Advanced Modular Development

Alan Bateman
Java Platform Group, Oracle
February 2016

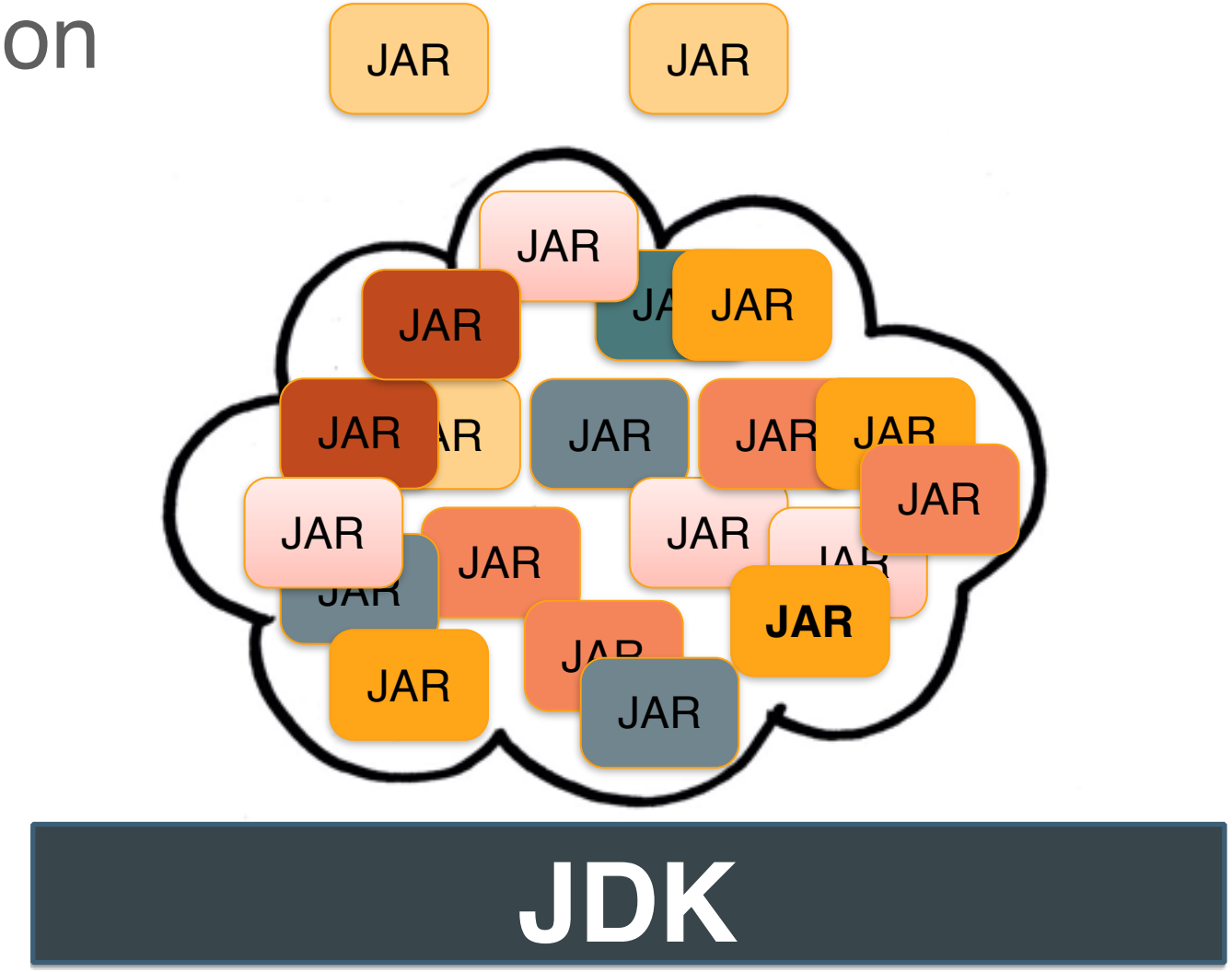
http://openjdk.java.net/projects/jigsaw

#Jfokus #Jigsaw

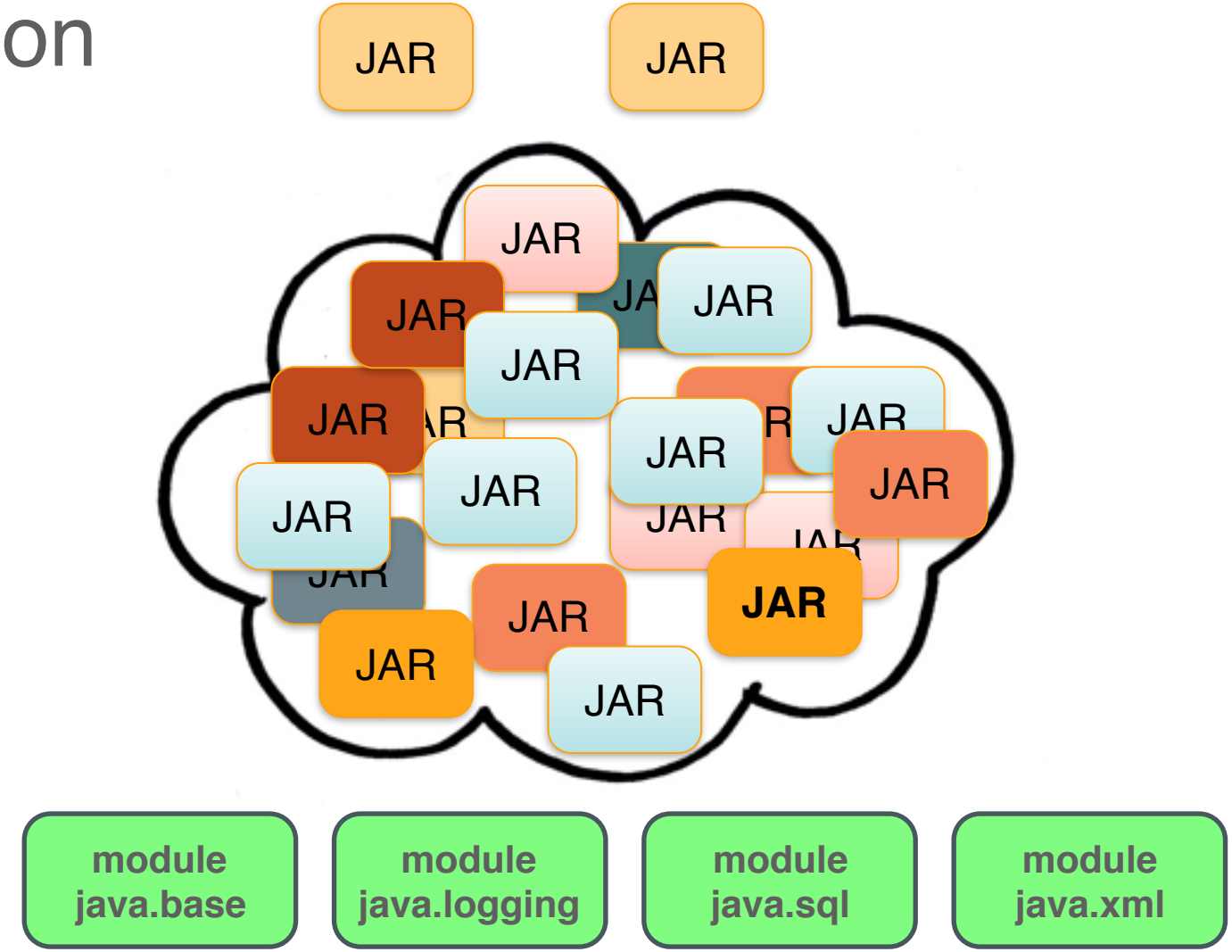
Application Migration

#Jfokus #Jigsaw

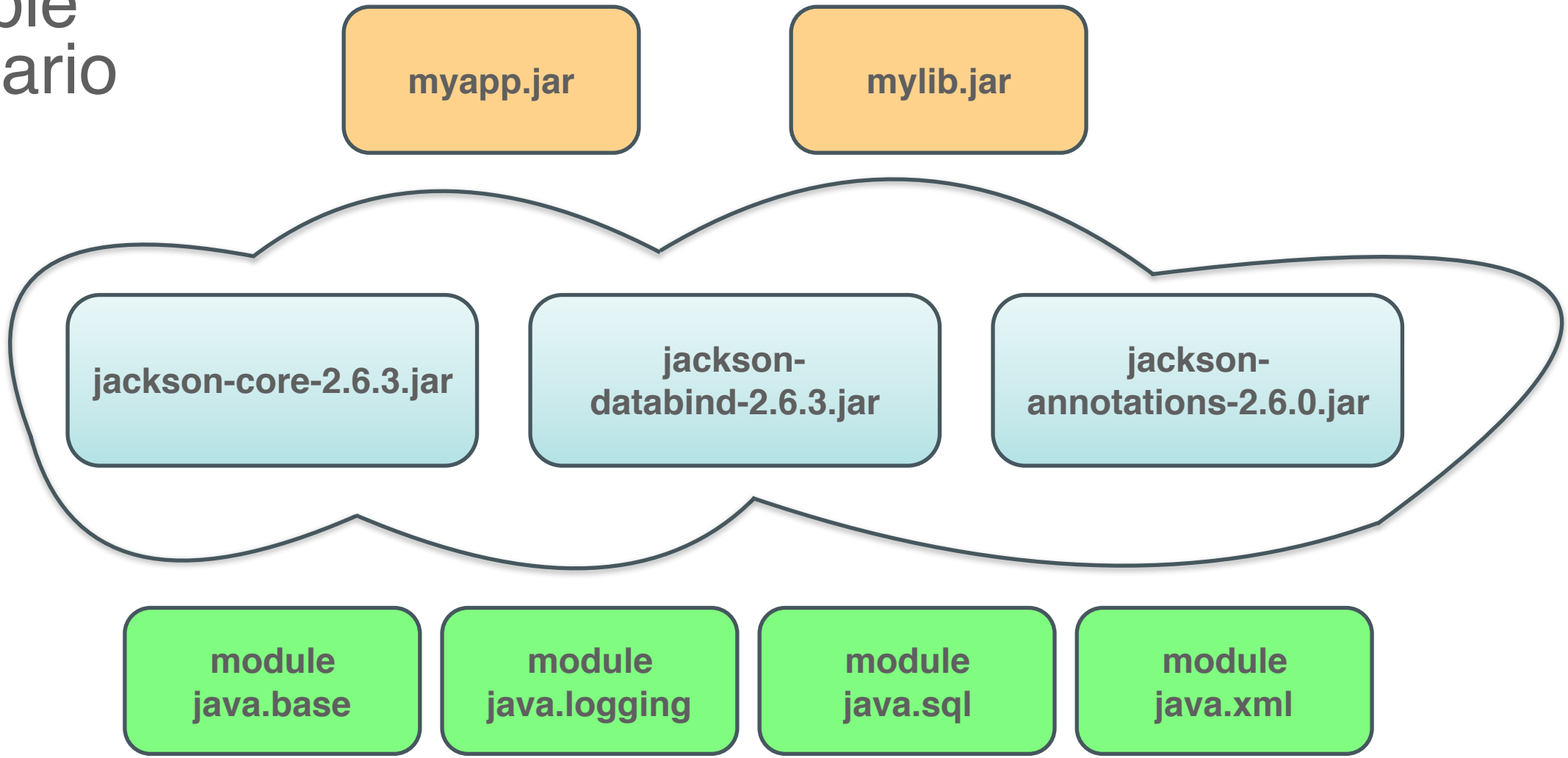
Typical application



Typical application



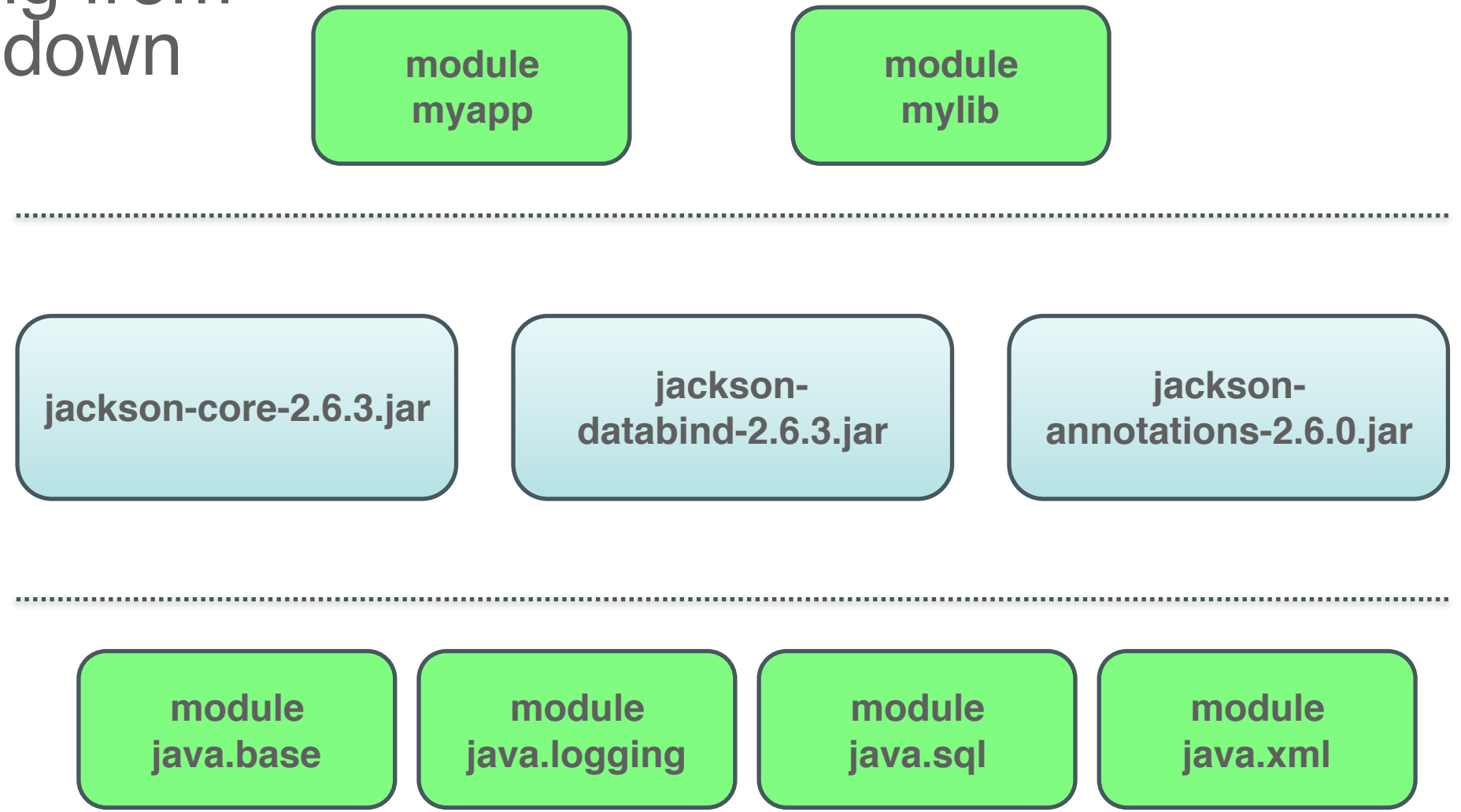
Sample Scenario



Running my application

```
$ java -cp \
lib/myapp.jar:\
lib/mylib.jar:\
lib/jackson-core-2.6.3.jar:\
lib/jackson-databind-2.6.3.jar:\
lib/jackson-annotations-2.6.0.jar\
  myapp.Main
```

Migrating from the top down



Migrating from the top down

- module myapp requires?
- module myapp exports?

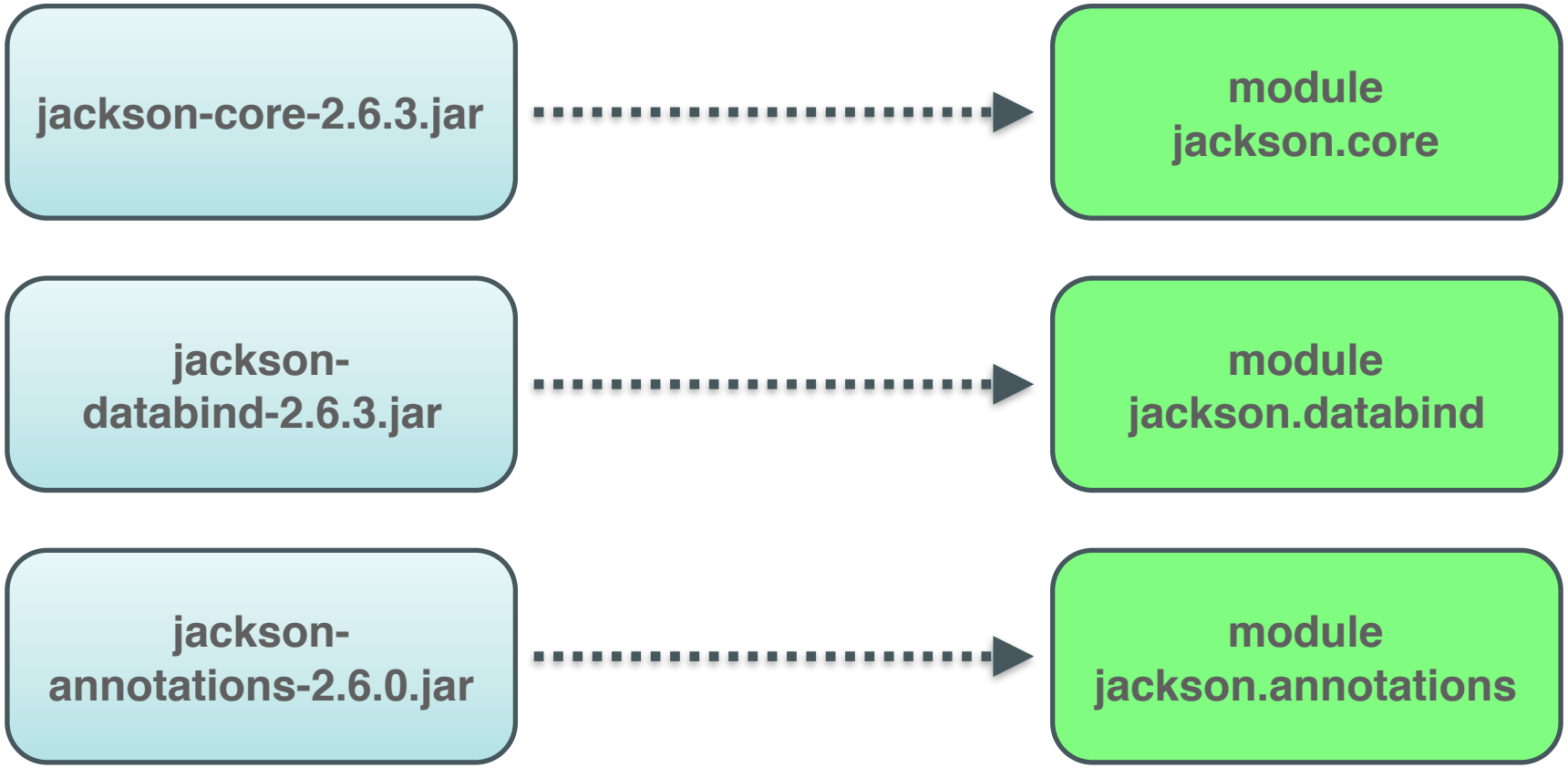
- module mylib requires?
- module mylib exports?

```
$ jdeps -s lib/myapp.jar lib/mylib.jar
myapp.jar -> lib/jackson-core-2.6.3.jar
myapp.jar -> lib/jackson-databind-2.6.3.jar
myapp.jar -> mylib.jar
myapp.jar -> java.base
myapp.jar -> java.sql
mylib.jar -> java.base
```

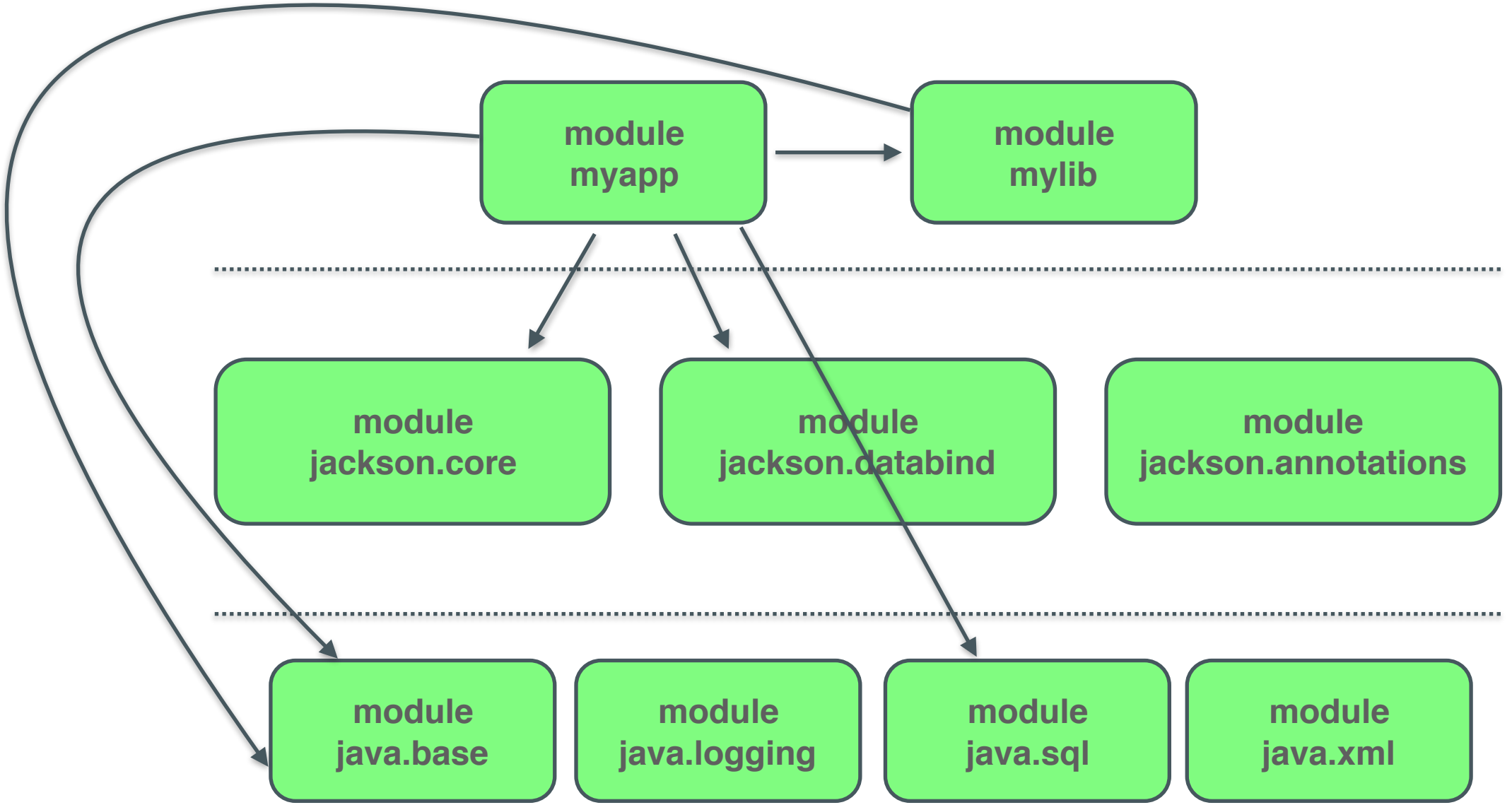
```
// src/mylib/module-info.java
module mylib {
    requires java.base;
    exports com.myapp.lib.util to myapp;
}
```

```
// src/myapp/module-info.java
module myapp {
    requires mylib;
    requires java.base;
    requires java.sql;
    ??? requires jackson.core ???
    ??? requires jackson.databind ???
}
```

If only …

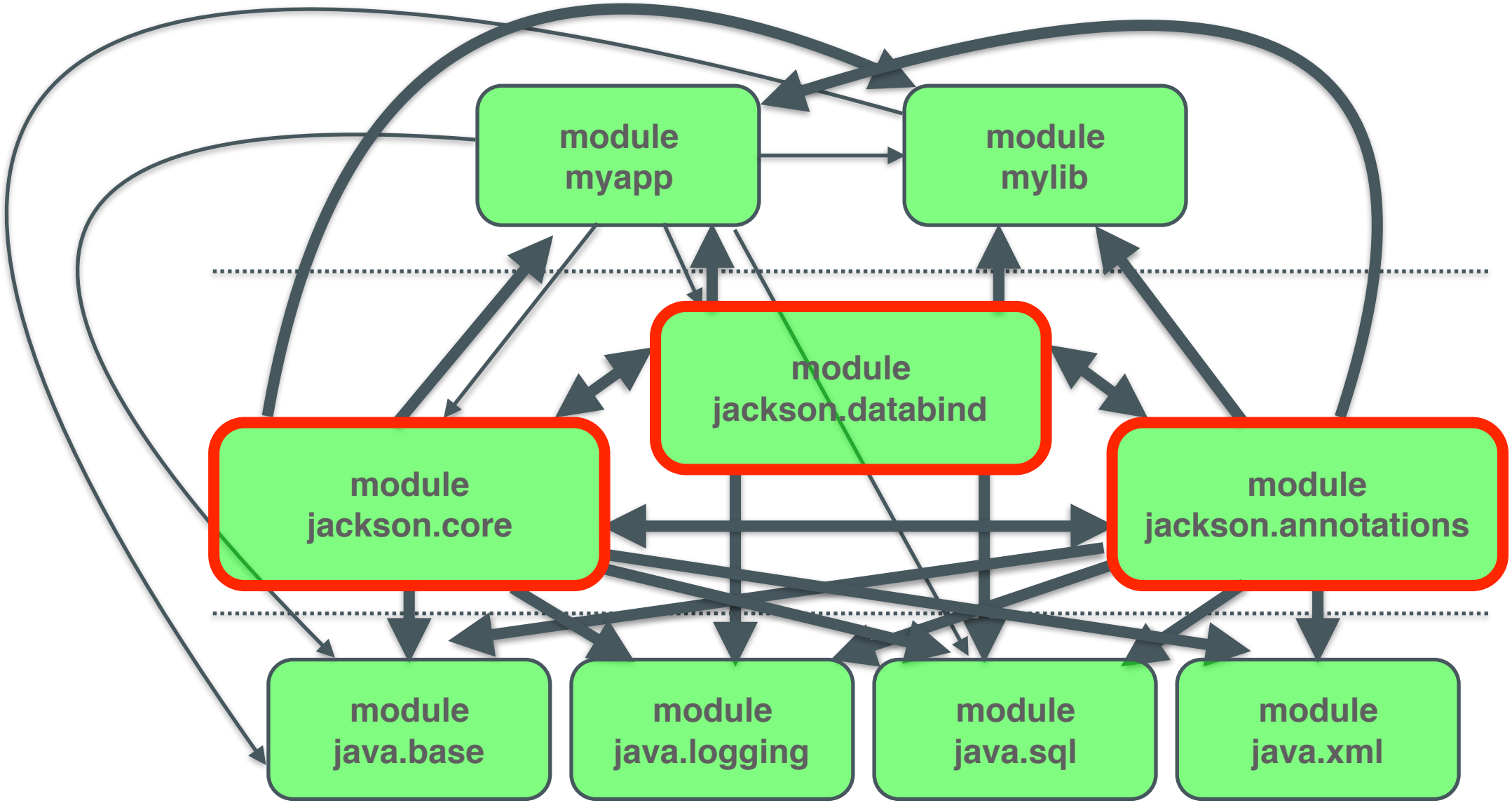


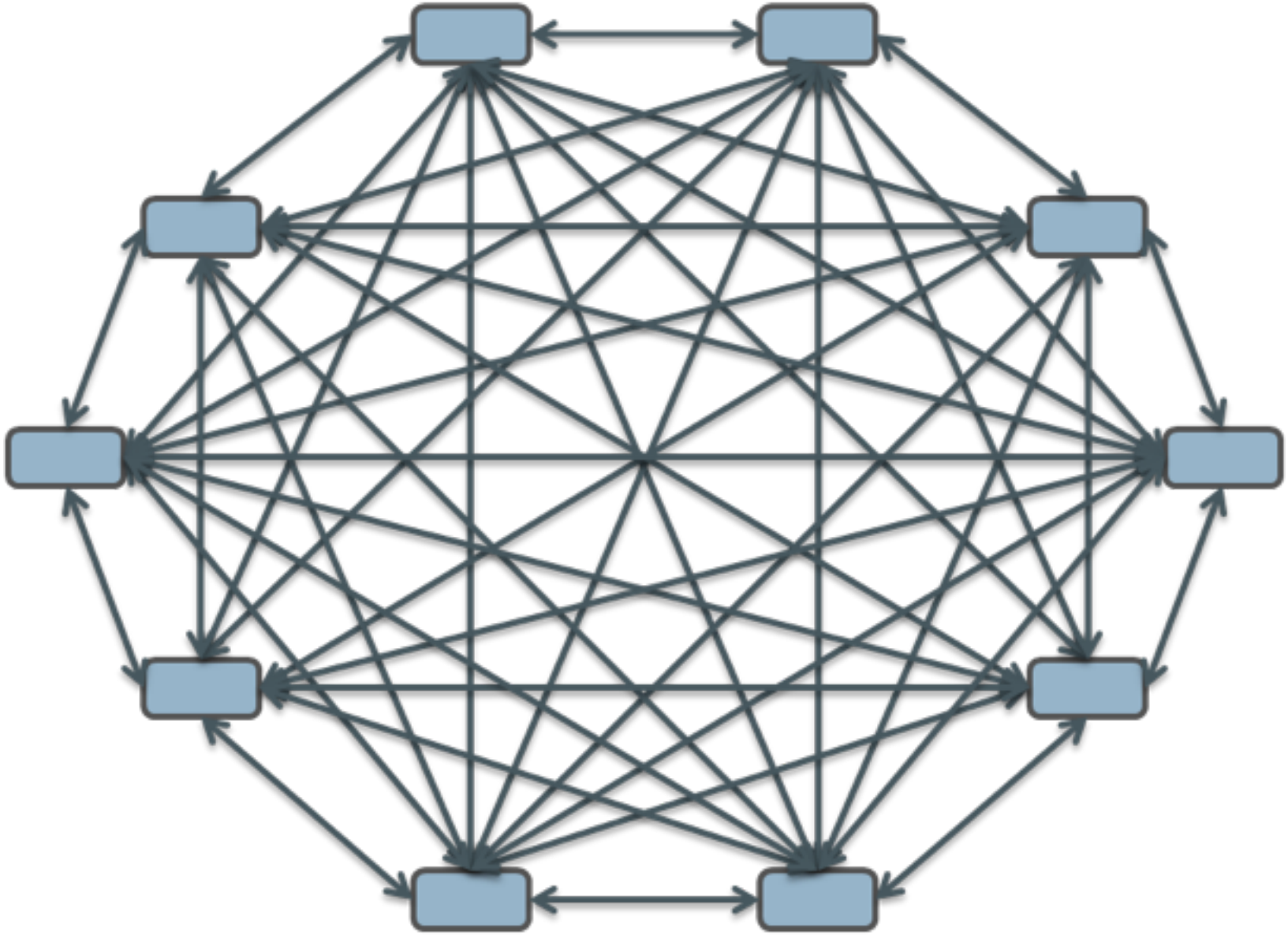
```
// src/myapp/module-info.java
module myapp {
    requires mylib;
    requires java.base;
    requires java.sql;
    requires jackson.core;
    requires jackson.databind;
}
```



Automatic modules

- “Real” modules
- No changes to someone else’s JAR file :-)
- Module name derived from JAR file name
- Exports all its packages
- Requires all other modules





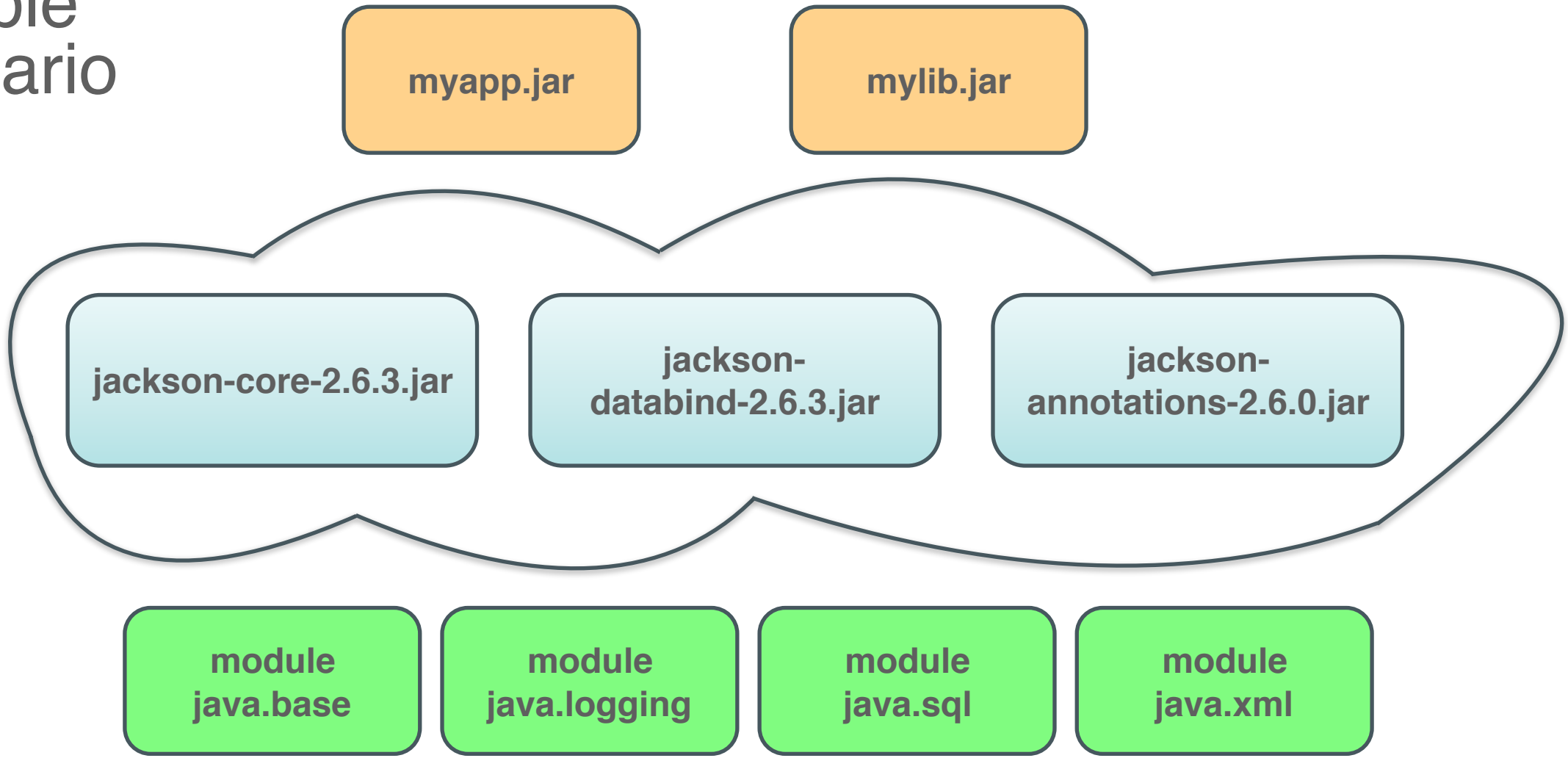
```
lib/jackson-core-2.6.3.jar
lib/jackson-databind-2.6.3.jar
lib/jackson-annotations-2.6.0.jar

src/myapp/module-info.java
src/myapp/...

src/mylib/module-info.java
src/mylib/...

$ javac   -modulesourcepath src   -mp lib   -d mods ...

$ jar --create   --file mlib/mylib.jar   -C mods/mylib .

$ jar --create   --file mlib/myapp.jar   -C mods/myapp . \
      --main-class myapp.Main
```

```
$ java -cp \
lib/myapp.jar:\
lib/mylib.jar:\
lib/jackson-core-2.6.3.jar:\
lib/jackson-databind-2.6.3.jar:\
lib/jackson-annotations-2.6.0.jar \
    myapp.Main
```

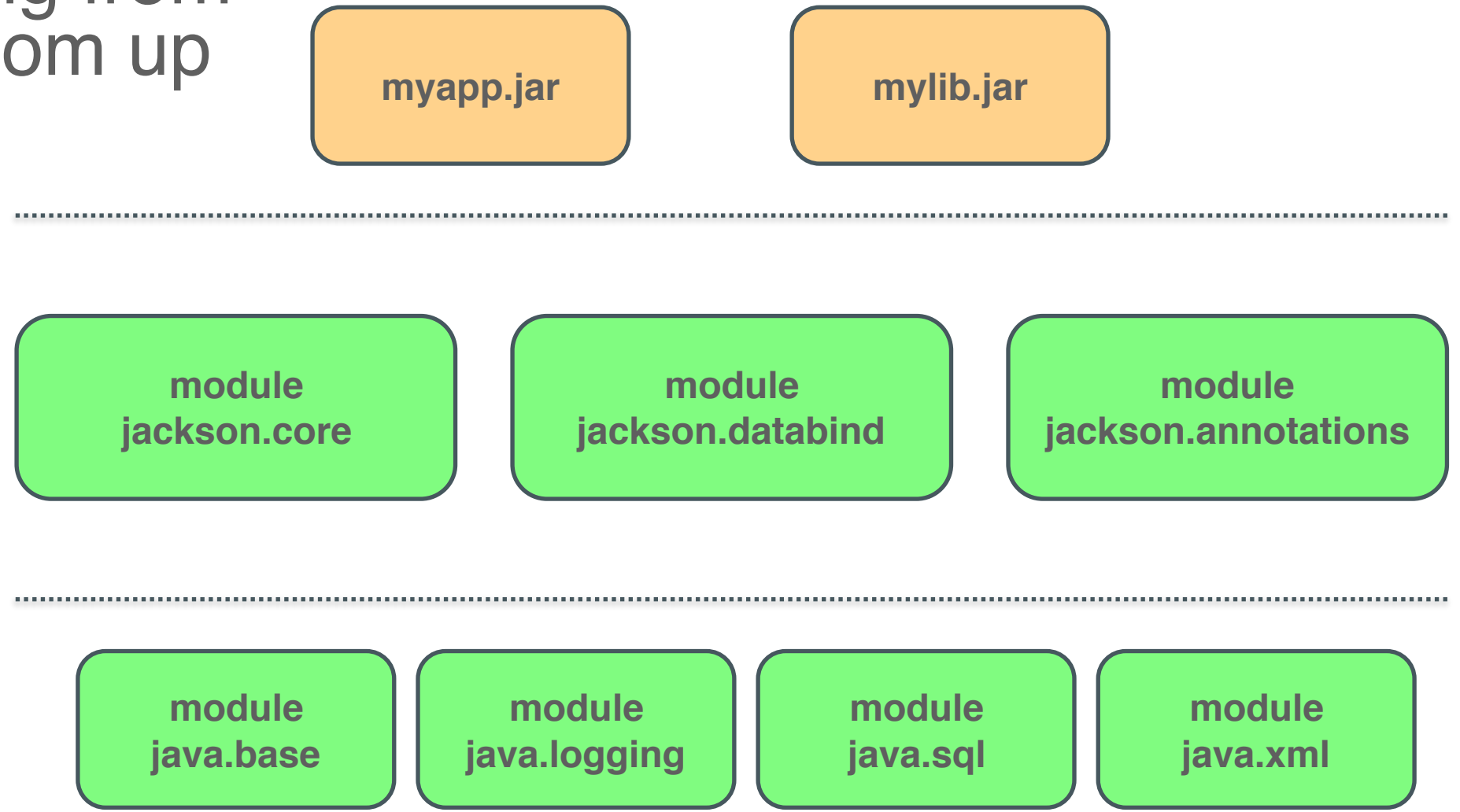
```
$ java –mp mlib:lib –m myapp
```

Library Migration

Sample Scenario



Migrating from the bottom up

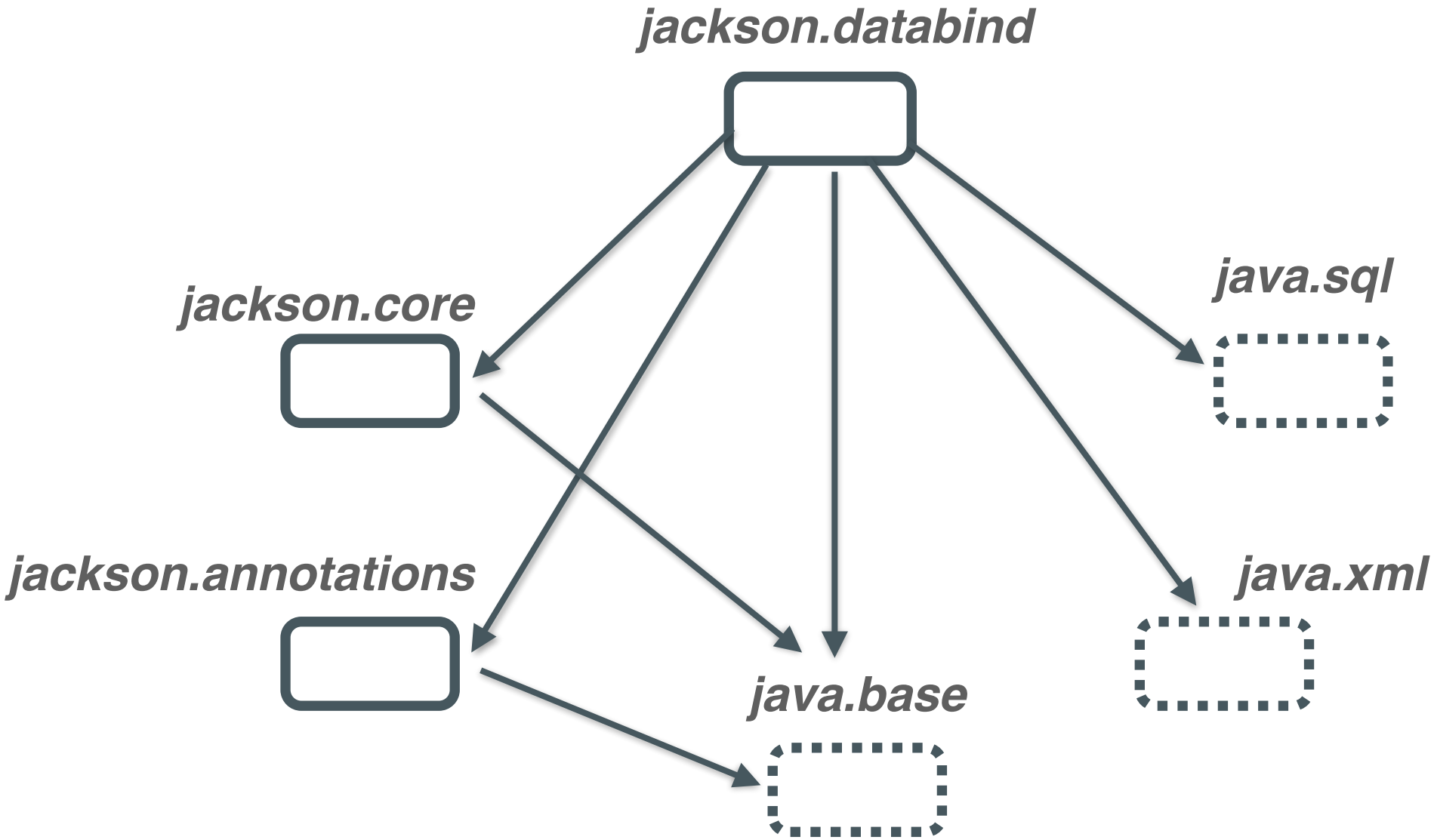


Migrating from the bottom

- module jackson.core requires?
- module jackson.core exports?
- module jackson.databind requires?
- module jackson.databind exports?
- module jackson.annotations requires?
- module jackson.annotations exports?

Requires?

```
$ jdeps -s lib/jackson*.jar
jackson-annotations-2.6.0.jar -> java.base
jackson-core-2.6.3.jar -> java.base
jackson-databind-2.6.3.jar -> lib/jackson-annotations-2.6.0.jar
jackson-databind-2.6.3.jar -> lib/jackson-core-2.6.3.jar
jackson-databind-2.6.3.jar -> java.base
jackson-databind-2.6.3.jar -> java.sql
jackson-databind-2.6.3.jar -> java.xml
```



Creating the module-info.java for each module

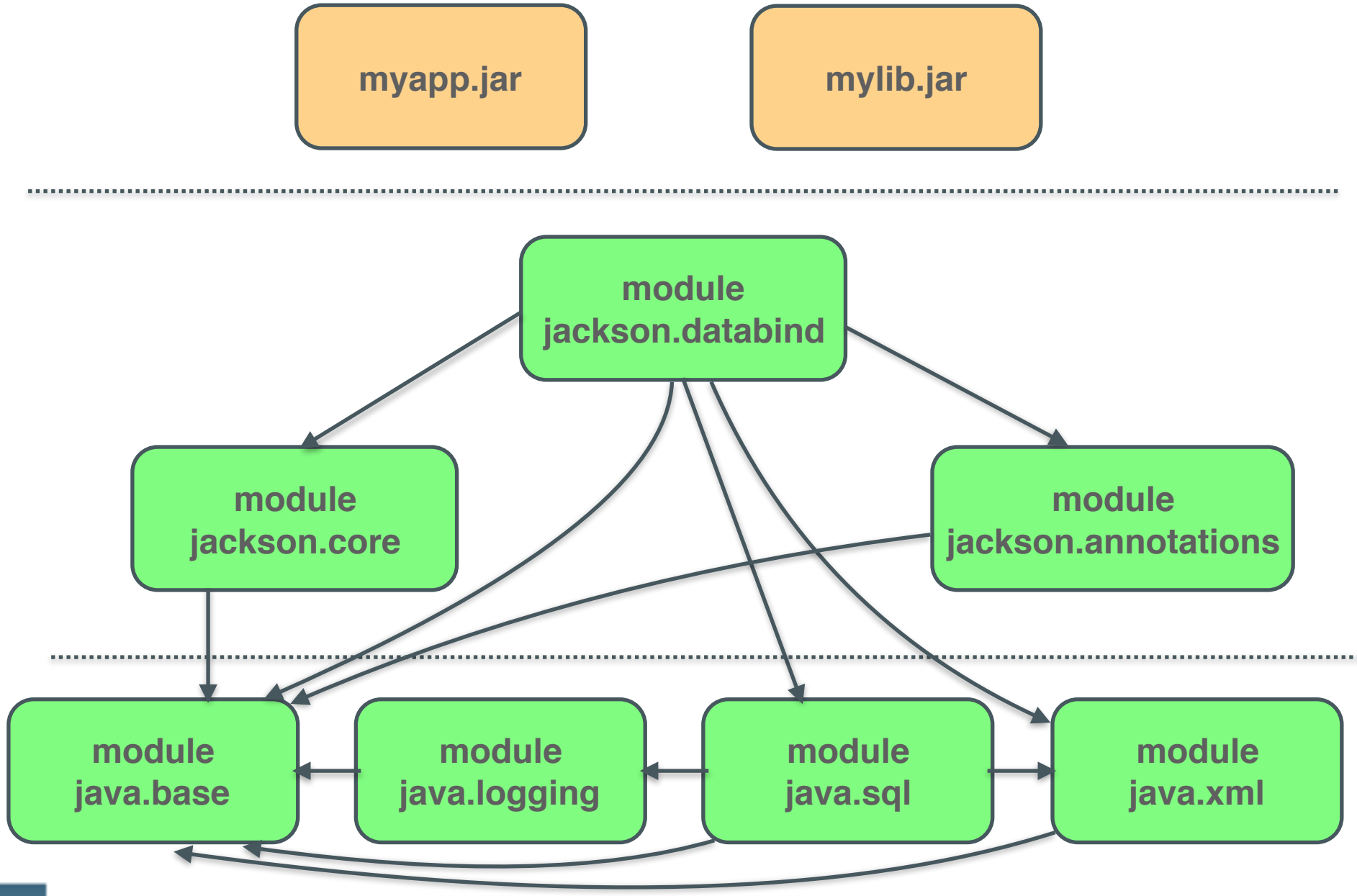
```
$ jdeps -genmoduleinfo src *.jar
writing to src/jackson.annotations/module-info.java
writing to src/jackson.databind/module-info.java
writing to src/jackson.core/module-info.java
```

```
// src/jackson.databind/module-info.java
module jackson.databind {
    requires public java.sql;
    requires public java.xml;
    requires public jackson.annotations;
    requires public jackson.core;
    exports com.fasterxml.jackson.databind;
    exports com.fasterxml.jackson.databind.annotation;
    exports com.fasterxml.jackson.databind.cfg;
    exports com.fasterxml.jackson.databind.deser;
    exports com.fasterxml.jackson.databind.deser.impl;
    exports com.fasterxml.jackson.databind.jsontype;
    exports com.fasterxml.jackson.databind.jsontype.impl;
    exports com.fasterxml.jackson.databind.module;
    exports com.fasterxml.jackson.databind.node;
    exports com.fasterxml.jackson.databind.ser;
    exports com.fasterxml.jackson.databind.ser.impl;
    exports com.fasterxml.jackson.databind.ser.std;
    exports com.fasterxml.jackson.databind.type;
    exports com.fasterxml.jackson.databind.util;
}
```

```
// src/jackson.databind/module-info.java
module jackson.databind {
    requires public java.sql;
    requires public java.xml;
    requires public jackson.annotations;
    requires public jackson.core;
    exports com.fasterxml.jackson.databind;
    exports com.fasterxml.jackson.databind.annotation;
    exports com.fasterxml.jackson.databind.cfg;
    exports com.fasterxml.jackson.databind.deser;
    exports com.fasterxml.jackson.databind.deser.impl;
    exports com.fasterxml.jackson.databind.jsontype;
    exports com.fasterxml.jackson.databind.jsontype.impl;
    exports com.fasterxml.jackson.databind.module;
    exports com.fasterxml.jackson.databind.node;
    exports com.fasterxml.jackson.databind.ser;
    exports com.fasterxml.jackson.databind.ser.impl;
    exports com.fasterxml.jackson.databind.ser.std;
    exports com.fasterxml.jackson.databind.type;
    exports com.fasterxml.jackson.databind.util;
}
```

```
src/jackson.core/module-info.java
src/jackson.core/...

src/jackson.databind/module-info.java
src/jackson.databind/...

src/jackson.annotations/module-info.java
src/jackson.annotations/...
```

```
$ javac -modulesourcepath src -d mods ...

$ jar --create --file mlib/jackson.core-2.6.3.jar \
   --module-version 2.6.3 -C mods/jackson.core .

$ jar --create --file mlib/jackson.databind-2.6.3.jar \
   --module-version 2.6.3 -C mods/jackson.databind .

$ jar --create --file mlib/jackson.annotations-2.6.0.jar \
   --module-version 2.6.0 -C mods/jackson.annotations .
```

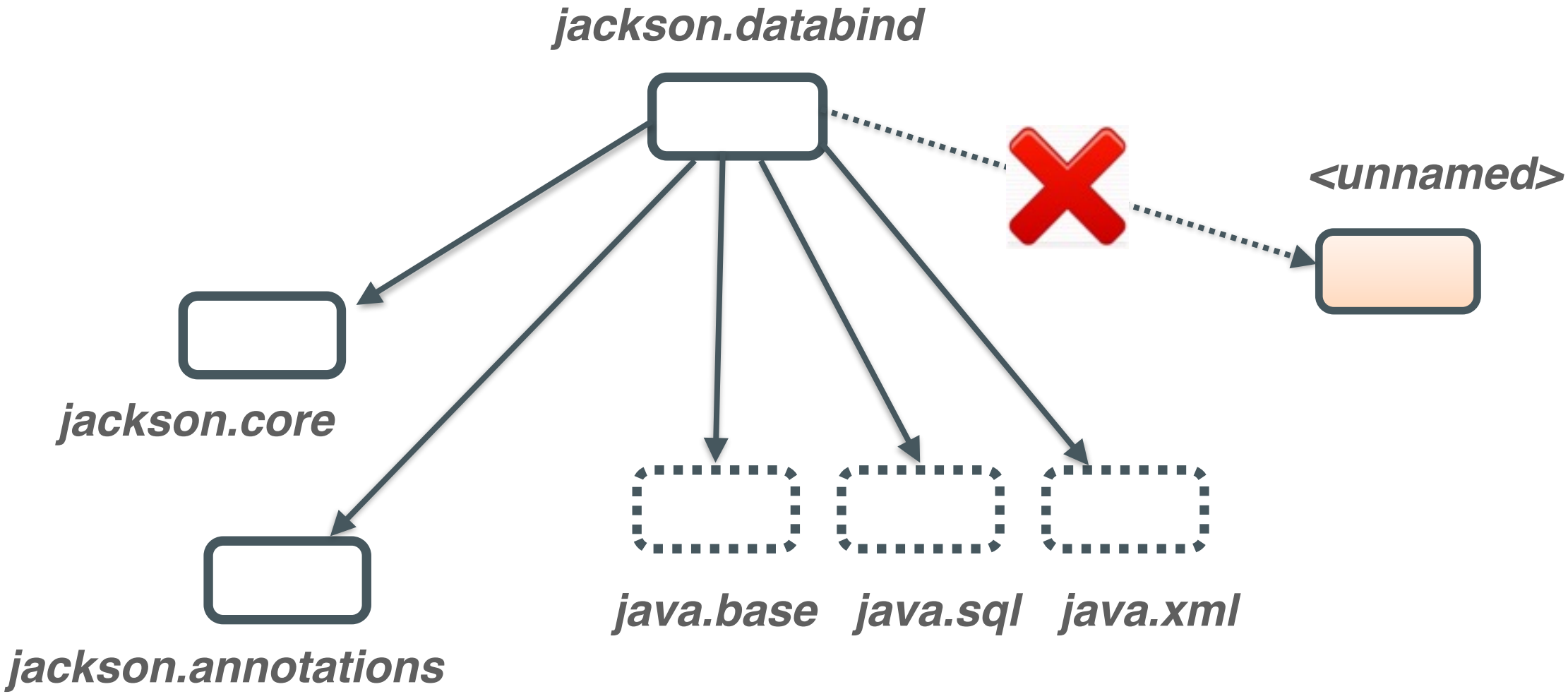


~~$ java -cp \~~
~~lib/myapp.jar:\~~
~~lib/mylib.jar:\~~
~~lib/jackson-core-2.6.3.jar:\~~
~~lib/jackson-databind-2.6.3.jar:\~~
~~lib/jackson-annotations-2.6.0.jar \~~
~~myapp.Main~~

```
$ java -mp mlib -cp lib/myapp.jar:lib/mylib.jar
  -addmods jackson.databind \
  myapp.Main
```

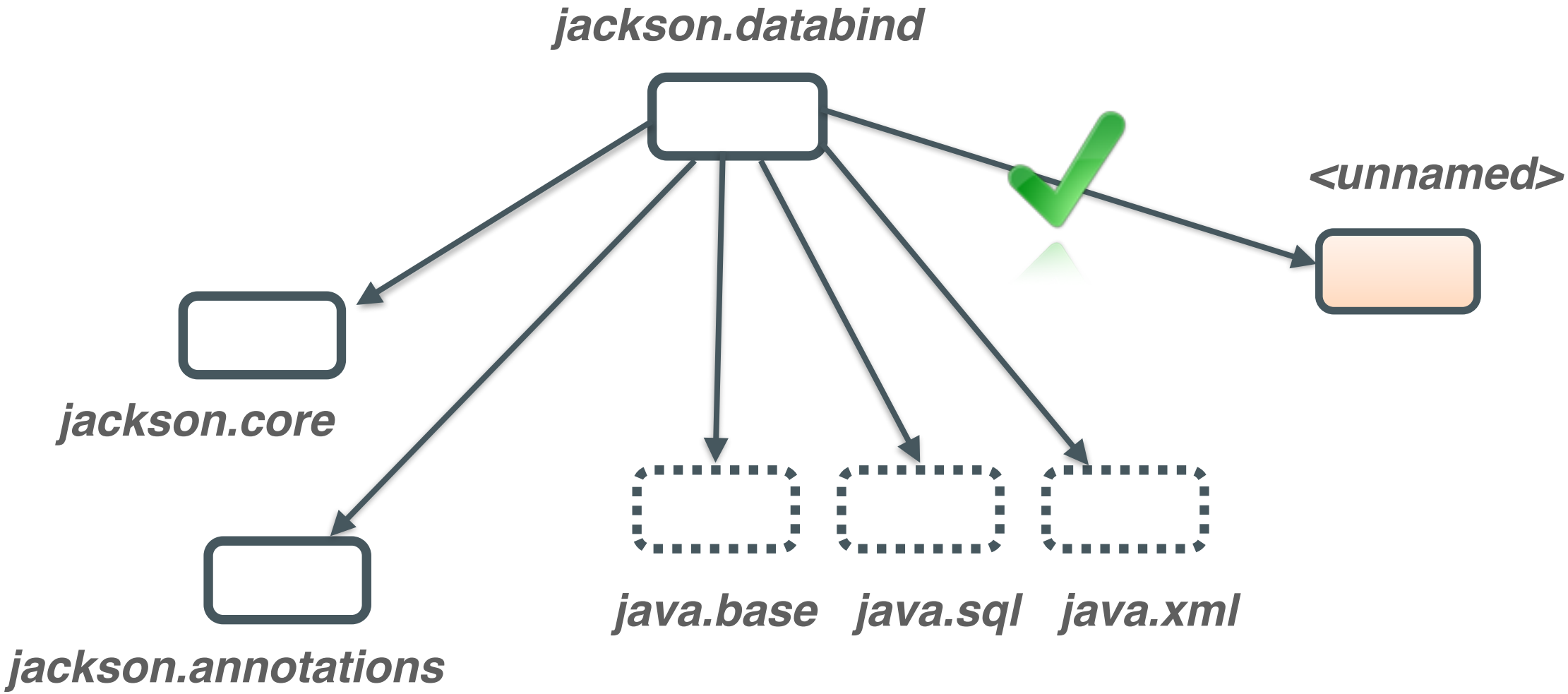
```
$ java –mp mlib –cp lib/myapp.jar:lib/mylib.jar \
   –addmods jackson.databind myapp.Main
```

```
Exception in thread "main" java.lang.reflect.InaccessibleObjectException: Unable
to make member of class app.MyValue accessible: module jackson.databind does not
read <unnamed module @6536e911>
   at sun.reflect.Reflection.throwInaccessibleObjectException(java.base@9/Reflection.java:464)
   at java.lang.reflect.AccessibleObject.checkCanSetAccessible(java.base@9/AccessibleObject.java:175)
   at java.lang.reflect.Constructor.checkCanSetAccessible(java.base@9/Constructor.java:174)
   at java.lang.reflect.Constructor.setAccessible(java.base@9/Constructor.java:167)
   at com.fasterxml.jackson.databind.util.ClassUtil.checkAndFixAccess(jackson.databind/ClassUtil.java:505)
   at com.fasterxml.jackson.databind.deser.impl.CreatorCollector._fixAccess(jackson.databind/
CreatorCollector.java:280)
   at com.fasterxml.jackson.databind.deser.impl.CreatorCollector.setDefaultCreator(jackson.databind/
CreatorCollector.java:155)
   :
```

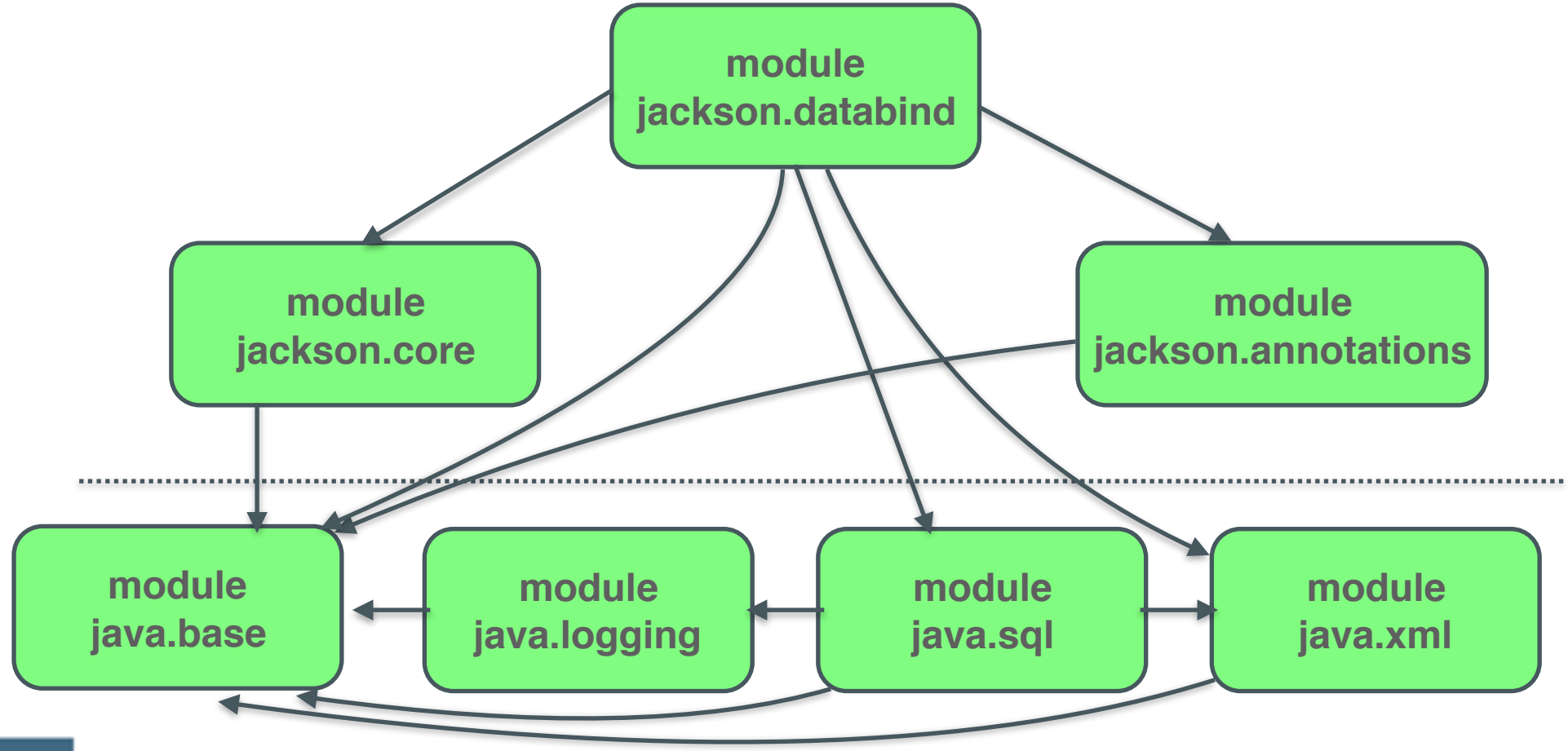


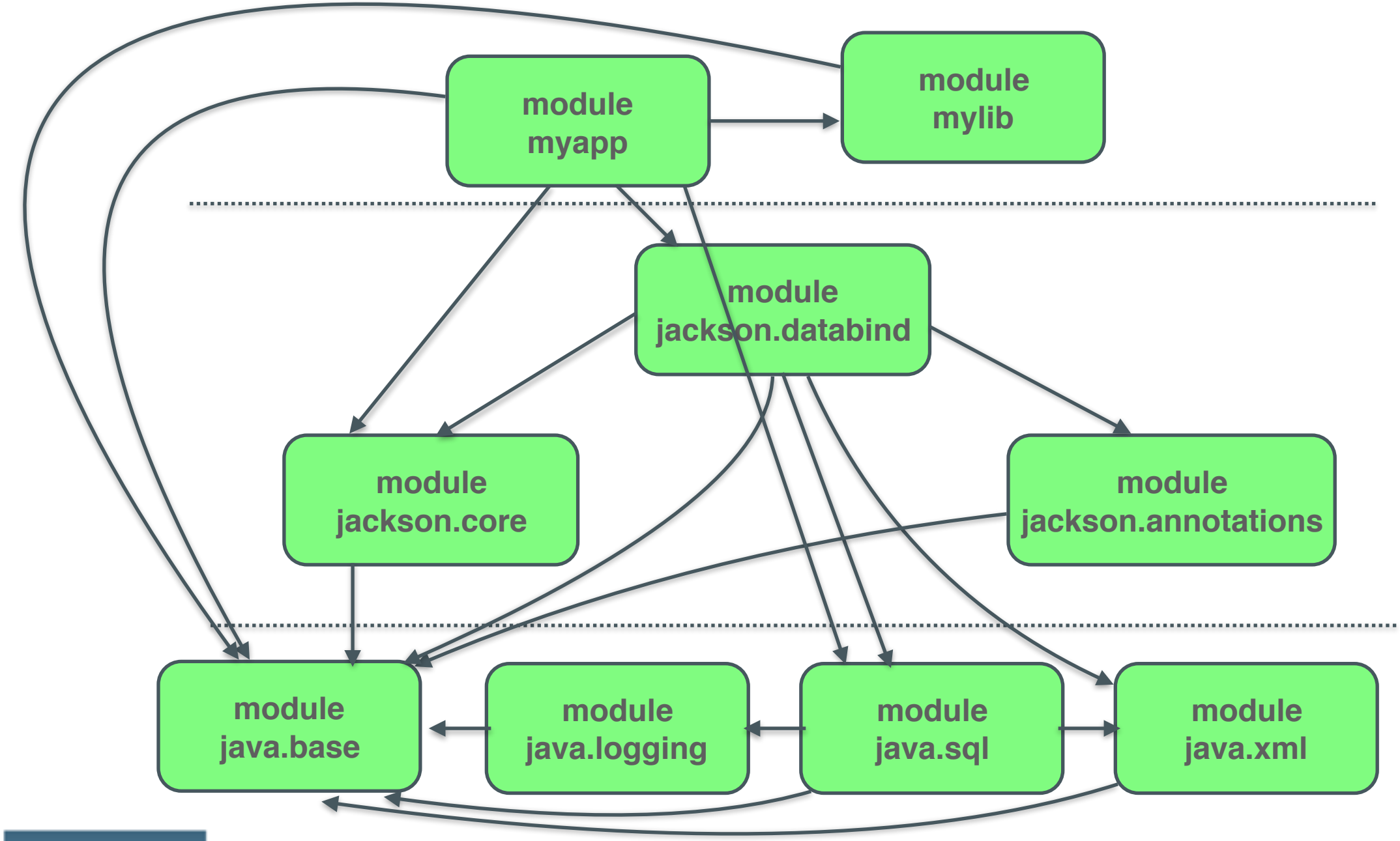
```
package java.lang.reflect;

public final class Module {

    public String getName();

    public boolean canRead(Module source);

    public Module addReads(Module source);

    ...

}
```

```
Module source = clazz.getModule();
this.getClass().getModule().addReads(source);
```



Putting it all together





```
$ java -mp mlib -m myapp
```

Linking

```
$ jlink –mp $JDKMODS:mlib –addmods myapp –output myimage

$ ls myimage
bin    conf    lib    release

$ ls myimage/bin
myapp    java    keytool

$ myimage/bin/java –listmods
myapp
mylib
jackson.annotations@2.6.0
jackson.core@2.6.3
jackson.databind@2.6.3
java.base@9
java.logging@9
java.sql@9
java.xml@9
```

```
$ myimage/bin/java -m myapp
Greetings from myapp, here's some json!
```

```
$ myimage/bin/myapp
Greetings from myapp, here’s some json!
```

Summary

- Freedom to adopt modules at your own pace
  - Modularize your application before its libraries
  - Modularize libraries independently
- Different kinds of modules
  - Explicit vs. automatic
- Some libraries will need changes to work as modules

Go forth and modularize!

More Information

OpenJDK Project Jigsaw

http://openjdk.java.net/projects/jigsaw/

mailto:jigsaw-dev@openjdk.java.net

Early Access Builds

http://openjdk.java.net/projects/jigsaw/ea

Safe Harbor Statement

The preceding is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.


ORACLE®