

Boosting Developer Productivity Through Better Modularity

Jendrik Johannes

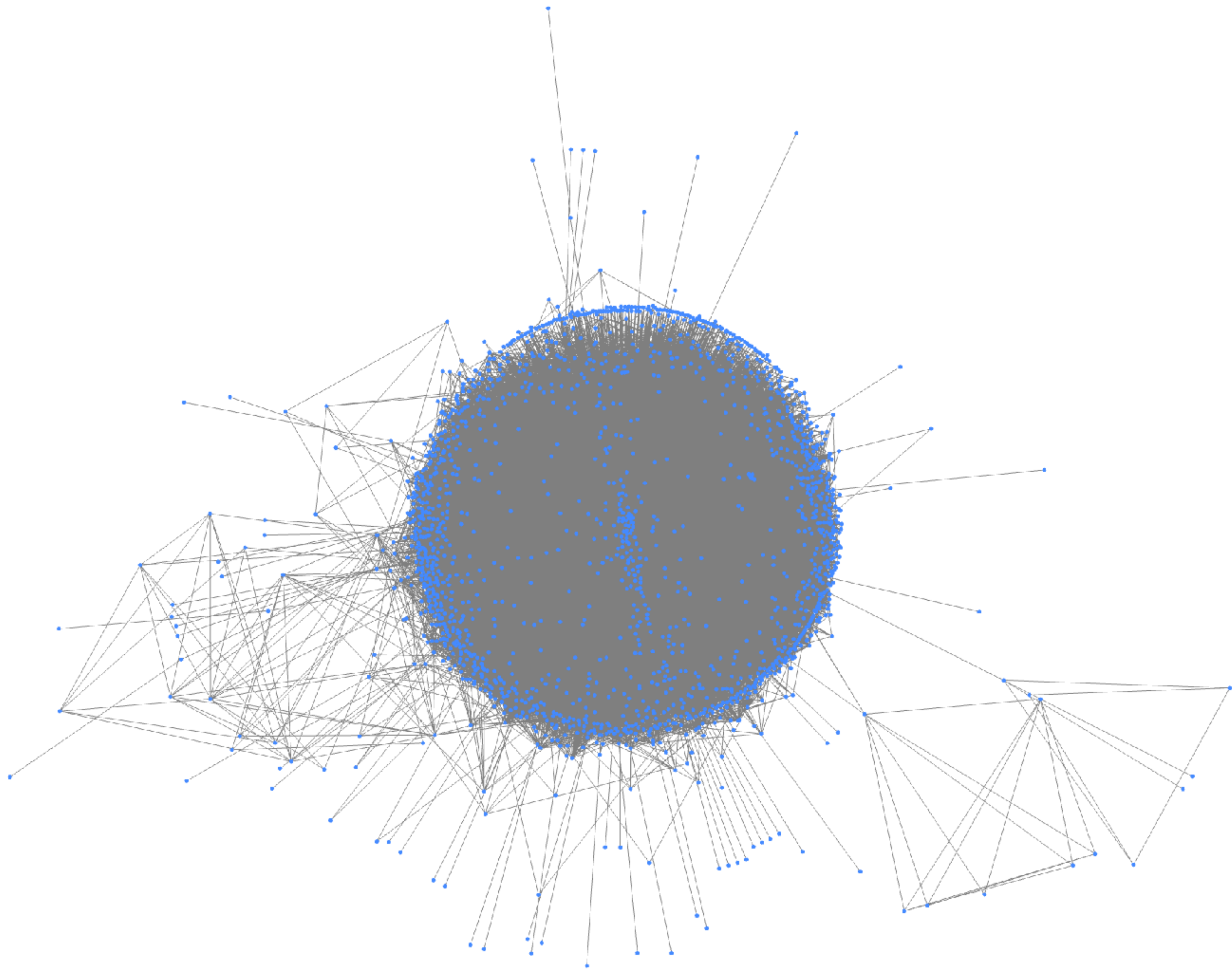
github.com/jjohannes

DPE Summit 2024

Part 1

Complexity in

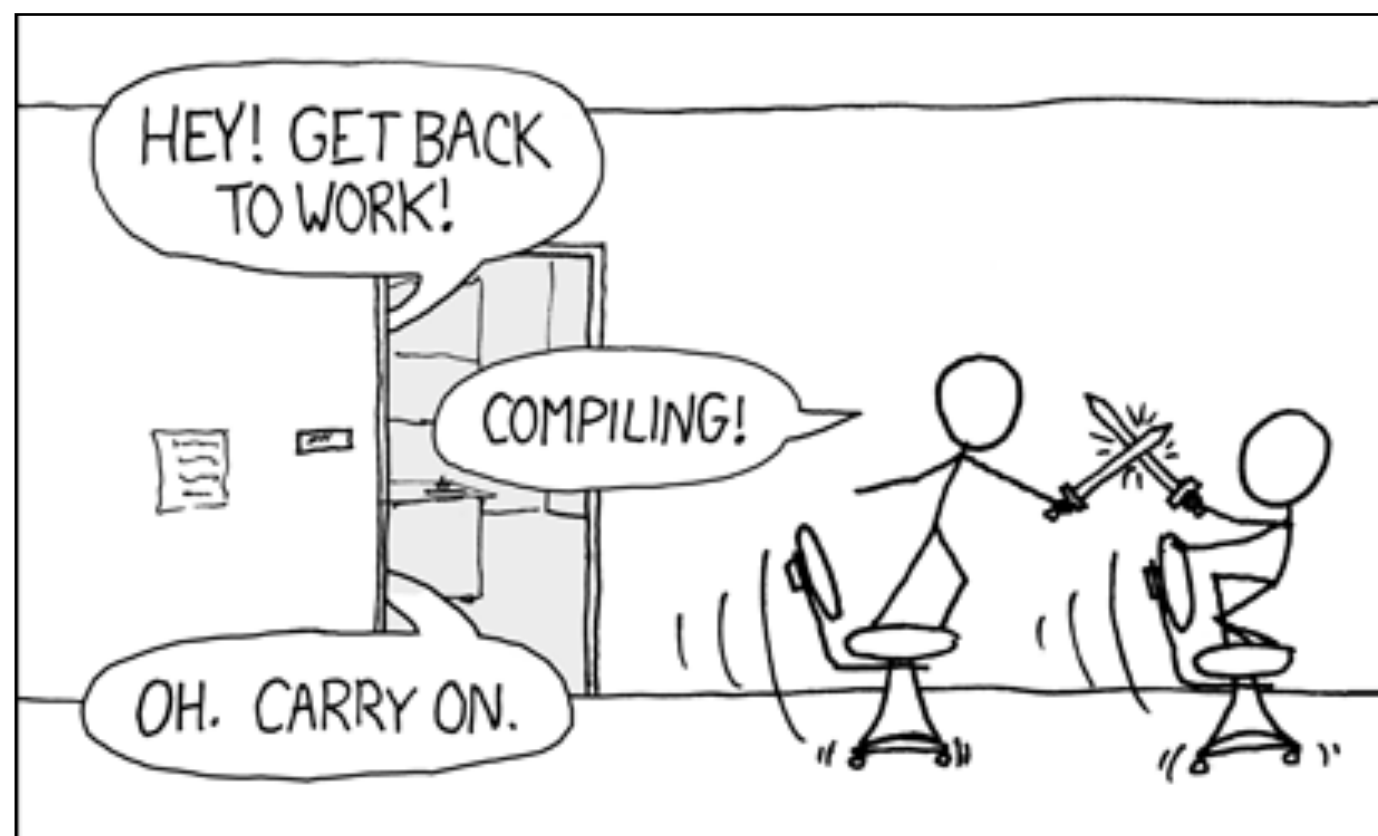
Module Definition



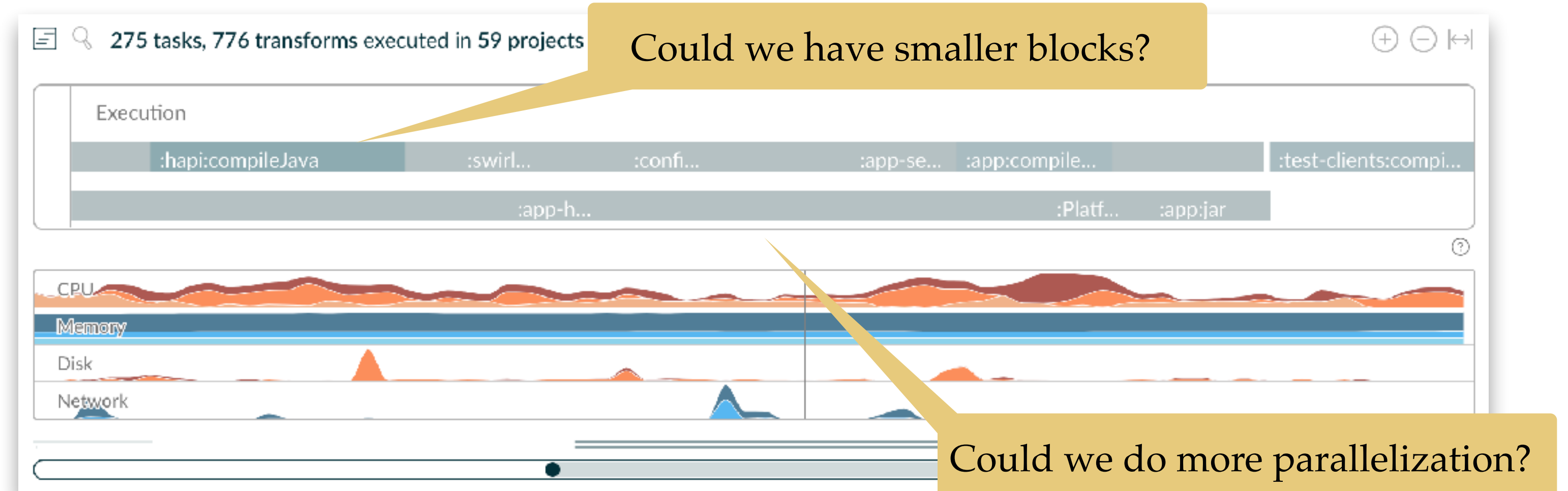


What makes us productive?

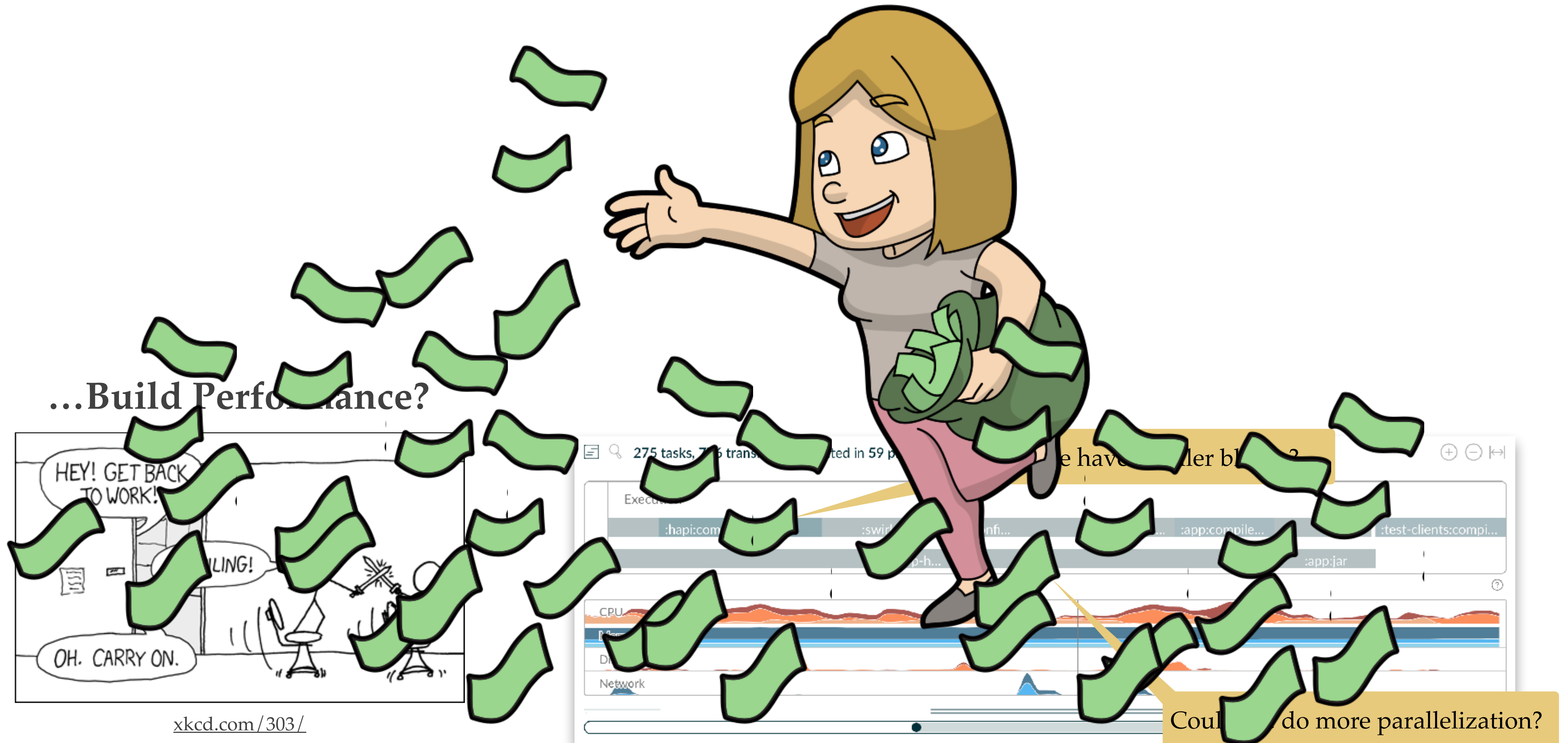
...Build Performance?



xkcd.com/303/

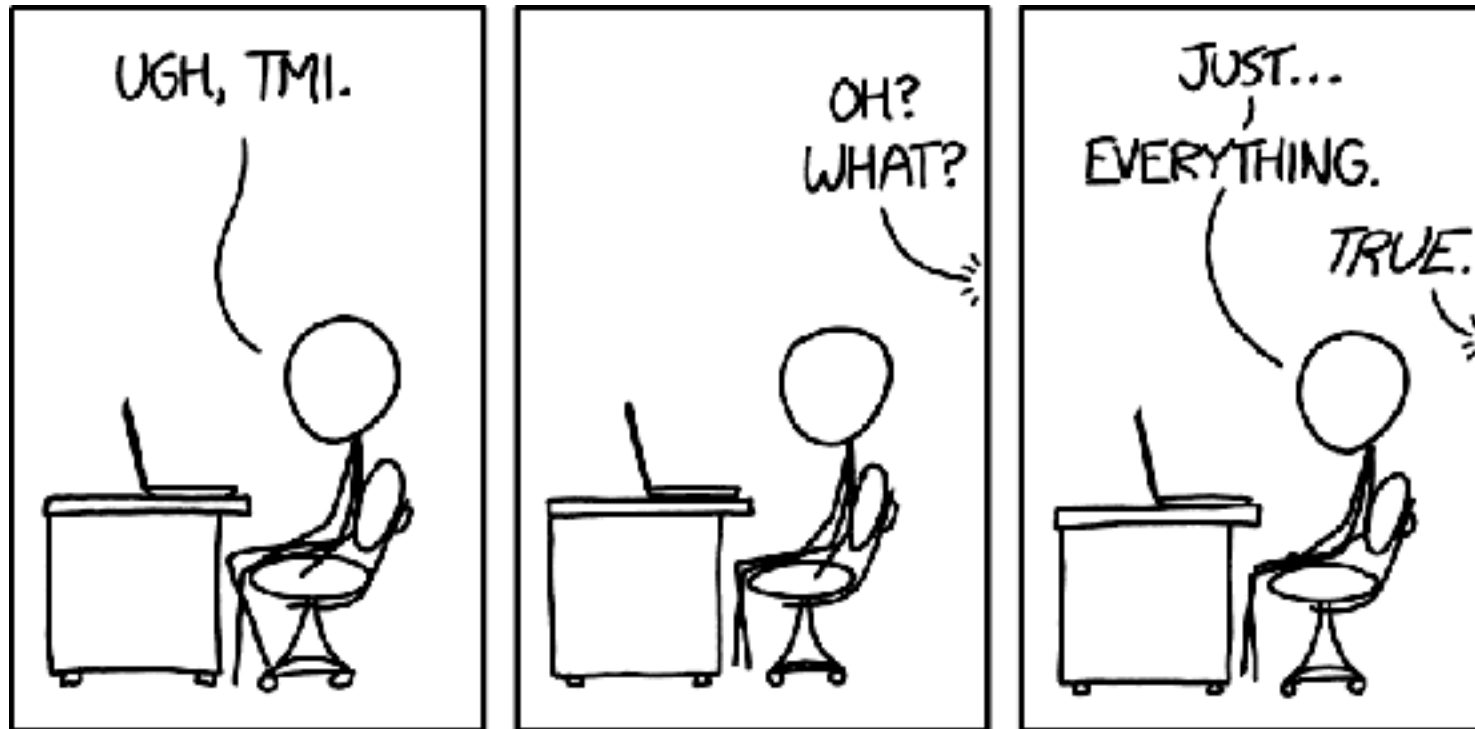


What makes us productive?

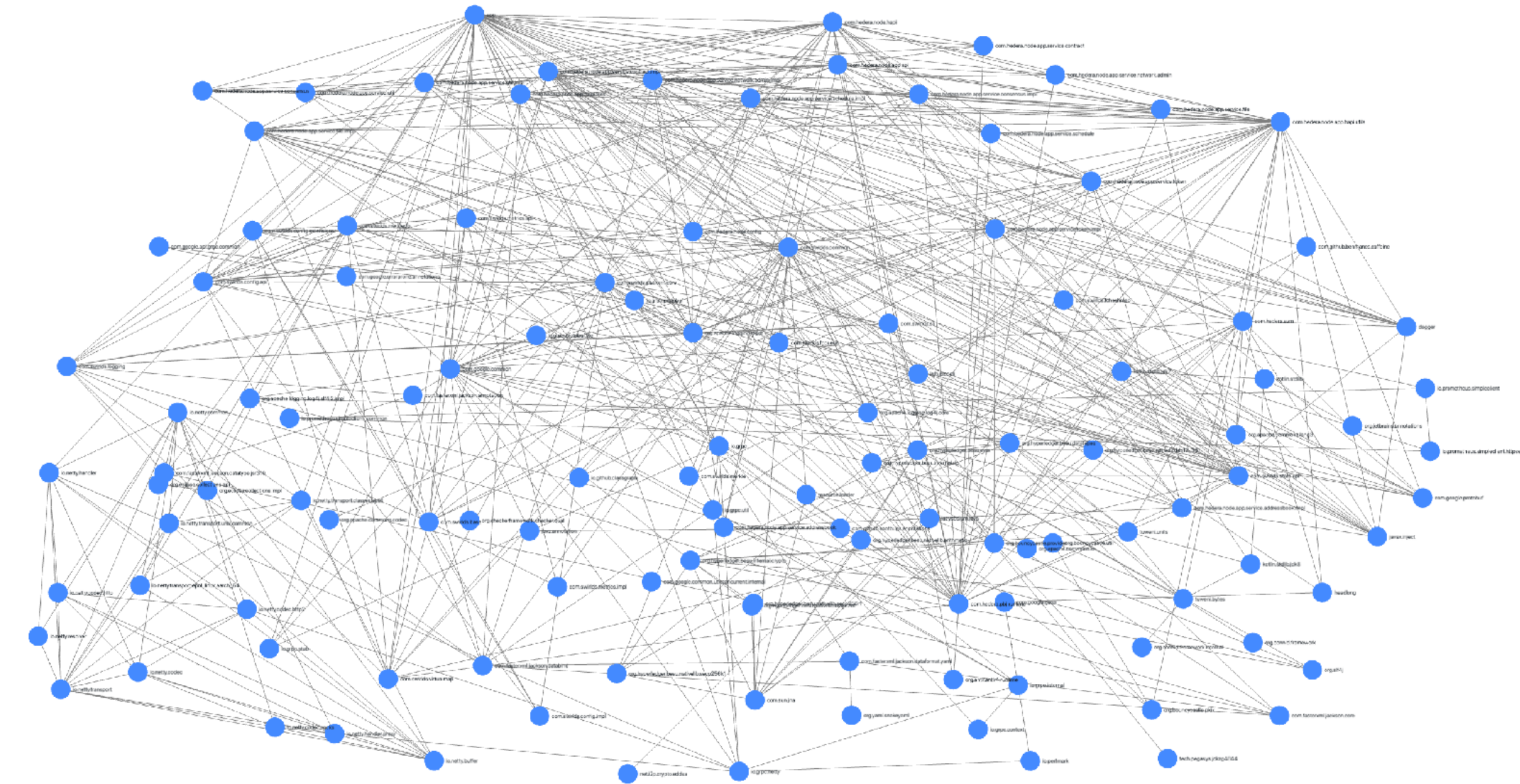
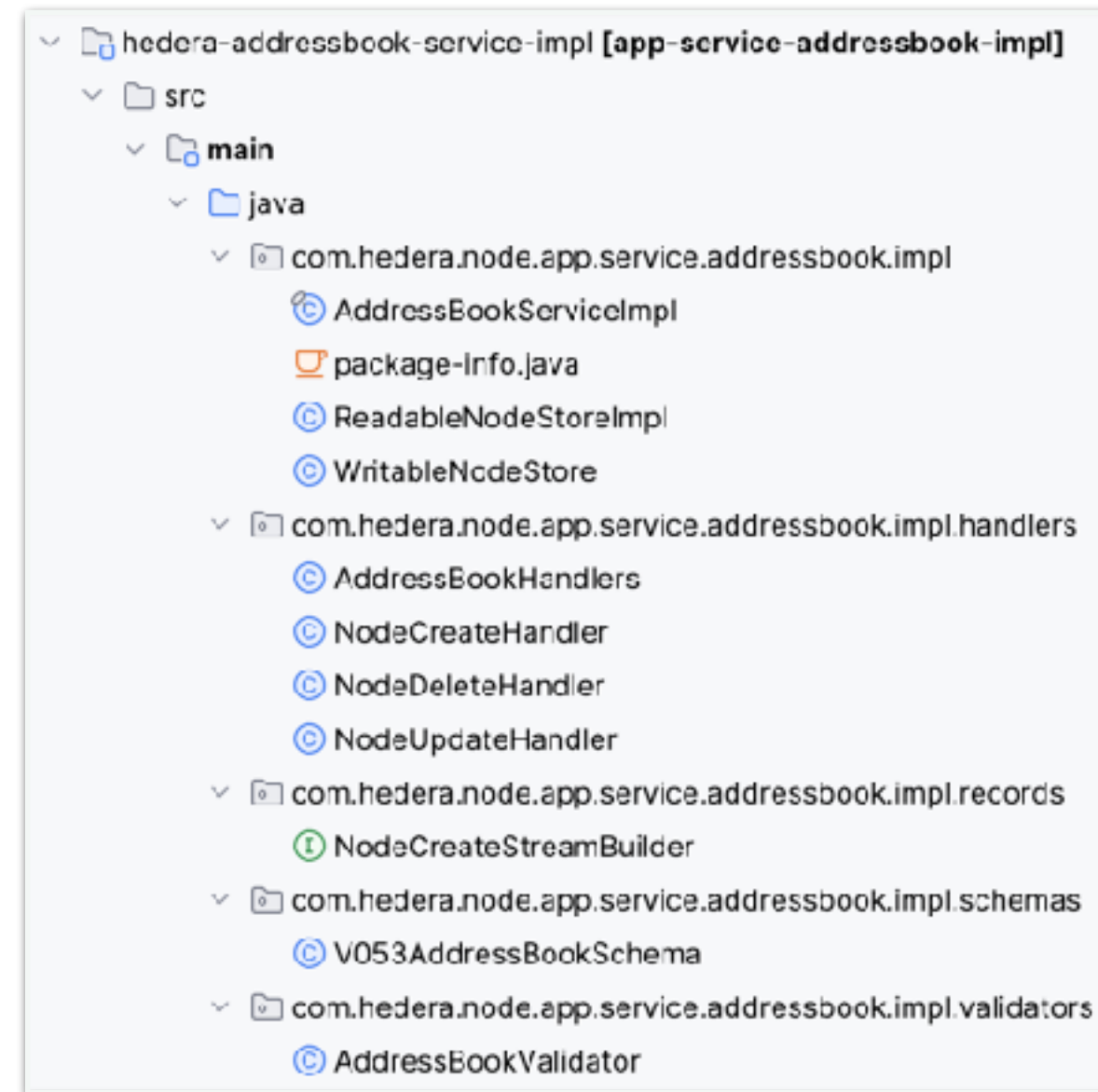


What makes us productive?

...Comprehensibility?

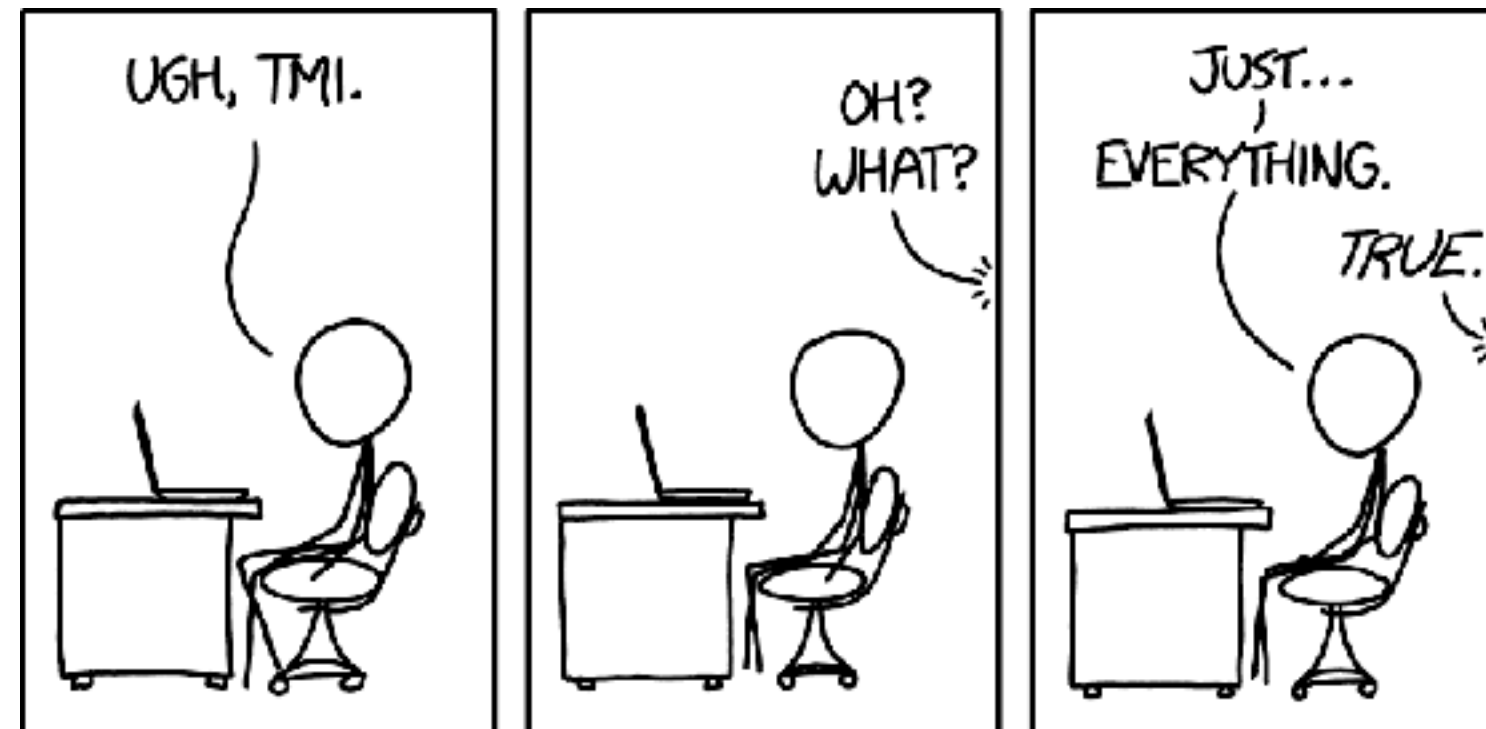


xkcd.com/1369/

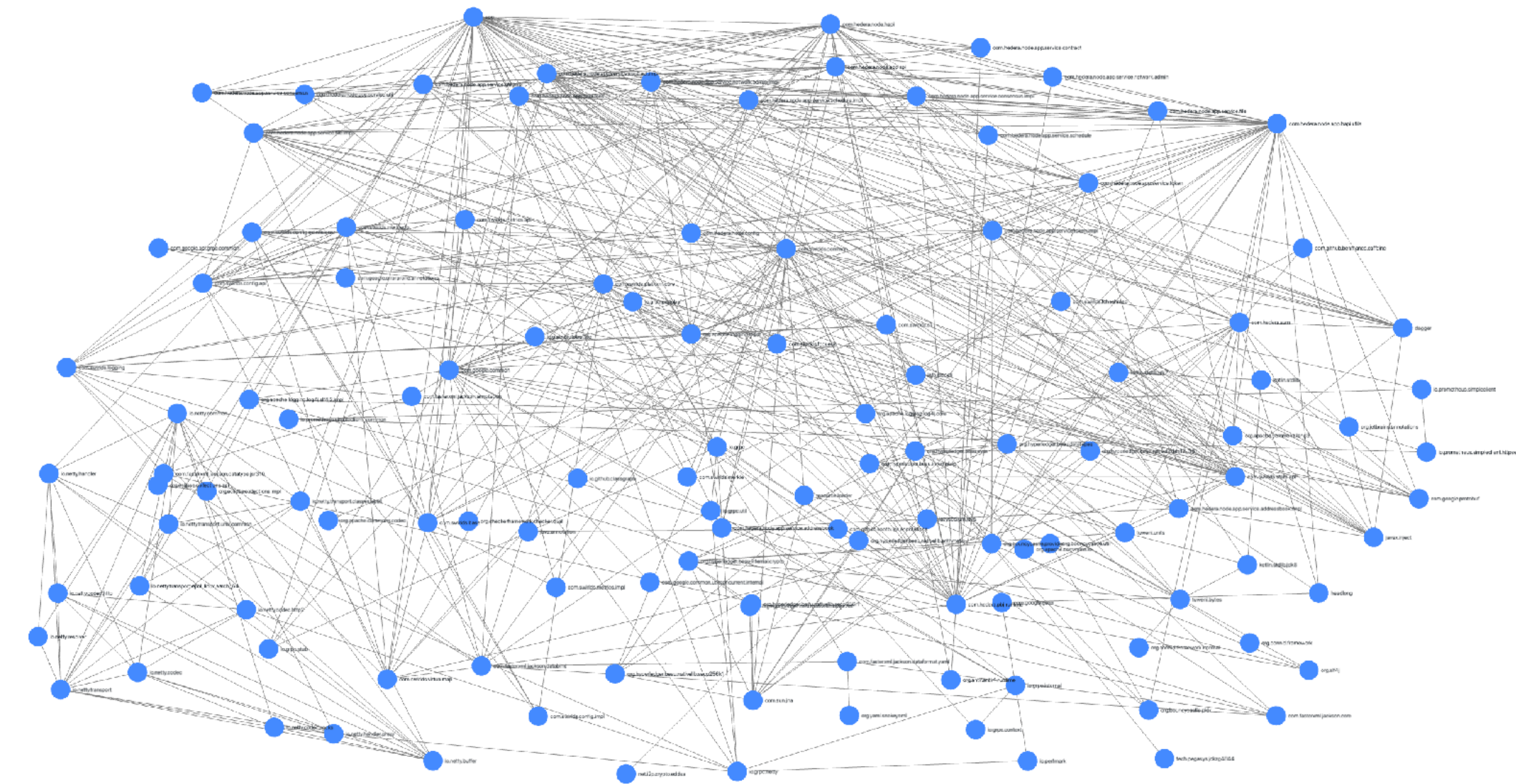
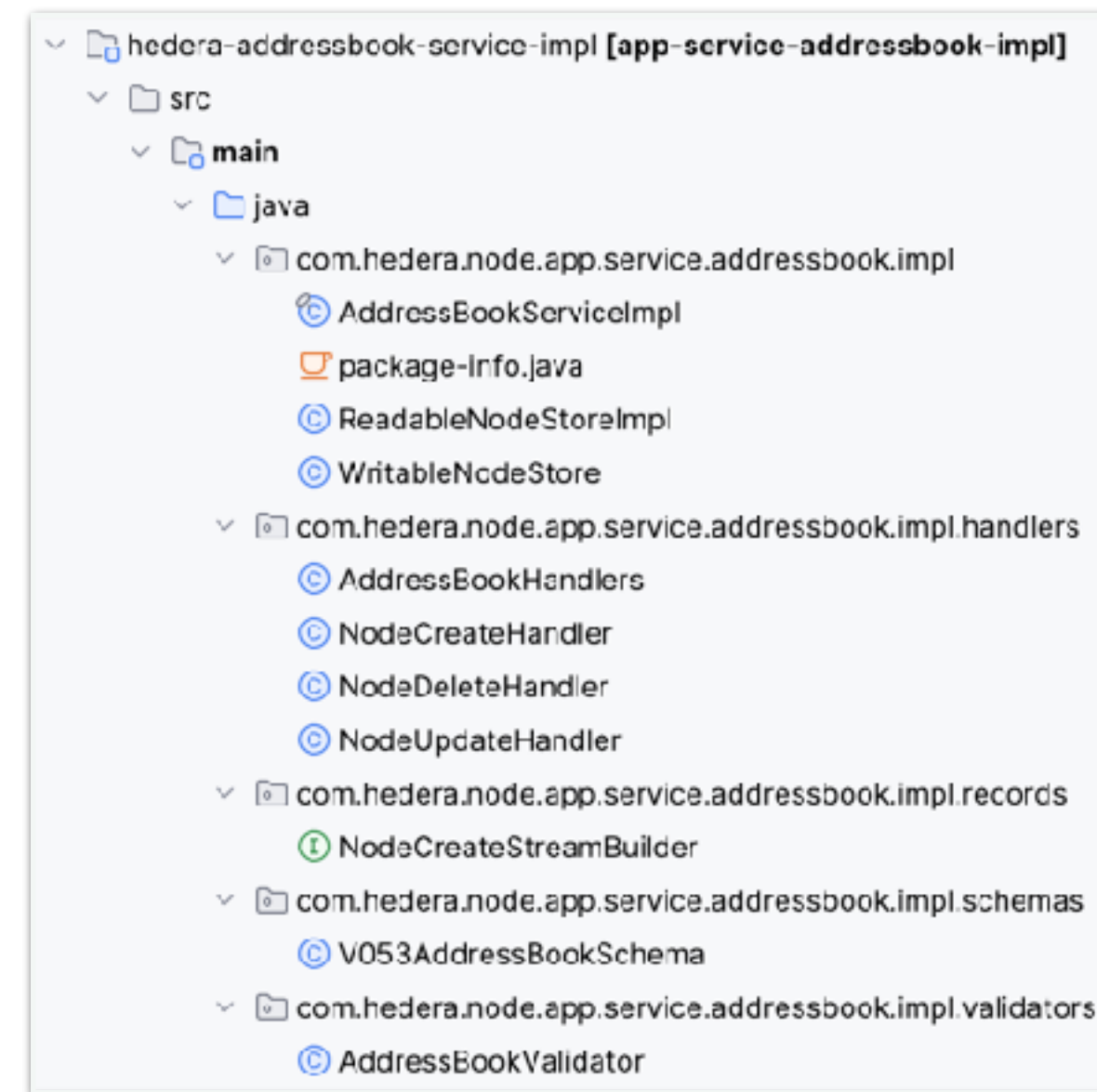


What makes us productive?

...Comprehensibility?



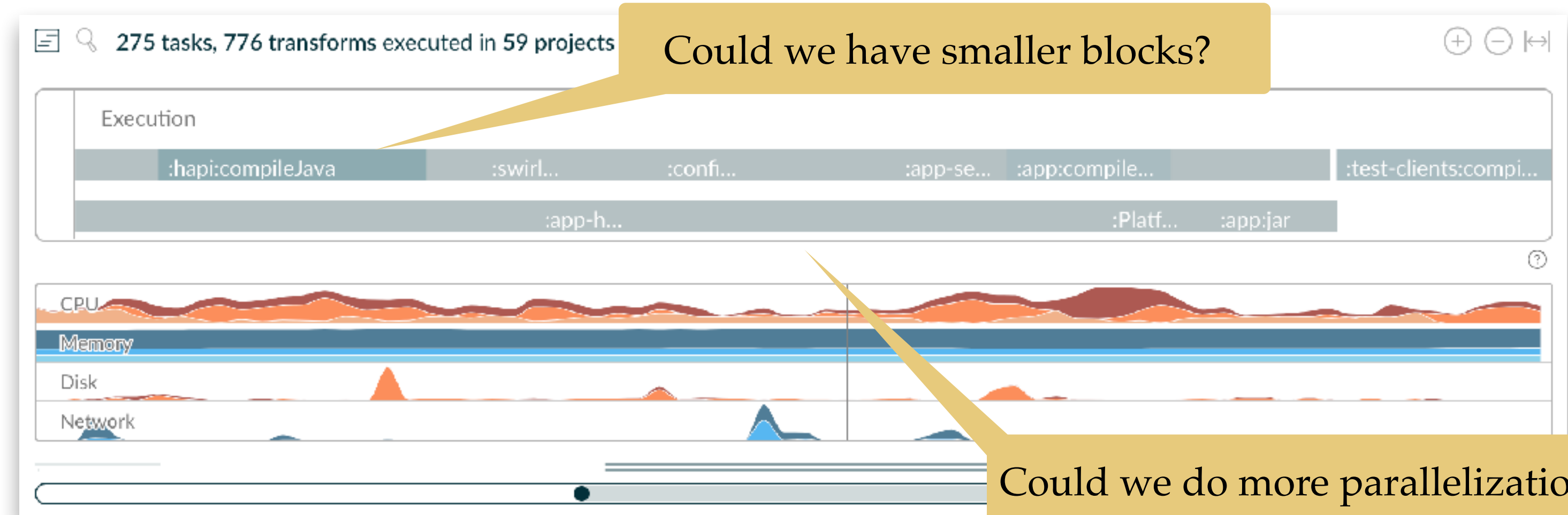
xkcd.com/1369/

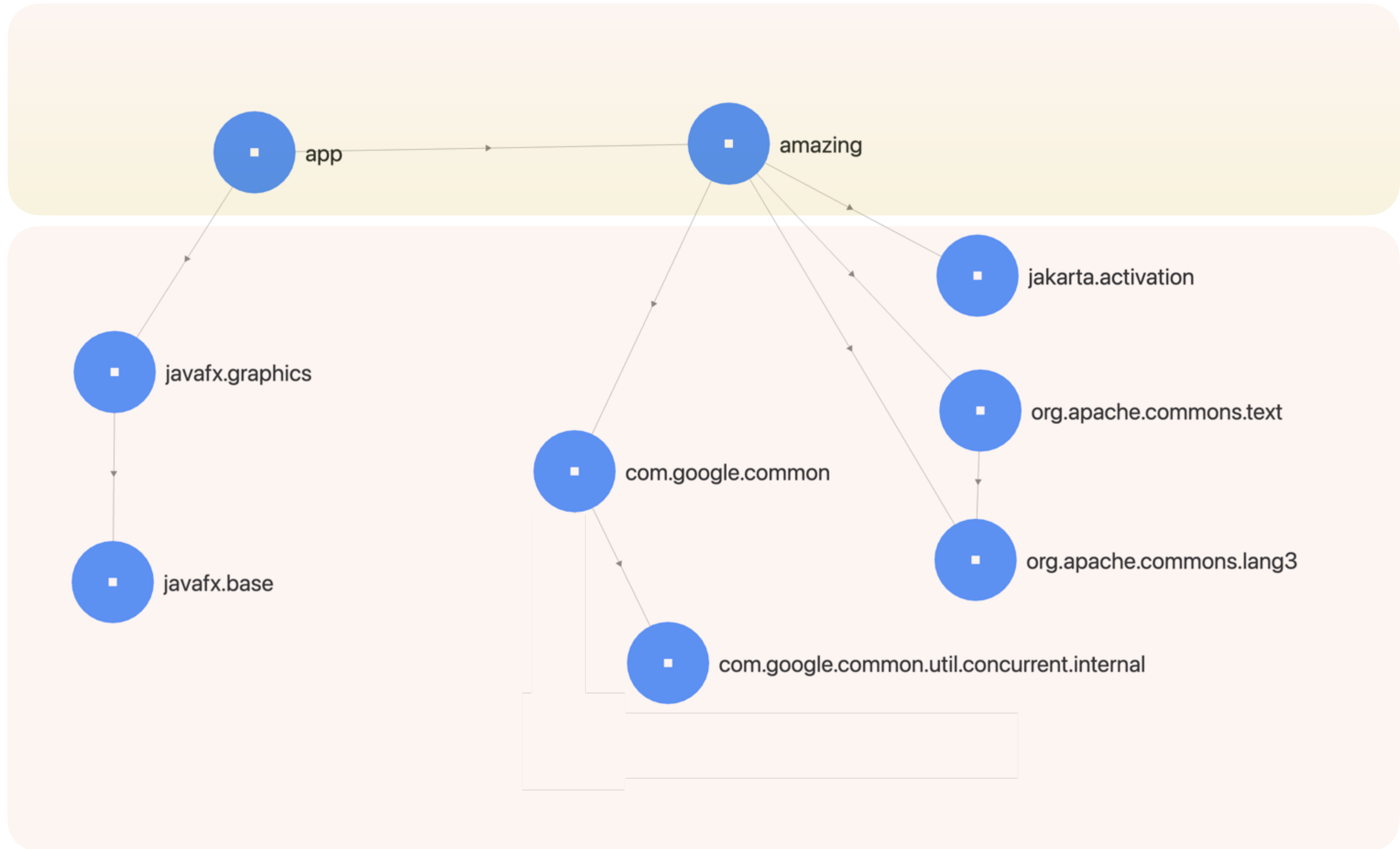


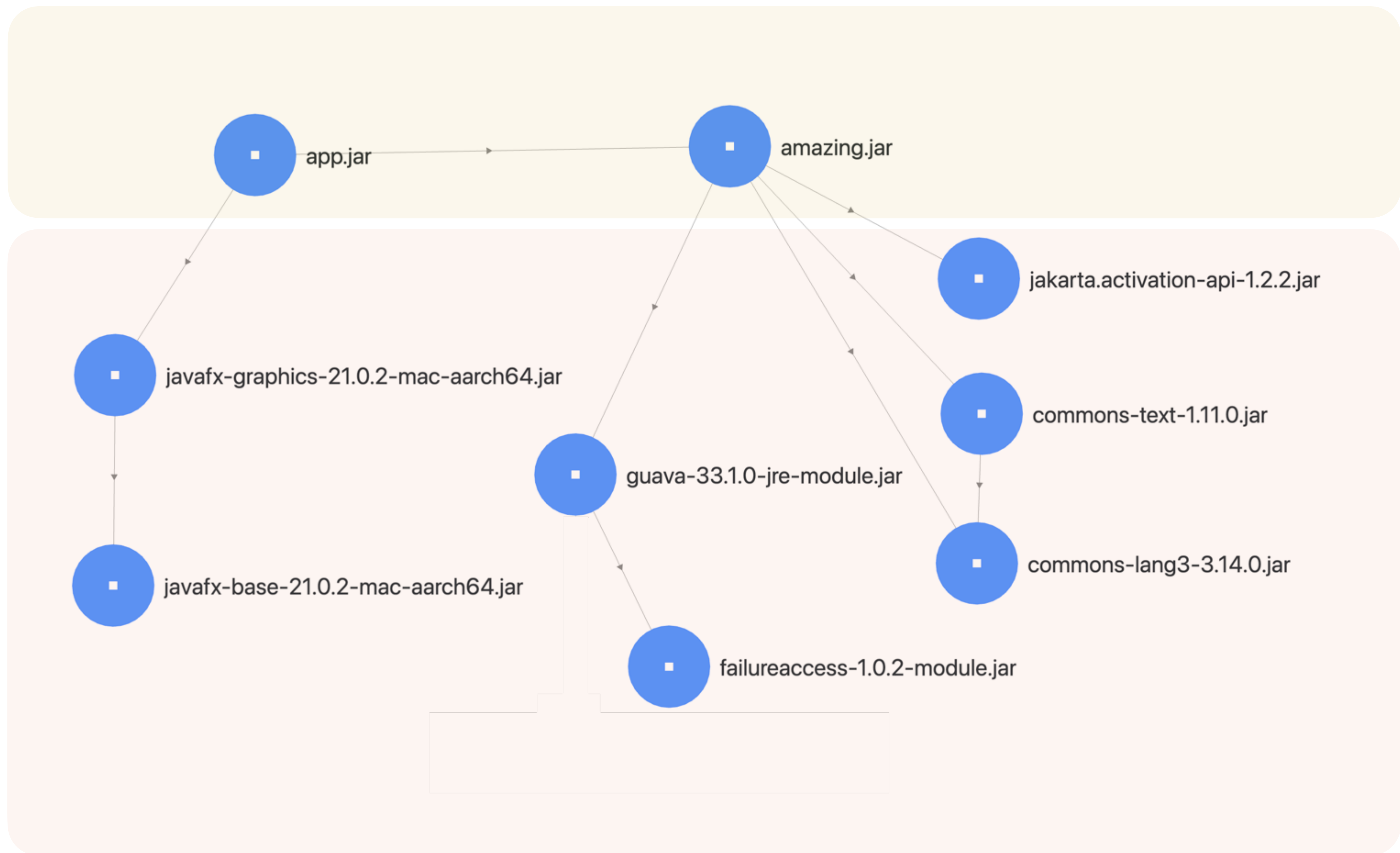
...Build Performance?



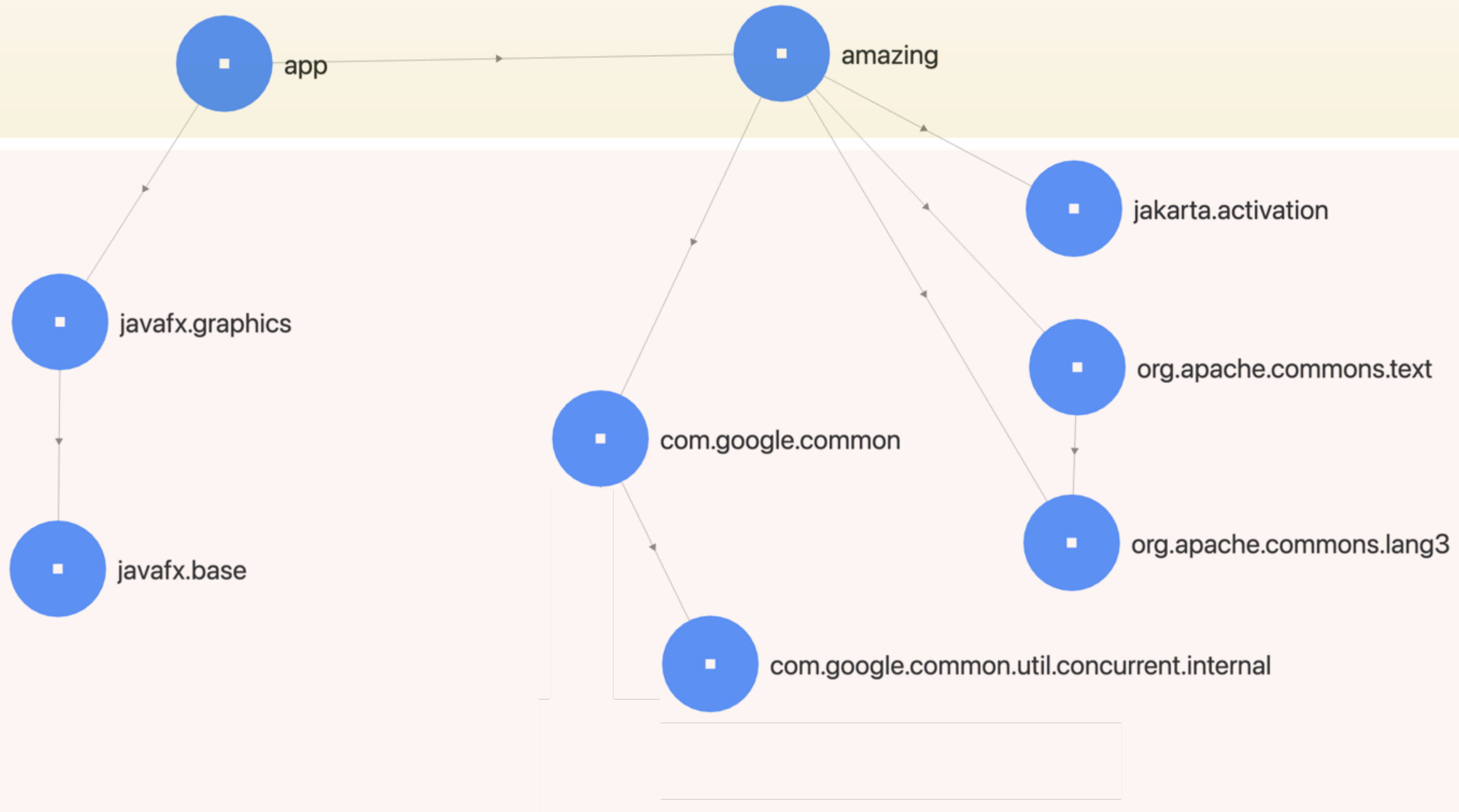
xkcd.com/303/



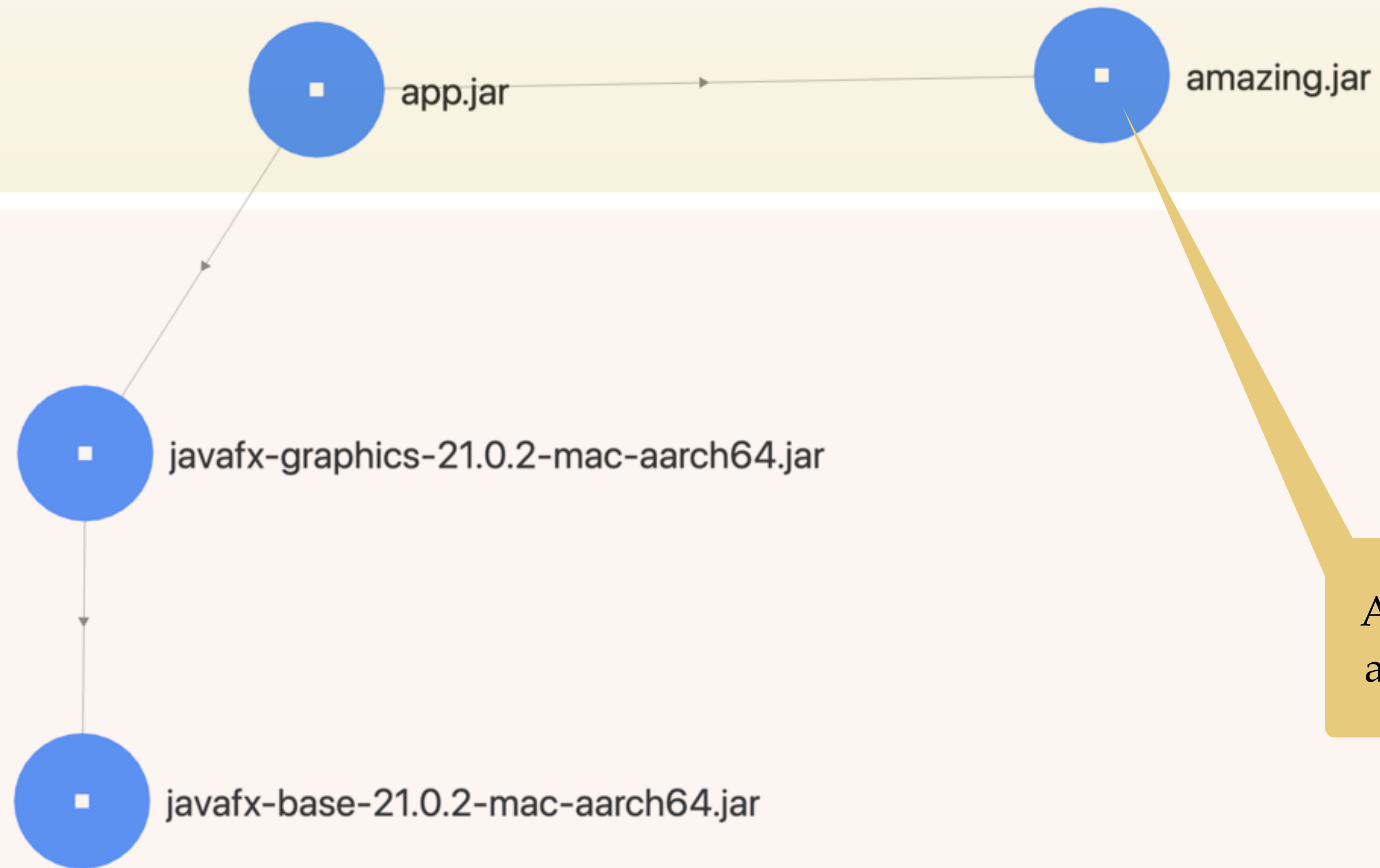




Essential Complexity #1
Scopes are important

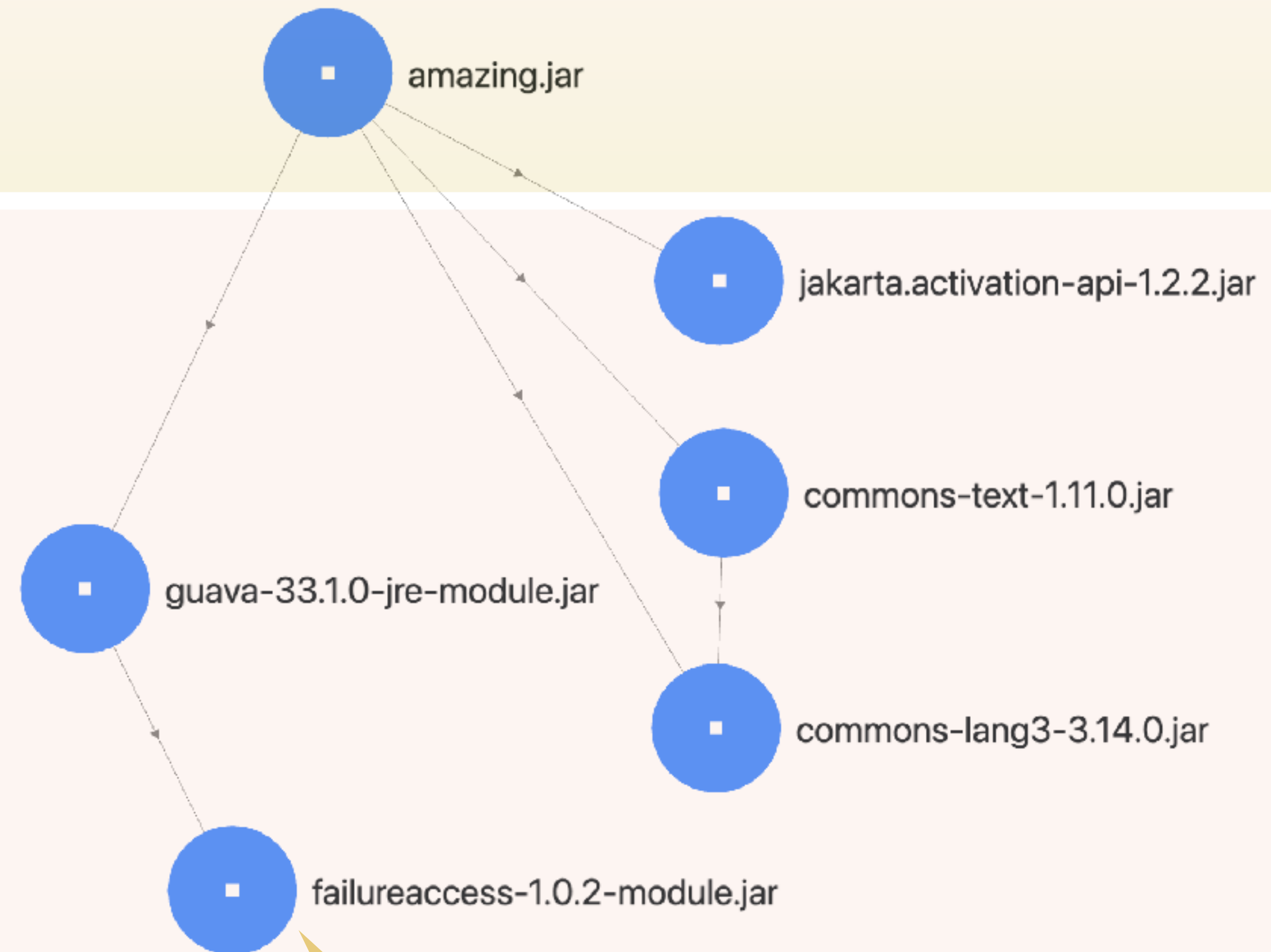


Essential Complexity #1
Scopes are important



All 3rd party dependencies
are implementation details

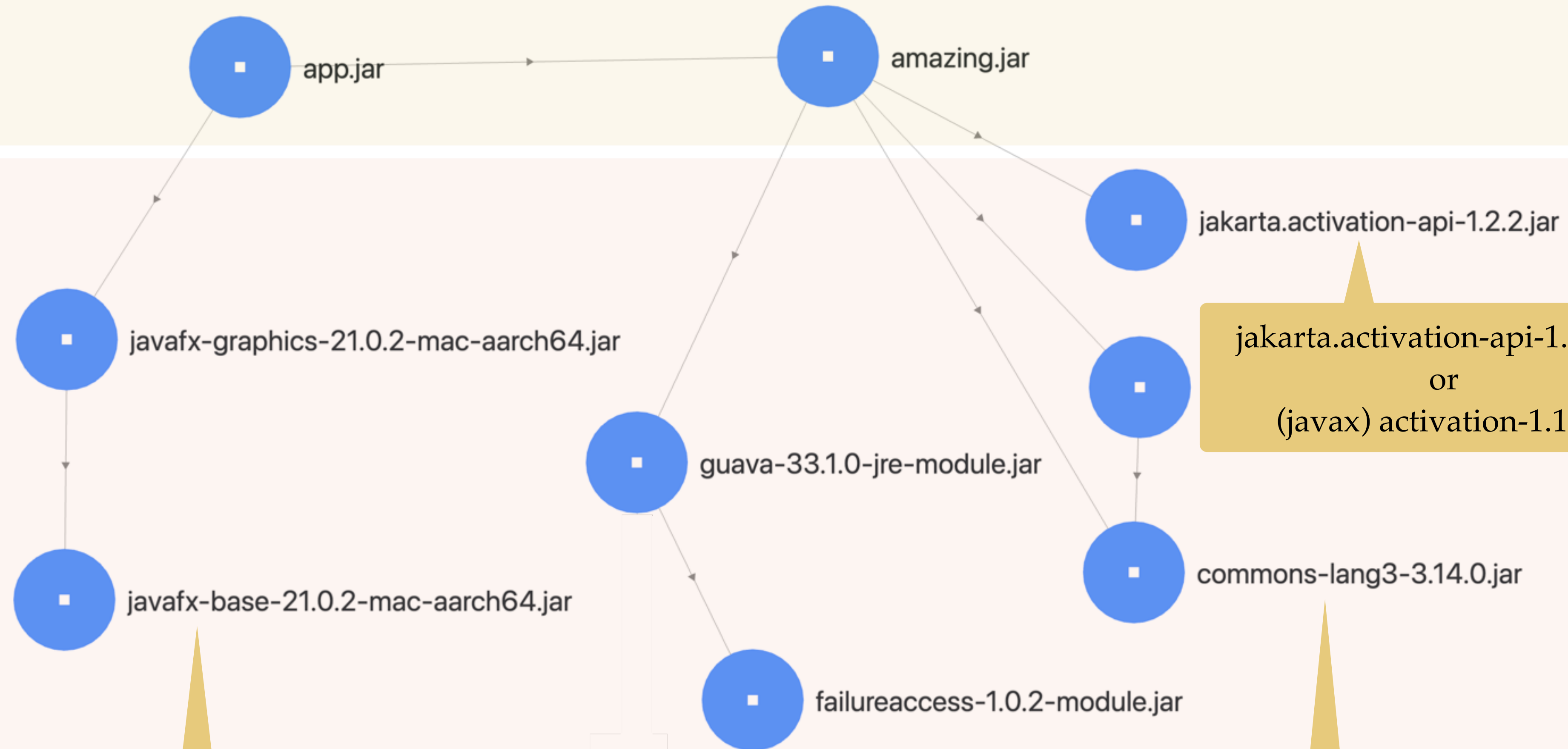
Essential Complexity #1
Scopes are important



Should this be
visible?

Essential Complexity #1
Scopes are important

Essential Complexity #2
Multiple Versions/Variants of 3rd party Modules



javafx-base-21.0.2-mac-aarch64.jar
or
javafx-base-21.0.2-win.jar

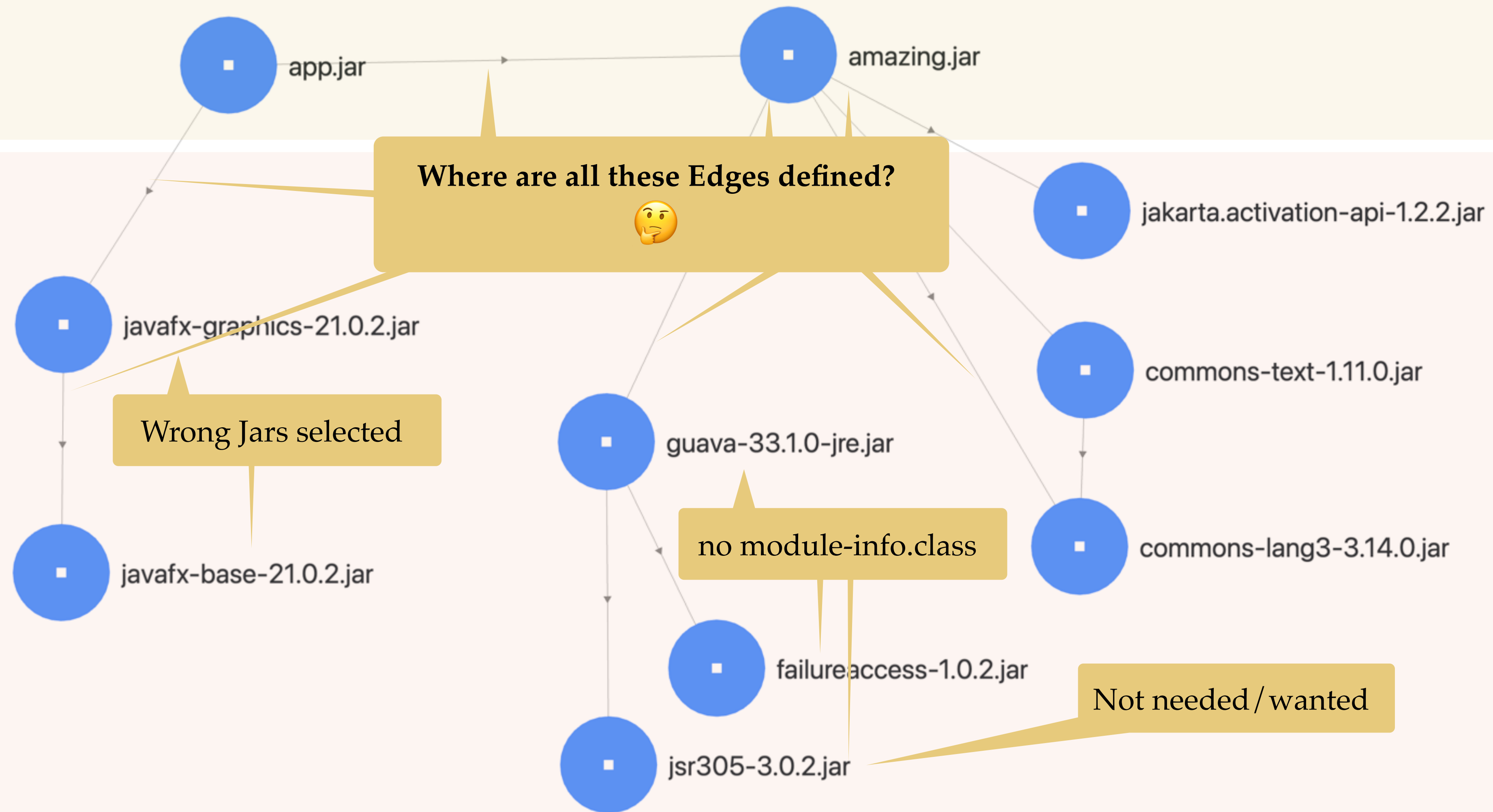
jakarta.activation-api-1.2.2.jar
or
(javax) activation-1.1.jar

commons-lang3-3.14.0.jar
or
commons-lang3-3.15.0.jar

Essential Complexity #1
Scopes are important

Essential Complexity #2
Multiple **Versions/Variants** of 3rd party Modules

“Essential” Complexity #3
The world is **not perfect**



Part 2

Accidental Complexity
introduced through
insufficient Tooling and Knowledge

github.com/hibernate/hibernate-orm/blob/main/hibernate-core/hibernate-core.gradle

~300 Lines total
~20 Lines Module Definition

```
29
30 <dependencies>
31
32 <dependency>
33 <groupId>org.slf4j</groupId>
34 <artifactId>slf4j-api</artifactId>
35 </dependency>
36
37 <dependency>
38 <groupId>org.apache.hadoop</groupId>
39 <artifactId>hadoop-auth</artifactId>
40 </dependency>
41
42 <dependency>
43 <groupId>org.apache.hadoop</groupId>
44 <artifactId>hadoop-annotations</artifactId>
45 </dependency>
46
```

```
29
30 dependencies {
31     api jakartaLibs.jpa
32     api jakartaLibs.jta
33
34     implementation libs.hcann
35     implementation libs.jandex
36     implementation libs.classmate
37     implementation libs.byteBuddy
38
39     implementation jakartaLibs.jaxbApi
40     implementation jakartaLibs.jaxb
41     implementation jakartaLibs.inject
42
43     implementation libsantlrRuntime
44
```

~300 Lines total
~100 Line Module Definition

github.com/apache/hadoop/blob/trunk/hadoop-common-project/hadoop-registry/pom.xml

Accidental Complexity #0
Module definition mixed
with other build concerns

Maven Repository: org.apache.commons

mvnrepository.com/artifact/org.apache.commons/commons-text/1.12.0

Home » org.apache.commons » commons-text » 1.12.0



Apache Commons Text » 1.12.0

The Commons Text library provides additions to the standard JDK text handling. It includes algorithms for string similarity and for calculating the distance between strings.

License	Apache 2.0
Categories	String Utilities
Tags	text string apache commons
HomePage	https://commons.apache.org/proper/commons-text
Date	Apr 16, 2024
Files	pom (19 KB) jar (245 KB) View All
Repositories	Central
Ranking	#144 in MvnRepository (See Top Artifacts) #1 in String Utilities
Used By	3,599 artifacts

Maven

Gradle

Gradle (Short)

Gradle (Kotlin)

SBT

Ivy

Grape

Leiningen

Buildr

```
<dependency>
  <groupId>org.apache.commons</groupId>
  <artifactId>commons-text</artifactId>
  <version>1.12.0</version>
</dependency>
```

Scope?

Accidental Complexity #1

Module definition mixed
with other build concerns

Accidental Complexity #2

Scopes
not cared about (enough)

Maven Repository: org.apache

mvnrepository.com/artifact/org.apache.commons/commons-text/1.12.0

Home » org.apache.commons » commons-text » 1.12.0



Apache Commons Text » 1.12.0

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Maven

Gradle

Gradle (Short)

Gradle (Kotlin)

SBT

Ivy

Grape

Leiningen

Buildr

```
implementation("org.apache.commons:commons-text:1.12.0")
```

api? runtimeOnly?

Accidental Complexity #0
Module definition mixed
with other build concerns

Accidental Complexity #1
Scopes
not cared about (enough)

repo1.maven.org/maven2/org/openjfx/javafx-graphics/21.0.2/

```
org/openjfx/javafx-graphics/21.0.2/  
├── javafx-graphics-21.0.2.pom  
├── javafx-graphics-21.0.2.module  
├── javafx-graphics-21.0.2.jar  
├── javafx-graphics-21.0.2-linux.jar  
│   └── module-info.class  
├── javafx-graphics-21.0.2-mac.jar  
│   └── module-info.class  
└── javafx-graphics-21.0.2-win.jar  
    └── module-info.class
```

No rich metadata beyond
POM 4.0.0



Empty Jar to get Maven to do
a OS-based selection
-> such hacks shouldn't be needed
-> does not work for Gradle



Java Module Descriptor
(Java Module System / JPMS)
"Java standard notation"



Accidental Complexity #0
Module definition mixed
with other build concerns

Accidental Complexity #1
Scopes
not cared about (enough)

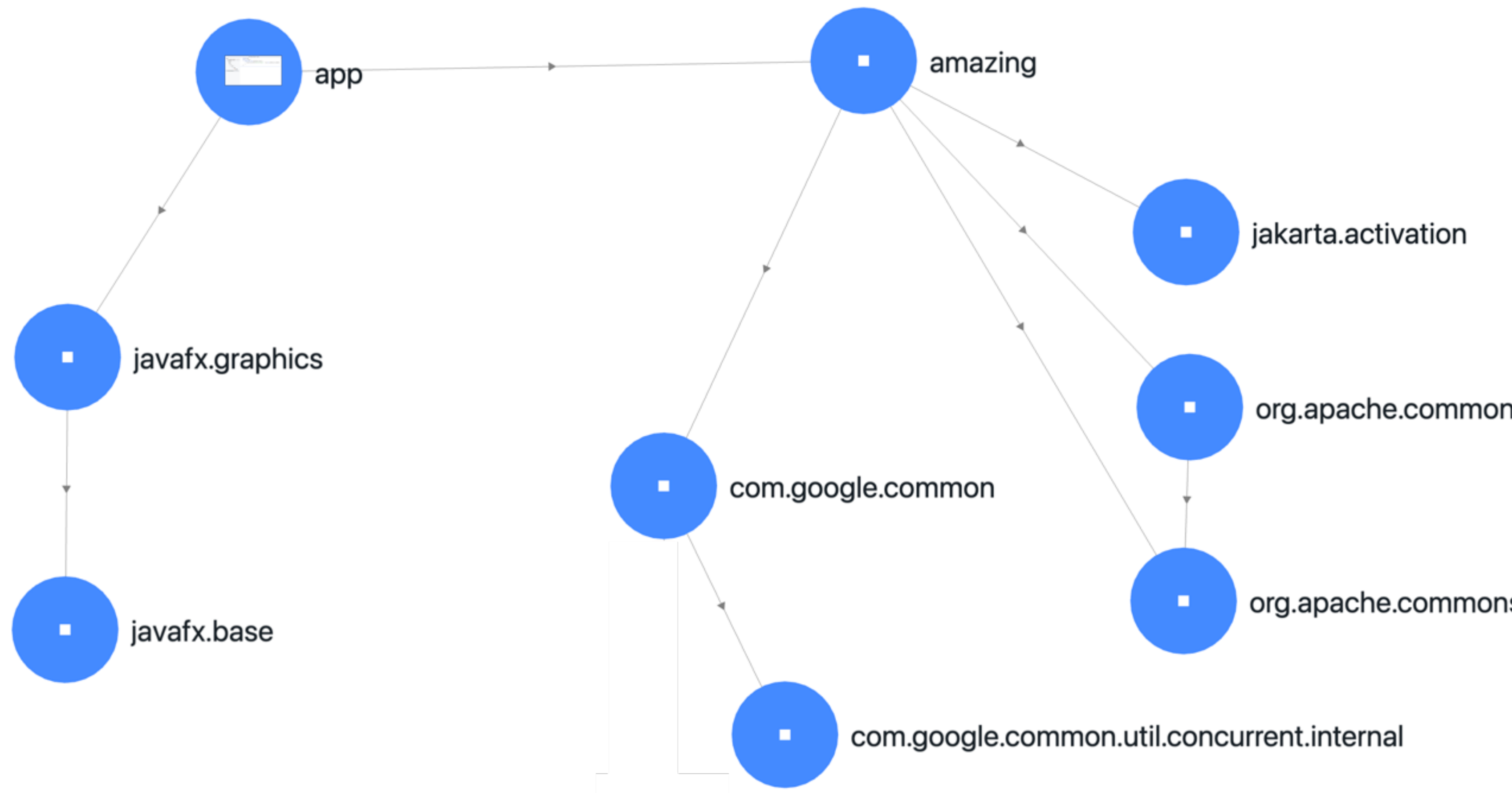
Accidental Complexity #2
Multiple Version / Variants
not cared about (enough)

Accidental Complexity #3
Metadata of 3rd party modules
is incomplete or wrong

Part 3

How to do

Better?



Project ▾

java-module-system ~/projects/gradle/hov

gradle

modules

amazing [java-module-system.amazi

src

main

java

amazing

build.gradle.kts

app [java-module-system.app]

src

main

java

app

build.gradle.kts

settings.gradle.kts

java-module-system – build.gradle.kts (:amazing)

build.gradle.kts (:amazing) ×

1dependencies {

2implementation("com.google.guava:guava")

3implementation("org.apache.commons:commons-text")

4}

5

build.gradle.kts (:app) ×

1dependencies {

2implementation(project(":amazing"))

3implementation("org.openjfx:javafx-graphics")

4}

5

 Module Definition

Project ▾

- ▾ java-module-system ~/projects/gradle/howto/java-moc
 - ▾ gradle
 - ▾ plugins
 - ▾ src
 - ▾ main
 - ▾ kotlin
 - build-performance.settings.gradle.kts
 - compile-and-test.gradle.kts
 - dependency-analysis.gradle.kts
 - java-module.gradle.kts
 - metadata-patch.gradle.kts
 - module-locations.settings.gradle.kts
 - targets.gradle.kts
 - build.gradle.kts
 - ▾ versions [java-module-system.versions]
 - build.gradle.kts
 - > modules
 - settings.gradle.kts

```
plugins {  
    id("java")  
    id("org.gradle.java-module-testing")  
}  
  
java {  
    toolchain.languageVersion = JavaLanguageVersion.of(21)  
}  
  
tasks.withType<JavaCompile>().configureEach {  
    options.encoding = "UTF-8"  
}  
  
tasks.withType<Test>().configureEach {  
    maxParallelForks = 4  
    maxHeapSize = "1g"  
}
```



Other Build Concerns

Project ▾

- ▾ java-module-system ~/projects/gradle/howto/
 - ▾ gradle
 - ▾ plugins
 - ▾ src
 - ▾ main
 - ▾ kotlin
 - build-performance.settings.gr
 - compile-and-test.gradle.kts
 - dependency-analysis.gradle.k
 - java-module.gradle.kts
 - metadata-patch.gradle.kts
 - module-locations.settings.gra
 - targets.gradle.kts
 - build.gradle.kts
 - ▾ versions [java-module-system.versions]
 - build.gradle.kts
 - > modules
 - settings.gradle.kts

```
jvmDependencyConflicts { // Patch Maven/Gradle metadata (*.pom / *.module) ✓
    patch {
        module("com.google.guava:guava") {
            removeDependency("com.google.code.findbugs:jsr305")
            removeDependency("org.checkerframework:checker-qual")
            removeDependency("com.google.errorprone:error_prone_annotations")
        }
        listOf("base", "graphics", "controls").forEach { jfxModule ->
            module("org.openjfx:javafx-$jfxModule") {
                addTargetPlatformVariant("linux", OperatingSystemFamily.LINUX)
                addTargetPlatformVariant("mac", OperatingSystemFamily.MACOS,
                addTargetPlatformVariant("mac-aarch64", OperatingSystemFamily
                addTargetPlatformVariant("win", OperatingSystemFamily.WINDOWS
            }
        }
    }
}
```

Project ▾

java-module-system ~/projects/gradle/hov

gradle

modules

amazing [java-module-system.amazi]

src

main

java

amazing

build.gradle.kts

app [java-module-system.app]

src

main

java

app

build.gradle.kts

settings.gradle.kts

java-module-system – build.gradle.kts (:amazing)

build.gradle.kts (:amazing) ×

1 dependencies {

2 implementation("com.google.guava:guava")

3 implementation("org.apache.commons:commons-text")

4 }

5

build.gradle.kts (:app) ×

1 dependencies {

2 implementation(project(":amazing"))

3 implementation("org.openjfx:javafx-graphics")

4 }

5

 Module Definition

Project ▾

java-module-system ~/projects/gradle/hov

> gradle

modules

amazing [java-module-system.amazi

src

main

java

amazing

module-info.java

app [java-module-system.app]

src

main

java

app

module-info.java

settings.gradle.kts

java-module-system – module-info.java (app)

module-info.java (amazing) ×

1 module amazing {

2 requires com.google.common;

3 requires org.apache.commons.text;

4

5 exports amazing;

6 }

module-info.java (app) ×

1 module app {

2 requires amazing;

3 requires javafx.graphics;

4

5 exports app;

6 }

 Module Definition

Project ▾

- ▾ java-module-system ~/projects/gradle
 - ▾ gradle
 - ▾ plugins
 - > src
 - build.gradle.kts
 - versions [java-module-system]
 - build.gradle.kts
 - > modules
 - settings.gradle.kts

```
plugins {  
    `kotlin-dsl`  
}  
  
repositories {  
    gradlePluginPortal()  
}  
  
dependencies {  
    implementation("com.autonomousapps:dependency-analysis-gradle-plugin:1.32.0")  
    implementation("com.gradle:develocity-gradle-plugin:3.17.5")  
    implementation("org.gradlex:extra-java-module-info:1.8")  
    implementation("org.gradlex:java-module-dependencies:1.7")  
    implementation("org.gradlex:java-module-packaging:0.1")  
    implementation("org.gradlex:java-module-testing:1.4")  
    implementation("org.gradlex:jvm-dependency-conflict-resolution:2.1.1")  
}
```



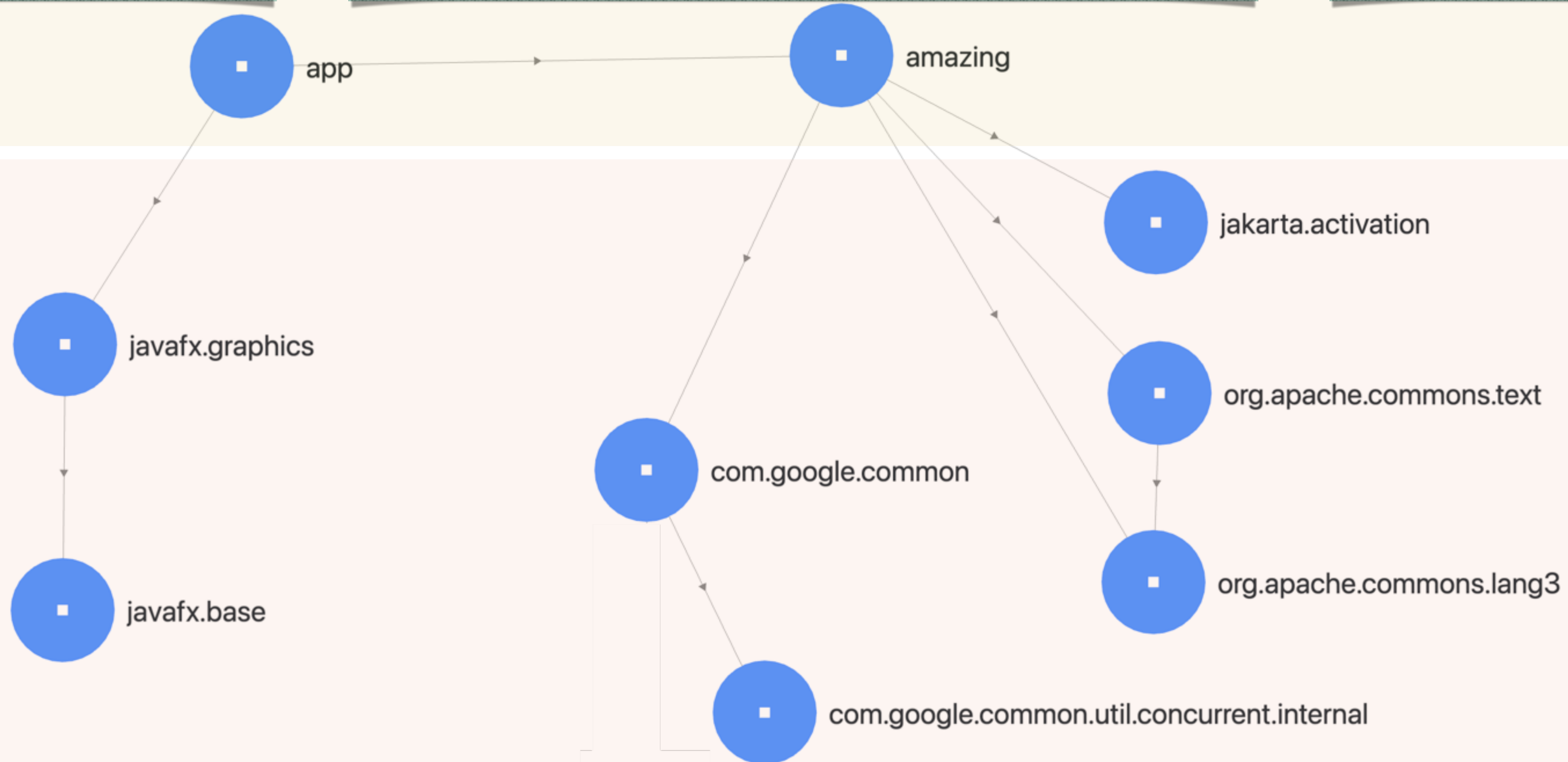
Plugins for Module Management

Summary

Essential Complexity #1
Scopes are important

Essential Complexity #2
Multiple **Versions/Variants** of 3rd party Modules

“Essential” Complexity #3
The world is **not perfect**



**Dedicated places for
dependency definitions**

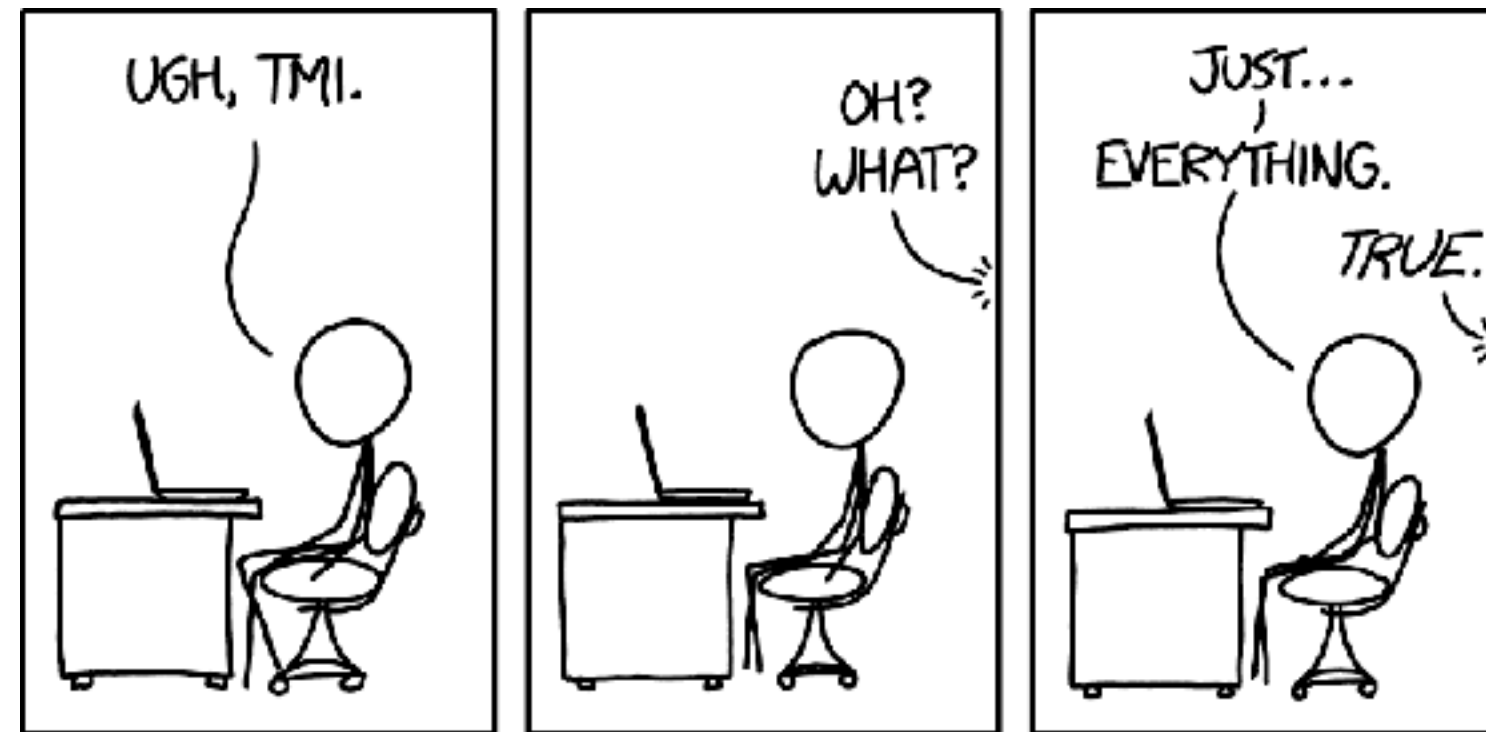
**Unified syntax for
scope definition**

Variant-aware conflict
detection and resolution
(as provided in Gradle)

Central patch file(s) to
enrich an fix metadata

What makes us (more) productive?

...Comprehensibility?

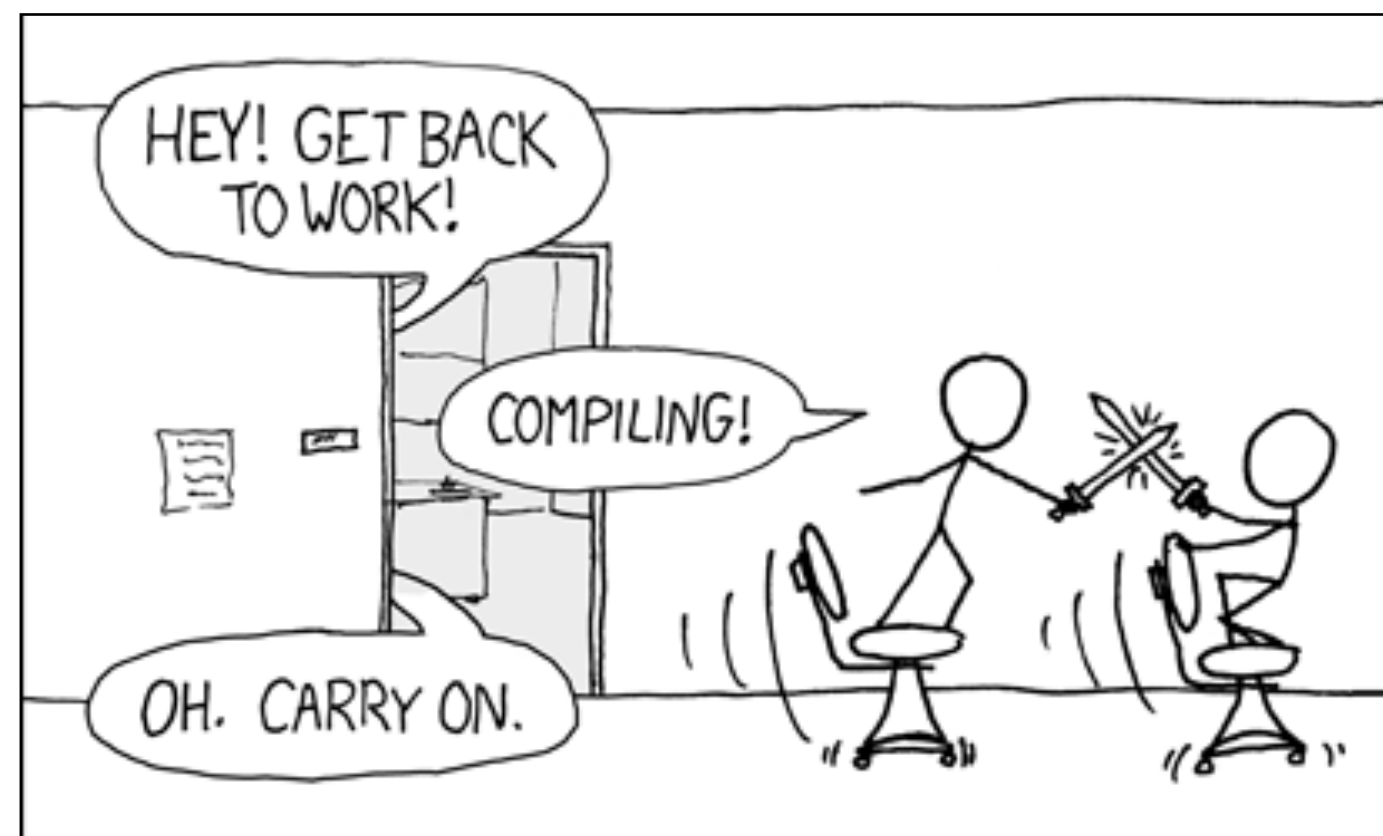


xkcd.com/1369/

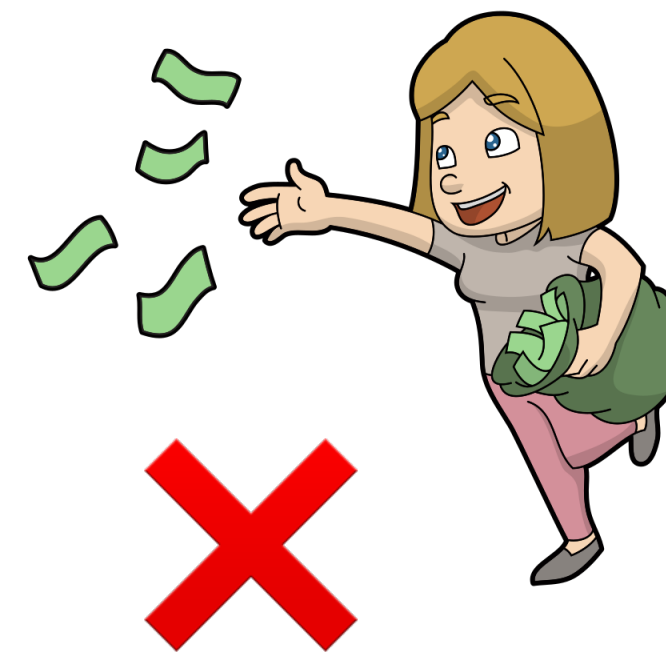
With infinite
speed/memory/money



...Build Performance?

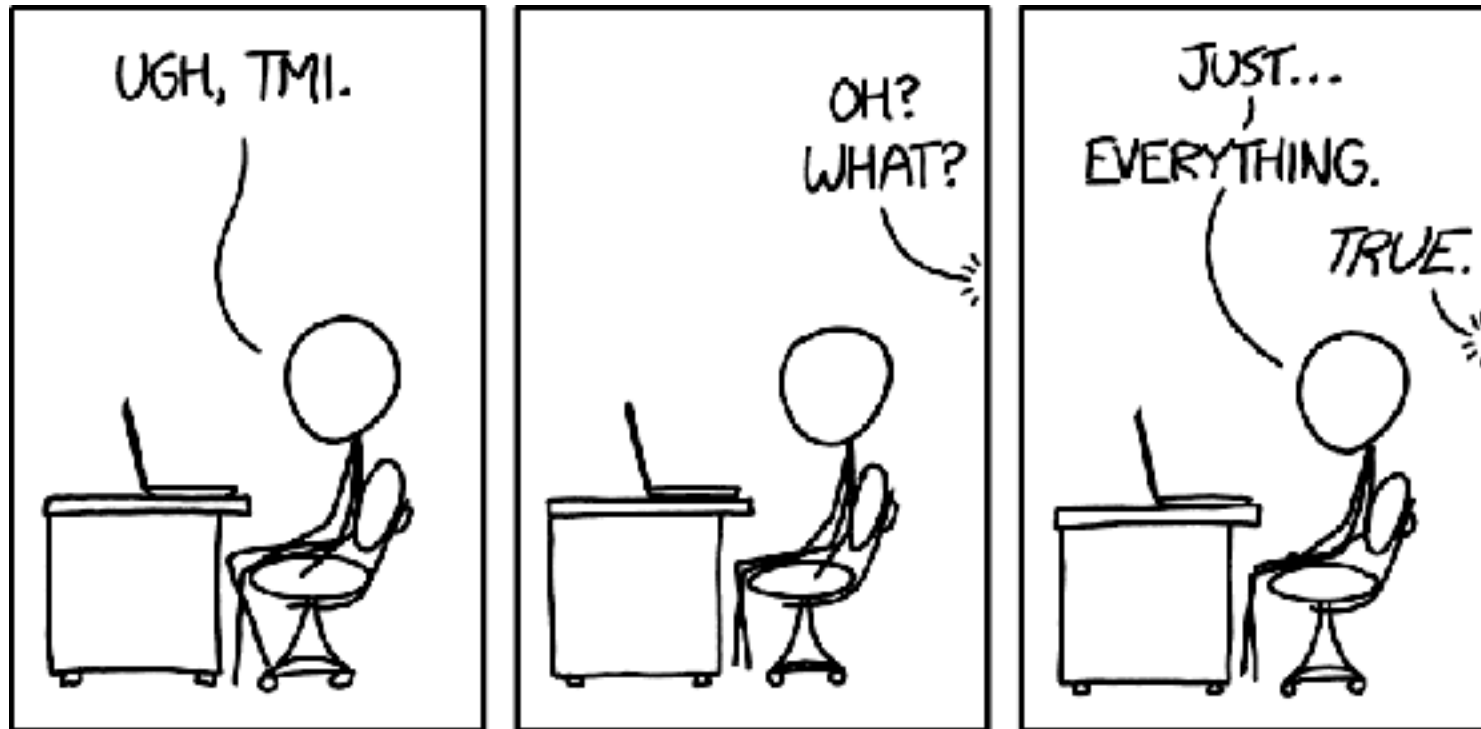


xkcd.com/303/



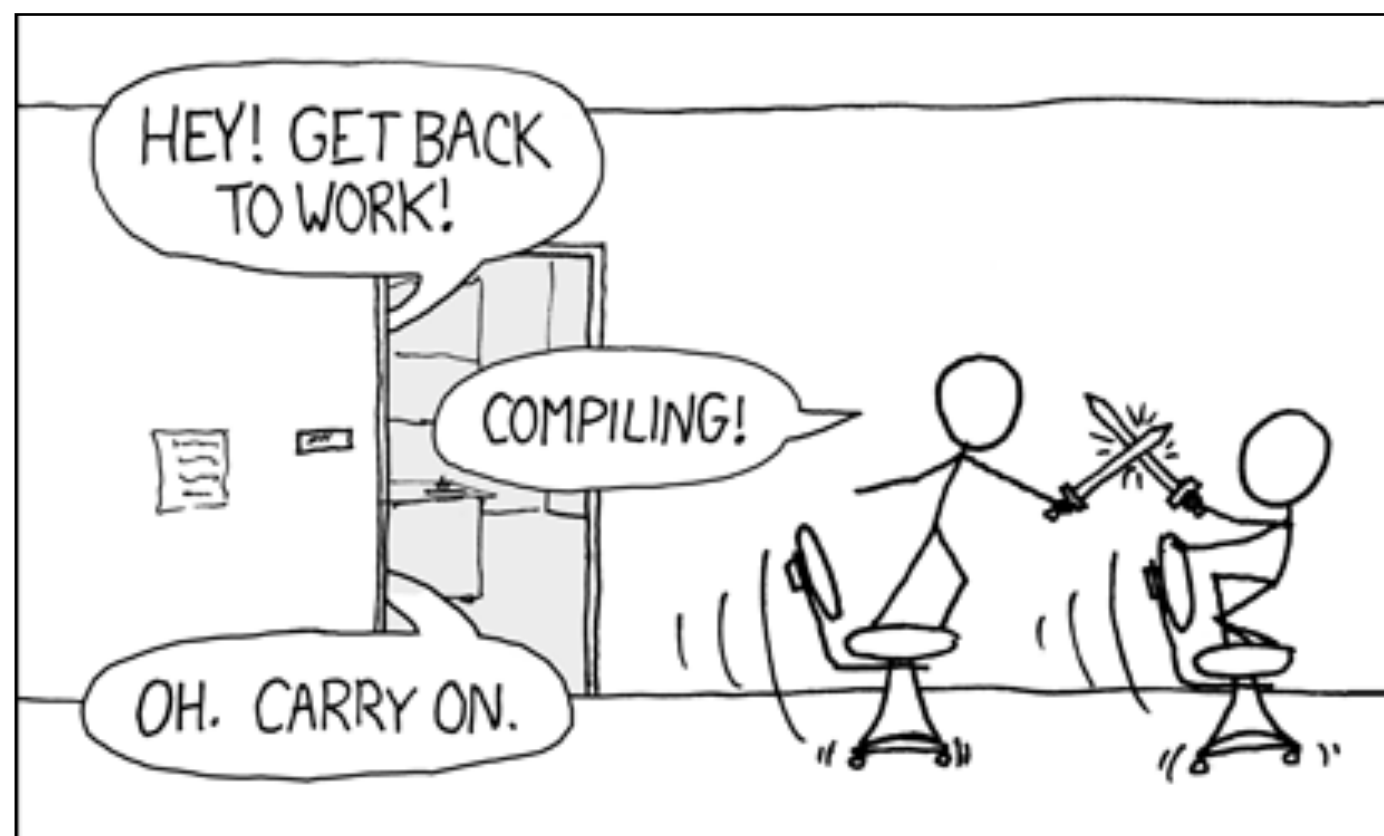
What makes us (more) productive?

...Comprehensibility?



xkcd.com/1369/

...Build Performance?



xkcd.com/303/

Current Focus of off-the-shelf DPE Tools*



discover
problematic
modules

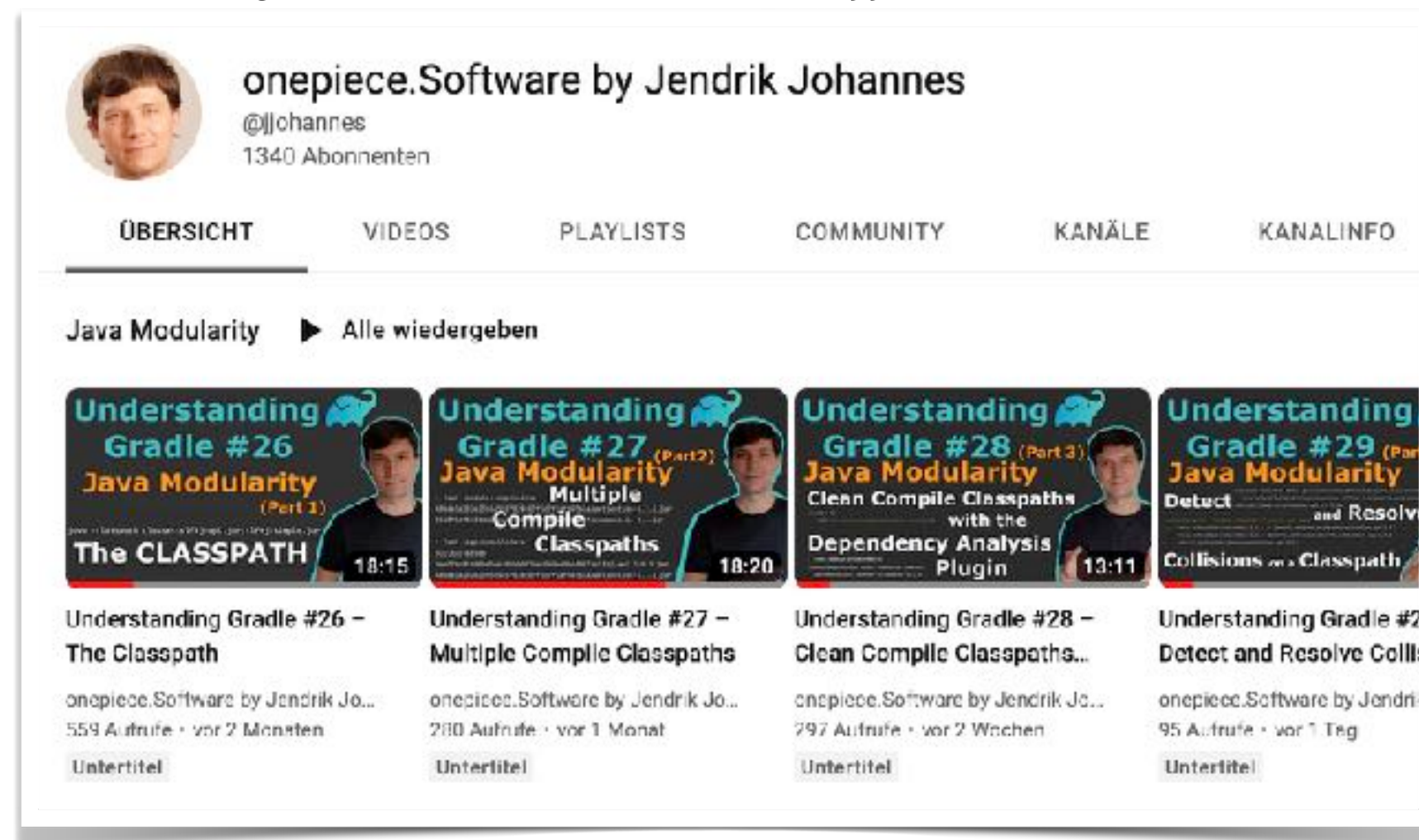


better
build speed
through small
and decoupled
modules

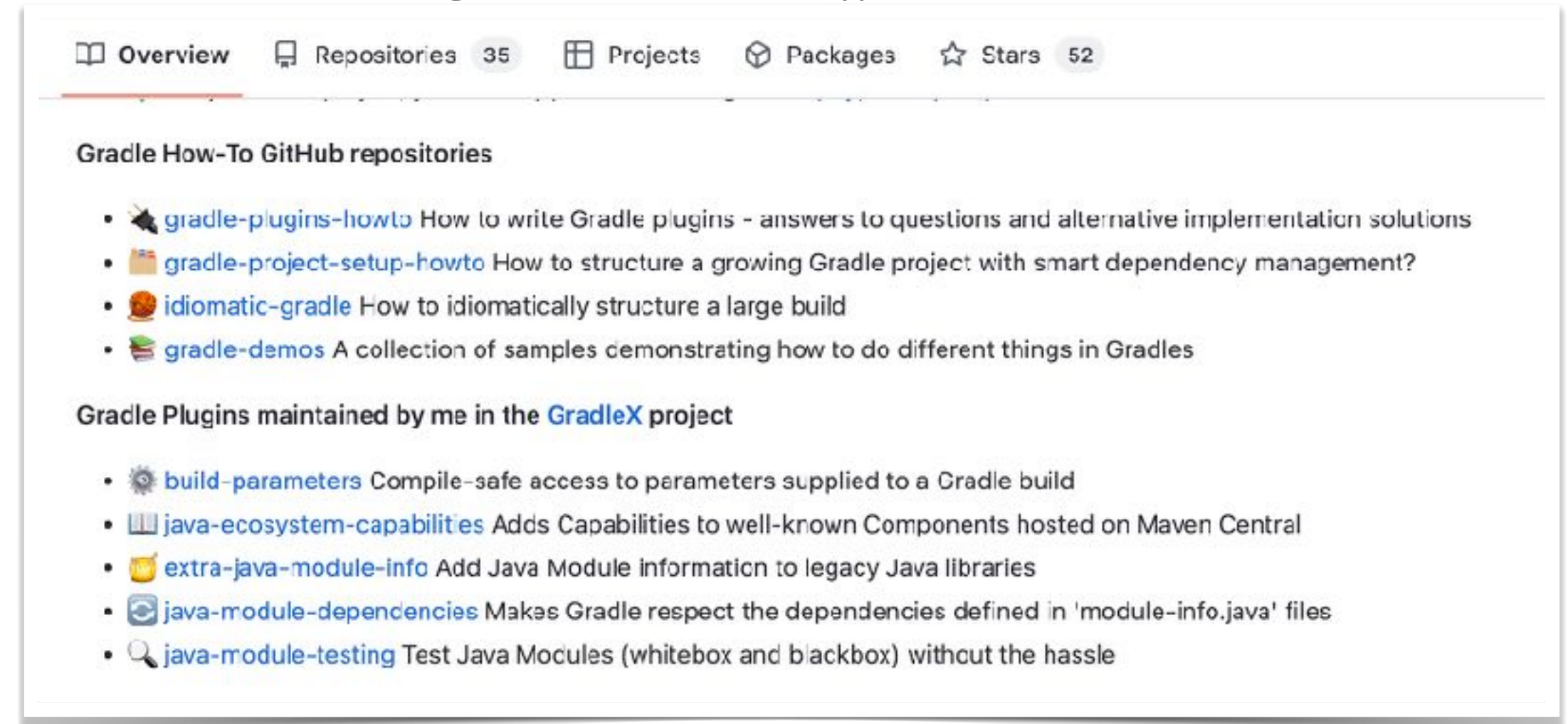


*subjective impression

[youtube.com / @jjohannes](https://youtube.com/@jjohannes)



[github.com / jjohannes](https://github.com/jjohannes)



[github.com / jjohannes / java-module-system](https://github.com/jjohannes/java-module-system)

[github.com / jjohannes / gradle-project-setup-howto](https://github.com/jjohannes/gradle-project-setup-howto)

[github.com / hashgraph / hedera-services](https://github.com/hashgraph/hedera-services)

stay in touch

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