Neuerungen in Java 7
Die wichtigsten Änderungen, Erweiterungen

ORACLE®

JDK 7

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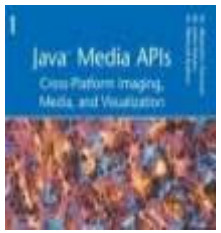
Priorities for the Java Platforms

- Grow Developer Base
- Grow Adoption
- Increase Competitiveness
- Adapt to change

Java Communities

JCP Reforms

- Developers' voice in the Executive Committee
  - SOUJava
  - Goldman Sachs
  - London JavaCommunity
  - Alex Terrazas
- JCP starting a program of reform
  - JSR 348: Towards a new version of the JCP



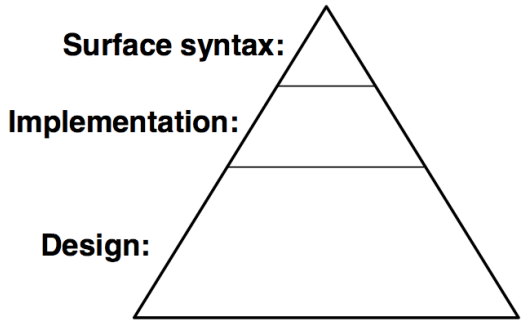
Evolving the Language

From "Evolving the Java Language" - JavaOne 2005

- Java language principles
  - Reading is more important than writing
  - Code should be a joy to read
  - The language should not hide what is happening
  - Code should do what it seems to do
  - Simplicity matters
  - Every "good" feature adds more "bad" weight
  - Sometimes it is best to leave things out
- One language: with the same meaning everywhere
  - No dialects
- We will evolve the Java language
  - But cautiously, with a long term view
  - "first do no harm"

So you want to change the language?

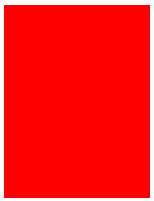
- Update the Java Language Spec.
- Compiler Implementation
- Essential library support
- Write tests
- Update the JVM Spec.
- Future language evolution
- Update the JVM and class file tools
- Update JNI
- Update the reflective APIs
- Update serialization
- Update javadoc output
- Kinds of compatibility



Java SE 7 Release Contents

- Java Language
  - Project Coin (JSR-334)
- Class Libraries
  - NIO2 (JSR-203)
  - Fork-Join framework, ParallelArray (JSR-166y)
- Java Virtual Machine
  - The DaVinci Machine project (JSR-292)
  - InvokeDynamic bytecode
- Miscellaneous Things
- JSR-336: Java SE 7 Release Contents


Small
Language
Changes
Project Coin



Project Coin Constraints

- *Small* language changes
  - Small in specification, implementation, testing
  - No new keywords!
  - Wary of type system changes
- Coordinate with larger language changes
  - Project Lambda
  - Modularity
- One language, one javac

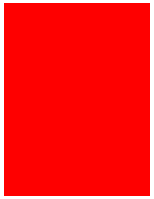
Better Integer Literal

- Binary literals

```
int mask = 0b101010101010;
```

- With underscores for clarity

```
int mask = 0b1010_1010_1010;
long big = 9_223_783_036_967_937L;
```



String Switch Statement

- Today case label includes integer constants and enum constants
- Strings are constants too (immutable)

Distinguish Strings Today

```
int monthNameToDays(String s, int year) {

if("April".equals(s) || "June".equals(s) ||
     "September".equals(s) ||"November".equals(s))
   return 30;

if("January".equals(s) || "March".equals(s) ||
   "May".equals(s) || "July".equals(s) ||
   "August".equals(s) || "December".equals(s))
     return 31;

if("February".equals(s))
   ...
```

Strings in Switch Statements

```
int monthNameToDays(String s, int year) {
  switch(s) {
    case "April": case "June":
    case "September": case "November":
      return 30;

    case "January": case "March":
    case "May": case "July":
    case "August": case "December":
      return 31;

    case "February”:
      ...
    default:
      ...
```

Simplifying Generics

- Pre-generics

```
List strList = new ArrayList();
```

Simplifying Generics

- Pre-generics

```
List strList = new ArrayList();
```

- With Generics

```
List<String> strList = new ArrayList<String>();
```

Simplifying Generics

- Pre-generics

```
List strList = new ArrayList();
```

- With Generics

```
List<String> strList = new ArrayList<String>();
List<Map<String, List<String>> strList =
  new ArrayList<Map<String, List<String>>();
```

Diamond Operator

- Pre-generics

```
List strList = new ArrayList();
```

- With Generics

```
List<String> strList = new ArrayList<String>();
List<Map<String, List<String>> strList =
  new ArrayList<Map<String, List<String>>();
```

- With diamond (<>) compiler infers type

```
List<String> strList = new ArrayList<>();
List<Map<String, List<String>> strList =
  new ArrayList<>();
```

Copying a File

```
InputStream in = new FileInputStream(src);
OutputStream out = new FileOutputStream(dest);

byte[] buf = new byte[8192];
int n;

while (n = in.read(buf)) >= 0)
  out.write(buf, 0, n);
```

Copying a File (Better, but wrong)

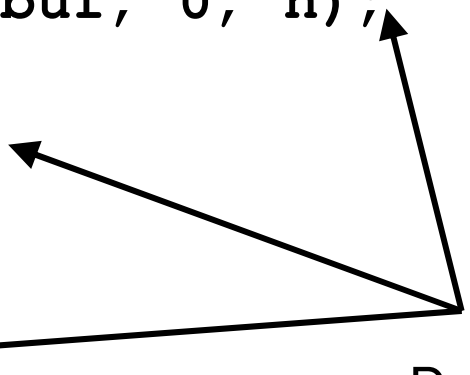
```
InputStream in = new FileInputStream(src);
OutputStream out = new FileOutputStream(dest);

try {
  byte[] buf = new byte[8192];
  int n;
  while (n = in.read(buf)) >= 0)
    out.write(buf, 0, n);
} finally {
  in.close();
  out.close();
}
```

Copying a File (Correct, but complex)

```
InputStream in = new FileInputStream(src);
try {
  OutputStream out = new FileOutputStream(dest);
  try {
    byte[] buf = new byte[8192];
    int n;
    while (n = in.read(buf)) >= 0)
      out.write(buf, 0, n);
  } finally {
    out.close();
  }
} finally {
  in.close();
}
```

Copying a File (Correct, but complex)

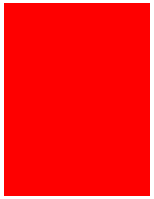
```
InputStream in = new FileInputStream(src);
try {
  OutputStream out = new FileOutputStream(dest);
  try {
    byte[] buf = new byte[8192];
    int n;
    while (n = in.read(buf)) >= 0)
      out.write(buf, 0, n);
  } finally {
    out.close();
  }
} finally {
  in.close();
}
```



Exception thrown from potentially three places.
Details of first two could be lost

Automatic Resource Management

```
try (InputStream in = new FileInputStream(src),
     OutputStream out = new FileOutputStream(dest))
{
  byte[] buf = new byte[8192];
  int n;
  while (n = in.read(buf)) >= 0)
    out.write(buf, 0, n);
}
```



The Details

- Compiler de-sugars try-with-resources into nested try-finally blocks with variables to track exception state
- Suppressed exceptions are recorded for posterity using a new facility of Throwable
- API support in JDK 7
  - New superinterface **`java.lang.AutoCloseable`**
  - All **`AutoCloseable`** and by extension java.io.Closeable types useable with try-with-resources
  - Anything with a **`void close()`** method is a candidate
  - JDBC 4.1 retro-fitted as **`AutoCloseable`** too

More Informative Backtraces

```
java.io.IOException
     at Suppress.write(Suppress.java:19)
     at Suppress.main(Suppress.java:8)
     Suppressed:  java.io.IOException
         at Suppress.close(Suppress.java:24)
         at Suppress.main(Suppress.java:9)
     Suppressed:  java.io.IOException
         at  Suppress.close(Suppress.java:24)
         at  Suppress.main(Suppress.java:9)
```

Varargs Warnings

```
class Test {
   public static void main(String... args) {
      List<List<String>> monthsInTwoLanguages =
        Arrays.asList(Arrays.asList("January",
                                    "February"),
                      Arrays.asList("Enero",
                                    "Febrero" ));
   }
}
```

```
Test.java:7:  warning:
[unchecked]  unchecked  generic  array  creation
for  varargs parameter  of  type  List<String>[]
         Arrays.asList(Arrays.asList("January",
                       ^
1  warning
```

Heap Pollution – JLSv3 4.12.2.1

- A variable of a parameterized type refers to an object that is not of that parameterized type
- For example, the variable of type `List<String>[]` might point to an array of `Lists` where the `Lists` did not contain strings
- Reports possible locations of `ClassCastExceptions` at runtime
- A consequence of erasure
- Possibly properly addressed by reification in the future

Varargs Warnings Revised

- New mandatory compiler warning at suspect varargs method declarations
- By applying an annotation at the declaration, warnings at the declaration *and call sites* can be suppressed
- `@SuppressWarnings(value = "unchecked")`
- `@SafeVarargs`

Lots of Exceptions

```
try {
...
} catch(ClassNotFoundException cnfe) {
   doSomethingClever(cnfe);
   throw cnfe;
} catch(InstantiationException ie) {
   log(ie);
   throw ie;
} catch(NoSuchMethodException nsme) {
   log(nsme);
   throw nsme;
} catch(InvocationTargetException ite) {
   log(ite);
   throw ite;
}
```

Multi-Catch

```
try {
...
} catch (ClassCastException e) {
  doSomethingClever(e);
  throw e;
} catch(InstantiationException |
  NoSuchMethodException |
  InvocationTargetException e) {
log(e);
throw e;
}
```

IDE Support

- Beta support in Eclipse
  - http://thecoderlounge.blogspot.com/2011/06/java-7-support-in-eclipse-jdt-beta.html
- IntelliJIDEA 10.5
- NetBeans7.0
  - http://netbeans.org/kb/docs/java/javase-jdk7.html
- Demo

```
37
38
39
40
42
43
44
45
```

Can be replaced with multicatch
--
(Alt-Enter shows hints)

```
NotFoundException("adasdf");
        } catch (FileNotFoundException fnfo) {
            fnfo.printStackTrace();
        } catch (IOException ioe) {
            ioe.printStackTrace();
        }
```


Library Changes
iPod
THE BEST MARGARITA

New I/O 2 (NIO2) Libraries

JSR 203

- Original Java I/O APIs presented challenges for developers
- Need something better than java.io.File
  - Doesn't work consistently across platforms
  - No useful exceptions when a file operation fails
  - Missing basic operations (file copy, move, ...)
  - Limited support for symbolic links
  - Limited support for file attributes, performance issues
  - No way to plug-in other file system implementations
- Java NIO2 solves these problems

Java NIO2 Features

- Path is a replacement for File
  - Biggest impact on developers
- Better directory support
- Files
  - Static methods to operate on files and directories
  - Support for symbolic links
- FileStore
  - Represents underlying file storage (partition, concrete file system)
- FileSystem
  - SPI interface to a filesystem (FAT, ZFS, Zip archive, network, etc)
- Access to file metadata

`Path` Class

- Equivalent of **`java.io.File`** in the new API
  - Immutable
- Have methods to access and manipulate **`Path`**
- Supports old libraries
  - Create File from Path using toFile

```
//Make a reference to the path
Path home = Paths.get("/home/fred");

//Resolve tmp from /home/fred -> /home/fred/tmp
Path tmpPath = home.resolve("tmp");

//Create a relative path from tmp -> ..
Path relativePath = tmpPath.relativize(home)

File file = relativePath.toFile();
```

File Operation – Copy, Move

- File copy is really easy
  - With fine grain control

```
Path src = Paths.get("/home/fred/readme.txt");
Path dst = Paths.get("/home/fred/copy_readme.txt");

Files.copy(src, dst,
   StandardCopyOption.COPY_ATTRIBUTES,
   StandardCopyOption.REPLACE_EXISTING);
```

- File move is supported
  - Optional atomic move supported

```
Path src = Paths.get("/home/fred/readme.txt");
Path dst = Paths.get("/home/fred/readme.1st");

Files.move(src, dst, StandardCopyOption.ATOMIC_MOVE);
```

Directories

- DirectoryStream iterate over entries
  - Scales to large directories
  - Uses less resources
  - Smooth out response time for remote file systems
  - Implements **`Iterable`** and **`Closeable`** for productivity
- Filtering support
  - Build-in support for glob, regex and custom filters

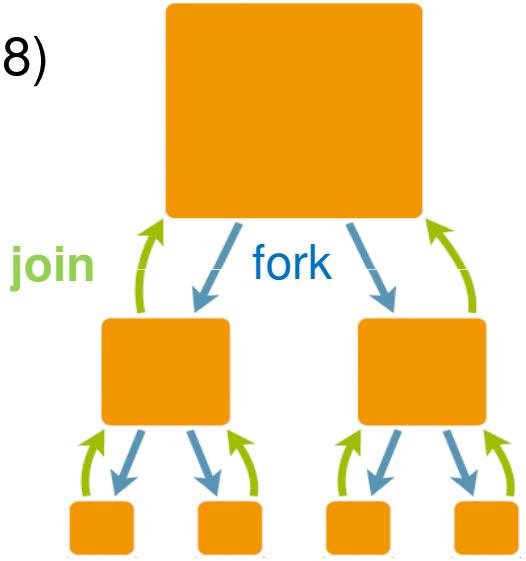
```
Path srcPath = Paths.get("/home/fred/src");

try (DirectoryStream<Path> dir =
   srcPath.newDirectoryStream("*.java")) {
for (Path file: dir)
   System.out.println(file.getName());
}
```

Concurrency APIs

- JSR166y
  - Update to JSR166x which was an update to JSR166
- Adds a lightweight task framework
  - Also referred to as Fork/Join
- **`Phaser`**
  - Barrier similar to **`CyclicBarrier`** and **`CountDownLatch`**
- **`TransferQueue`** interface
  - Extension to **`BlockingQueue`**
  - Implemented by **`LinkedTransferQueue`**

Fork Join Framework

- Goal is to take advantage of multiple processor
- Designed for task that can be broken down into smaller pieces
  - Eg. Fibonacci number fib(10) = fib(9) + fib(8)
- Typical algorithm that uses fork join




```
if I can manage the task
perform the task
else
fork task into x number of smaller/similar task
join the results
```

Key Classes

- **`ForkJoinPool`**
  - Executor service for running **`ForkJoinTask`**
- **`ForkJoinTask`**
  - The base class for forkjoin task
- **`RecursiveAction`**
  - A subclass of **`ForkJoinTask`**
  - A recursive resultless task
  - Implements **`compute()`** abstract method to perform calculation
- **`RecursiveTask`**
  - Similar to **`RecursiveAction`** but returns a result

ForkJoin Example – Fibonacci

```
public class Fibonacci extends RecursiveTask<Integer> {
    private final int number;
    public Fibonacci(int n) { number = n; }

    @Override protected Integer compute() {
        switch (number) {
            case 0: return (0);
            case 1: return (1);
            default:
                Fibonacci f1 = new Fibonacci(number - 1);
                Fibonacci f2 = new Fibonacci(number - 2);
                f1.fork(); f2.fork();
                return (f1.join() + f2.join());
        }
    }
}
```

ForkJoin Example – Fibonacci

```
ForkJoinPool pool = new ForkJoinPool();
Fibonacci r = new Fibonacci(10);
pool.submit(r);

while (!r.isDone()) {
//Do some work
...
}

System.out.println("Result of fib(10) = "
  + r.get());
```

ForkJoin Performance Discussion

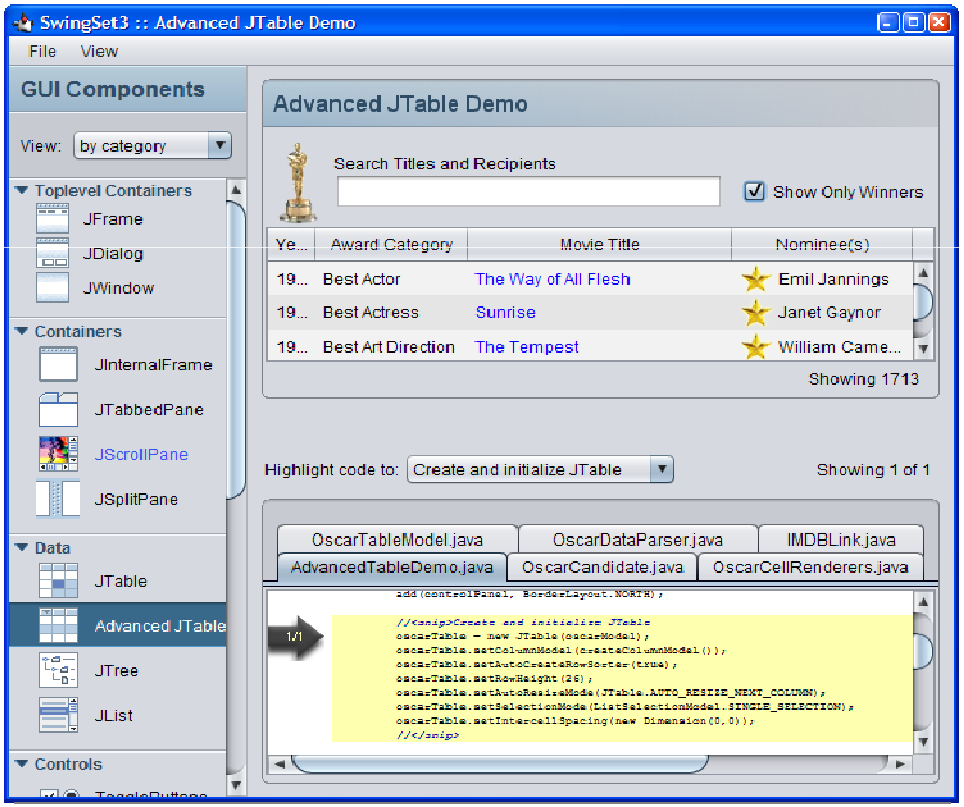
- Choosing the sequential threshold
  - Smaller tasks increase parallelism
  - Larger tasks reduce coordination overhead
  - Ultimately you must profile your code
- Minimizes overhead for compute-intensive tasks
  - Not recommended for tasks that mix CPU and I/O activity
- A portable way to express many parallel algorithms
  - Reasonably efficient for a wide range of core counts
  - Library-managed parallelism

Client Libraries

- Nimbus Look and Feel
- Platform APIs for shaped and translucent windows
- JLayer (formerly from Swing labs)
- Optimized 2D rendering

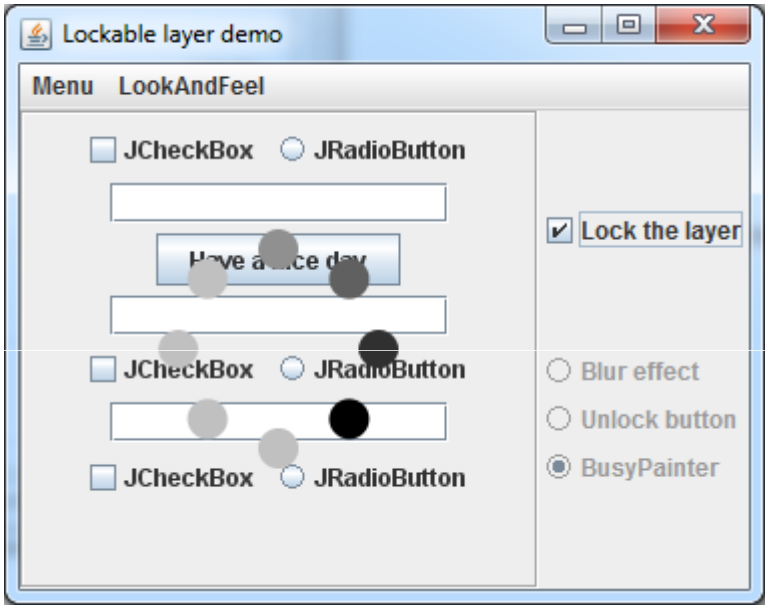
Nimbus Look and Feel

- Better than Metal for cross platform look-and-feel
- Introduced in Java SE 6u10, now part of Swing
- Not the default L&F



JLayer component

Easy enrichment for Swing components



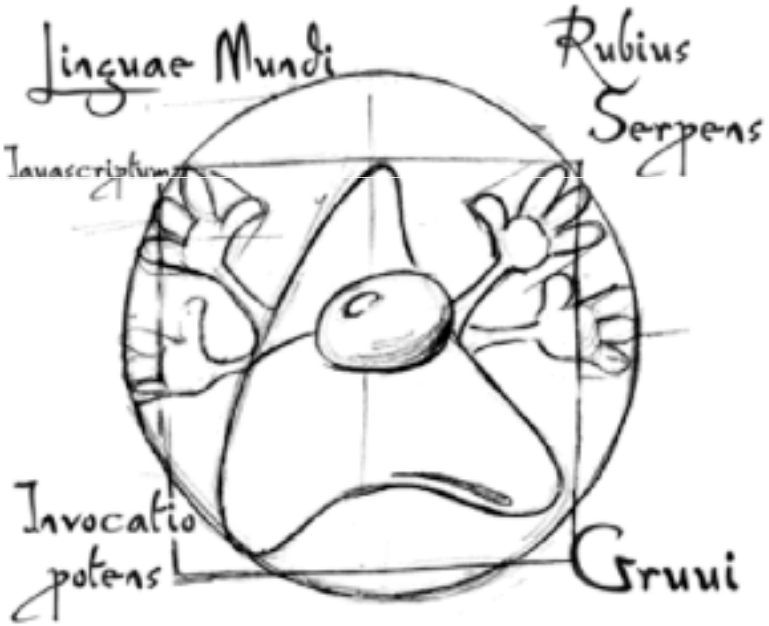
JLayer component

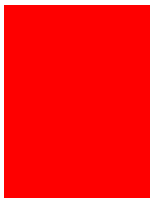
The universal decorator

- Transparent decorator for a Swing component
- Controls the painting of its subcomponents
- Catches all input and focus events for the whole hierarchy

```
// wrap your component with JLayer
JLayer<JPanel> layer = new JLayer<JPanel>(panel);

// custom ui provides all extra functionality
layer.setUI(myLayerUI);

// add the layer as usual component
frame.add(layer);
```

The DaVinci Machine Project (JSR-292)
(A multi-language renaissance for the JVM)





Languages Like Virtual Machines

- Programming languages need runtime support
  - Memory management / Garbage collection
  - Concurrency control
  - Security
  - Reflection
  - Debugging integration
  - Standard libraries
- Compiler writers have to build these from scratch
- Targeting a VM allows reuse of infrastructure

JVM Specification

"The Java virtual machine knows nothing about the Java programming language, only of a particular binary format, the class file format."

1.2 The Java Virtual Machine Spec.

Languages Running on the JVM

Groovy
JRuby
…
…
Scala
Clojure

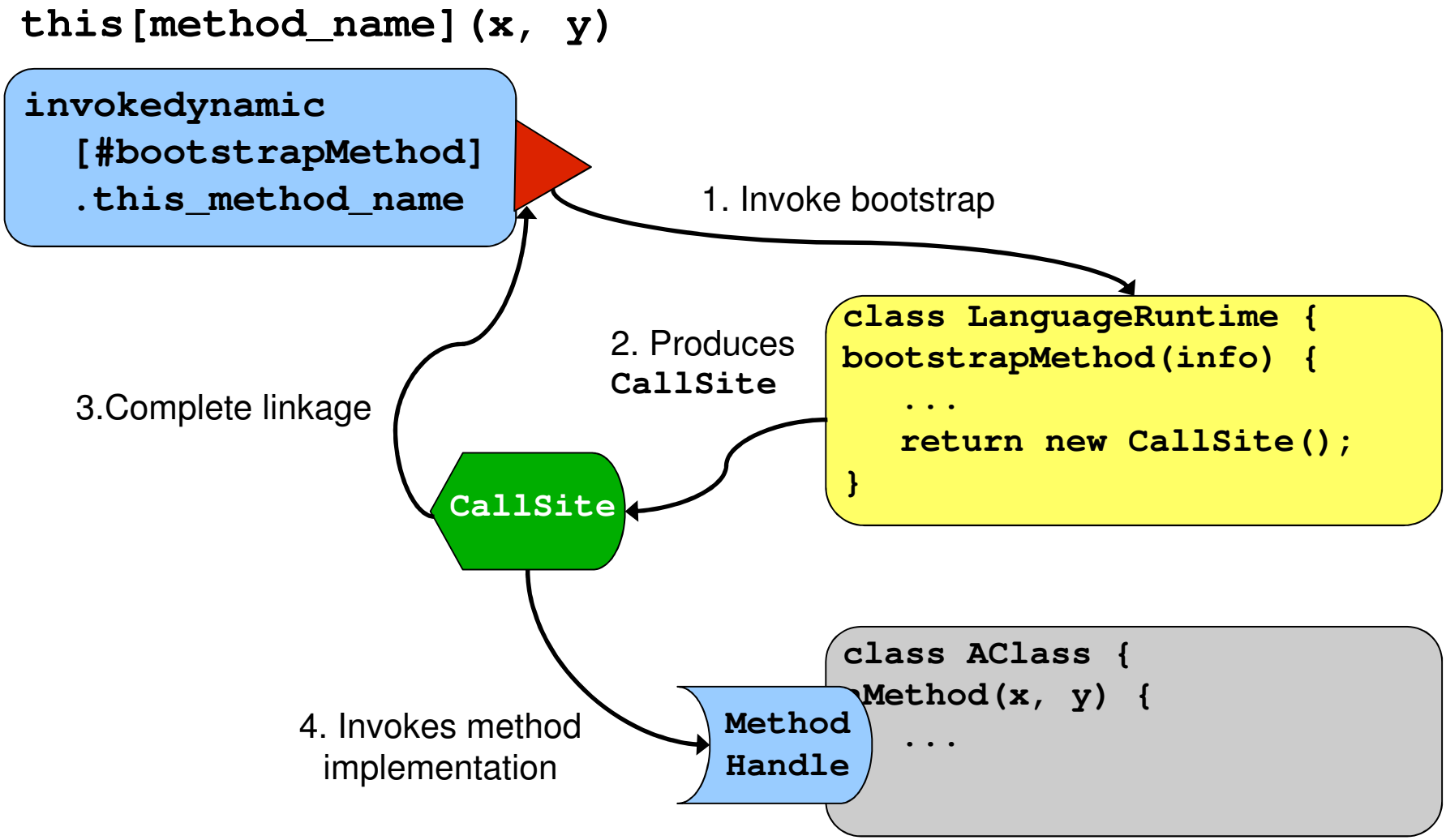
InvokeDynamic Bytecode

- JVM currently has four ways to invoke method
  - Invokevirtual, invokeinterface, invokestatic, invokespecial
- All require full method signature data
- InvokeDynamic will use method handle
  - Effectively an indirect pointer to the method
- When dynamic method is first called bootstrap code determines method and creates handle
- Subsequent calls simply reference defined handle
- Type changes force a re-compute of the method location and an update to the handle
  - Method call changes are invisible to calling code

`CallSite` and `MethodHandle`

- **`invokedynamic`** linked to a **`CallSite`**
  - **`CallSite`** can be linked or unlinked
  - **`CallSite`** holder of **`MethodHandle`**
- **`MethodHandle`** is a directly executable reference to an underlying method, constructor, field
  - Can transform arguments and return type
  - Transformation – conversion, insertion, deletion, substitution

`invokedynamic` Step 1-to-4



Miscellaneous Things

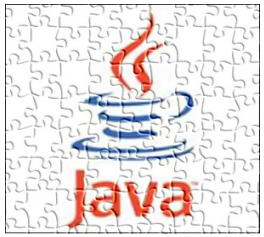
- Security
  - Elliptic curve cryptography
  - TLS 1.2
- JAXP 1.4.4
- JAX-WS 2.2
- JAXB 2.2
- ClassLoader architecture changes
- `close()` for URLClassLoader
- Javadoc support for CSS

JDK 7 Platform Support

- Windows x86
  - Server 2008, Server 2008 R2, 7 & 8 (when it GAs)
  - Windows Vista, XP
- Linux x86
  - Oracle Linux 5.5+, 6.x
  - Red Hat Enterprise Linux 5.5+, 6.x
  - SuSE Linux Enterprise Server 10.x, 11.x
  - Ubuntu Linux 10.04 LTS, 11.04
- Solaris x86/SPARC
  - Solaris 10.9+, 11.x
- Apple OSX x86
  - Will be supported post-GA, detailed plan TBD

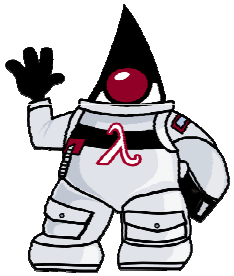
Note: JDK 7 should run on pretty much any Windows/Linux/Solaris. These configurations are the ones primarily tested by Oracle, and for which we provide commercial support.

Java SE 8



Project Jigsaw (JSR-294)

Modularizing the Java Platform



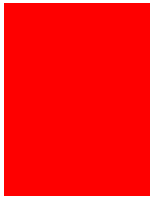
Project Lambda (JSR 335)

Closures and lambda expressions

Better support for multi-core processors

More Project Coin

Small Language Changes



Zusammenfassung

- Java SE 7
  - Incremental changes
  - Evolutionary, not revolutionary
  - Good solid set of features to make developers life easier
- Java SE 8
  - Major new features: Modularisation and Closures
  - More smaller features to be defined
- Java continues to grow and adapt to the changing world of IT

Vielen Dank für Ihre Aufmerksamkeit!

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