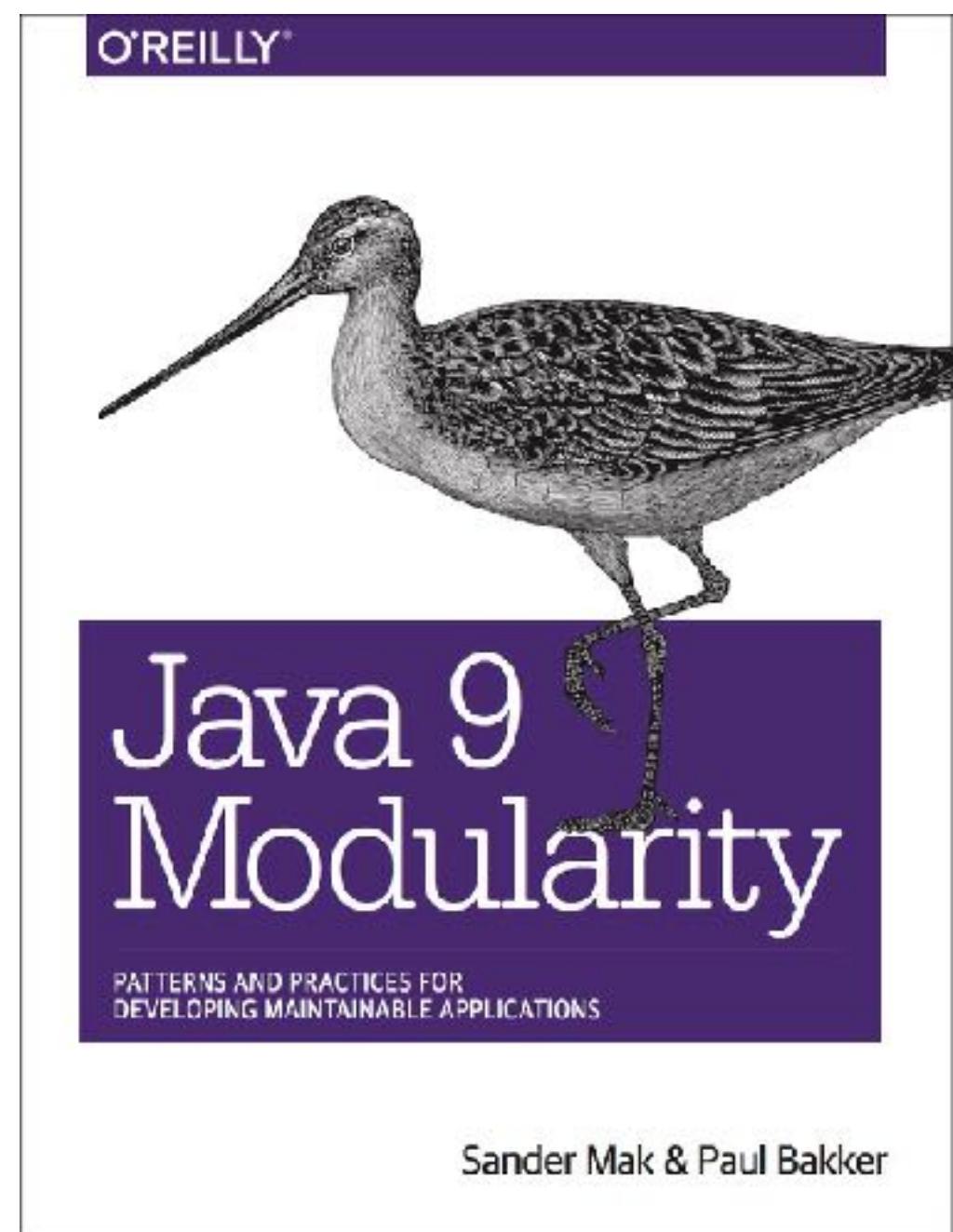


Java 9 Modularity in Action

By Sander Mak



@Sander_Mak

Today's journey

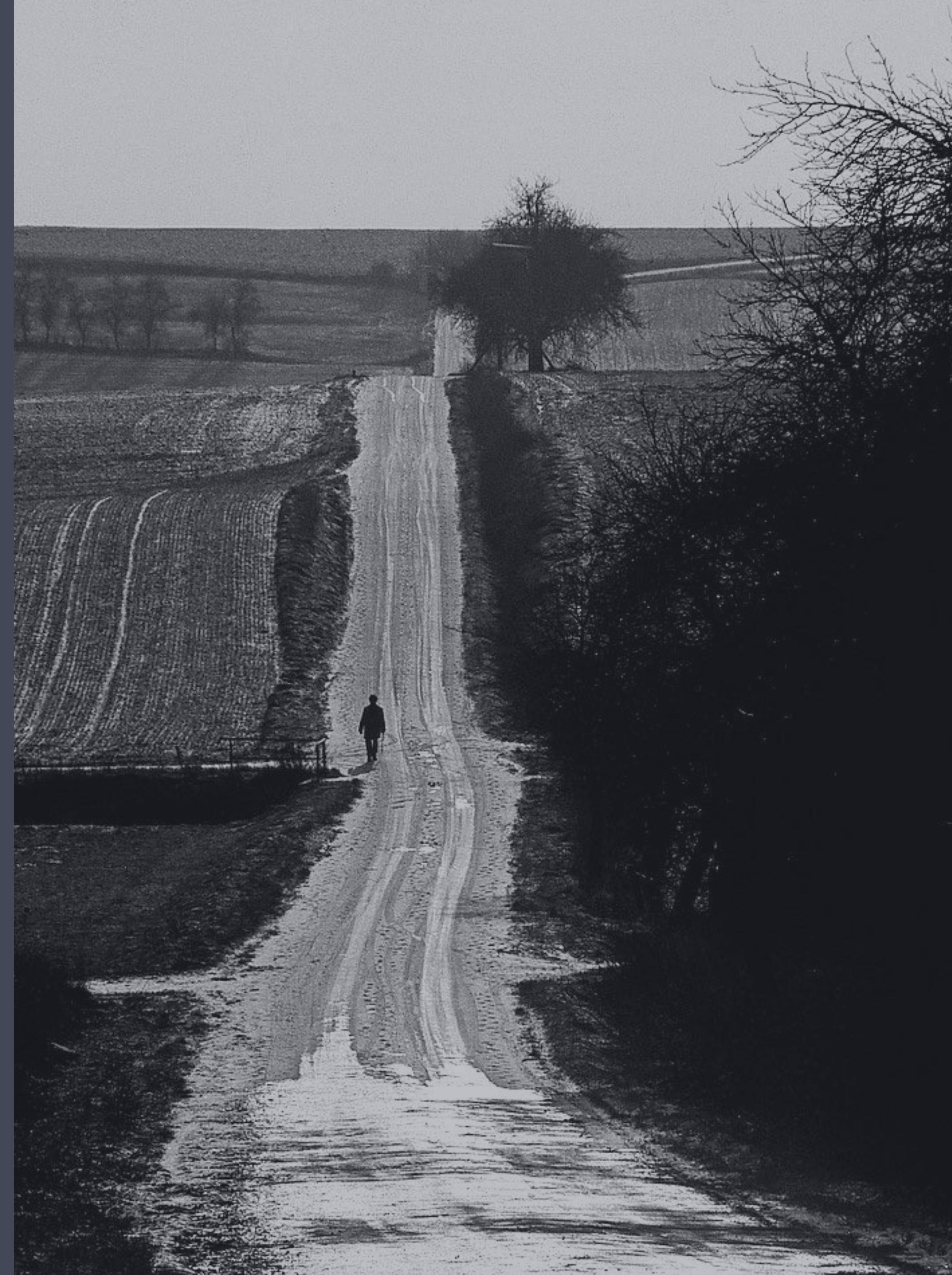
Modularity matters

Java 9 modules

Services

Linking

Migration

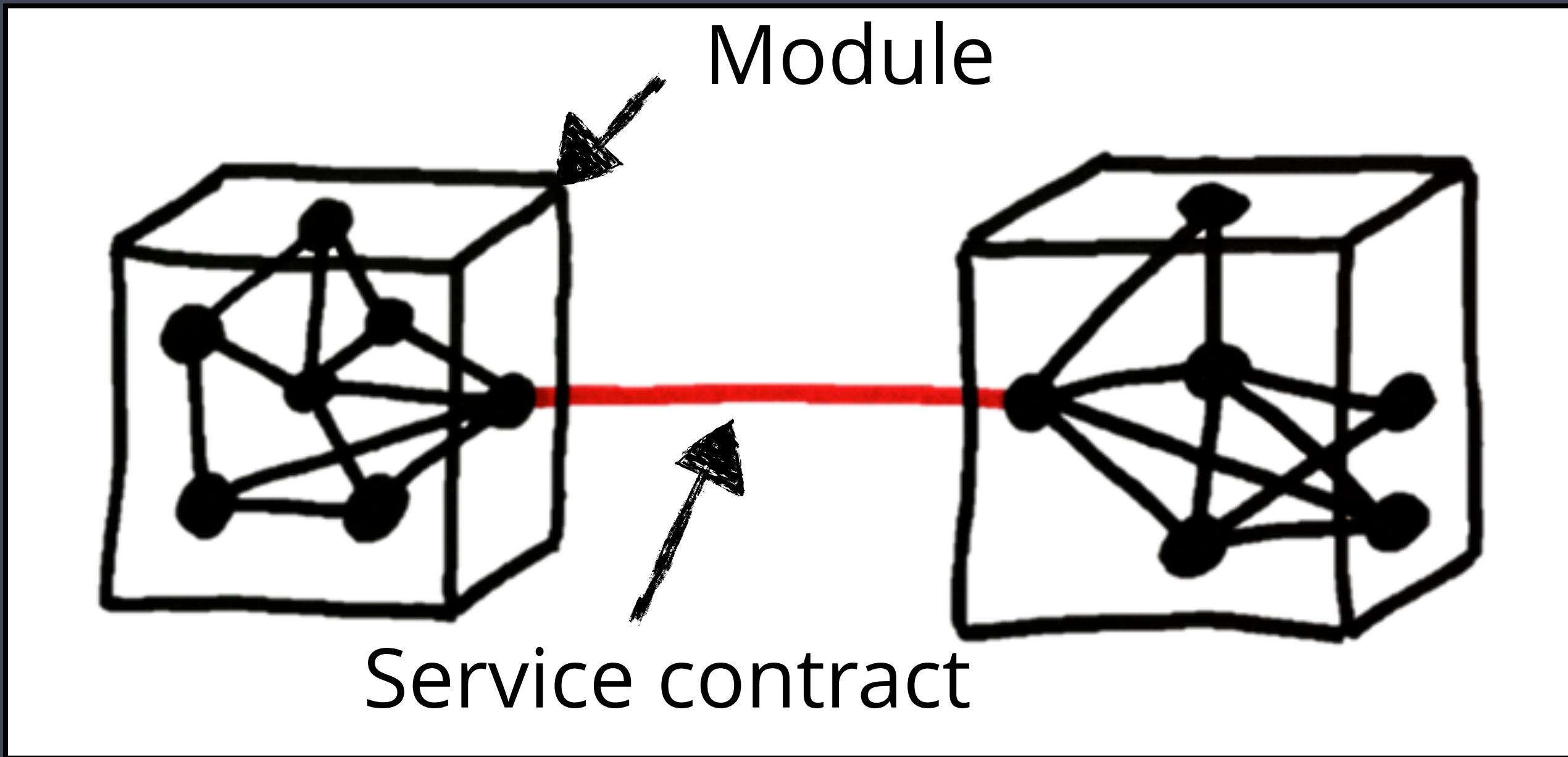




Modularity matters

Modularity is the ultimate
agile tool

Good fences make good neighbours



Hide your internals!



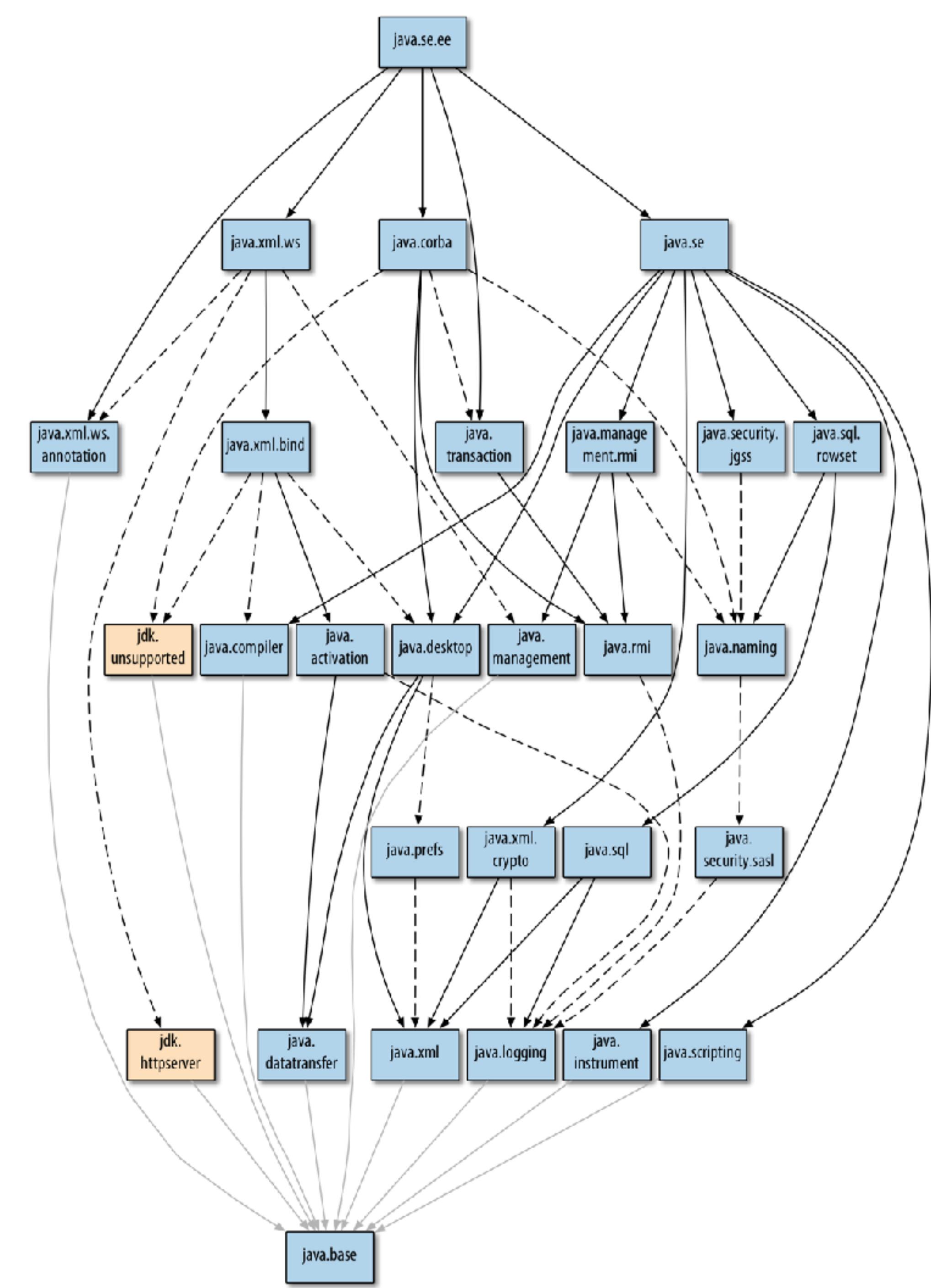
Java 9: Jigsaw, JSR-376



Goals

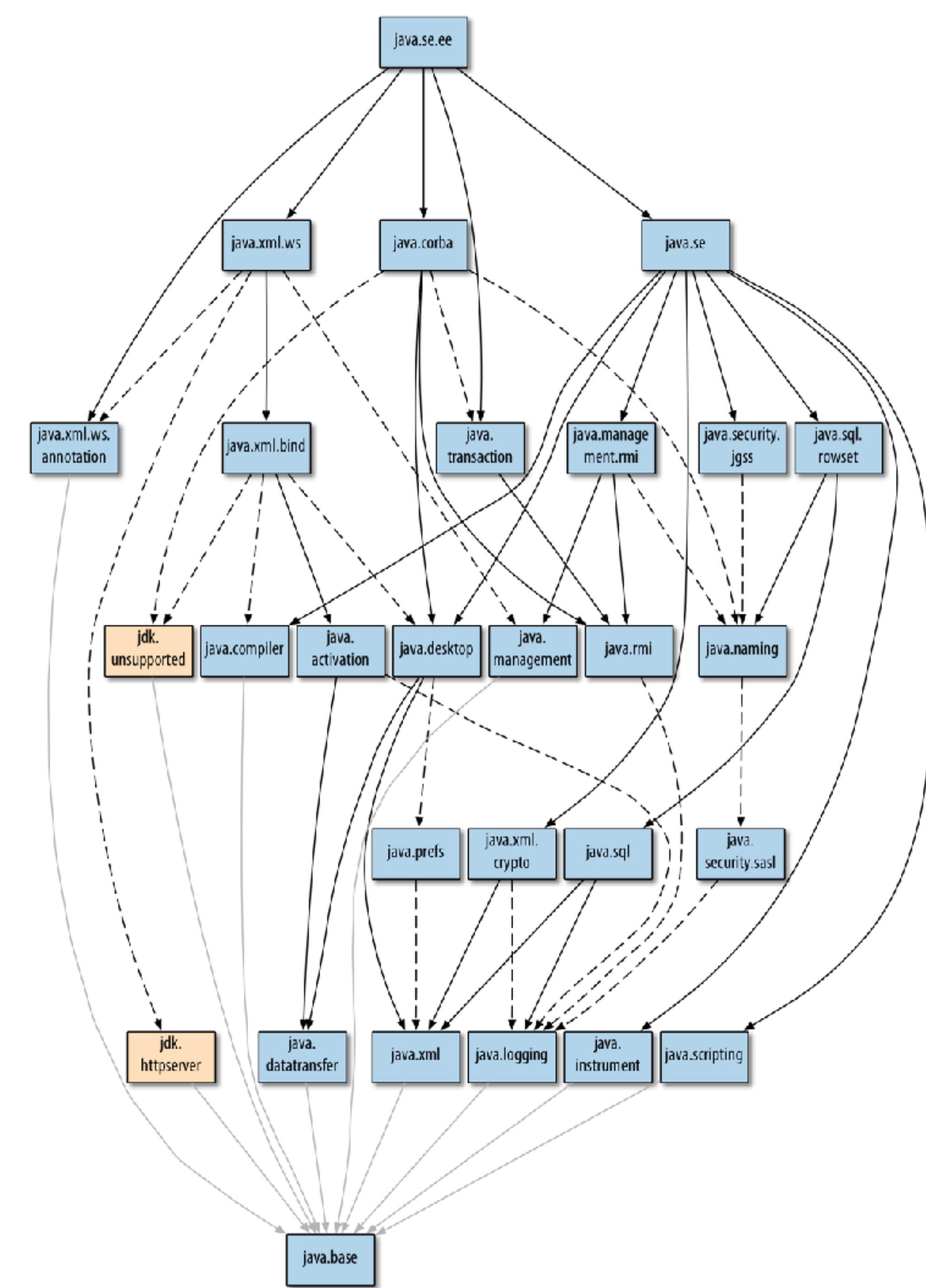
- ▶ Modularise the JDK
- ▶ Reliable application composition
- ▶ Strong encapsulation - hide platform internals
- ▶ Improved security

JEP 200: The Modular JDK



JEP 200: The Modular JDK

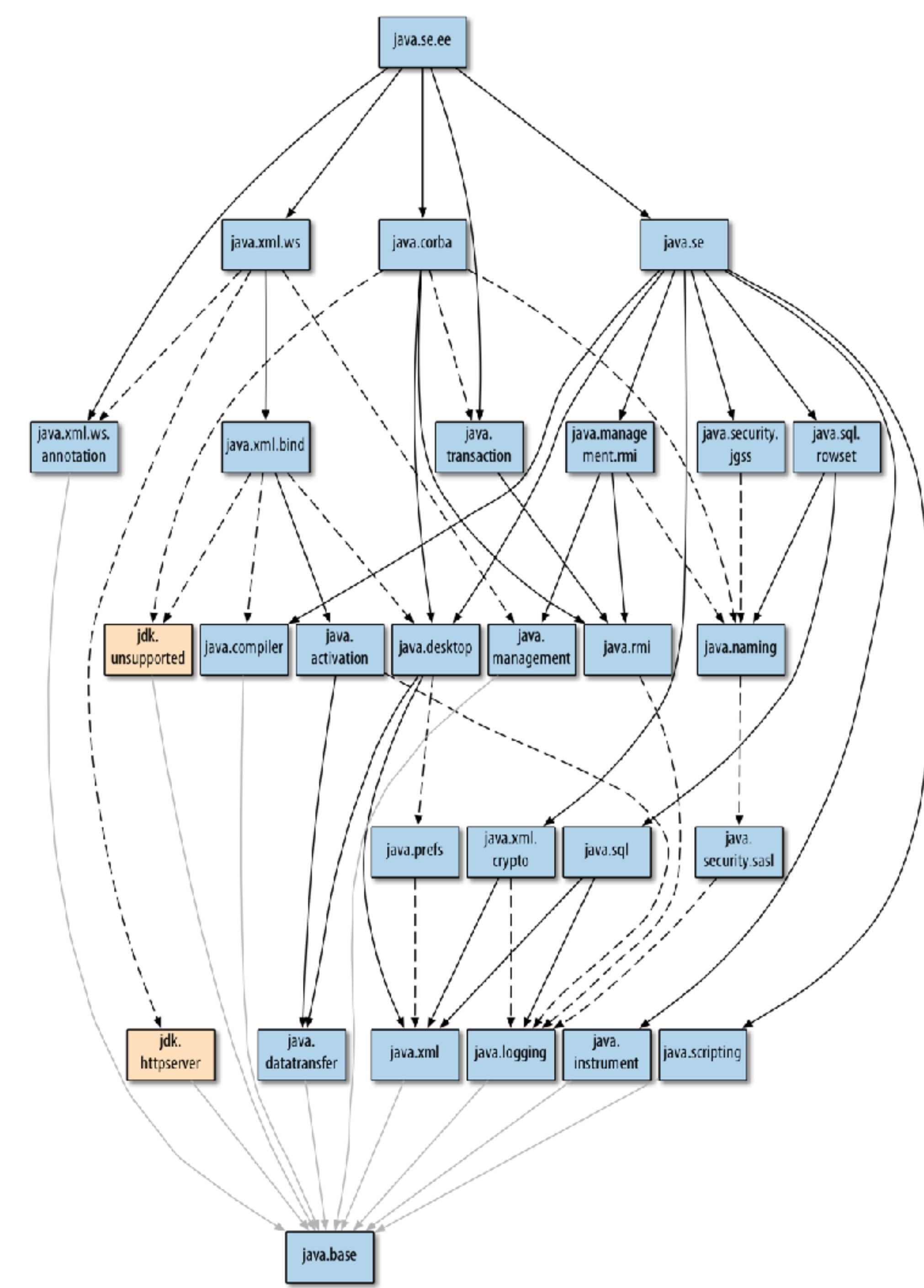
> 90 platform modules



JEP 200: The Modular JDK

> 90 platform modules

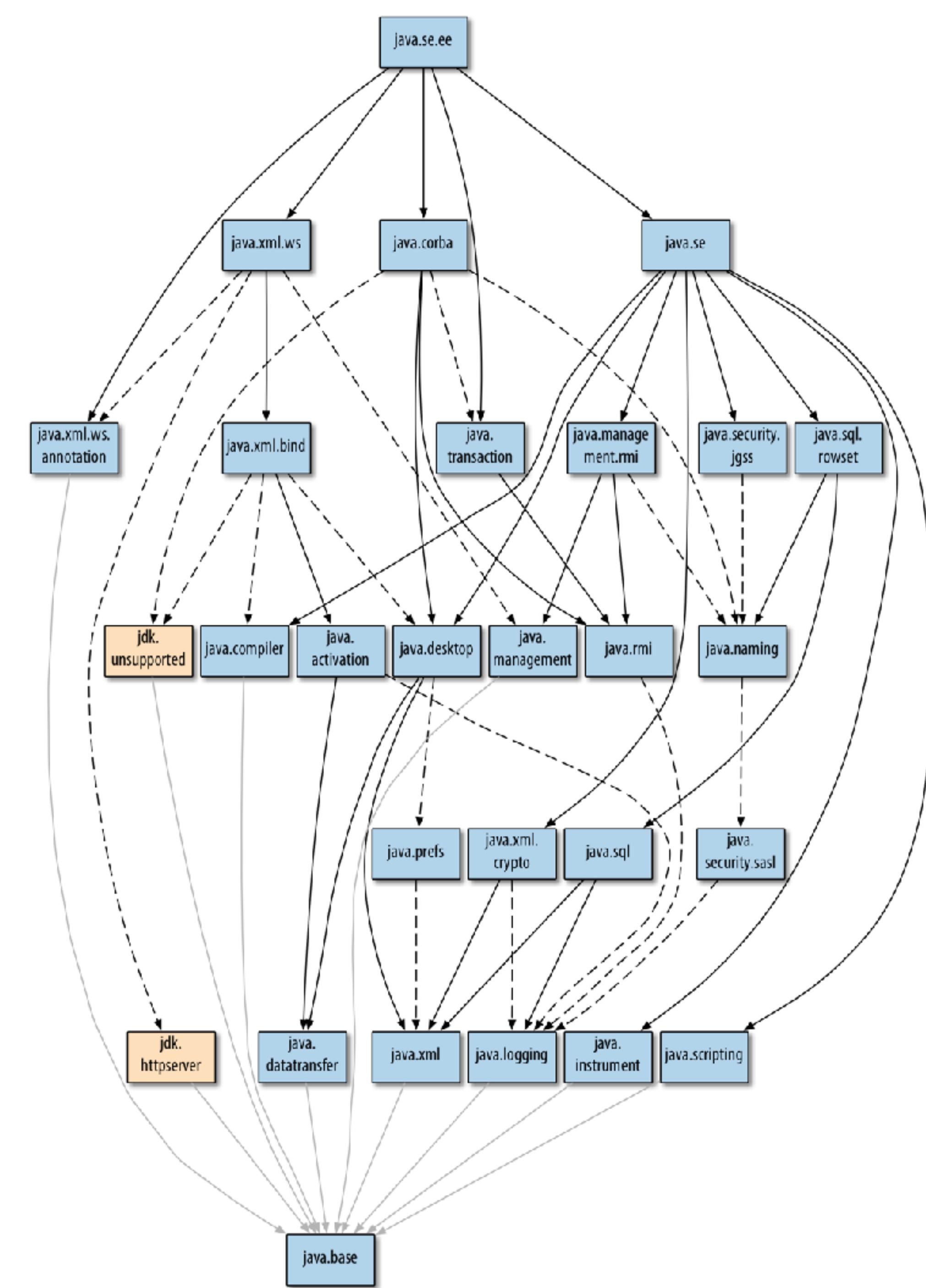
java.base



JEP 200: The Modular JDK

> 90 platform modules

java.base
Acyclic



Goodbye classpath

Reliable configuration

```
sbmak      31627  0.0  0.0  4523840  8376 s005 S+  Mon04PM  1:23.12 /Library/Java/JavaVirtualMachines/jdk1.8.0_60.jdk/Contents/Home/bin/java -server -Xms32m -Xmx512m -cp /usr/local/Cellar/orientdb/2.1.5/libexec/lib/activation-1.1.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/annotations-1.3.2.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/antlr-2.7.7.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/asm-3.2.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/asm-analysis-3.2.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/asm-commons-3.2.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/asm-util-3.2.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/blueprints-core-2.6.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/commons-beanutils-1.7.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/commons-beanutils-core-1.8.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/commons-collections-3.2.1.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/commons-configuration-1.6.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/commons-csv-1.2.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/commons-digester-1.8.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/commons-lang-2.4.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/commons-logging-1.1.1.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/concurrentlinkedhashmap-lru-1.4.1.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/gremlin-groovy-2.6.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/gremlin-java-2.6.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/groovy-1.8.9.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/hazelcast-all-3.3.5.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/hibernate-jpa-2.0-api-1.0.0.Final.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/hpc-0.6.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/jackson-annotations-2.2.3.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/jackson-core-2.2.3.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/jackson-databind-2.2.3.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/jansi-1.5.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/javassist-3.16.1-GA.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/jettison-1.3.3.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/jline-0.9.94.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/jna-4.0.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/jna-platform-4.0.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/lucene-analyzers-common-4.7.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/lucene-core-4.7.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/lucene-facet-4.7.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/lucene-memory-4.7.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/lucene-misc-4.7.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/lucene-queries-4.7.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/lucene-queryparser-4.7.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/lucene-sandbox-4.7.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/lucene-spatial-4.7.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/mail-1.4.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/minimal-json-0.9.1.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/orientdb-client-2.1.5.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/orientdb-core-2.1.5.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/orientdb-distributed-2.1.5.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/orientdb-etl-2.1.5.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/orientdb-graphdb-2.1.5.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/orientdb-lucene-2.1.5.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/orientdb-object-2.1.5.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/orientdb-server-2.1.5.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/orientdb-tools-2.1.5.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/pipes-2.6.0.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/spatial4j-0.4.1.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/snappy-java-1.1.0.1.jar:/usr/local/Cellar/orientdb/2.1.5/libexec/lib/stax-api-1.0.1.jar:.../plugins/*.jar com.tinkerpop.gremlin.groovy.console.Console
```

sbmak 35871 0.0 0.0 2441988 696 s008 S+ 10:20PM 0:00.00 grep activation
SanderMBP:~ sbmak\$



Goodbye classpath

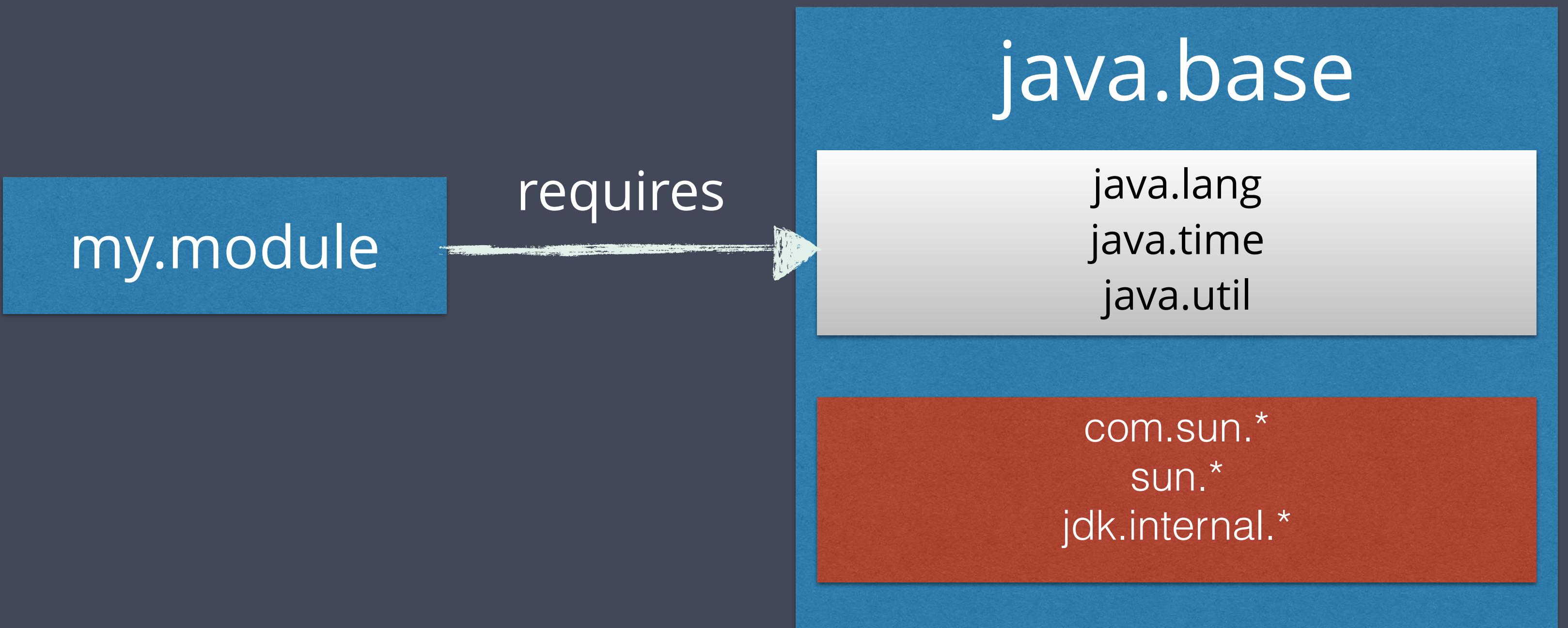
Modules with explicit dependencies





Strong encapsulation

Hide your internals



Access checks at VM level (even reflection)

Why not just use OSGi?

- ▶ OSGi is built on top of the JVM
- ▶ Can't be used to modularise the JDK itself

Why not just use OSGi?

- ▶ OSGi is built on top of the JVM
- ▶ Can't be used to modularise the JDK itself

Why not only modularise the JDK?

- ▶ Fair point :-)
- ▶ OSGi has never seen mass adoption, Java 9 will bring modularity to all of us

instantaneous Conquest of a very delicate
ture, not less than six Foot high.
some of the most experienced and ra-
us Debauchees are always upon the Watch
he eager Ruin of every fine, fresh Country-
that falls within their utmost Power; so,
wise, was this amorous Son of *Sodom* so ex-
tely wrought by the youthful Rofes which
w'd upon his regular rural Face; and the
om of which was so highly illustrated by the
ly, swift, and pleasant Glances of his spright-
eyes, that he was melting, from the very
t View of him, with a most intense Desire.
Chaps perfectly water'd; his Observations
ere *keen* and hungry; and his whole Soul was
uite wound up with *Love, Hope, and Fear.*
Poor *Silvius* was quite innocent and unap-
rized of the mighty *Tempest* he had thus raised;
nd his Insensibility of the least Part of any such
nnatural Passion, caused him to advance a very
great Encouragement in the Mind of his *Devo-*
tee; and which was occasion'd by his
ing to return.

Demo: EasyText

Analyze text complexity

easytext.cli

requires

easytext.analyis

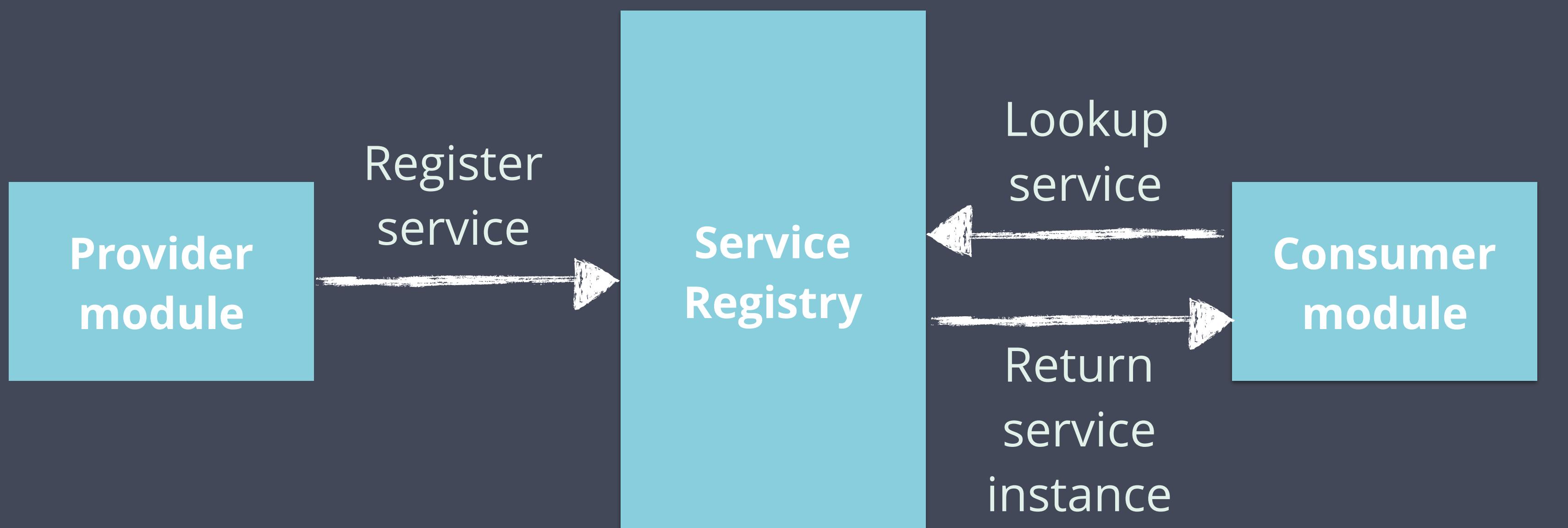
Contracts & Services

~~MyInterface i = new MyImpl();~~

How to use code
that you can't access?



Contracts & Services



Use an **interface** as contract



JSR-376 services

```
module myApi {  
    exports com.api;  
}
```

JSR-376 services

```
module myApi {  
    exports com.api;  
}
```

```
module myConsumer {  
    requires myApi;  
    uses com.api.MyService;  
}
```

JSR-376 services

```
module myApi {  
    exports com.api;  
}
```

```
module myConsumer {  
    requires myApi;  
    uses com.api.MyService;  
}
```

```
module myProvider {  
    requires myApi;  
    provides com.api.MyService  
        with myProvider.MyServiceImpl;  
}
```

- ▶ Services resolved and wired by modular runtime
- ▶ Use with 'enhanced' ServiceLoader API

JSR-376 services

```
module myApi {  
    exports com.api;  
}
```

```
module myConsumer {  
    requires myApi;  
    uses com.api.MyService;  
}
```

```
Iterable<MyService> services =  
    ServiceLoader.load(MyService.class);  
  
for(MyService svc: services) {  
    svc.doSomething();  
}
```

```
module myProvider {  
    requires myApi;  
    provides com.api.MyService  
        with myProvider.MyServiceImpl;  
}
```

- ▶ Services resolved and wired by modular runtime
- ▶ Use with 'enhanced' ServiceLoader API

instantaneous Conquest of a very delicate
ture, not less than six Foot high.
some of the most experienced and ra-
us Debauchees are always upon the Watch
he eager Ruin of every fine, fresh Country-
that falls within their utmost Power; so,
wise, was this amorous Son of *Sodom* so ex-
tely wrought by the youthful Roses which
w'd upon his regular rural Face; and the
om of which was so highly illustrated by the
ly, swift, and pleasant Glances of his spright-
eyes, that he was melting, from the very
t View of him, with a most intense Desire.
s Chaps perfectly water'd; his Observations
ere keen and hungry; and his whole Soul was
uite wound up with *Love, Hope, and Fear.*

Poor *Silvius* was quite innocent and unap-
rized of the mighty *Tempest* he had thus raised;
nd his Insensibility of the least Part of any such
nnatural Passion, caused him to advance a very
great Encouragement in the Mind of his *Devo-*
tee; and which was occasion'd by his
ing to return.

Demo: EasyText

Extensibility

instantaneous Conquest of a very delicate
ture, not less than six Foot high.
some of the most experienced and ra-
us Debauchees are always upon the Watch
he eager Ruin of every fine, fresh Country-
that falls within their utmost Power; so,
wise, was this amorous Son of *Sodom* so ex-
tely wrought by the youthful Roses which
w'd upon his regular rural Face; and the
om of which was so highly illustrated by the
ly, swift, and pleasant Glances of his spright-
eyes, that he was melting, from the very
t View of him, with a most intense Desire.
s Chaps perfectly water'd; his Observations
ere keen and hungry; and his whole Soul was
uite wound up with *Love, Hope, and Fear.*
Poor *Silvius* was quite innocent and unap-
rized of the mighty *Tempest* he had thus raised;
nd his Insensibility of the least Part of any such
nnatural Passion, caused him to advance a very
great Encouragement in the Mind of his *Devo-*
tee; and which was occasion'd by his
ing to return.

Demo: EasyText

Extensibility

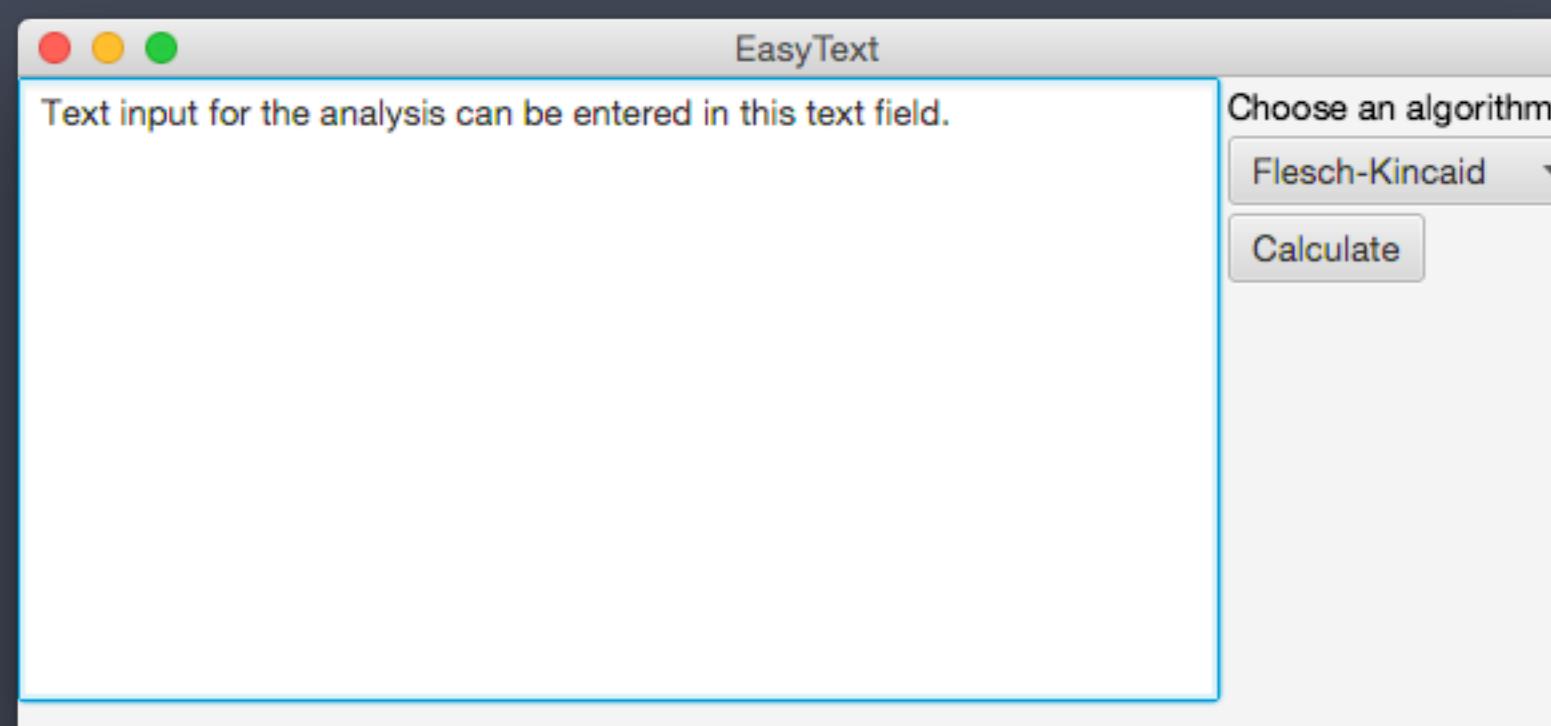
- Multiple algorithms:
 - ▶ Flesch-Kincaid
 - ▶ Coleman-Liau

instantaneous Conquest of a very delicate
ture, not less than six Foot high.
some of the most experienced and ra-
us Debauchees are always upon the Watch
he eager Ruin of every fine, fresh Country-
that falls within their utmost Power; so,
wise, was this amorous Son of *Sodom* so ex-
tely wrought by the youthful Roses which
w'd upon his regular rural Face; and the
om of which was so highly illustrated by the
ly, swift, and pleasant Glances of his spright-
eyes, that he was melting, from the very
t View of him, with a most intense Desire.
s *Chaps* perfectly water'd; his Observations
ere *keen* and hungry; and his whole Soul was
uite wound up with *Love, Hope, and Fear.*
Poor *Silvius* was quite innocent and unap-
rized of the mighty *Tempest* he had thus raised;
nd his Insensibility of the least Part of any such
nnatural Passion, caused him to advance a very
great Encouragement in the Mind of his *Devo-*
tee; and which was occasion'd by his
ing to return.

Demo: EasyText

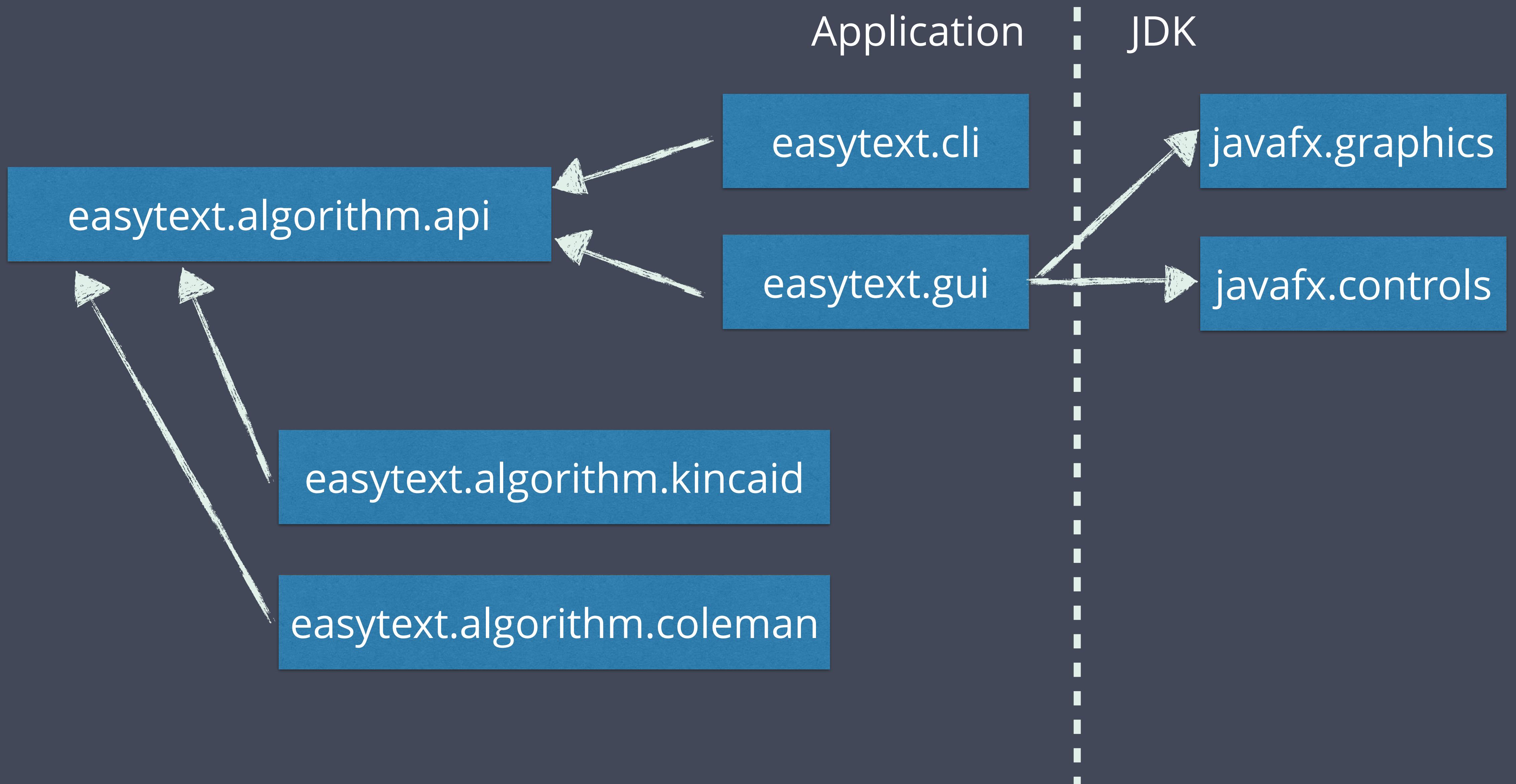
Extensibility

CLI & GUI?

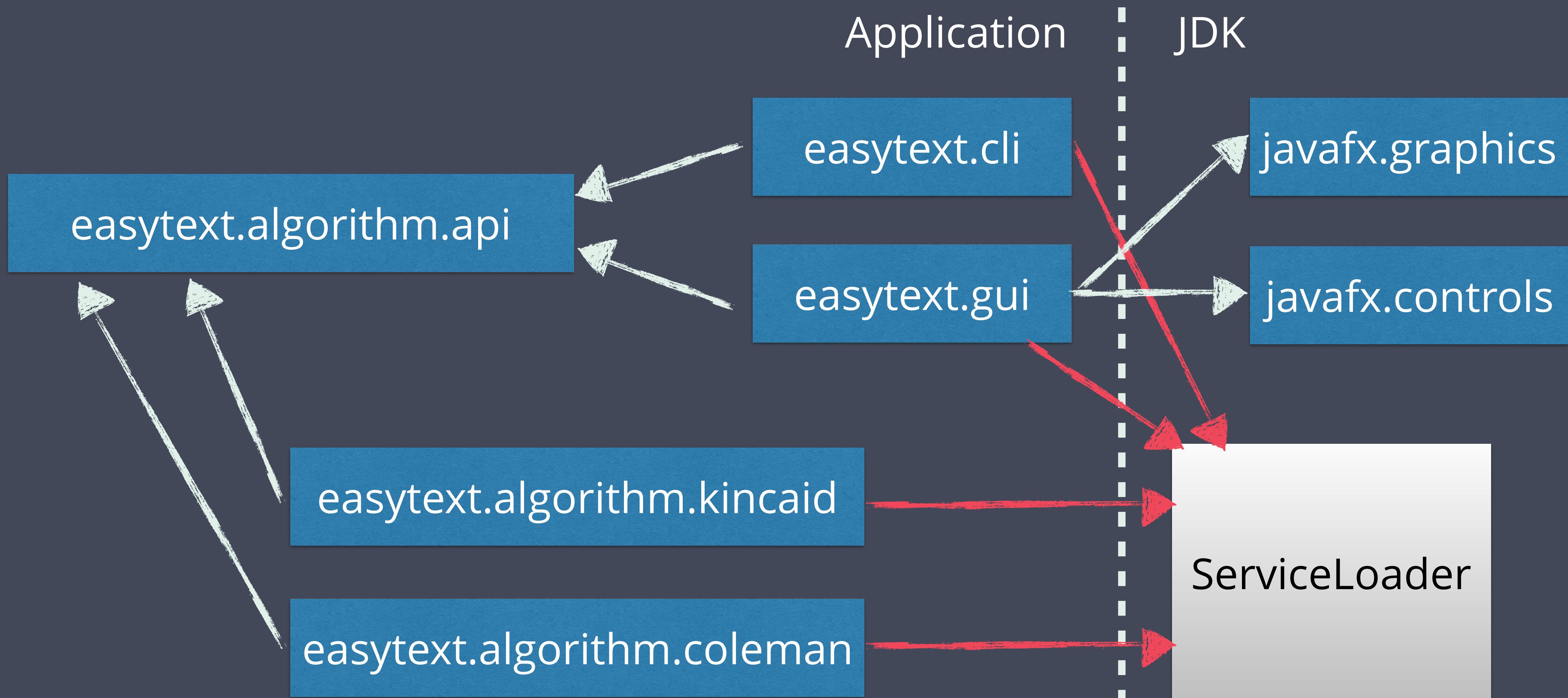


- ### Multiple algorithms:
- ▶ Flesch-Kincaid
 - ▶ Coleman-Liau

Demo: EasyText

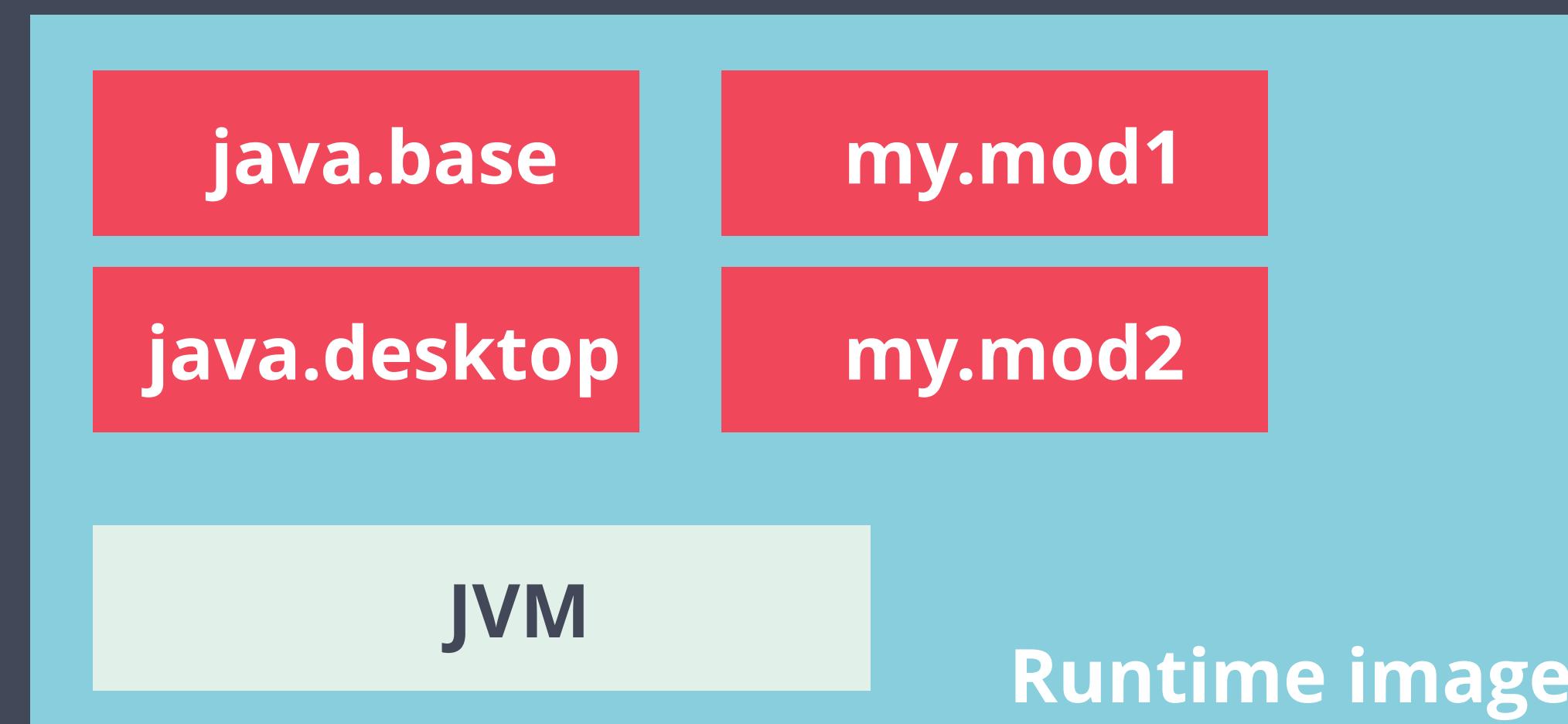


Demo: EasyText



JSR-376 linking

- ▶ Use a linking tool (jlink) to create a custom 'runtime image' with only the modules you need
- ▶ Uses explicit dependencies from module-info.class
- ▶ Allows for whole-program optimization



Demo: EasyText linking



Preparing for Java 9

- ▶ Use jdeps to audit your code
- ▶ Escape hatch:
--add-exports java.base/javax.security.auth.x500=ALL-UNNAMED

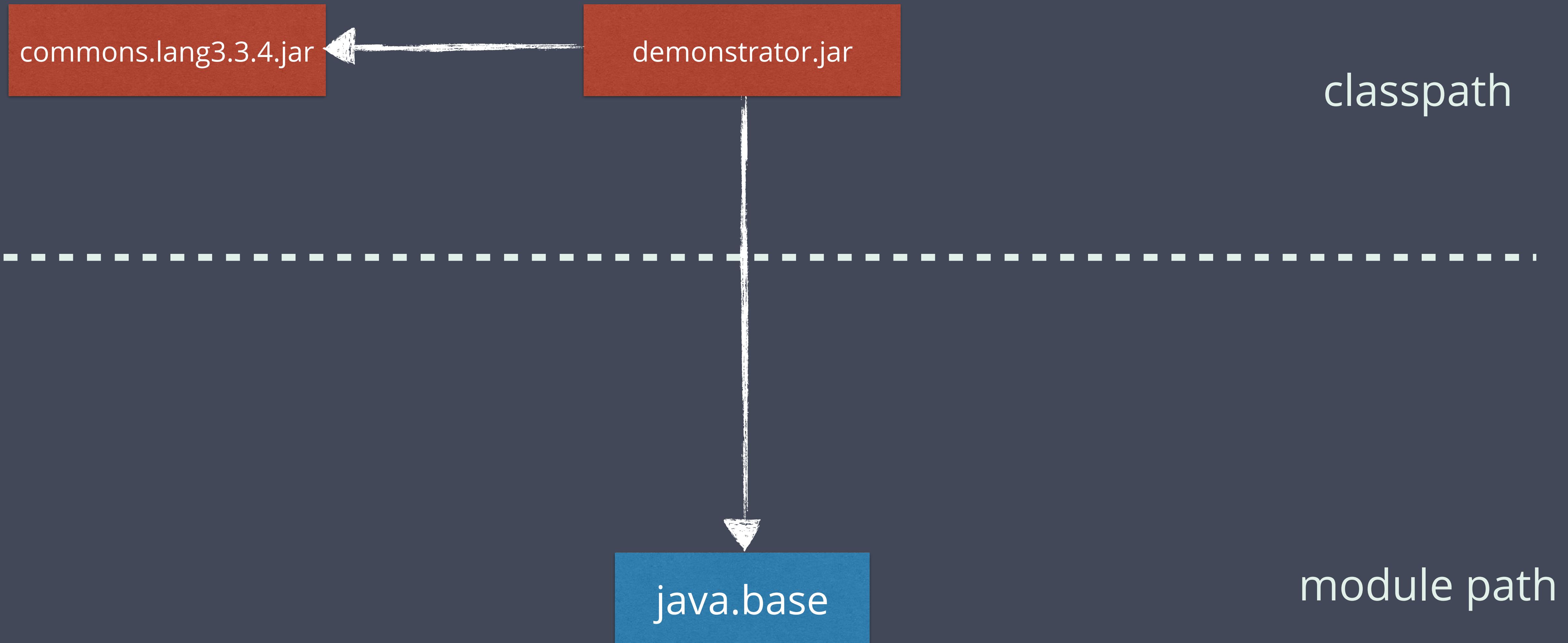


Preparing for Java 9

- ▶ Use jdeps to audit your code
- ▶ Escape hatch:
--add-exports java.base/javax.security.auth.x500=ALL-UNNAMED
- ▶ Gradual migration possible
- ▶ Mix classpath & modulepath
- ▶ Automatic modules



Top down migration



Classic classpath

```
package com.javamodularity.demonstrator;

import org.apache.commons.lang3.StringUtils;

public class Demo {

    public static void main(String args[]) {
        String output = StringUtils.leftPad("Leftpad FTW!", 20);
        System.out.println(output);
    }
}
```

Classic classpath

```
package com.javamodularity.demonstrator;

import org.apache.commons.lang3.StringUtils;

public class Demo {

    public static void main(String args[]) {
        String output = StringUtils.leftPad("Leftpad FTW!", 20);
        System.out.println(output);
    }
}
```

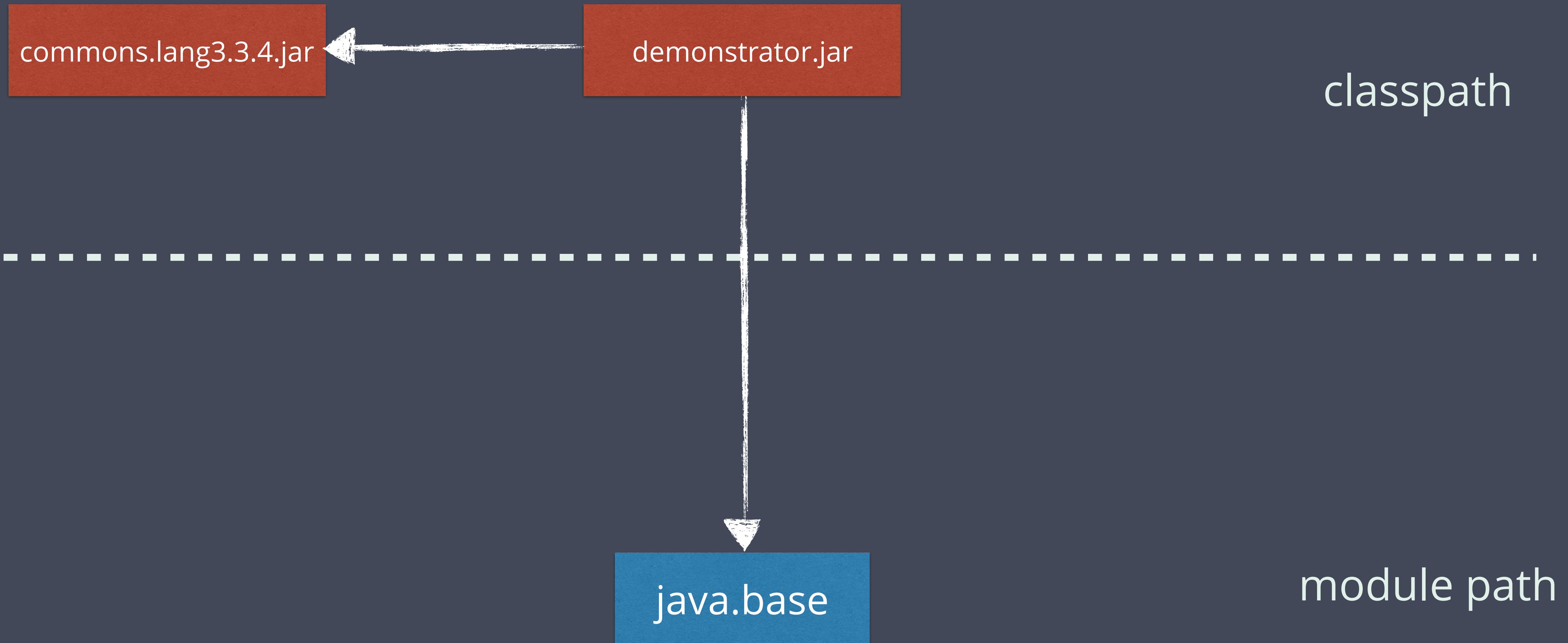
Compile

```
javac -cp lib/commons-lang3-3.4.jar
      -d out $(find src -name '*.java')
```

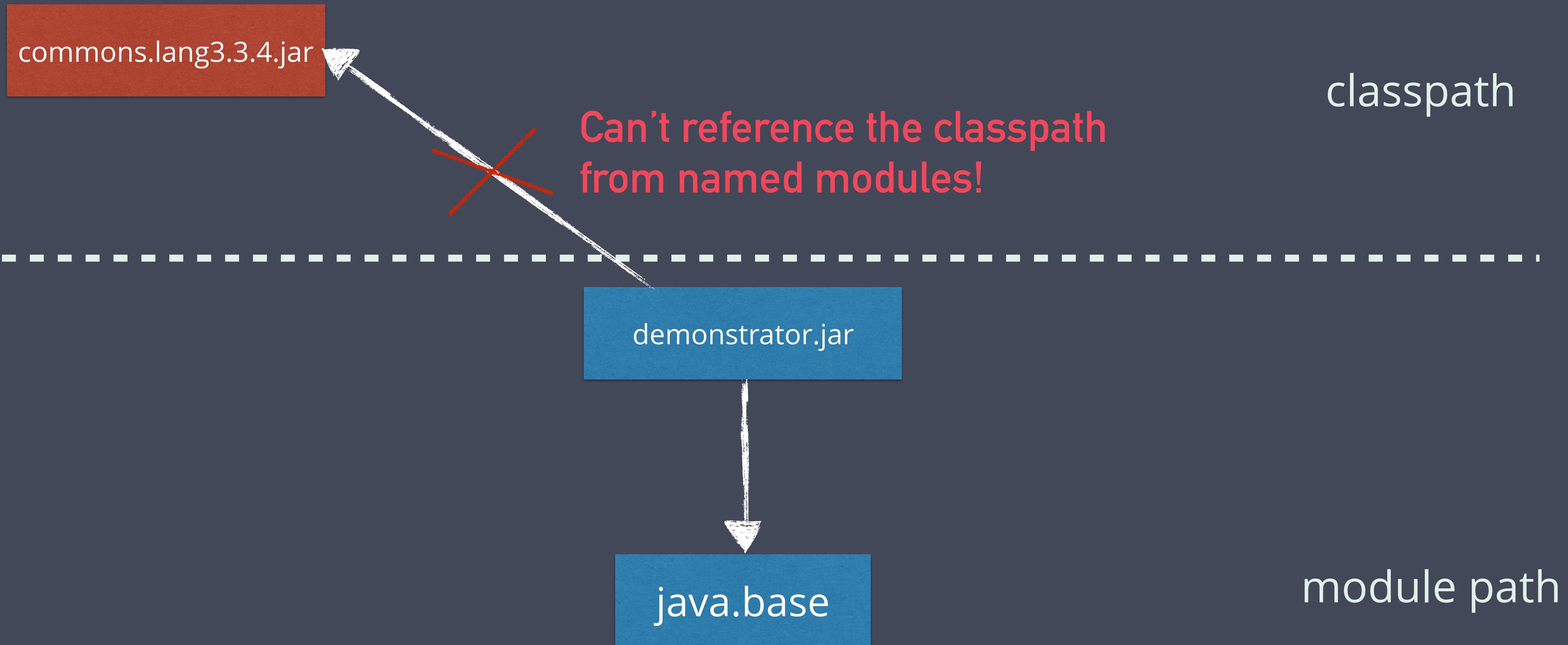
Run

```
java -cp out:lib/commons-lang3-3.4.jar
      com.javamodularity.demonstrator.Demo
```

Top down migration

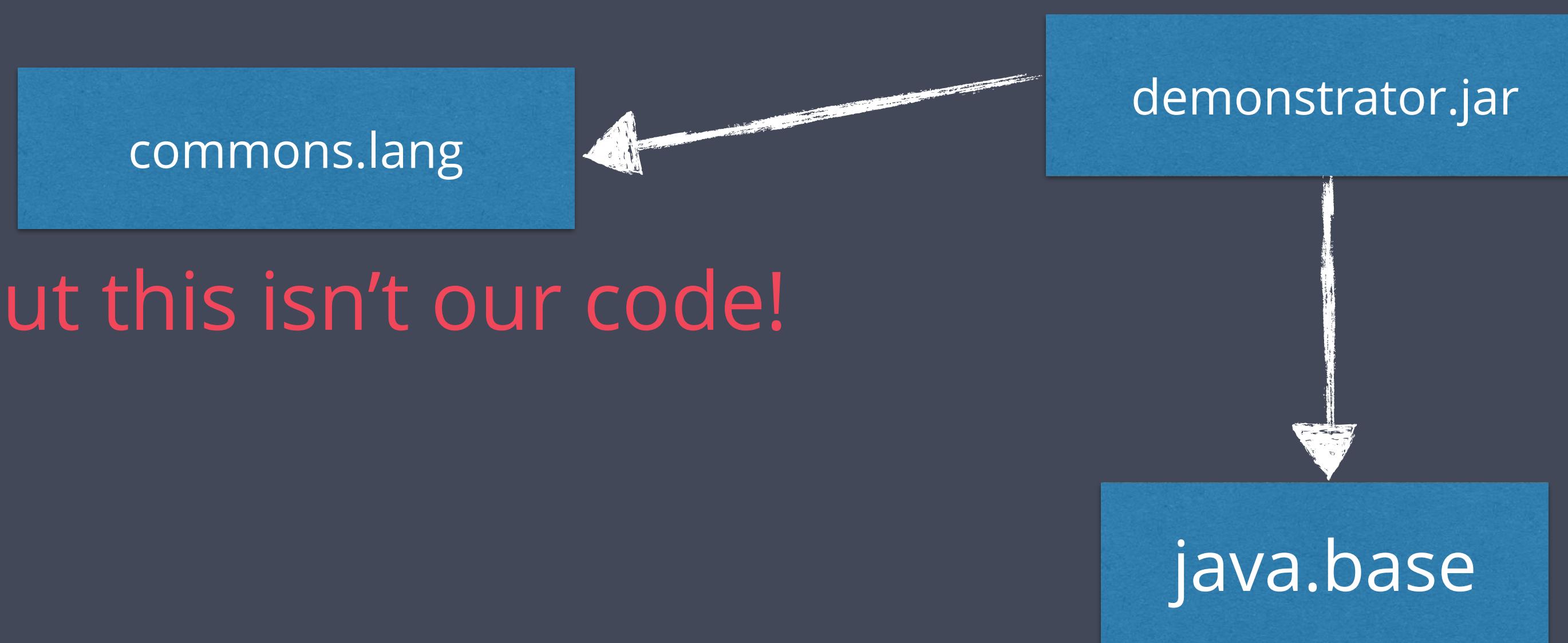


Top down migration



Top down migration

classpath



But this isn't our code!

module path

Automatic Modules

- ▶ A plain JAR on the module path becomes an **Automatic Module**
- ▶ Module name derived from JAR name
- ▶ Exports everything
- ▶ Reads all other modules

Using Automatic Modules

```
module demonstrator {  
    requires commons.lang;  
}
```

Using Automatic Modules

```
module demonstrator {  
    requires commons.lang;  
}
```

Compile

```
javac --module-path lib  
--module-source-path src  
-d mods $(find src -name '*.java')
```

Run

```
java --module-path mods:lib  
-m demonstrator/com.javamodularity.demonstrator.Demo
```

Java 9's promise

- ▶ JSR-376 forces module-aware tooling
- ▶ Modularity throughout all development phases

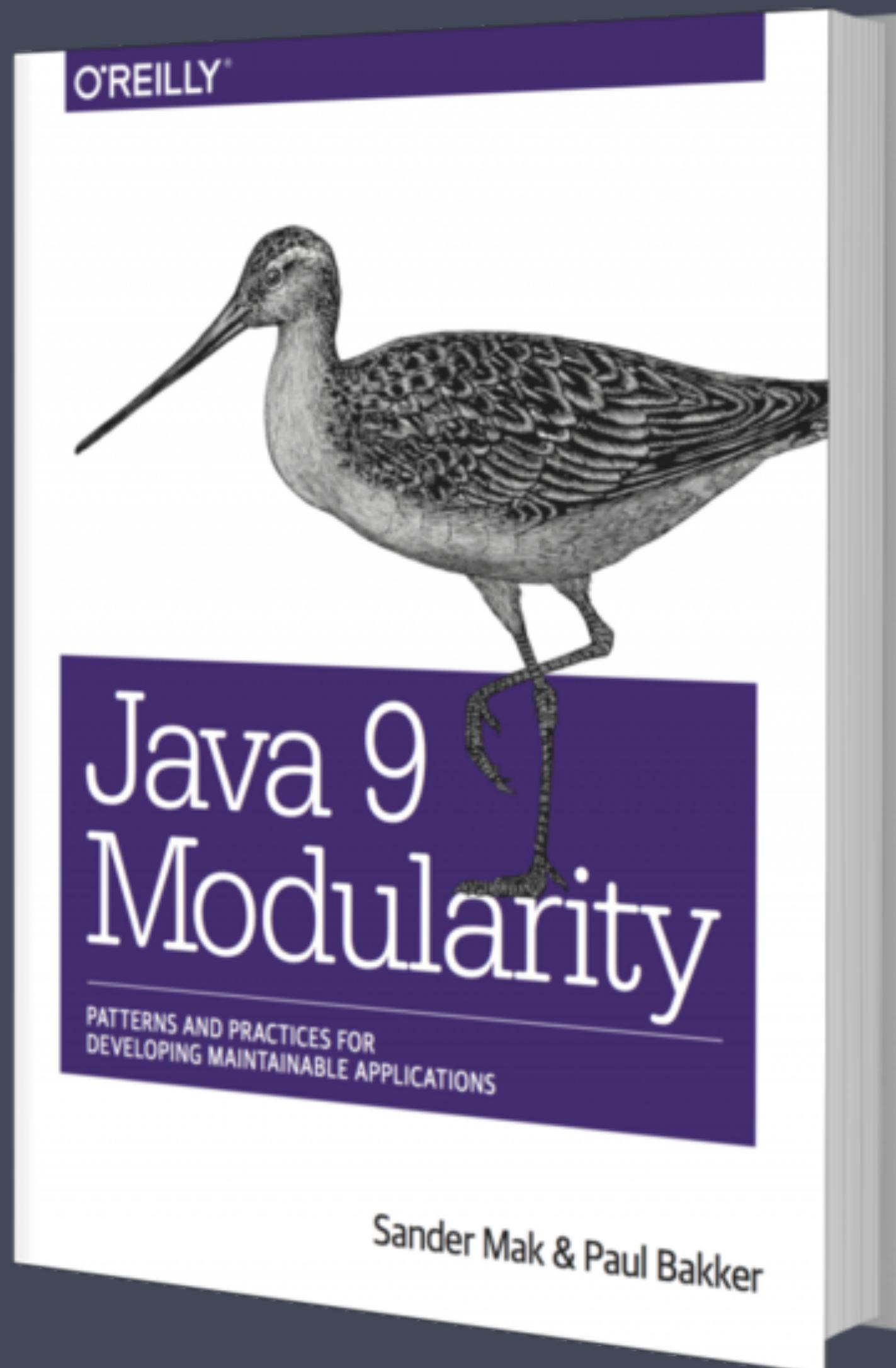


Java 9's promise

- ▶ JSR-376 forces module-aware tooling
- ▶ Modularity throughout all development phases

Spotlight on modularity == good





Thank you.
@Sander_Mak

Java 9 Modularity: First Look
What's New in Java 9



javamodularity.com

bit.ly/ps-sander