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Adventures in JSR-292 or How To Be A Duck Without Really Trying

Jim Laskey
Multi-language Lead
Java Language and Tools Group

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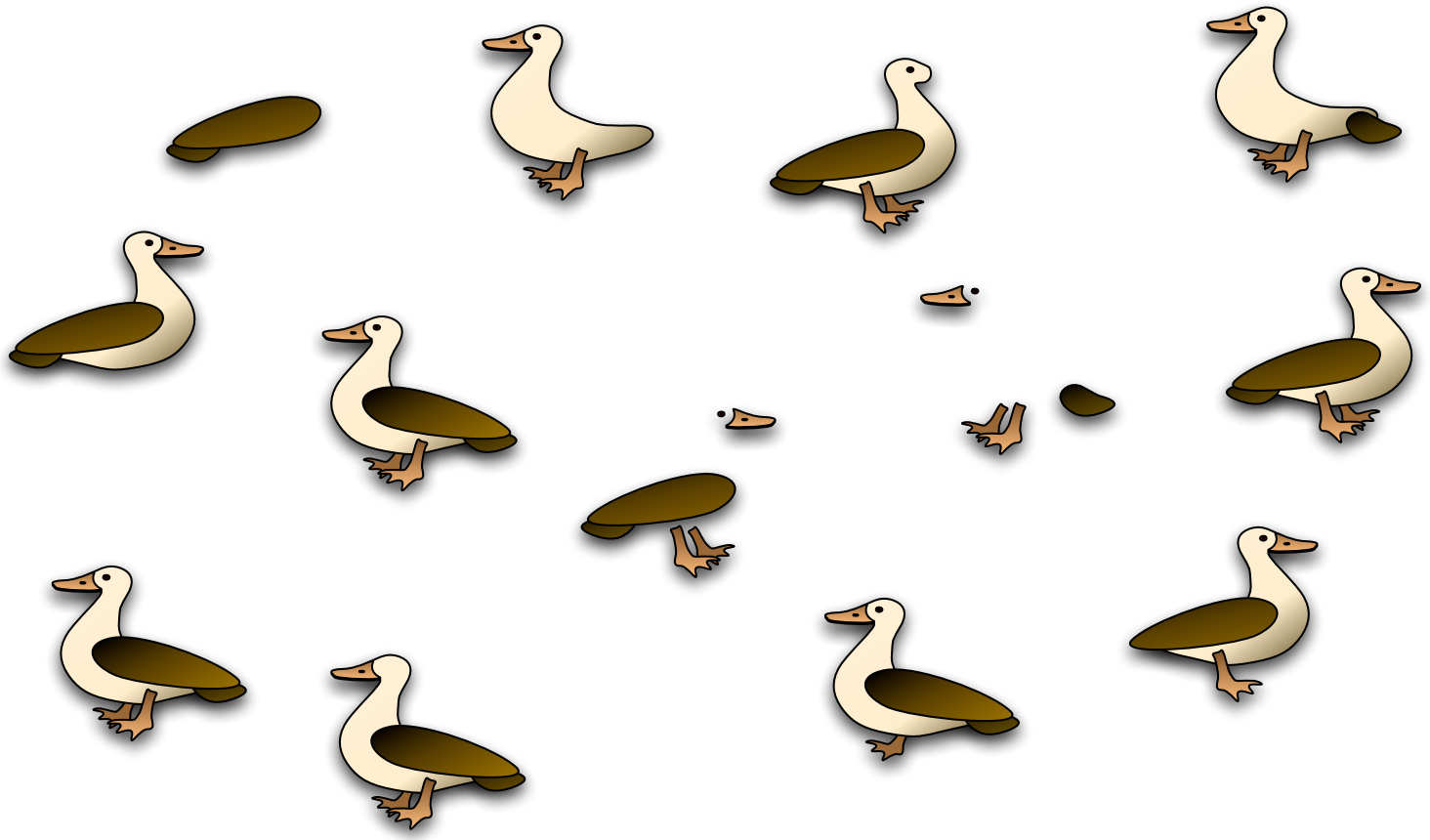
Agenda

- Introduction
- Nashorn
- JSR-292 Usage In Nashorn
- Avoiding Polymorphism At CallSites
- Q & A

INTRODUCKTION



The Importance Of Being Multilingual.

4GL
Ada
Algol/Simula
APL
Assembler
Basic/VisualBasic
BLISS
C/C++/Objective-C
C#
COBOL
Eiffel
Flex
Forth
Fortran/Fortran5
FoxPro
HTML/CSS
HyperTalk
Java
JavaScript
LabVIEW
Lisp/Dylan/Scheme
Lua
M (Mumps)
MEL (Maya)
Modula/Oberon
Occam
Pascal/ObjectPascal
Perl
PHP
Pilot/Tudor
PL/1
Postscript
Prograph
Prolog/MicroProlog
Python
QuartzComposer
Ruby
Self
Serius
Smalltalk
Snobol
SQL
Sympl
TorqueScript
Watfor/Watbol
XML
YACC/Bison/Antler

NASHORN

NASHORN Perfect Storm

- JavaFX Script
- HTML5/JavaScript
- Oracle acquisition
- Rhino
- John Rose taunt

NASHORN Goals

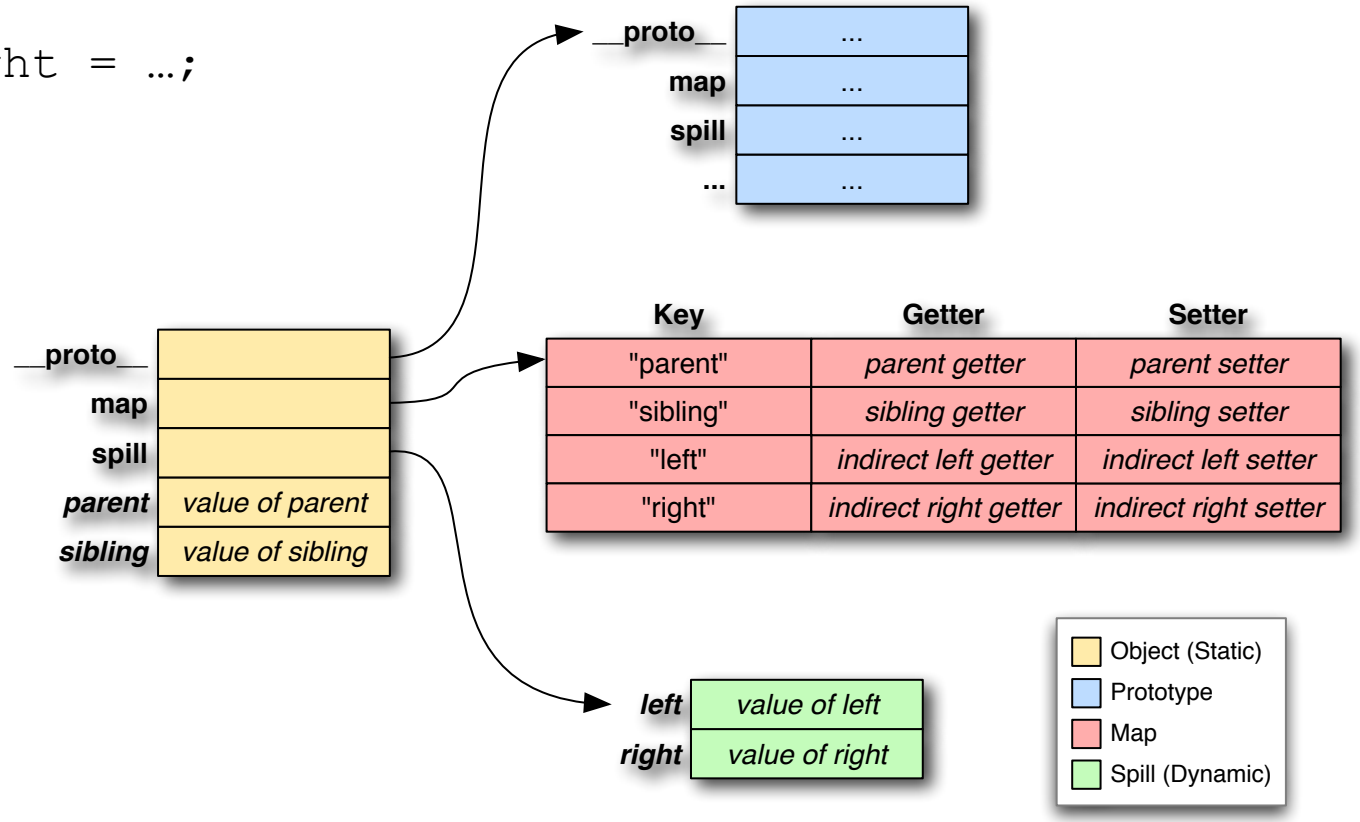
- Make scripting accessible to Java developers
  - Thin API, low overhead, Java objects, collections, Java Beans
- Based on ECMAScript-262
- Example of JSR-292 usage
- Promote the JVM relevance as a multi language platform
- Customizable to specialized needs

NASHORN Tentative Timetable

- Introduction at the JVM Language Summit in summer 2011
- Open source is TBD
- Release with JDK 8 – probably beta in the GA and fully supported in a later release

NASHORN Internals (Simplification)

```
var node = { parent: …, sibling: … };
node.__proto__ = …;
…
node.left = …;
…
node.right = …;
```



NASHORN Objects Objects Everywhere

- Basic objects
  - arrays, date, functions, regexp, ...
- Globals
  - global dynamic object
- Prototypes
  - delegate
- Scopes
  - chained objects
  - not always necessary (eval, arguments, nested functions)

NASHORN JSR-292 Usage In Nashorn

JSR-292 Handling Java void Methods

```
if (mh.type().returnType() == void.class) {
  mh = MethodHandles.filterReturnValue
       (mh, undefinedFilter);
}
…
static final MethodHandle undefinedFilter =
Linker.getMethodHandle
       (NativeJavaObject.class, "undefinedFilter");
…
public static Object undefinedFilter() {
  return ScriptRuntime.UNDEFINED;
}
```

JSR-292 JavaScript Closures

```
function gen() {
    var list = [];

    for (var i = 0; i < 5; i++) {
        list.push(function() { return i; });
    }

    i = "fish";

    return list;
}

var funcs = gen();

for (f in funcs) print(funcs[f]());
```

```
fish
fish
fish
fish
fish
```

JSR-292 JavaScript Closures

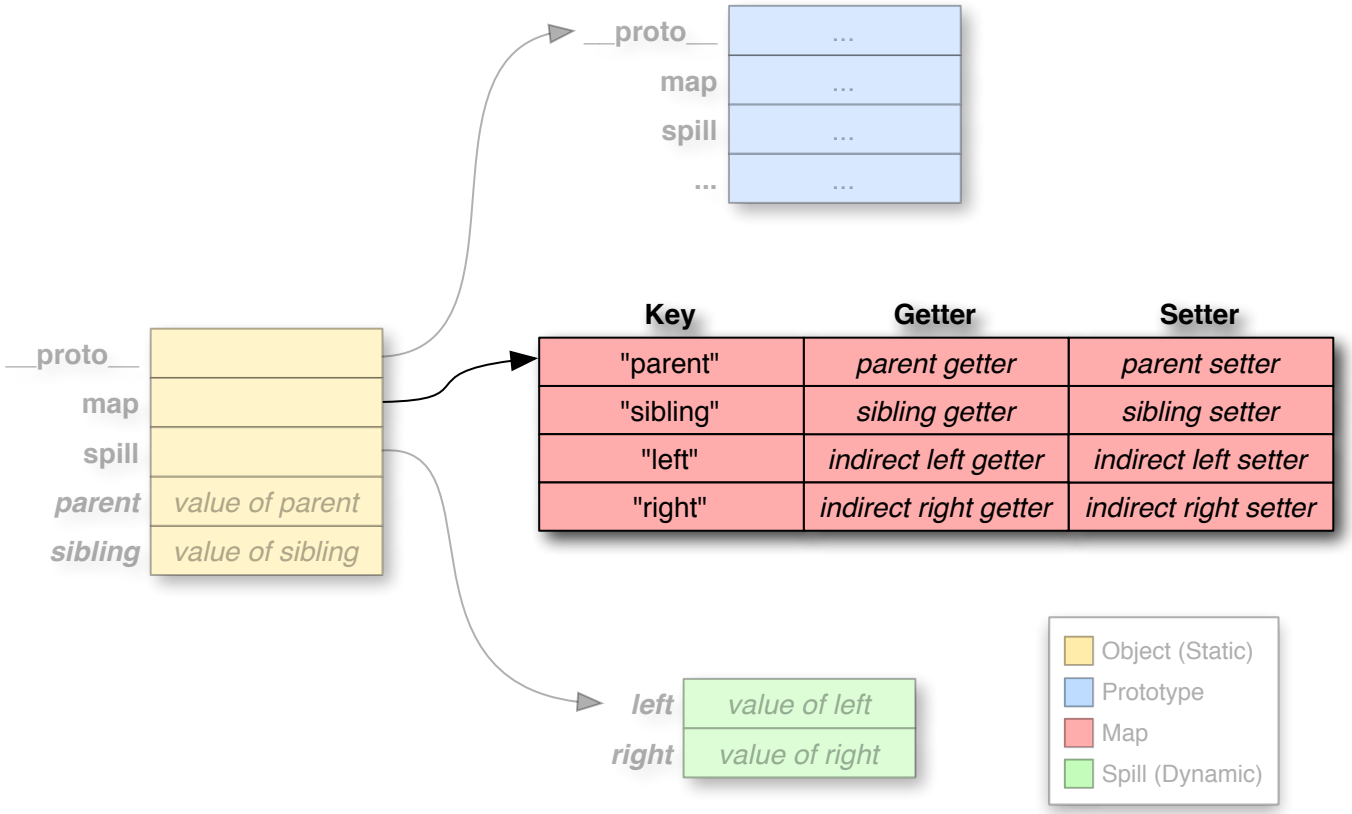
```
static Object gen(Object receiver, ScriptObject scope, …) {
  scope = new Scope(scope, scope$map, …);
  ScriptArray list = newScriptArray(0);

  …

  MethodHandle
    mh =linker.getMethod(scriptClass, "f$1", f$1$mt);
  mh = MethodHandles.insertArguments(mh, 1, scope);
  ScriptFunction function = new Function(mh);
  list.push(function);

  …

  return list;
}
```

JSR-292 Receivers

```
var x = node.left;
```

- InvokeDynamic to “left” with a GET bootstrap
- “left” could be a member of the object, or, a member of the object’s prototype

Binding **Receivers**



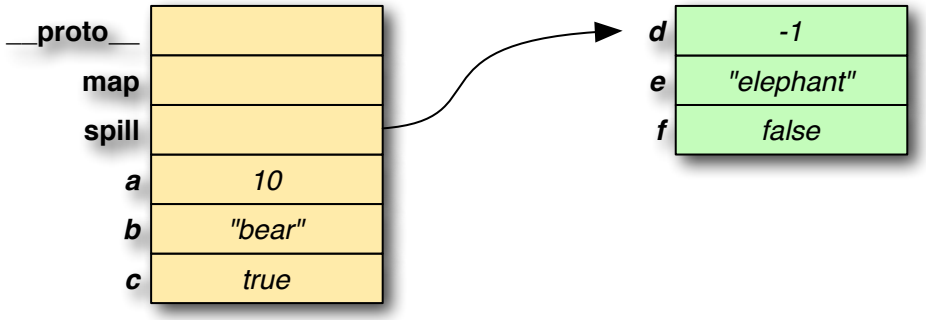
JSR-292 Receivers

- If found in the object's map, bind the getter to the call site as-is
- Otherwise, bind the getter's receiver arg to the prototype and bind the resulting mh to the call site

```
FindResult find = object.findProperty("left");
MethodHandle getter = find.getProperty().getGetter();
if (find.getDepth() == 0) {
  getter = getter.bindTo(find.getPrototype());
  getter = MethodHandles.dropArguments(getter, 0,
                    callSite.type().parameterType(0));
}
callSite.setMethod(getter, …);
```

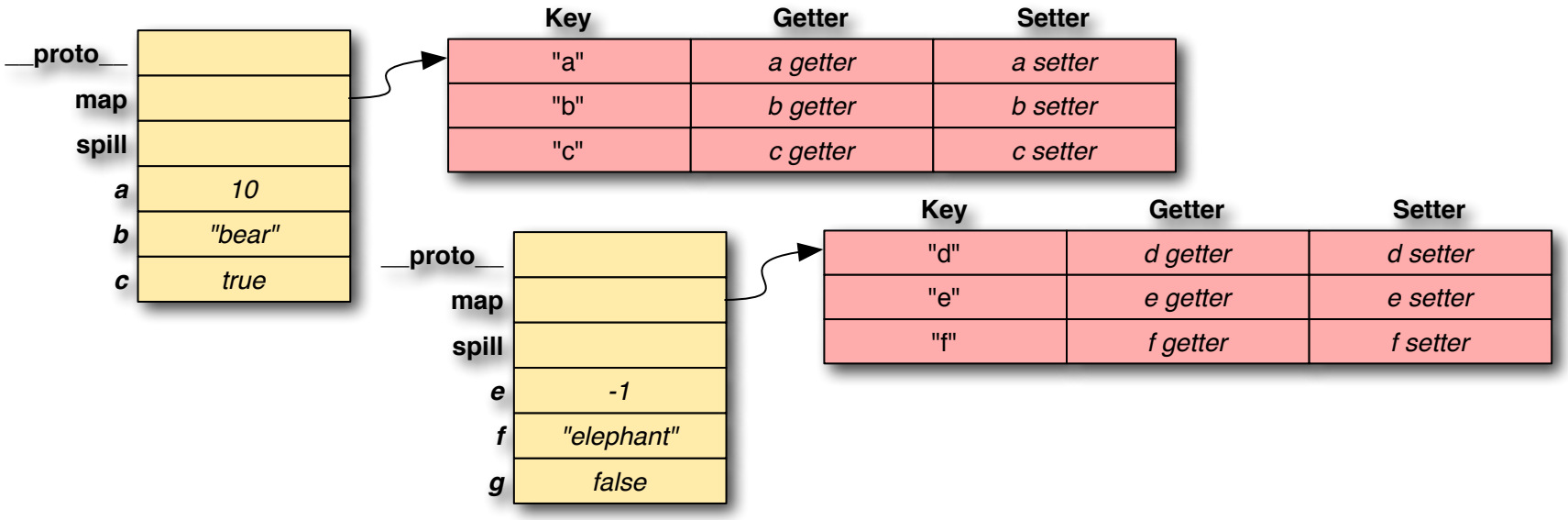
JSR-292 Direct References in Dynamic Situations

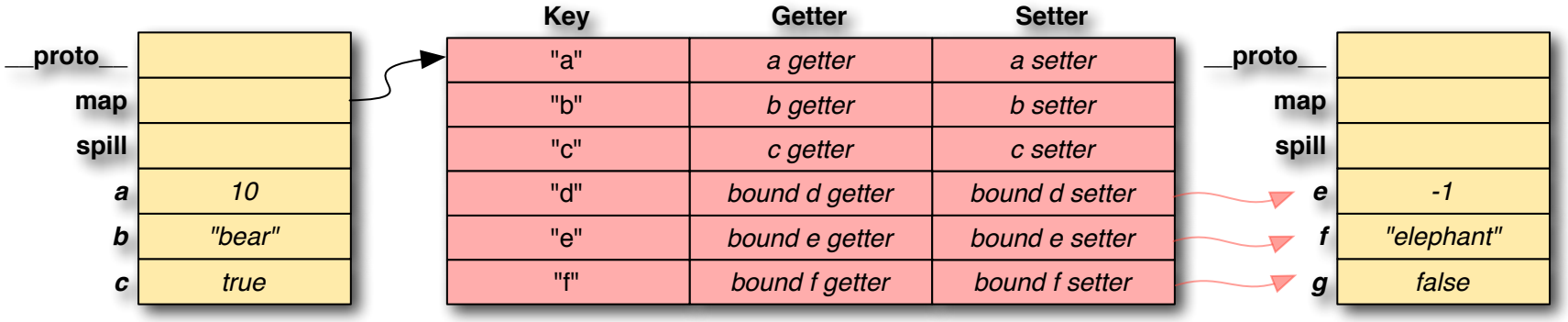
```
a = 10; b = "bear"; c = true;
eval("d = -1; e = "elephant"; f = false;");
```



- Global is a singleton
  - Getters/setters can be bound to the global
  - Can be bound to anything
- Map merging

JSR-292 Direct References in Dynamic Situations





POLYMORPHISM

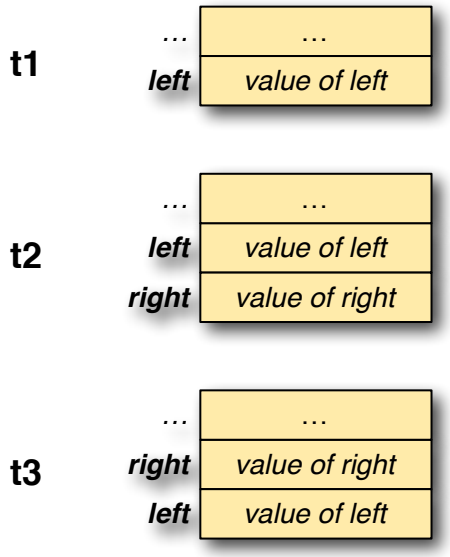
Avoiding Polymorphism At CallSites

POLYMORPHISM The Problem

```
var node = { parent: …, sibling: … };
node.__proto__ = …;
…
node.left = …;
…
node.right = …;
…
f(node.left);
```

OR

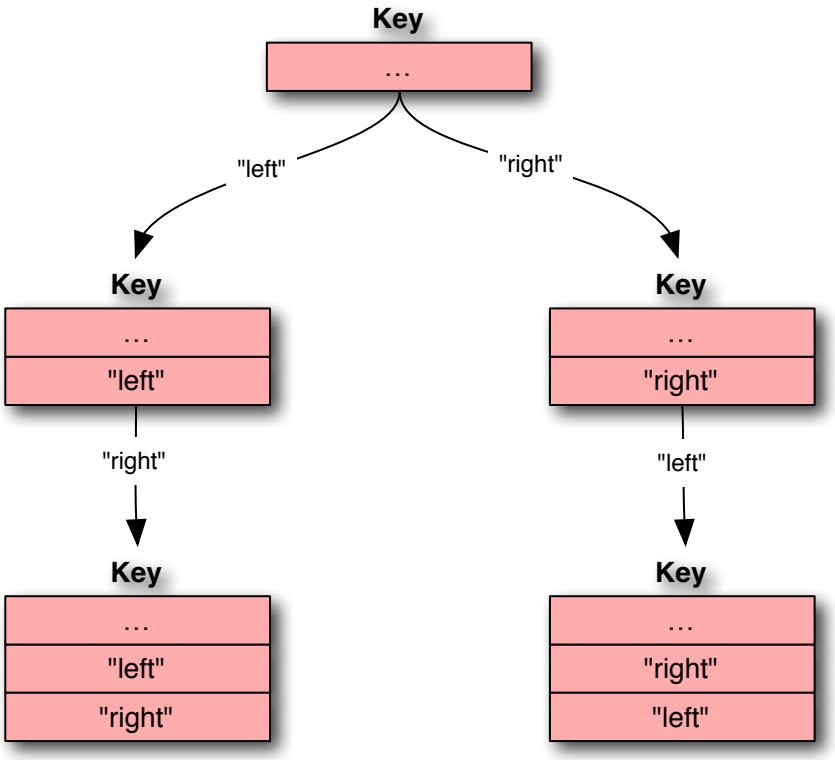
```
…
node.right = …;
…
node.left = …;
```




```
if (node isa t3)
   return t3.left
else if (node isa t2)
   return t2.left
else if (node isa t1)
   return t1.left
else
   lookup
```

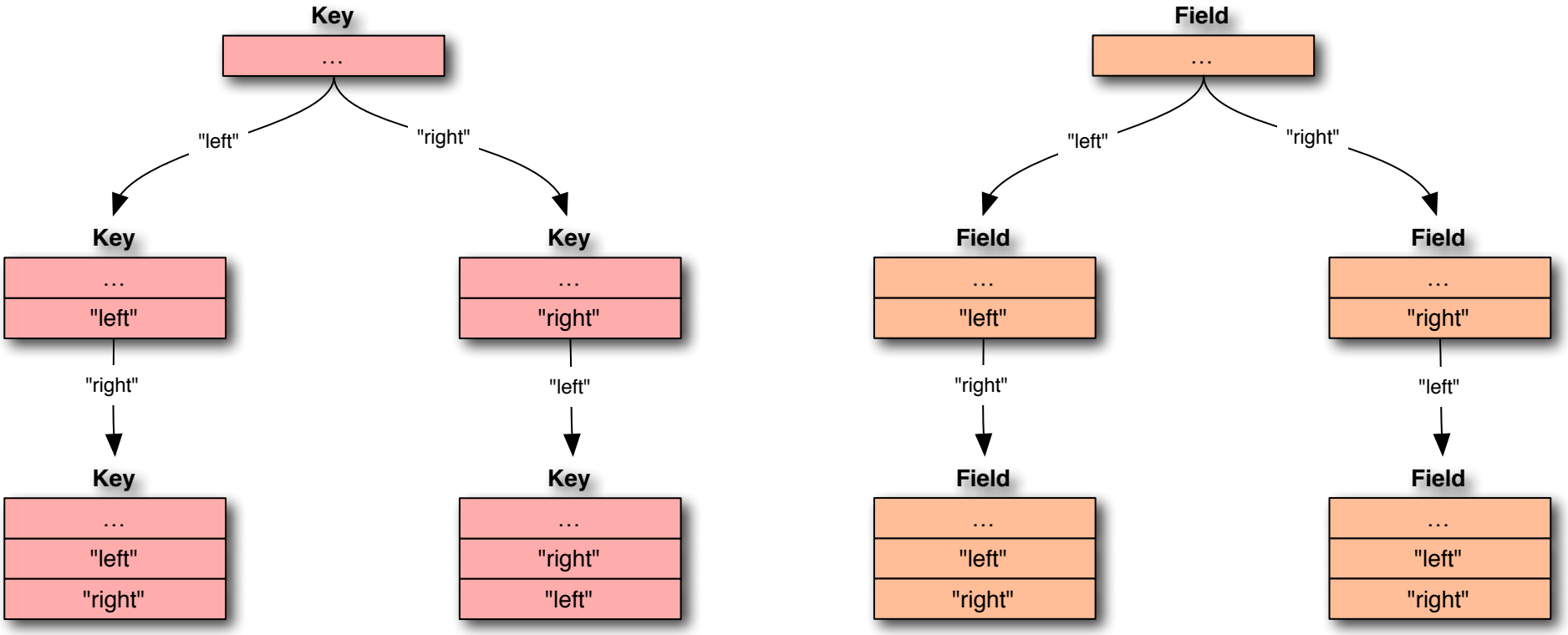
POLYMORPHISM By Map

- Guard by testing map
  - Immutable and interned to prevent proliferation



POLYMORPHISM By Organization

- Guard by testing organization
  - Reduce the number of cases by sorting fields



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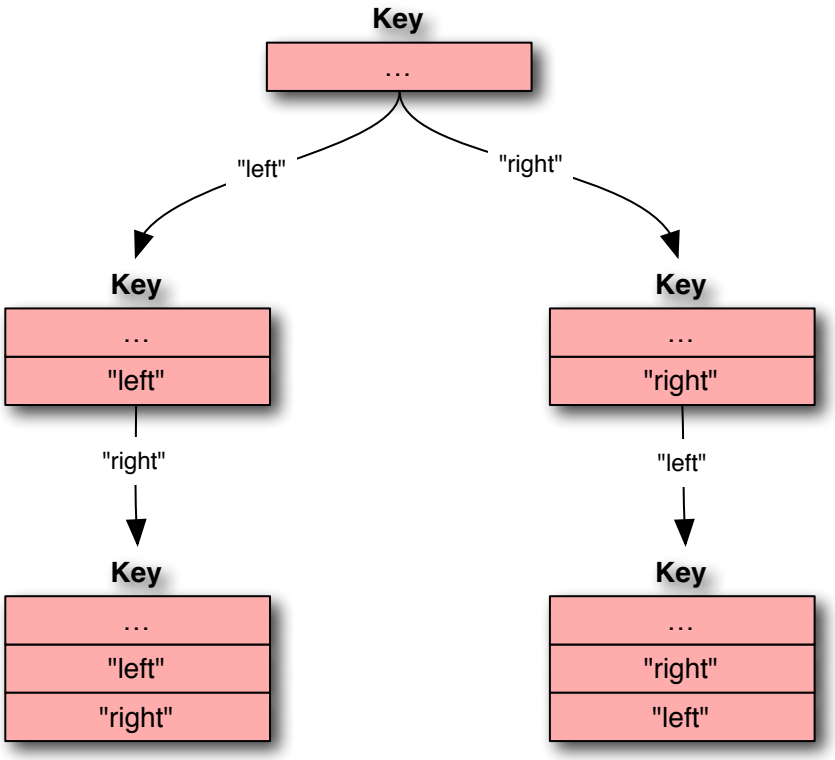
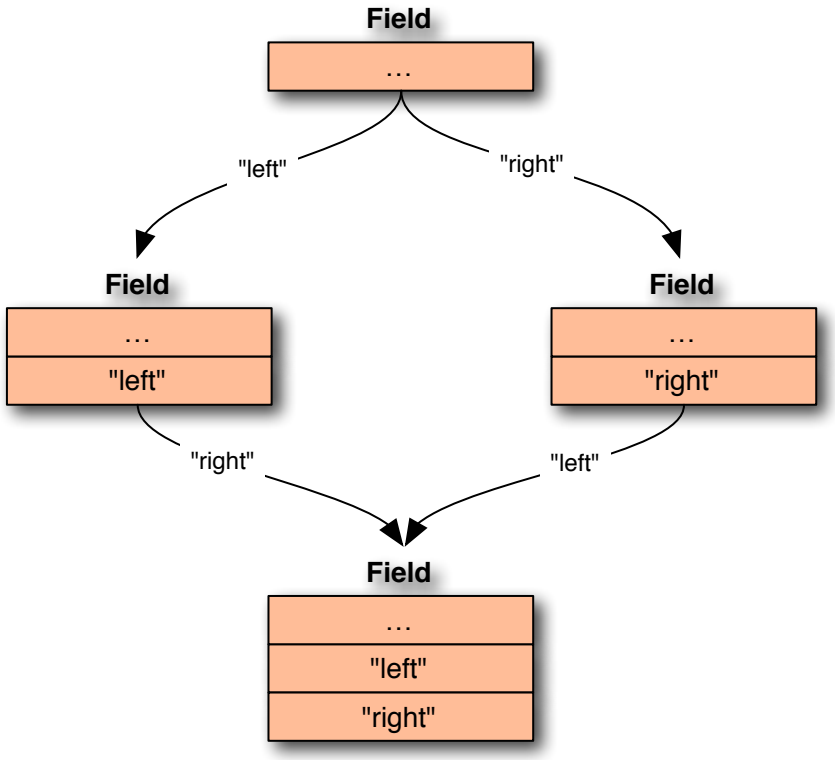
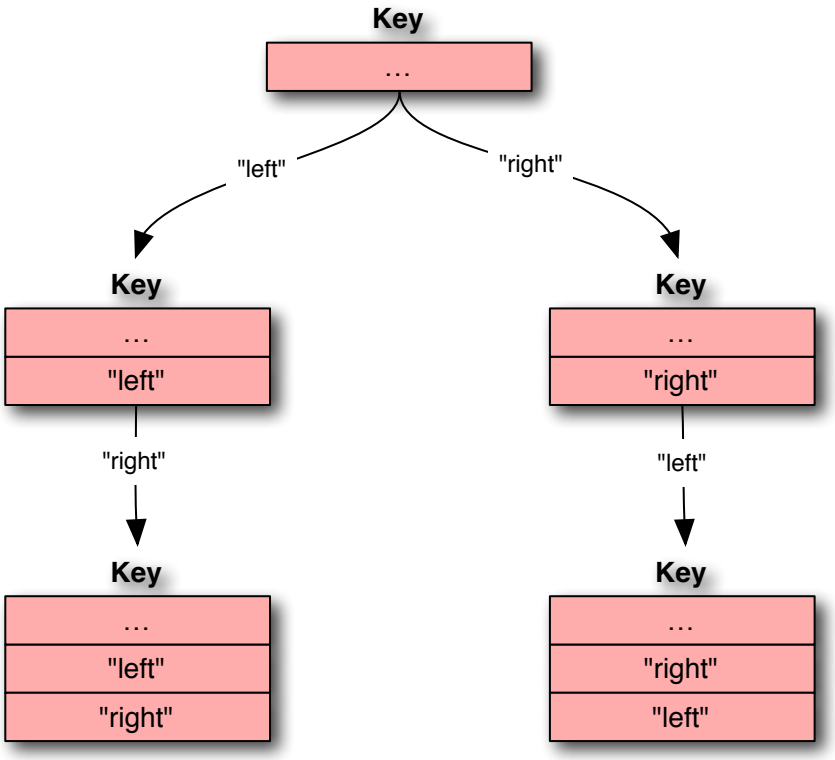
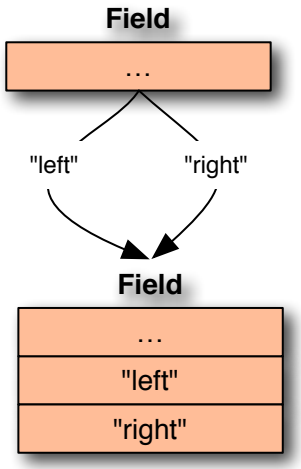




POLYMORPHISM By Predicted Organization

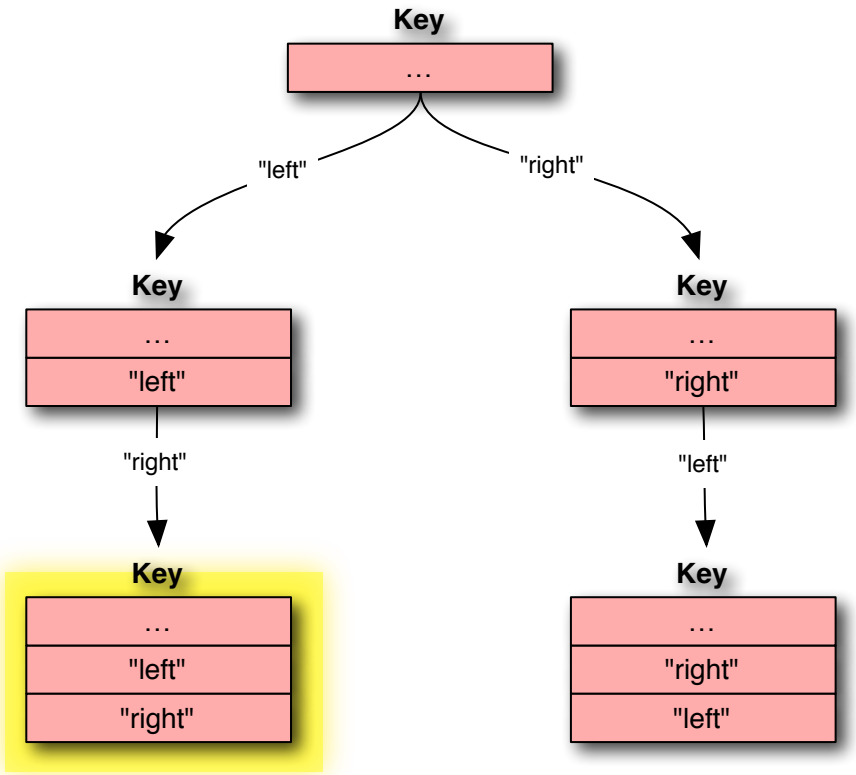
- Assume history will repeat itself

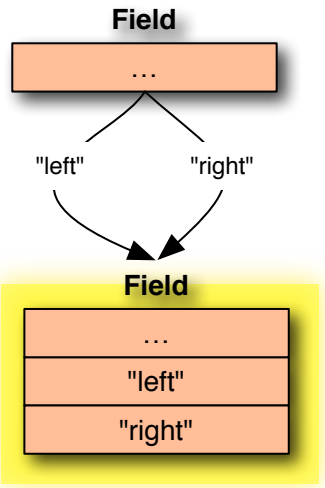




POLYMORPHISM First To

- No additional structure required.





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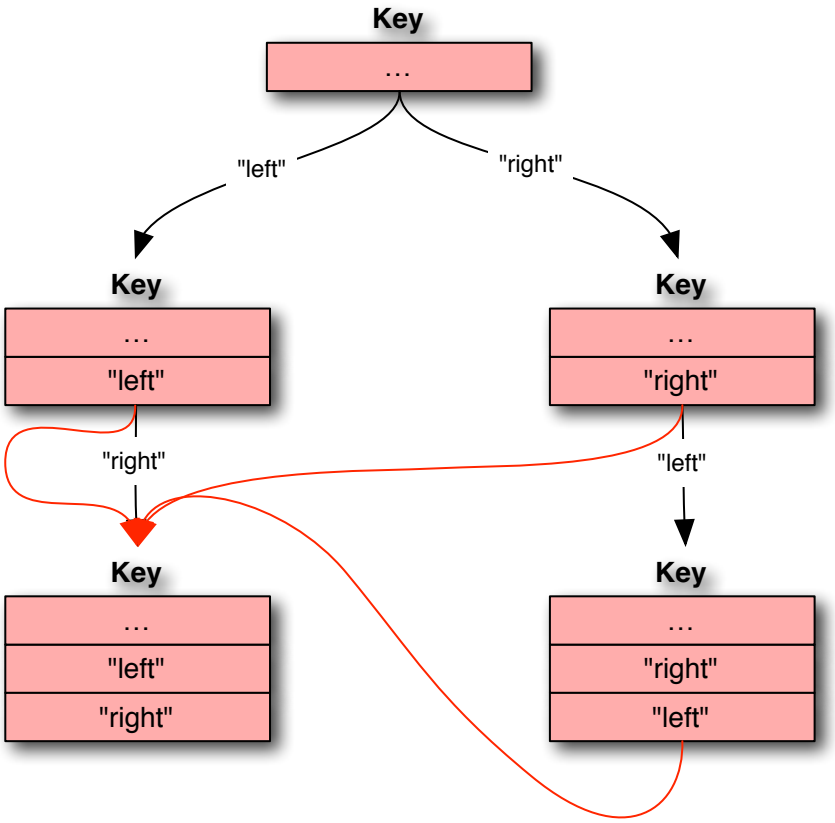
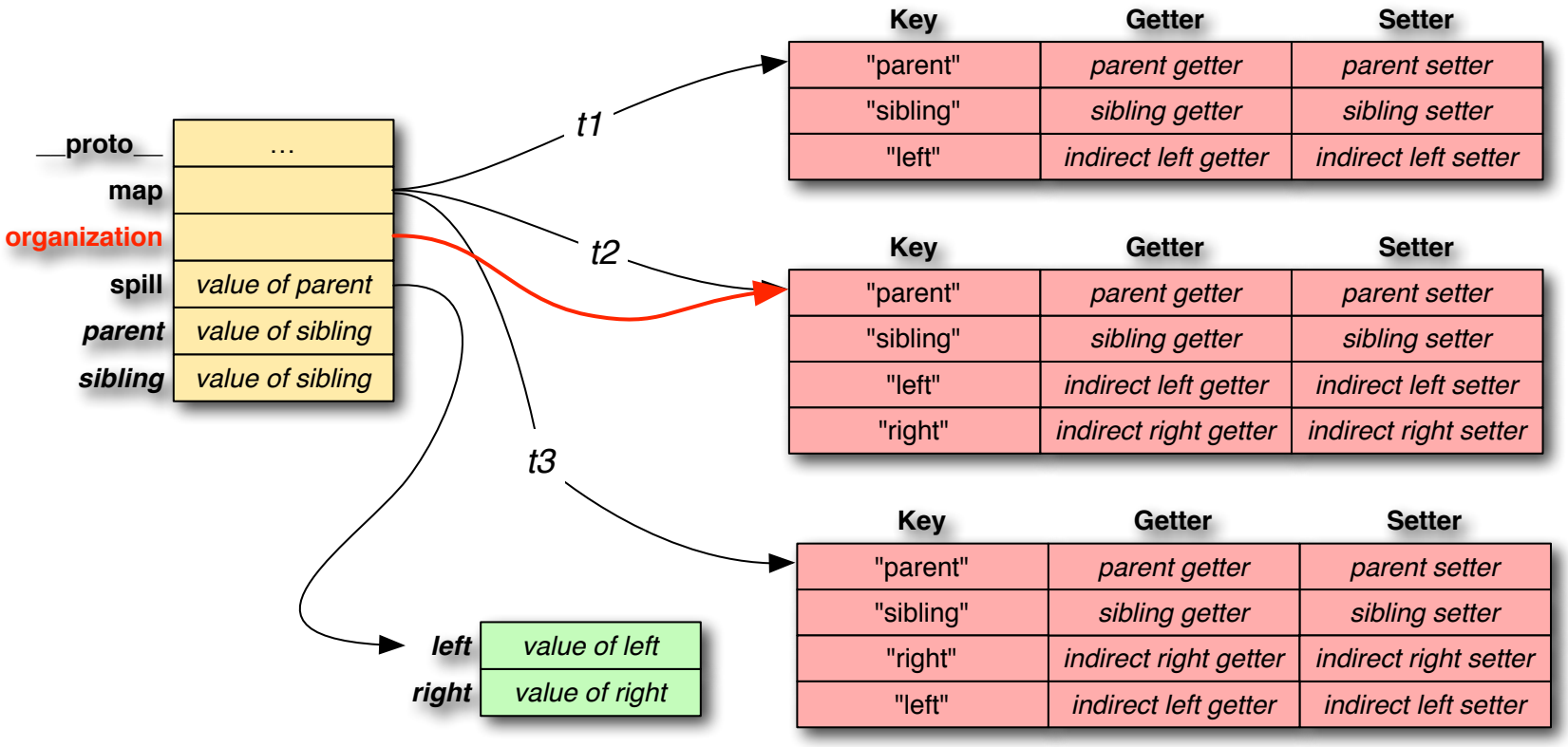


POLYMORPHISM Only The Map Changes



POLYMORPHISM Cost/Benefit

- The spill is dynamic anyway, no net loss
  - Allow for new properties,
  - Implies copying and slop
  - Quanta, cache lines, yada, yada, yada
  - Less copying
- Assuming that organization patterns will reoccur, yield of less thrashing at CallSites

POLYMORPHISM

NASHORN Contacts

Jim Laskey
james.laskey@oracle.com

mlvm-dev@openjdk.java.net

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Q&A