

Understanding the Modular JDK



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Java Champion

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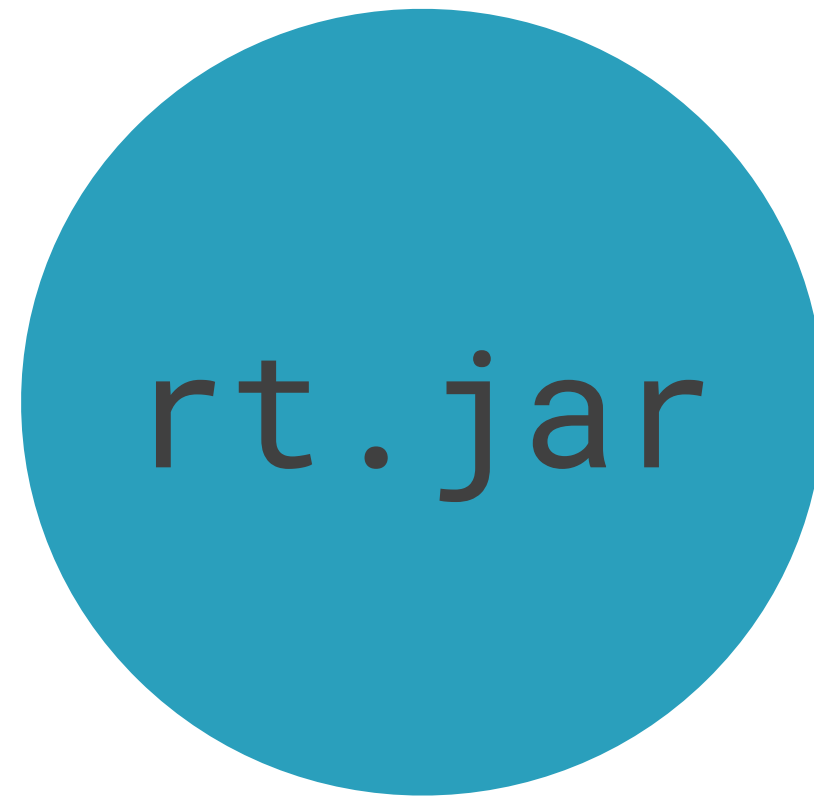
Before the Modular JDK

Before the Modular JDK



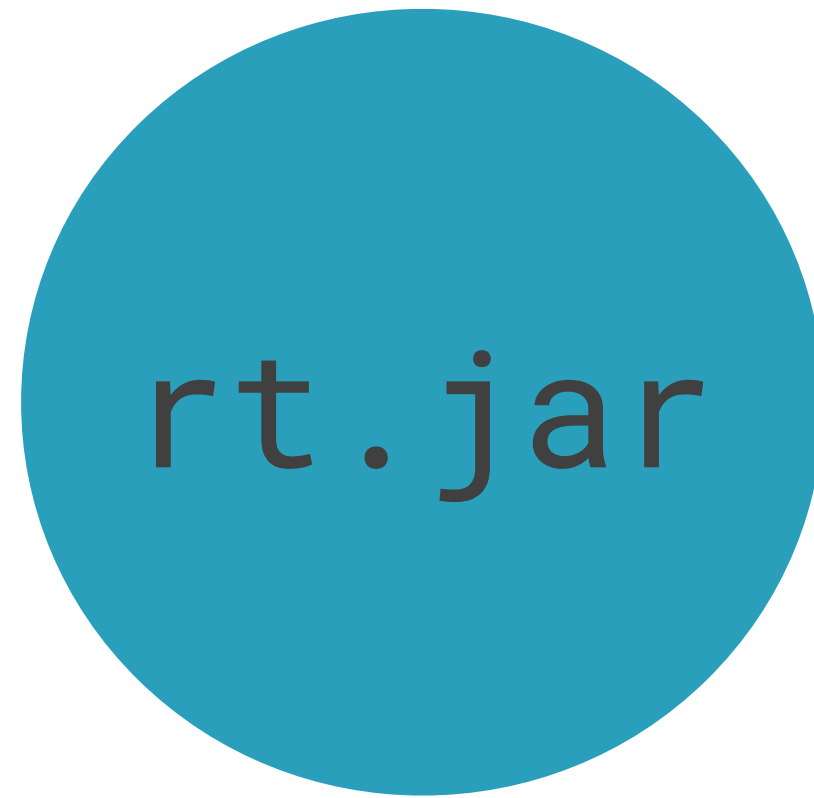
rt.jar

Before the Modular JDK



Tangled code

Before the Modular JDK



Tangled code

No encapsulation

Before the Modular JDK



Tangled code

No encapsulation

Private API abuse

Before the Modular JDK



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Private API abuse

All-or-nothing

Before the Modular JDK



Tangled code

No encapsulation

Private API abuse

All-or-nothing

Hard to evolve

Exploring the Modular JDK

Exploring the Modular JDK

```
java --list-modules
```

Exploring the Modular JDK

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java --list-modules
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```
java.base@11.0.10  
java.compiler@11.0.10  
java.datatransfer@11.0.10  
java.desktop@11.0.10
```

Exploring the Modular JDK

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.. 71 modules ..

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Exploring the Modular JDK

`java --list-modules`

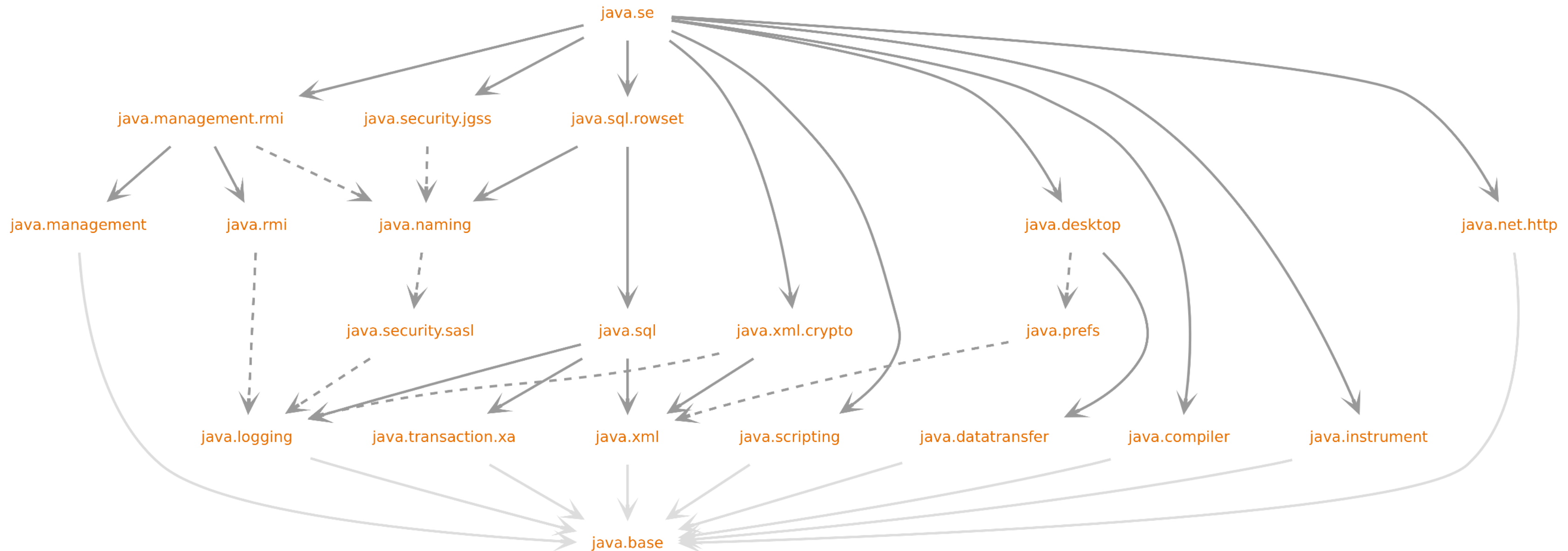
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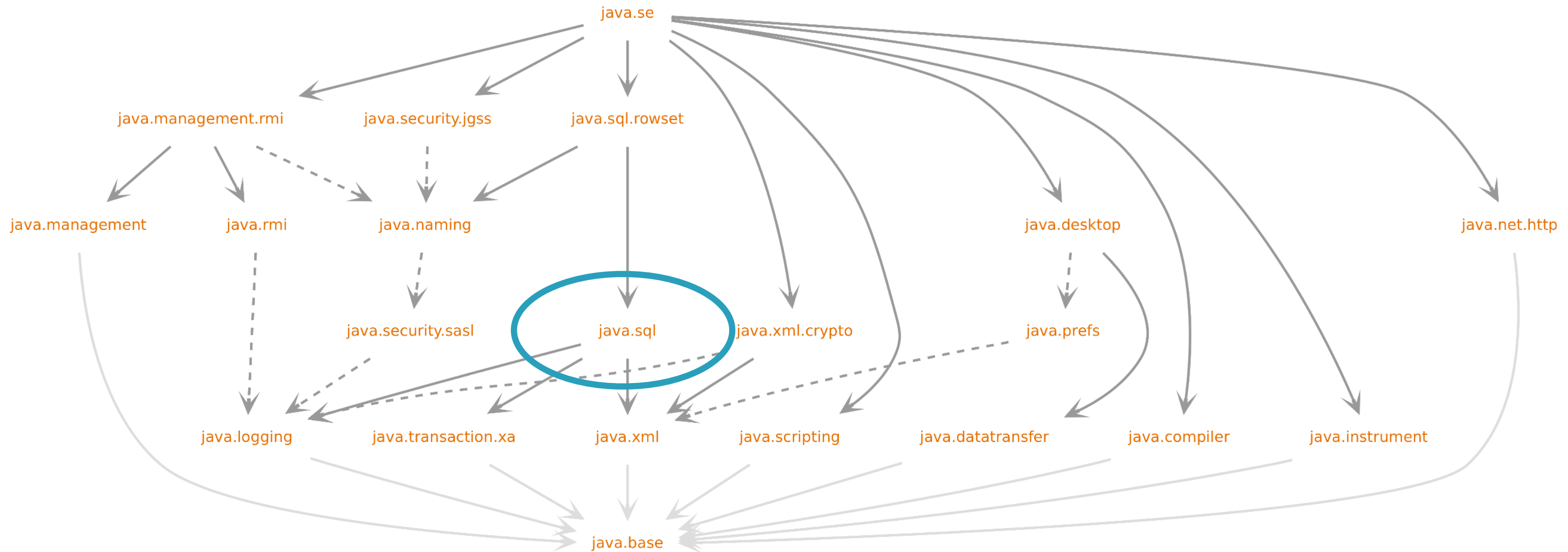
`java.*` vs. `jdk.*`

```
jdk.unsupported@11.0.10  
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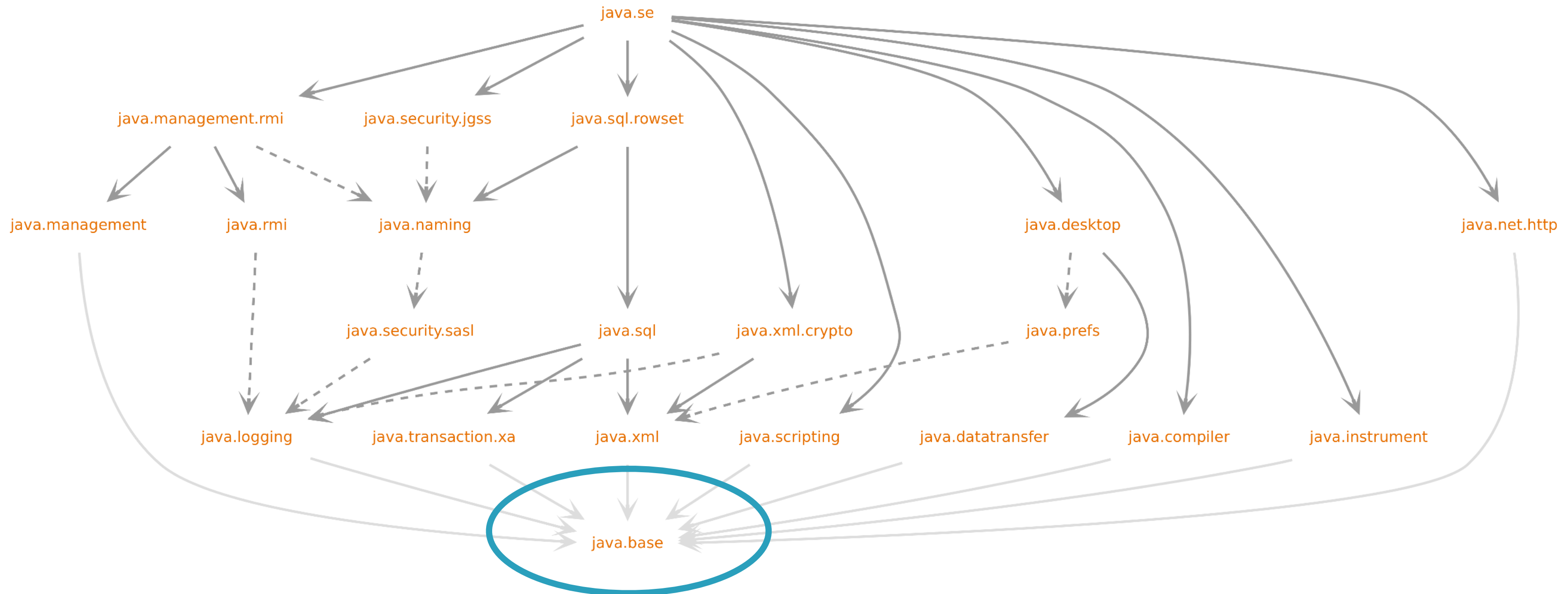
Exploring the Modular JDK



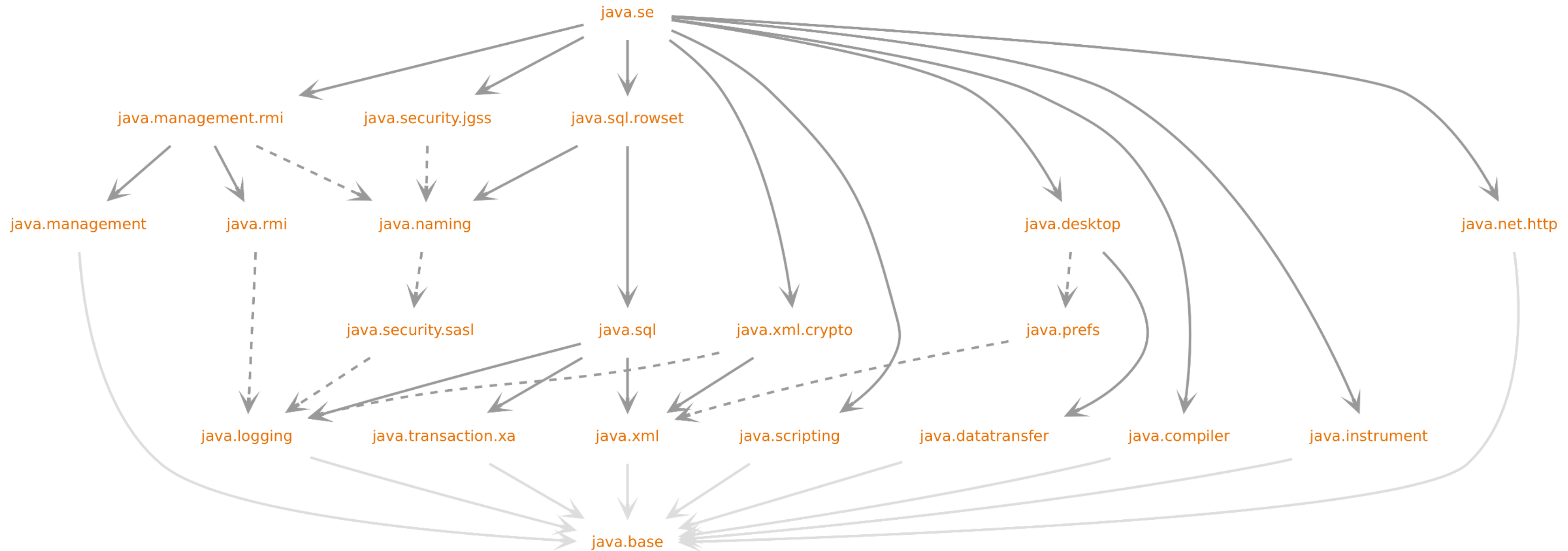
Exploring the Modular JDK



Exploring the Modular JDK



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Exploring the Modular JDK

Exploring the Modular JDK

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java --describe-module java.sql
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```
java.sql@11.0.10
```

```
exports java.sql
```

```
exports javax.sql
```

```
requires java.xml transitive
```

```
requires java.logging transitive
```

```
requires java.base mandated
```

```
requires java.transaction.xa transitive
```

```
uses java.sql.Driver
```

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Exploring the Modular JDK

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OVERVIEW MODULE PACKAGE **CLASS** USE TREE DEPRECATED INDEX HELP

ALL CLASSES

SUMMARY: NESTED | FIELD | CONSTR | METHOD DETAIL: FIELD | CONSTR | METHOD

Module java.logging
Package java.util.logging
Class **Logger**

java.lang.Object
 java.util.logging.Logger

public class **Logger**
extends Object

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Package java.util.logging
Class **Logger**

java.lang.Object
 java.util.logging.Logger

public class **Logger**
 extends Object

Depending on JDK Modules

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```
module mymodule {  
  requires util;  
}
```

```
module util {  
  exports com.pluralsight.util;  
}
```

Depending on JDK Modules



```
module mymodule {  
    requires util;  
}
```

```
module util {  
    exports com.pluralsight.util;  
}
```

```
import java.util.logging.Logger;  
  
// ..
```

Depending on JDK Modules



```
module mymodule {  
  requires util;  
}
```

```
module util {  
  exports com.pluralsight.util;  
  requires java.logging;  
}
```


Module Resolution: Step by Step



Module Resolution: Step by Step



Exercise files: `module4/resolution`

Module Resolution: Step by Step

```
java --show-module-resolution -p out -m mymodule
```

Module Resolution: Step by Step

```
java --show-module-resolution -p out -m mymodule
```

Root module



```
graph TD; Root[Root module] --> mymodule[mymodule];
```

mymodule

Module Resolution: Step by Step

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java --show-module-resolution -p out -m mymodule
```

Root module

mymodule

util

Module Resolution: Step by Step

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```

Root module

mymodule

util

java.logging

Module Resolution Checks



Module Resolution Checks

Valid module descriptors



Module Resolution Checks

Valid module descriptors

```
java.lang.module.FindException:
```

```
Error reading module: out/util
```

```
Caused by:
```

```
java.lang.module.InvalidModuleDescriptorException:
```

```
Package com.pluralsight.util not found in module
```



Module Resolution Checks

Only one module with a given name

`java.lang.module.FindException:`

Two versions of module `util`
found in out (`util2` and `util`)



Module Resolution Checks

Only one module with a given name

```
java.lang.module.FindException:  
  Two versions of module util  
  found in out (util2 and util)
```

```
java -p out1:out2 -m mymodule
```



Module Resolution Checks

Package must uniquely belong to single module

```
module mymodule reads package  
com.pluralsight.util from both util and  
util2
```



Module Resolution Checks

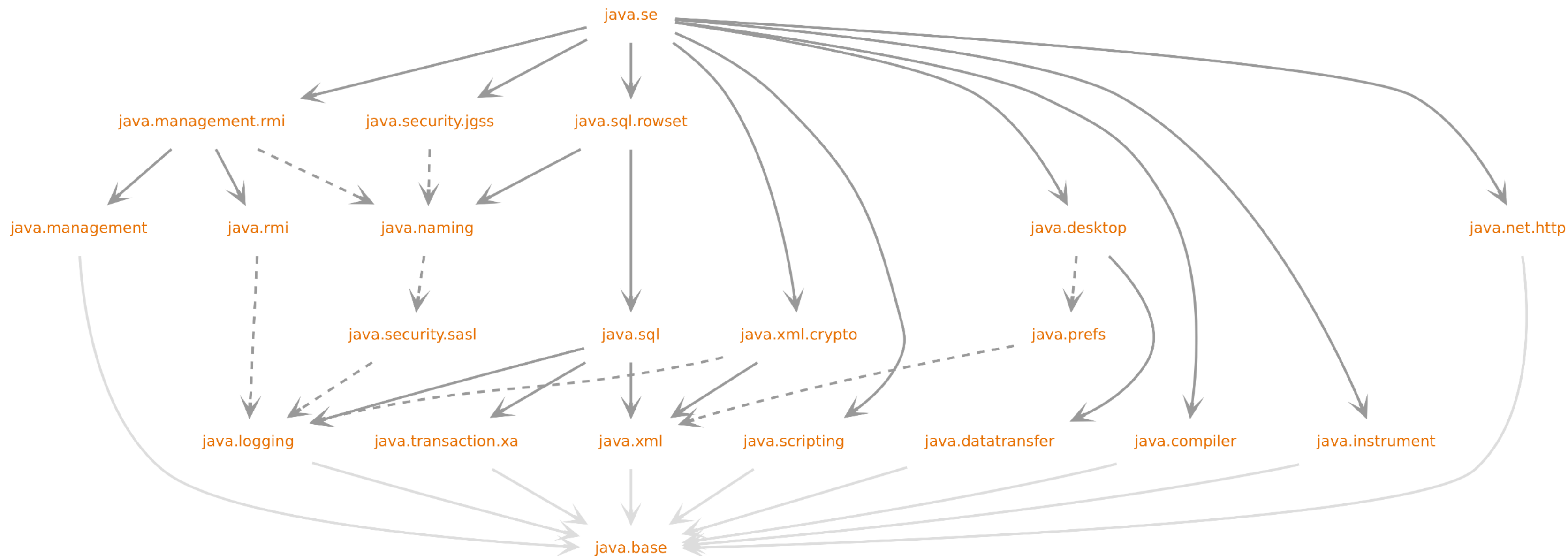
Package must uniquely belong to single module

Error occurred during initialization of
boot layer

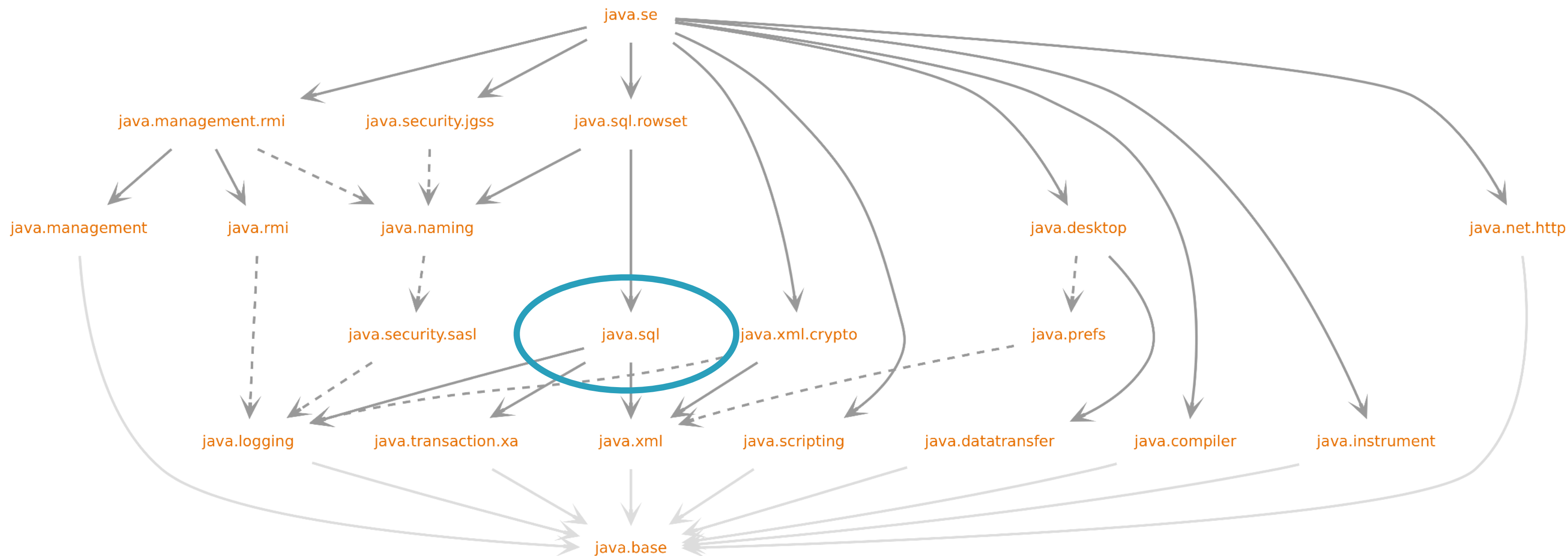
```
java.lang.LayerInstantiationException:  
Package com.pluralsight.util in  
both module util and module util2
```



Requires Transitive



Requires Transitive



Requires Transitive



Requires Transitive



```
package java.sql

import java.util.logging.Logger;

public interface Driver {
    // ..
    public Logger getParentLogger();
    //..
}
```

Requires Transitive

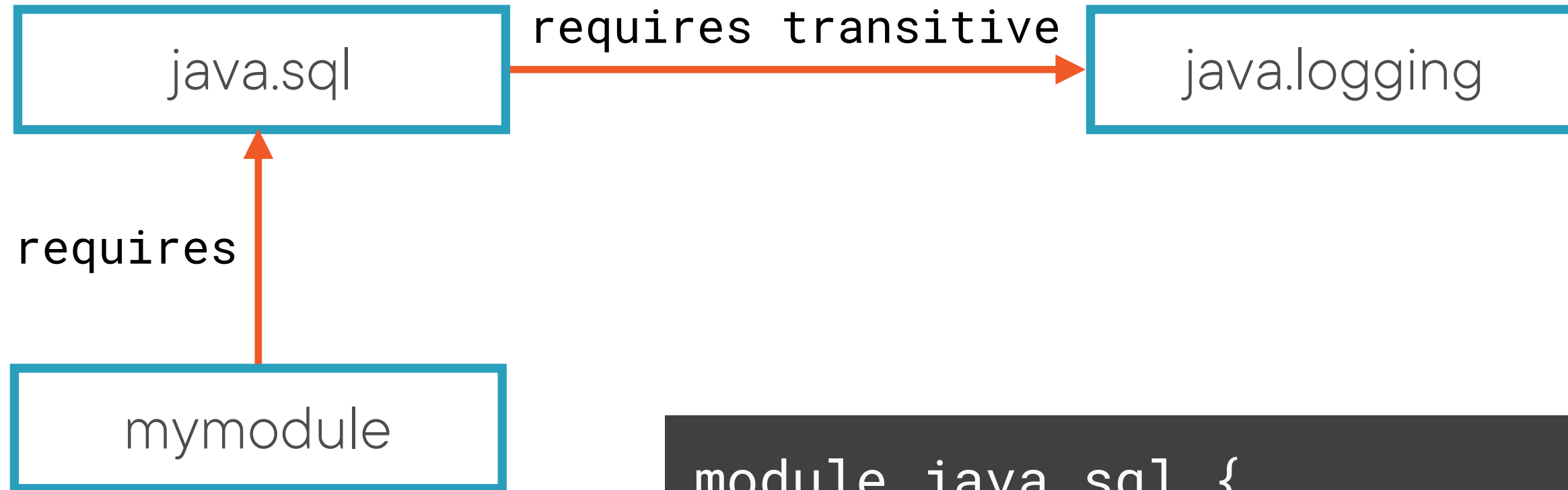


Requires Transitive



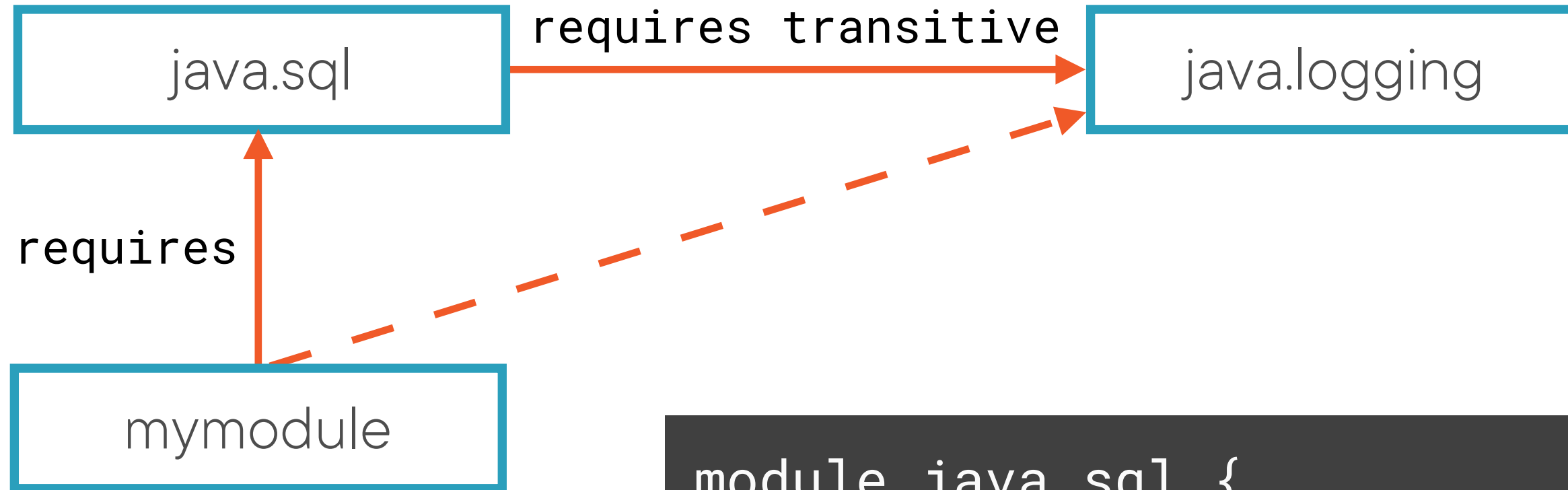
```
module java.sql {  
    // ...  
    requires transitive java.logging;  
    // ...  
}
```

Requires Transitive



```
module java.sql {  
    // ...  
    requires transitive java.logging;  
    // ...  
}
```

Requires Transitive



```
module java.sql {  
    // ...  
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    // ...  
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```

Packaging a Module



Packaging a Module



```
out/  
  com/pluralsight/A.class  
  com/pluralsight/B.class  
  com/pluralsight/util/C.class  
  module-info.class
```

Packaging a Module



```
out/  
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Exercise files: `module4/packaging`

Packaging a Module



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out/  
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Packaging a Module



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out/  
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```
jar --create
```

Packaging a Module



```
out/  
  com/pluralsight/A.class  
  com/pluralsight/B.class  
  com/pluralsight/util/C.class  
  module-info.class
```

```
jar --create  
    --file=mods/pluralsight.jar
```

Packaging a Module



```
out/  
  com/pluralsight/A.class  
  com/pluralsight/B.class  
  com/pluralsight/util/C.class  
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```

```
jar --create  
    --file=mods/pluralsight.jar  
    -C out/ .
```

Packaging a Module



```
out/  
  com/pluralsight/A.class  
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```
jar --create  
    --file=mods/pluralsight.jar  
    -C out/ .
```

```
jar --help
```

Packaging a Module



```
out/  
  com/pluralsight/A.class  
  com/pluralsight/B.class  
  com/pluralsight/util/C.class  
  module-info.class
```

```
jar --create  
    --file=mods/pluralsight.jar  
    -C out/ .
```

Versioning a Modular JAR



```
jar --create  
    --file=mods/pluralsight-1.0.0.jar  
    --module-version=1.0.0  
-C out/ .
```

Inspecting a Modular JAR



```
jar --describe-module  
    --file=mods/pluralsight-1.0.0.jar
```


Inspecting a Modular JAR



```
jar --describe-module  
    --file=mods/pluralsight-1.0.0.jar
```

```
com.pluralsight@1.0.0 jar:file:///[full path]/  
pluralsight-1.0.0.jar!/module-info.class  
exports com.pluralsight  
requires java.base mandated  
contains com.pluralsight.util
```

Alternative Packaging



jmod

Alternative Packaging



jmod

- Native libraries & header files
- Legal notices
- Not executable

Alternative Packaging



- jmod
- Native libraries & header files
 - Legal notices
 - Not executable

`$JAVA_HOME/jmods`

Alternative Packaging



- jmod
- Native libraries & header files
 - Legal notices
 - Not executable

`$JAVA_HOME/jmods`

Intended for use with `jlink` to create native images

Summary

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Modularized JDK

Summary



Modularized JDK



Requiring JDK modules

Summary



Modularized JDK



Requiring JDK modules



Packaging modular JARs