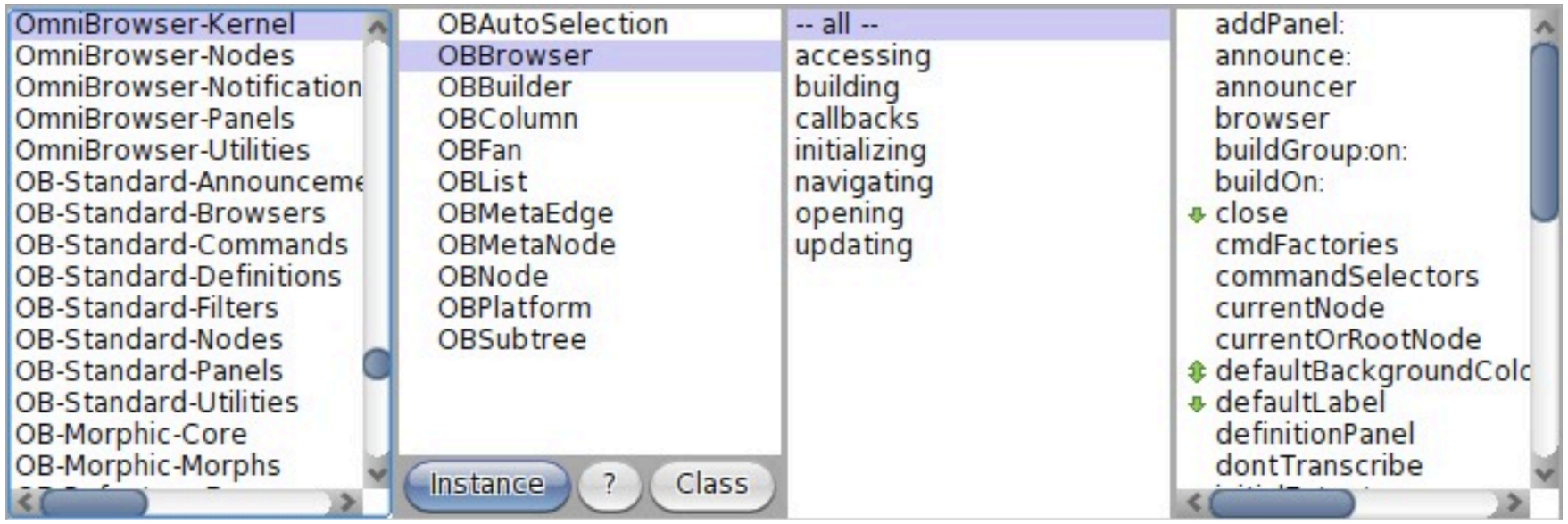
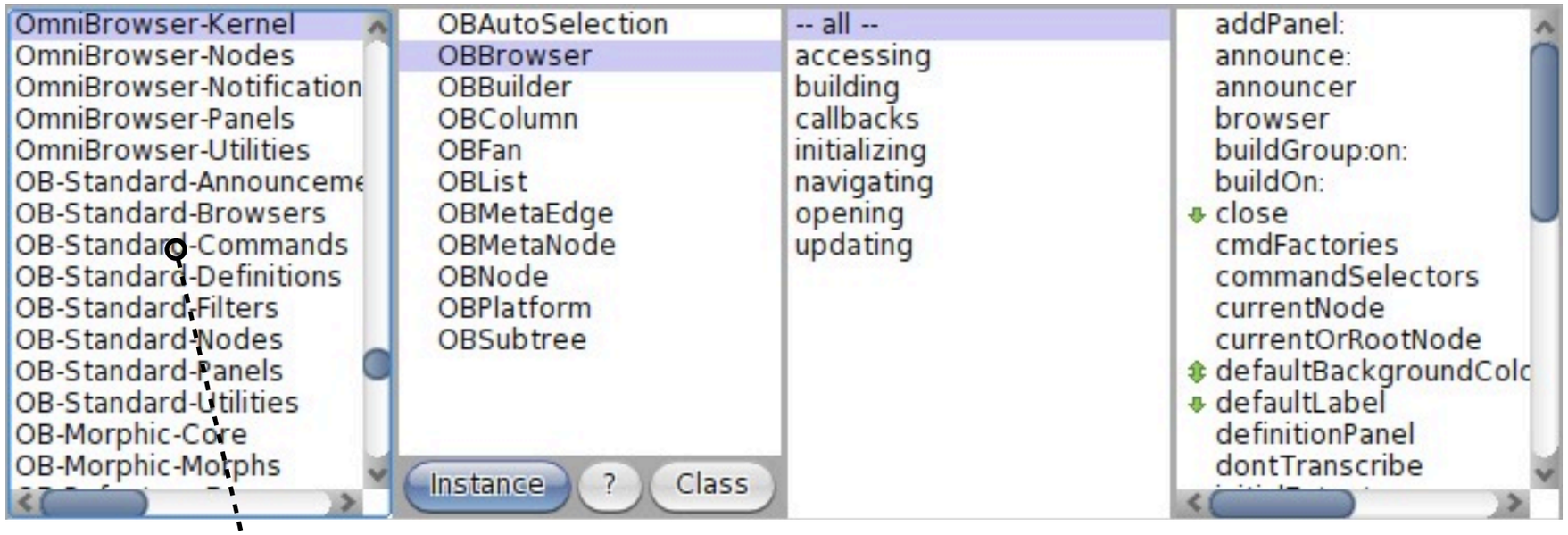
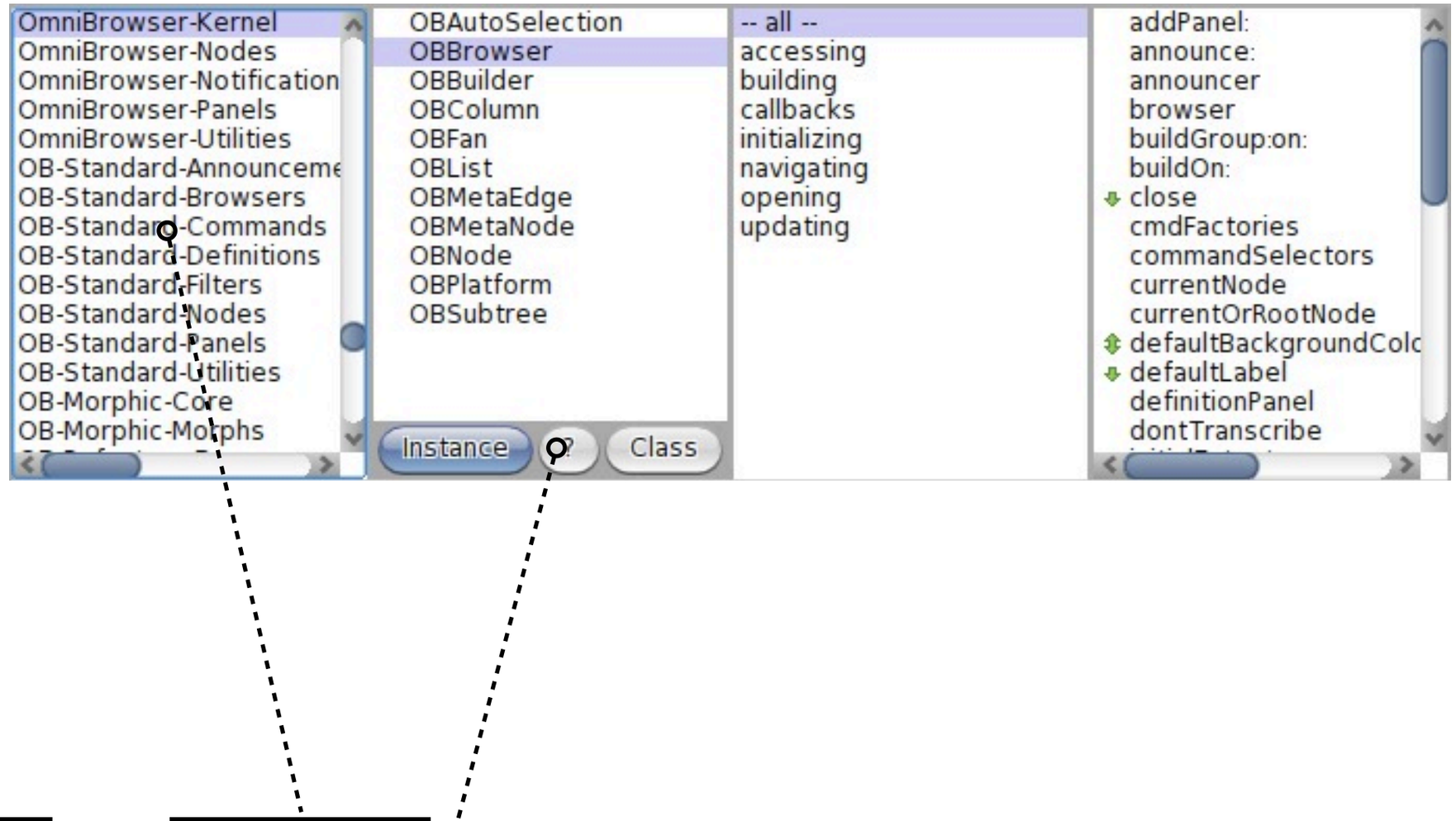


Environment



Environment → Category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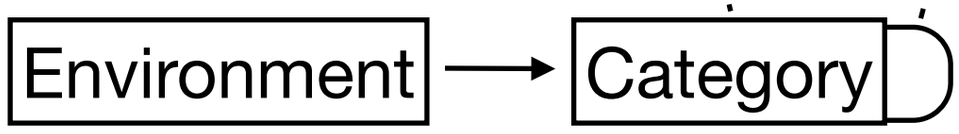
Environment
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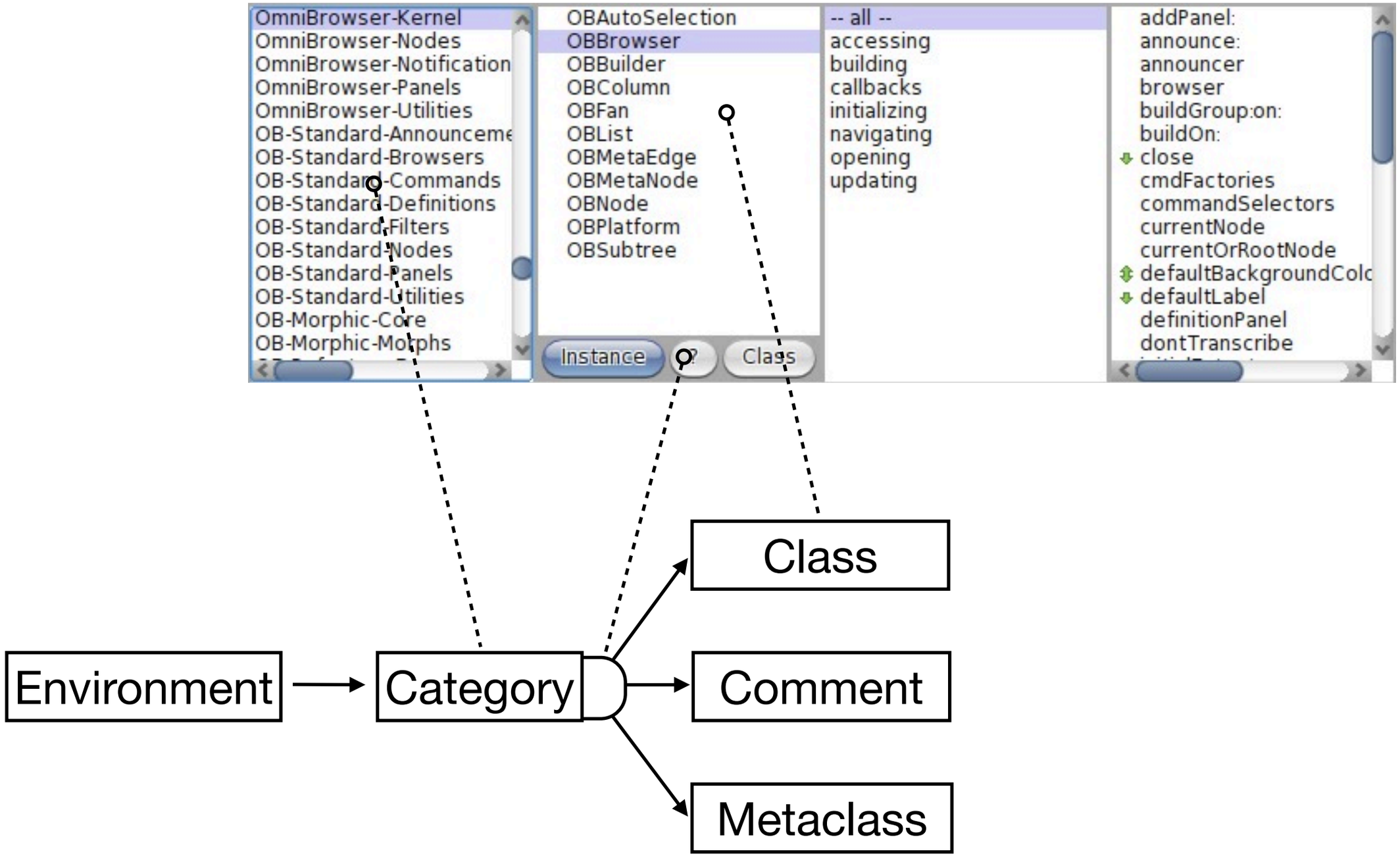
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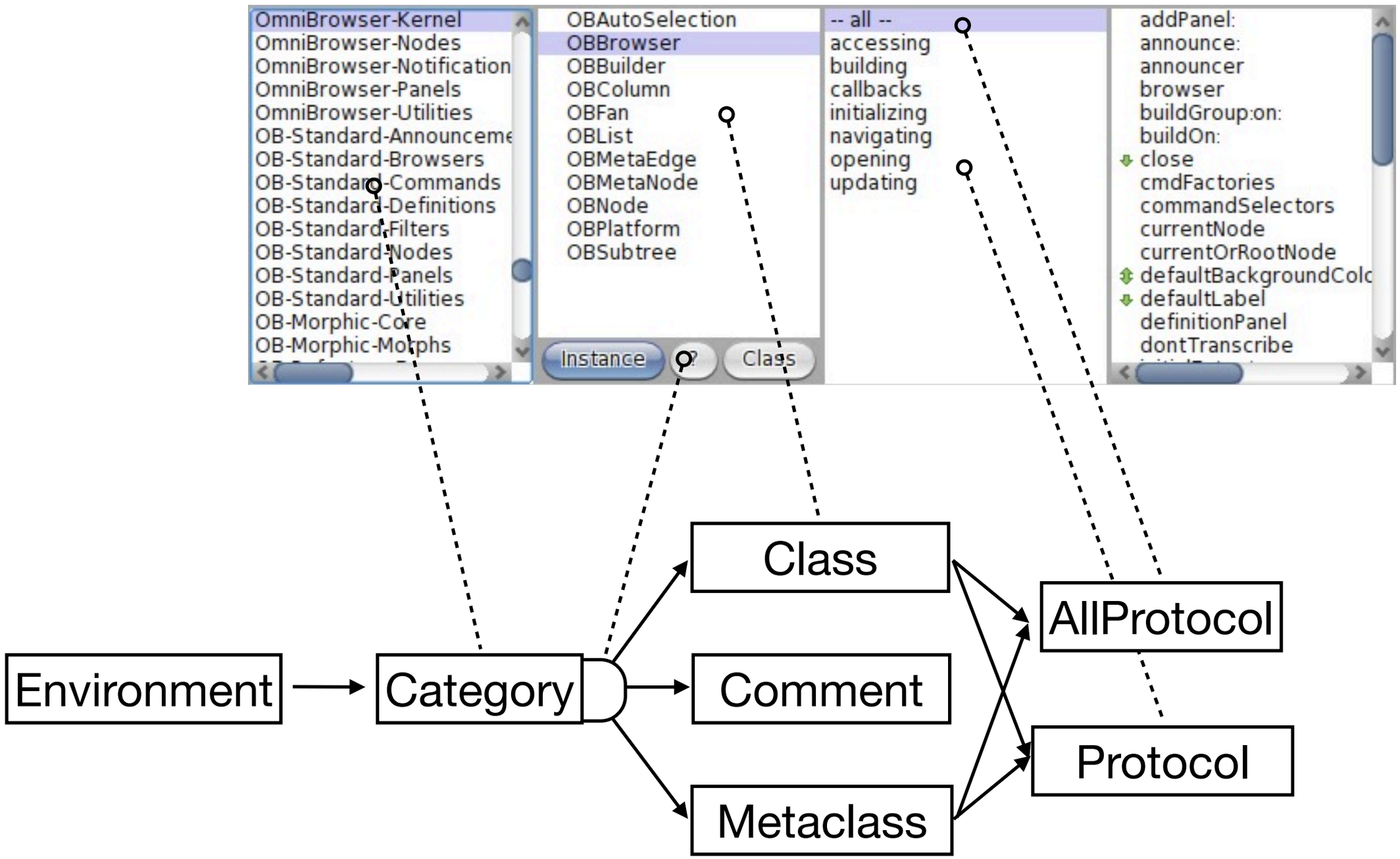
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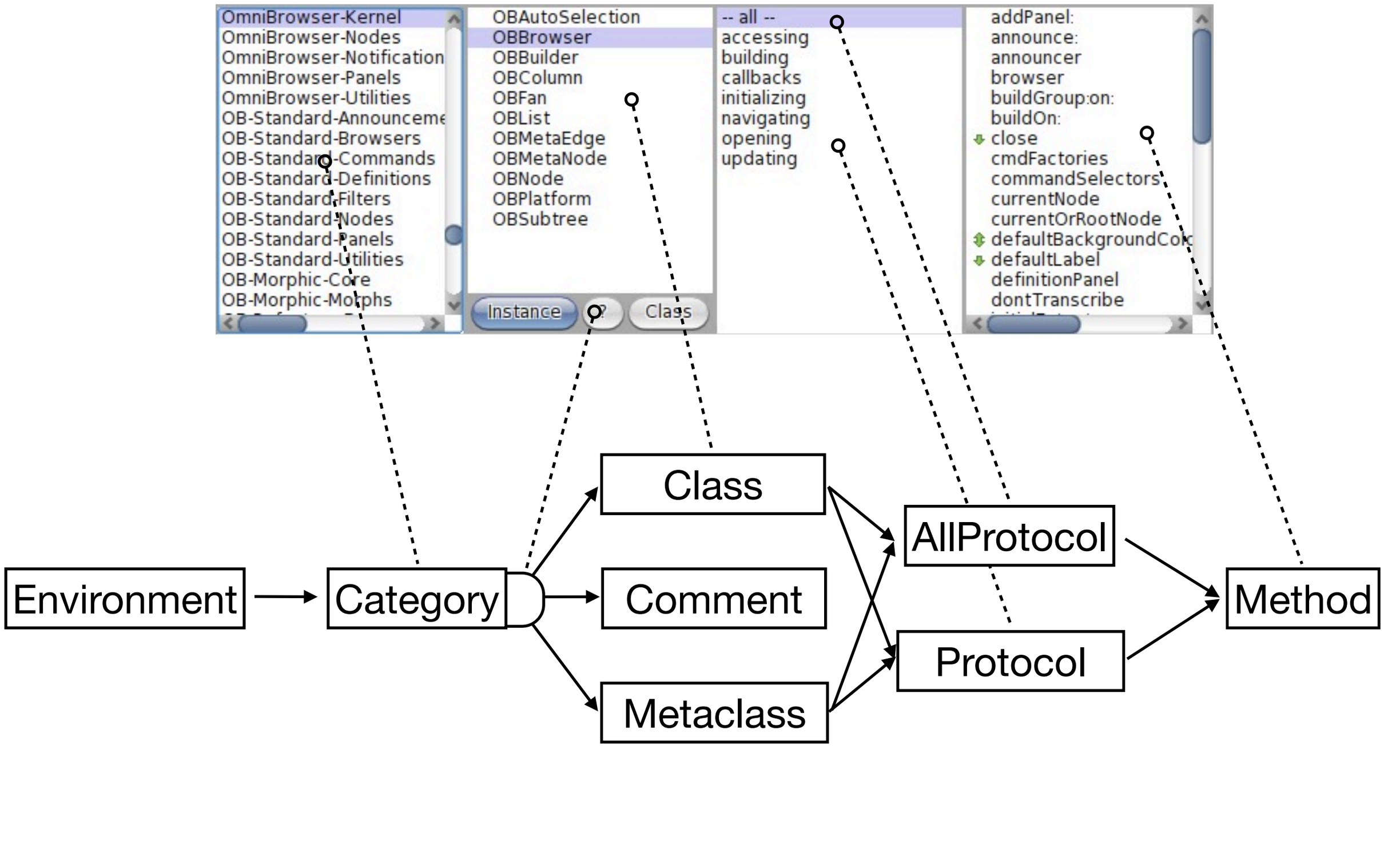
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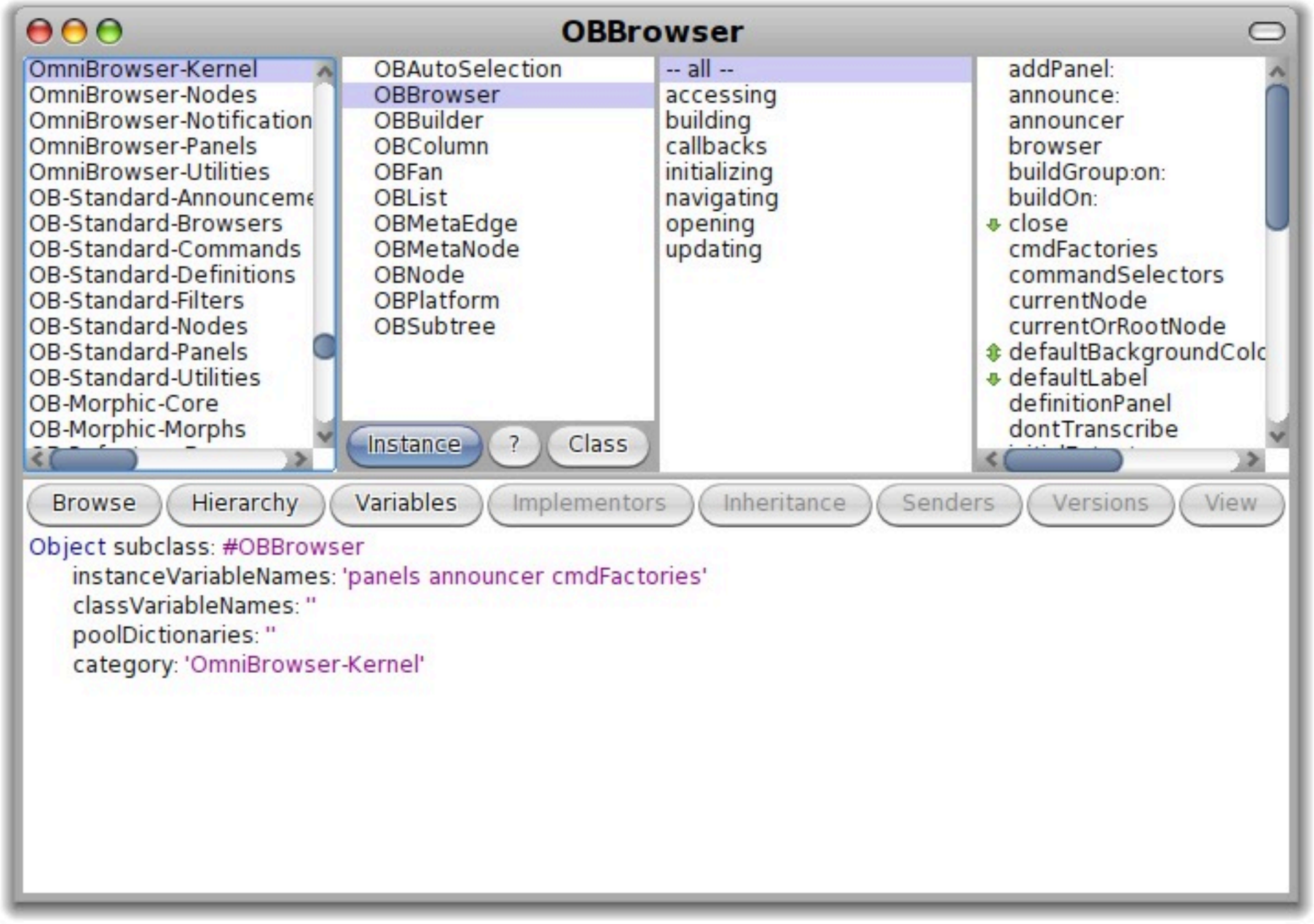
OB-Morph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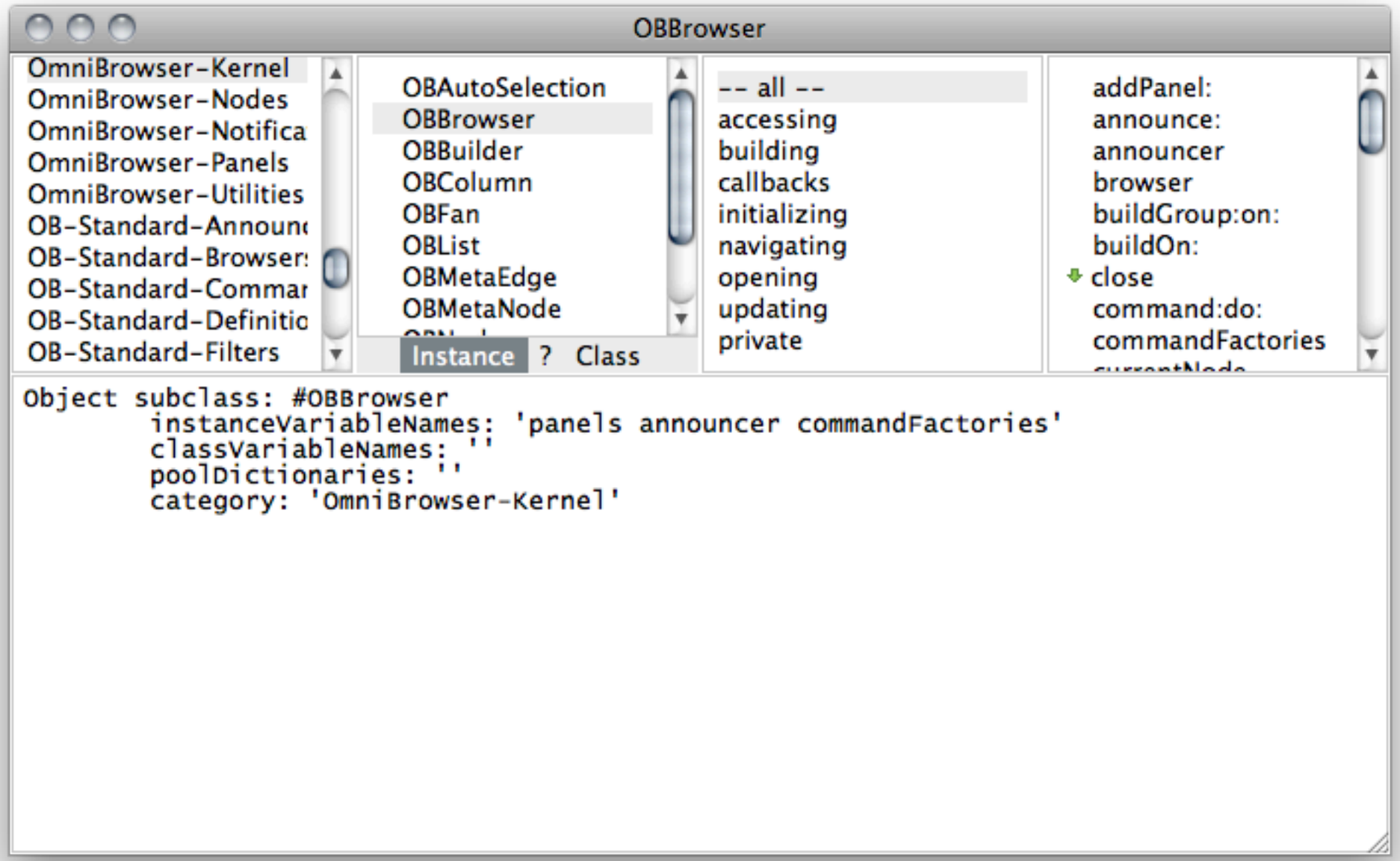
OB-Web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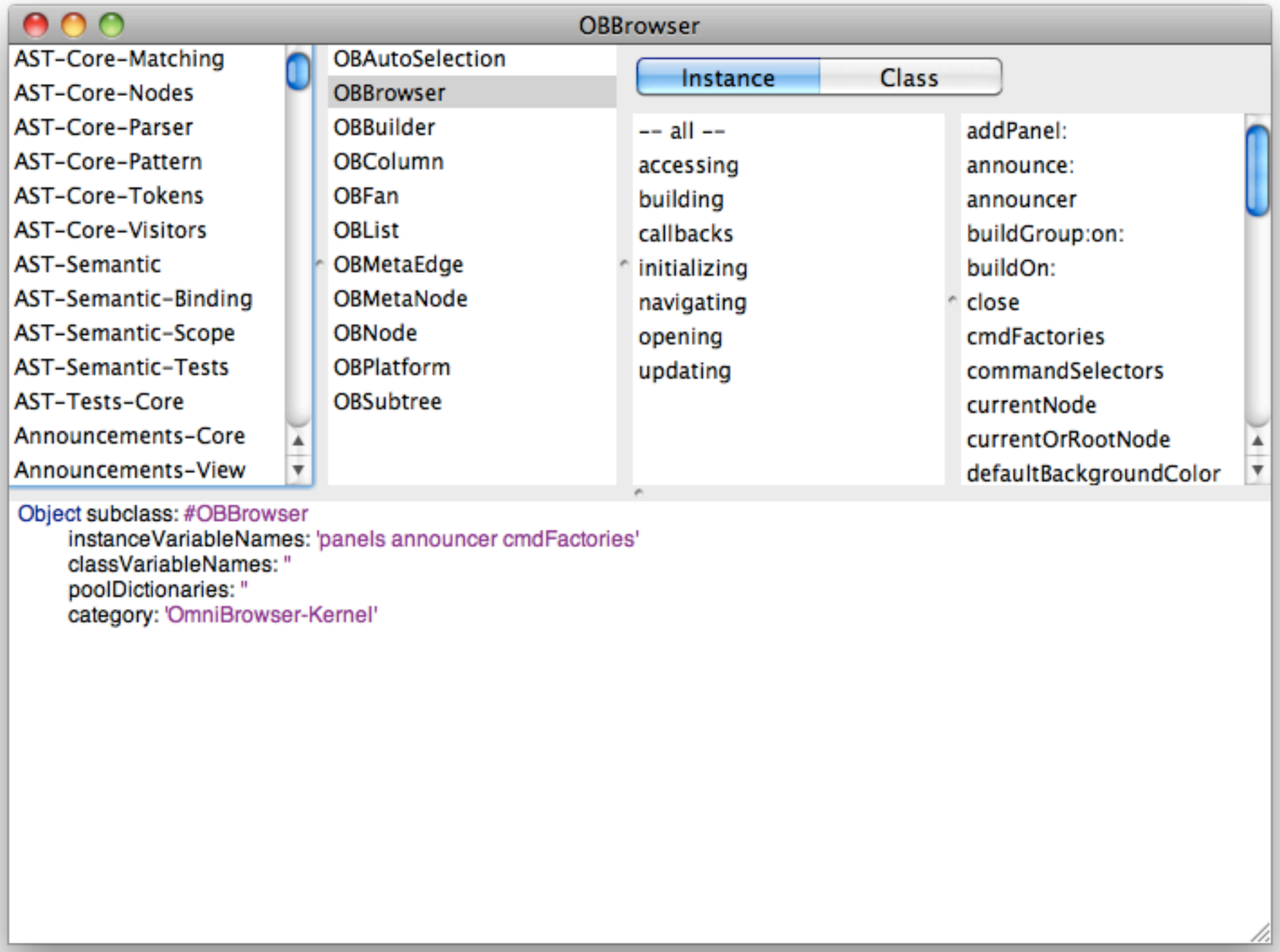
OB-Mars


OBBrowser
AST-Core-Matching
AST-Core-Nodes
AST-Core-Parser
AST-Core-Pattern
AST-Core-Tokens
AST-Core-Visitors
AST-Semantic
AST-Semantic-Binding
AST-Semantic-Scope
AST-Semantic-Tests
AST-Tests-Core
Announcements-Core
Announcements-View
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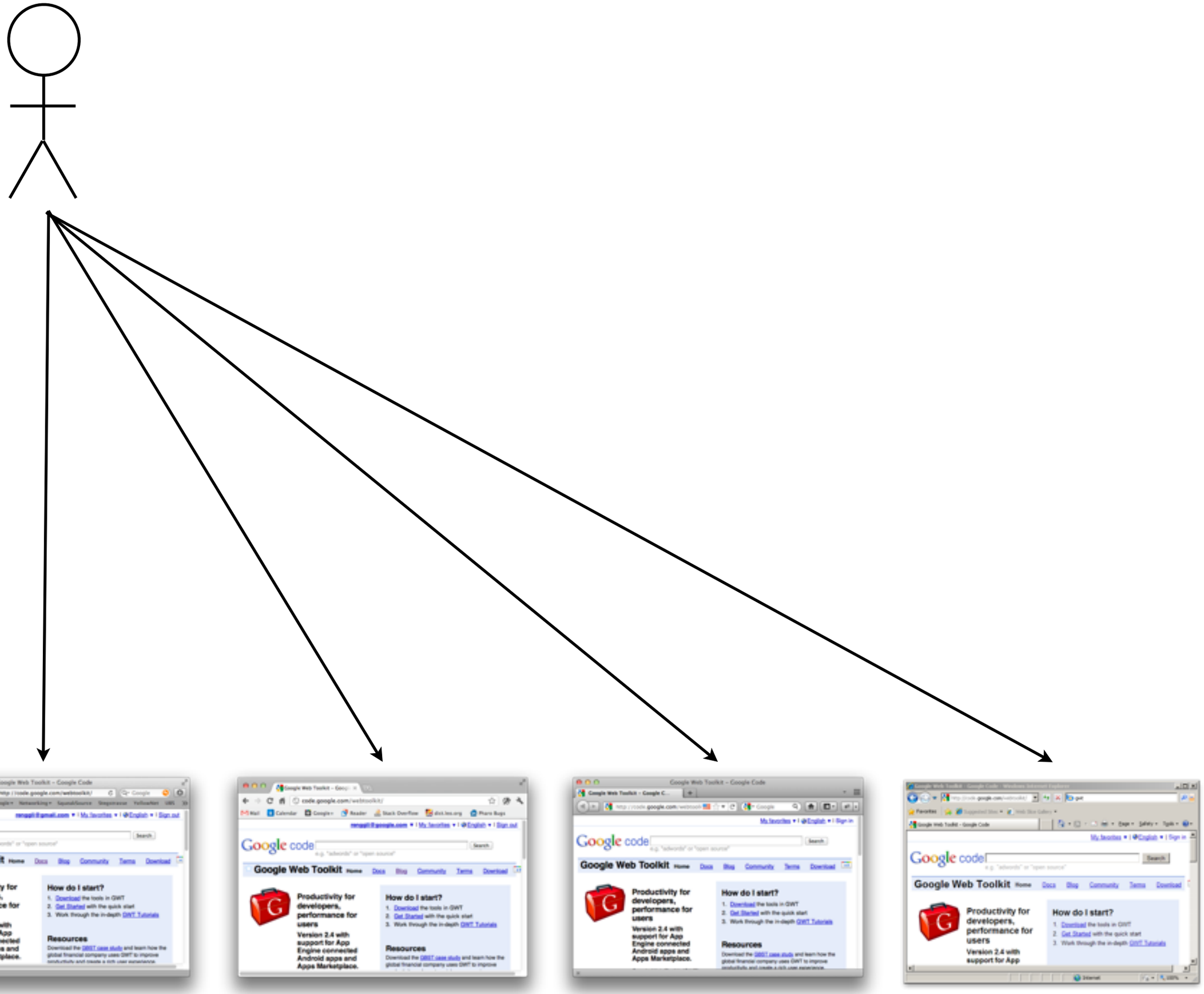
Discussion

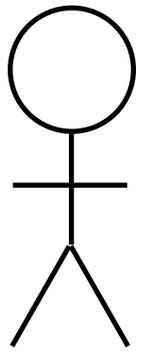
- Model the concepts of your domain
- Domain-specific reflection
- UI independent
- Can be limiting or slow
- People might get meta-confused

Google Web Toolkit

Model-driven web architecture

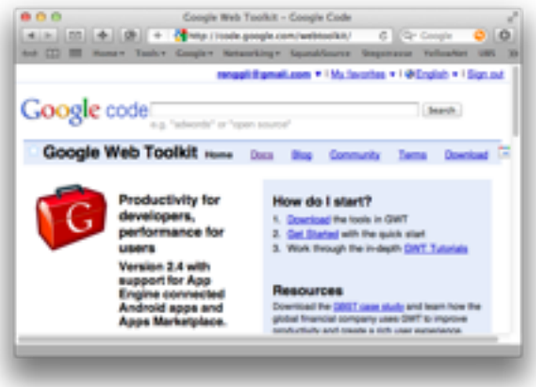
Write your application in Java,
run your application in JavaScript

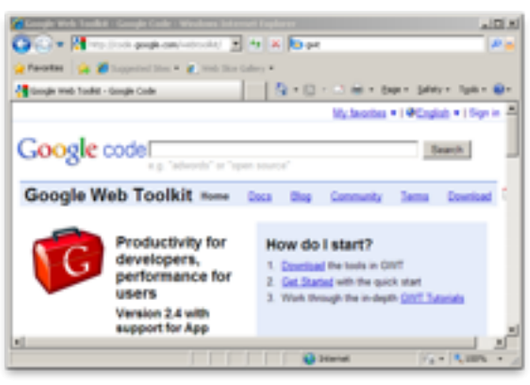

Google Web Toolkit – Google Code
Google code
Google Web Toolkit
Productivity for developers, performance for users
How do I start?
Resources



```
public class Main implements EntryPoint {
  public void onModuleLoad() {
    Label label = new Label("Hello World");
    RootPanel.add(label);
  }
}
```

platform independent model





Is this really a model?

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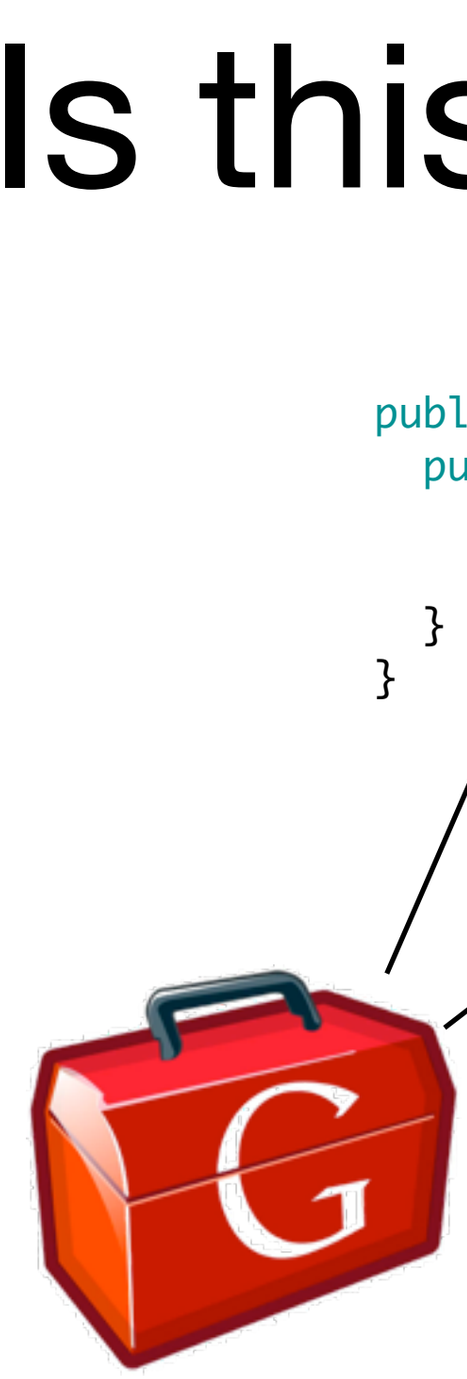

High-level
Widgets

Is this really a model?

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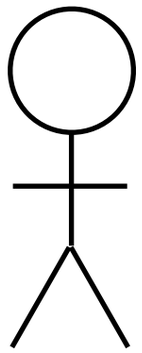
High-level Widgets

Description Language



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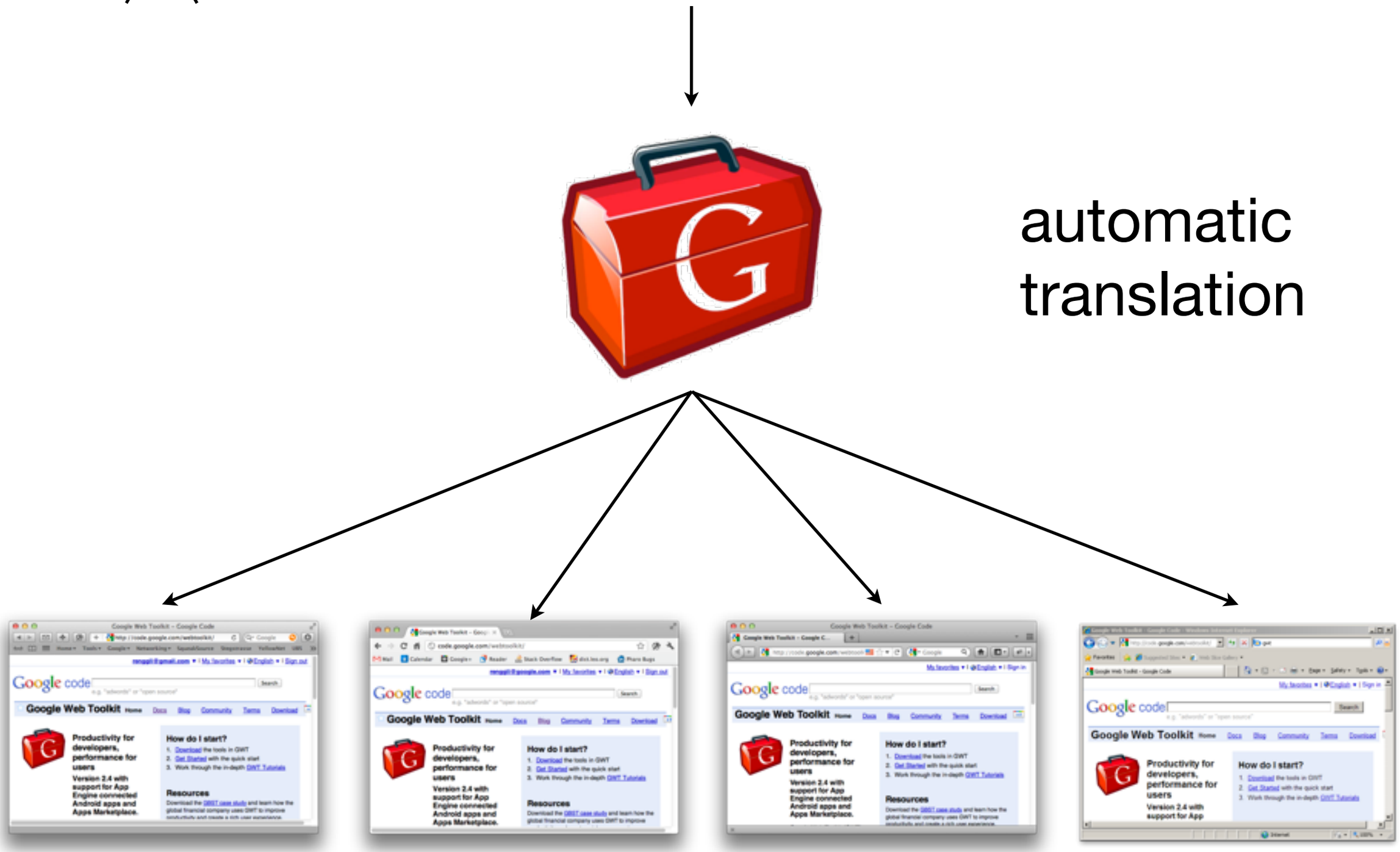
platform independent model



automatic translation

GWT Translation

	Mozilla	Chrome	Safari	IE	...
English					
French					
German					
...					

GWT Translation

	Mozilla	Chrome	Safari	IE	...
English					
French					
German					
...					

Discussion

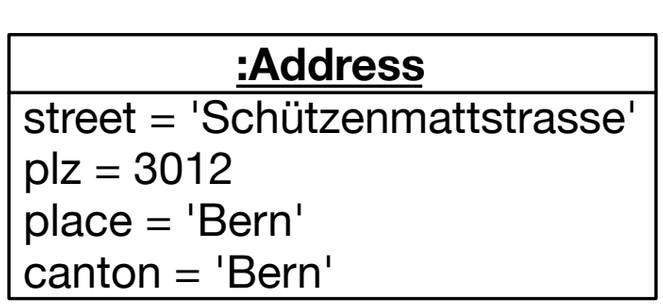
- Write JavaScript using a high-level widget library in a well defined (statically typed) language
- Translate and optimize code towards specific browsers
- Debugging, kind of works but you don’t want to know how

Magritte

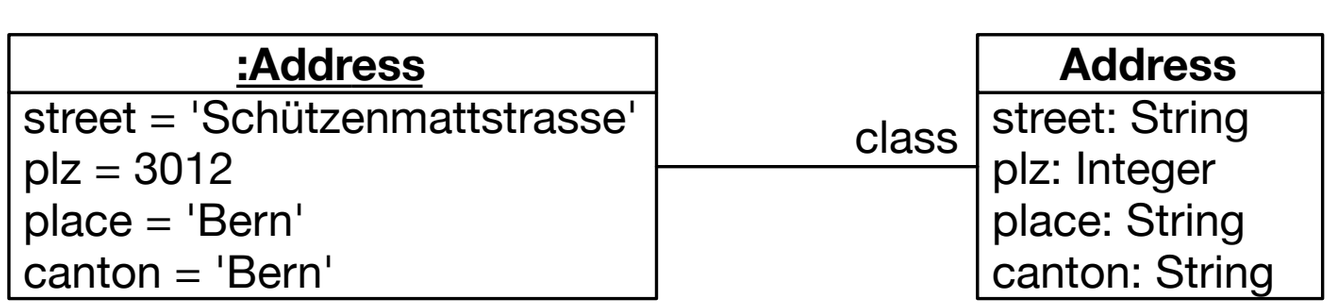
Generic Meta Meta-Model

Describe your objects once,
use the descriptions everywhere.

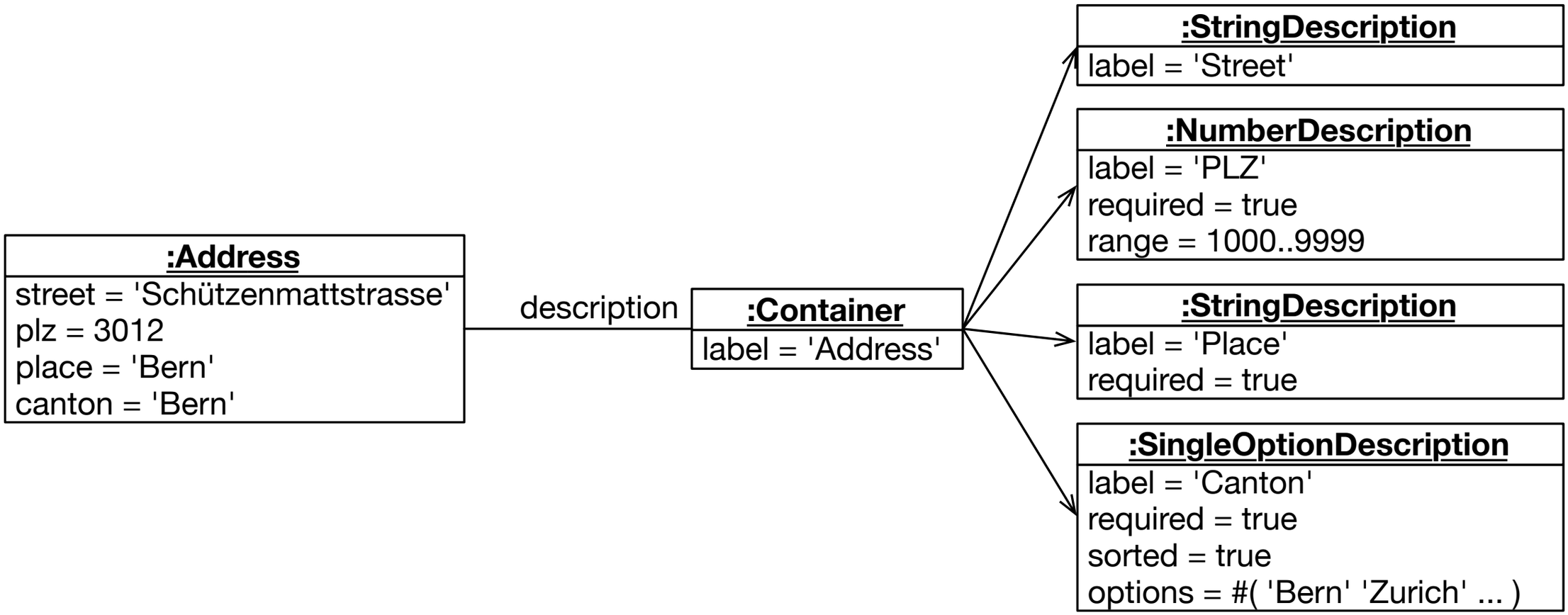
Address Object



Address Class



Address Description



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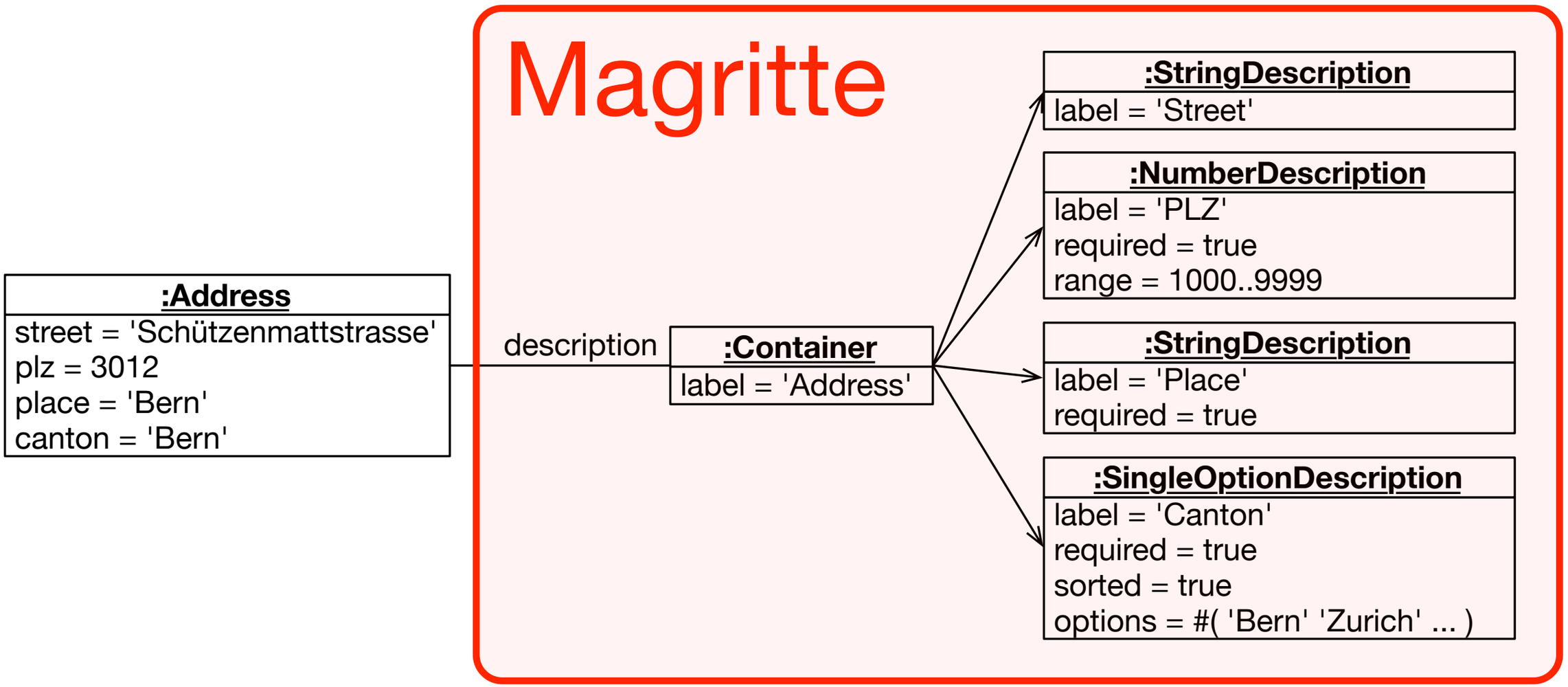
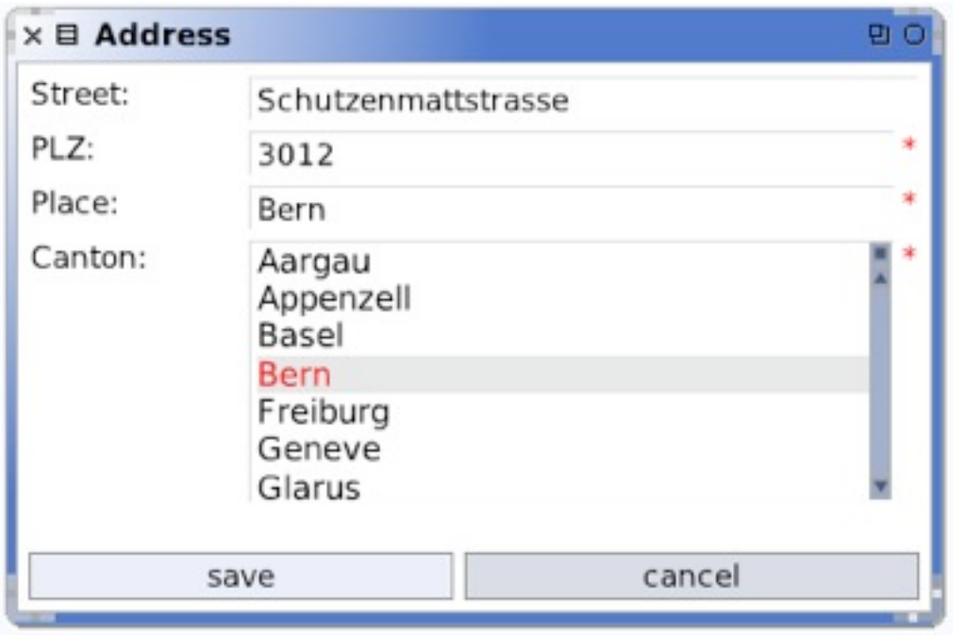


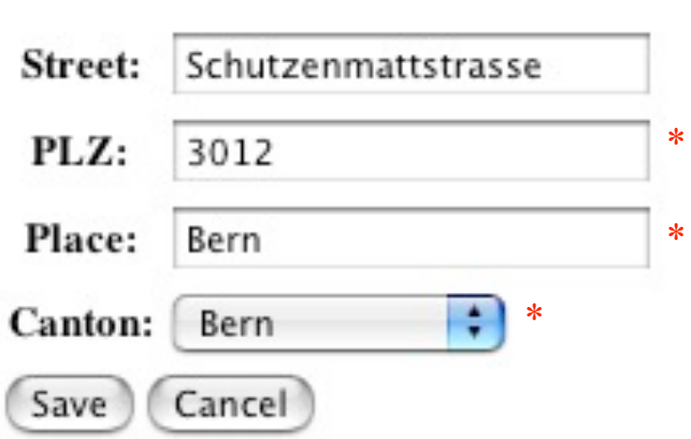
Morphic Rendering

```
result := anAddress asMorph
    addButtons;
    addWindow;
    callInWorld
```



Seaside Rendering

```
result := self call: (anAddress asComponent
    addValidatedForm;
    yourself)
```



Other Applications

- Viewer building
- Editor building
- Report building
- Documentation
- Data validation
- Query processing
- Object filtering
- Object serialization
- Object copying
- Object indexing
- Object initialization
- Object extension
- Object adaption
- Object customization
- Code generation

and much more ...

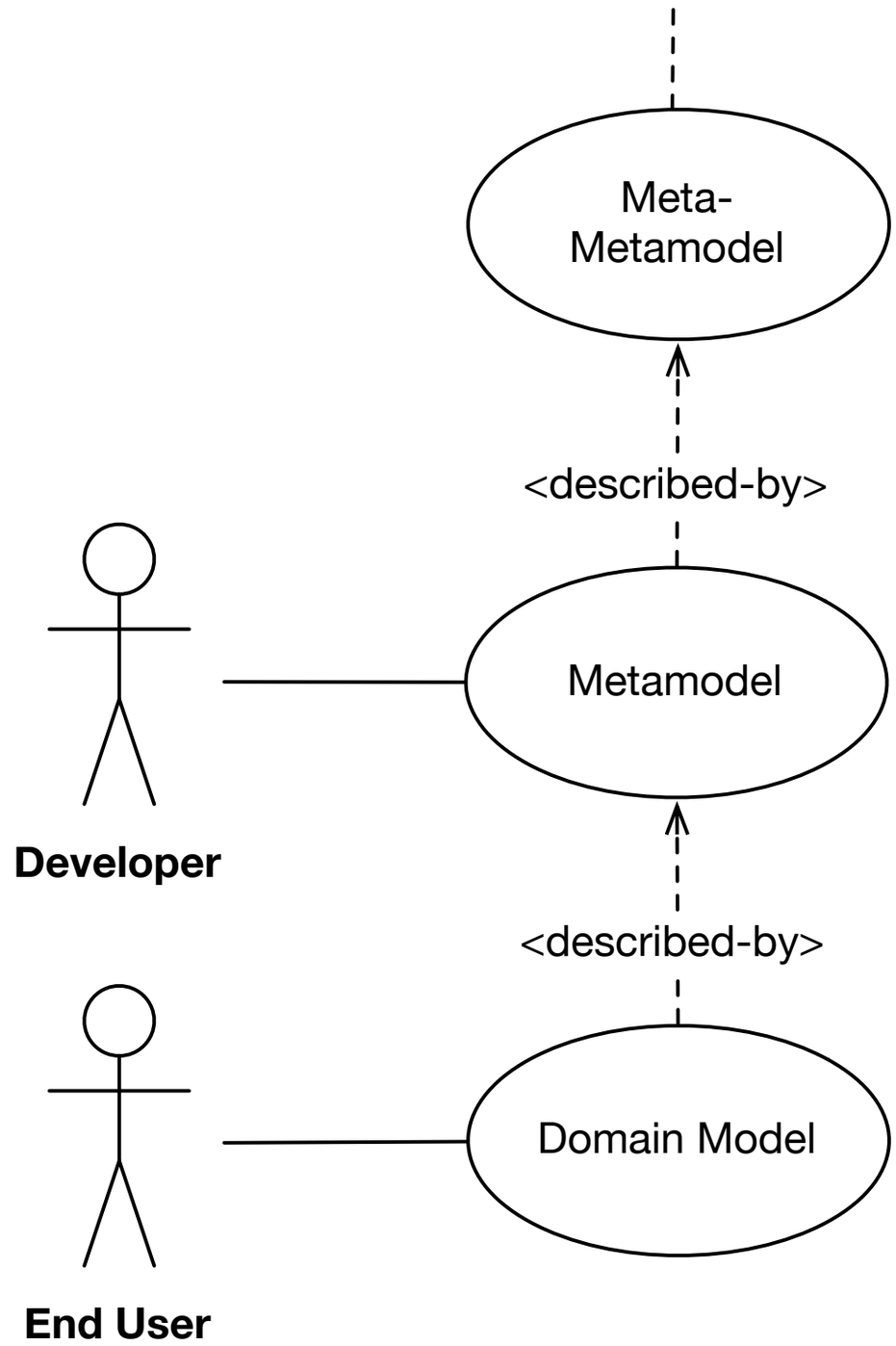
Why is it useful?

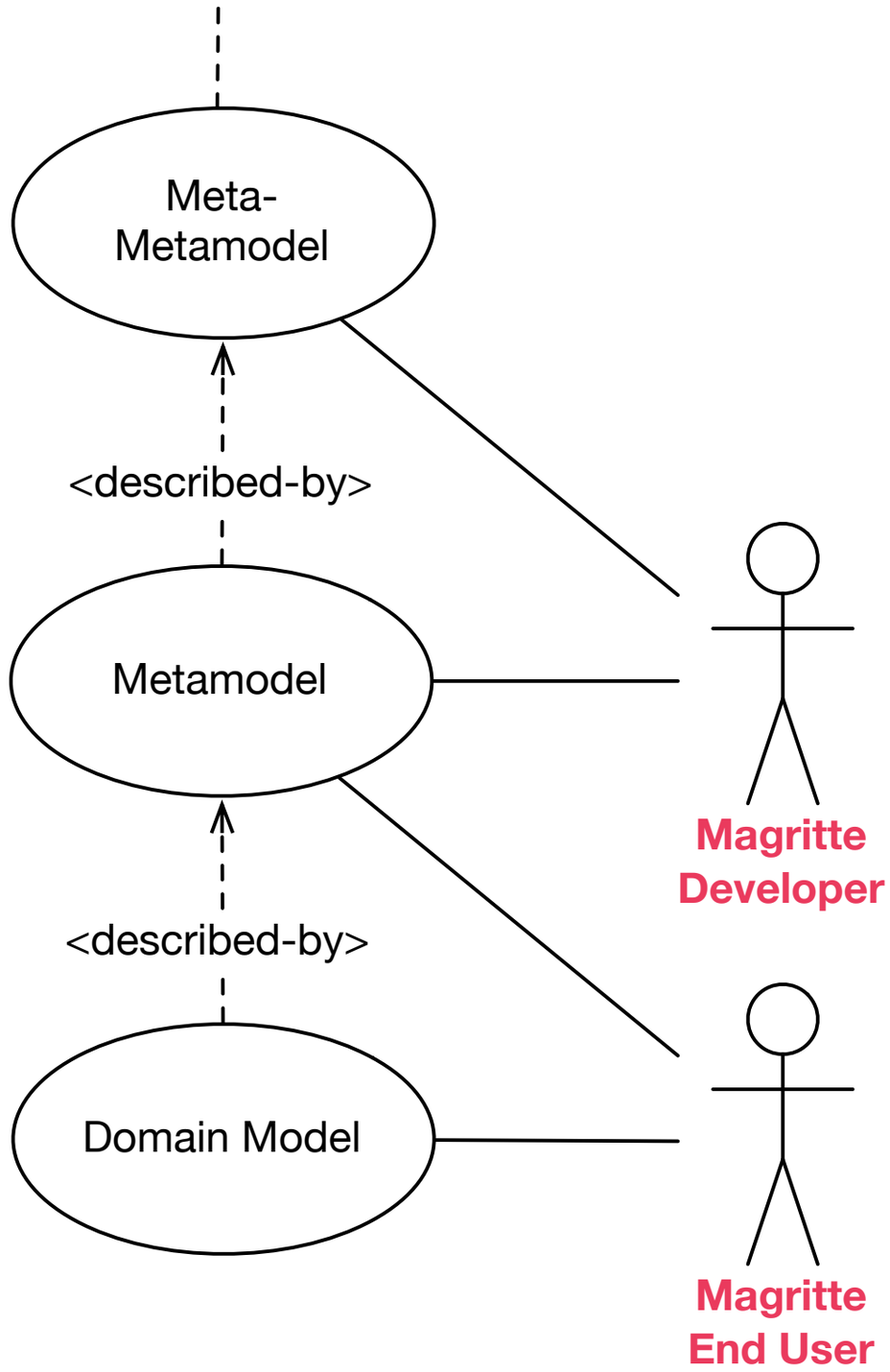
- Describe once, get everywhere.
- Extensibility of classes is ensured.
- Context dependent descriptions.
- End-user customizable.
- Developer configurable.

Why is it cool?

- Be more productive
- Lower coupling
- Do more, with less code
- Do more, with less hacking

- **Empower your users**


Meta-
Metamodel
<described-by>
Metamodel
Developer
<described-by>
Domain Model
End User


Meta-
Metamodel
<described-by>
Metamodel
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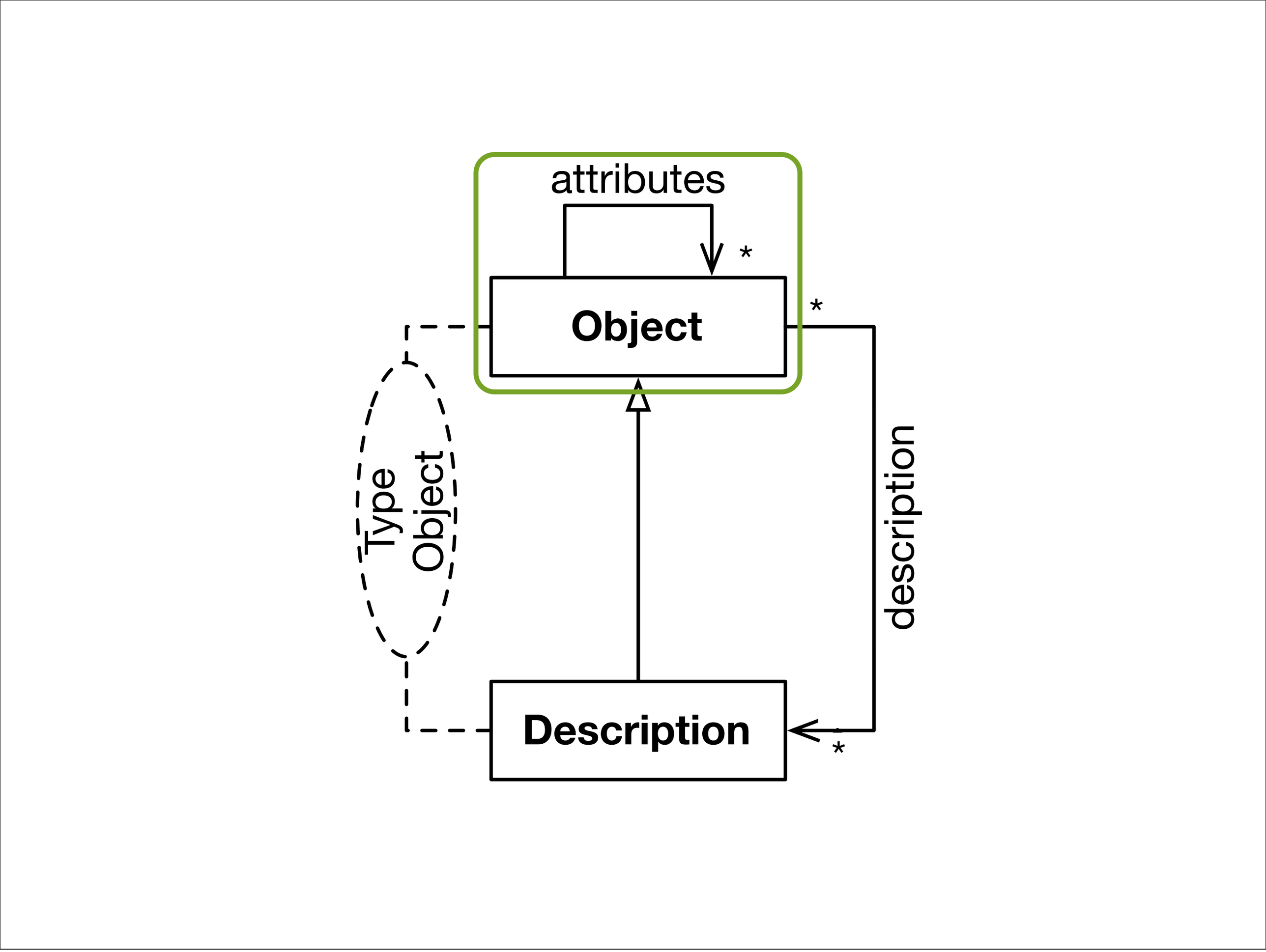
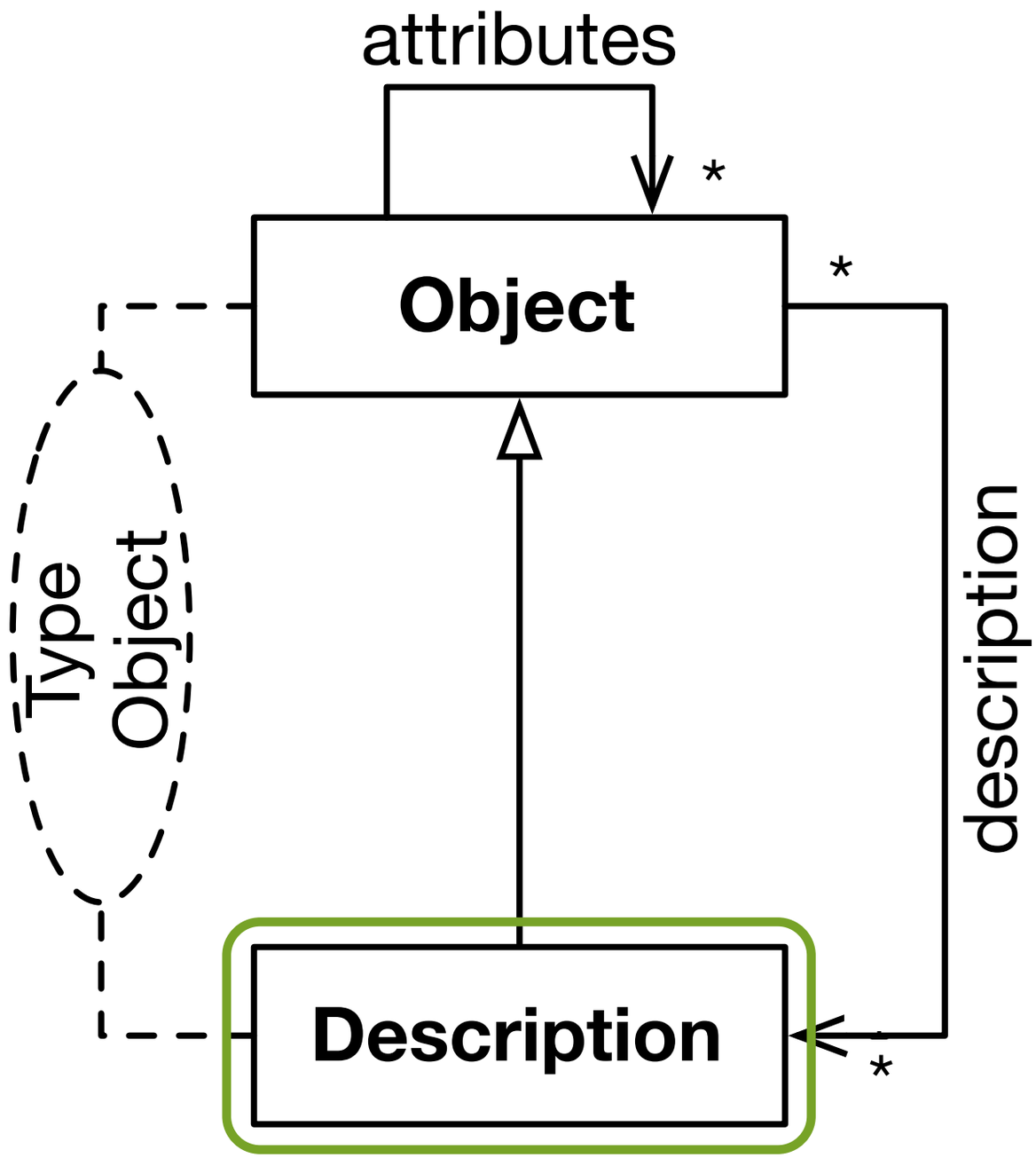
Domain Model
Magritte
Developer
Magritte
End User


attributes
*
Object
*
Type
Object
description
Description
*


attributes
*
Object
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Type
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description
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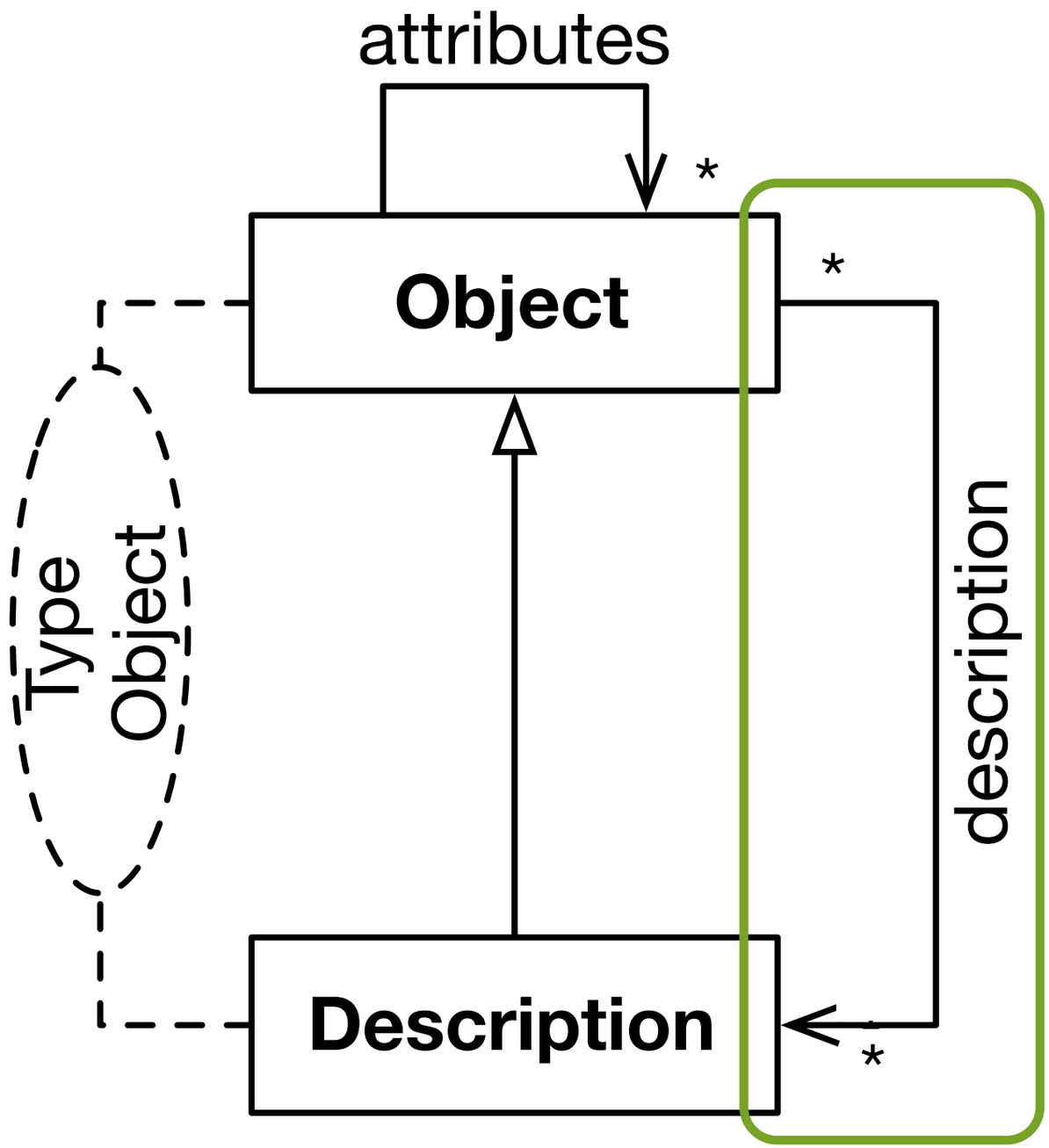
attributes
*
Object
*
Type
Object
description
Description
*

Run-time

Adaptive Object Model

End users customizability

DEMO

Discussion

- Very powerful and flexible
- Runtime adaptive code
- End-user programmable code
- Can cause meta meta-confusion
- Can be slower than hardcoding

Any sufficiently complicated program contains at least one meta-model.