Spring Framework 5.0 on JDK 8 & 9

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Spring Framework 5.0 (Overview)

- **5.0 GA as of September 28th, 2017 – one week after JDK 9 GA!**
- **Embracing JDK 9 as well as Kotlin and Project Reactor**
- **Driven by functional API design and reactive architectures**

- **Major baseline upgrade: Java SE 8+, Java EE 7+**
  - JDK 8, Servlet 3.1, Bean Validation 1.1, JPA 2.1, JMS 2.0
  - support for JUnit 5 (next to JUnit 4.12)

- **Comprehensive integration with Java EE 8 API level**
  - Servlet 4.0, Bean Validation 2.0, JPA 2.2, JSON Binding API 1.0
  - e.g. Tomcat 9.0, Hibernate Validator 6.0, Apache Johnzon 1.1

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Many Community Contributions

spring-projects / spring-framework

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Code | Pull requests 170 | Wiki | Insights | Settings

Filters | is:pr author:igor-suhorukov | Labels | Milestones | New pull request

Clear current search query, filters, and sorts

0 Open | 50 Closed | Author | Labels | Projects | Milestones | Reviews | Assignee | Sort

- **Polish: all branches in a conditional structure should not have exactly the same implementation** ✓
  #1766 by igor-suhorukov was merged 2 days ago
- **Polish: remove redundant check** ✓
  #1765 by igor-suhorukov was merged 2 days ago
- **Polish: short-circuit logic should be used in boolean contexts** ✓
  #1764 by igor-suhorukov was merged 2 days ago
- **Polish: simplify boolean method return value** ✓ 2
  #1763 by igor-suhorukov was closed 2 days ago
- **Polish: remove unreachable statement** ✓ 1
  #1760 by igor-suhorukov was closed 2 days ago
- **Polish: nested "enum"s should not be declared static** ✓ 1
  #1759 by igor-suhorukov was closed 3 days ago
- **Polish: avoid unnecessary autoboxing** ✓
  #1757 by igor-suhorukov was merged 3 days ago

JDK 8

Rich Java 8 Development Support in Spring Framework 4.3

- **Spring Framework 4.3 delivers a rich Java 8 experience for applications**
  - despite being Java 6 based in the core framework itself
  - feels like a Java 8 based framework already (for many scenarios)

- **Reflectively adapting to the use of Java 8 constructs in user code**
  - injection points, handler method parameters
  - Optional, CompletableFuture, java.time, etc

- **Alignment with Java 8 conventions**
  - callback interfaces as “functional interfaces” for lambda expressions
  - repeatable annotation declarations (simply ignored on Java 6 & 7)

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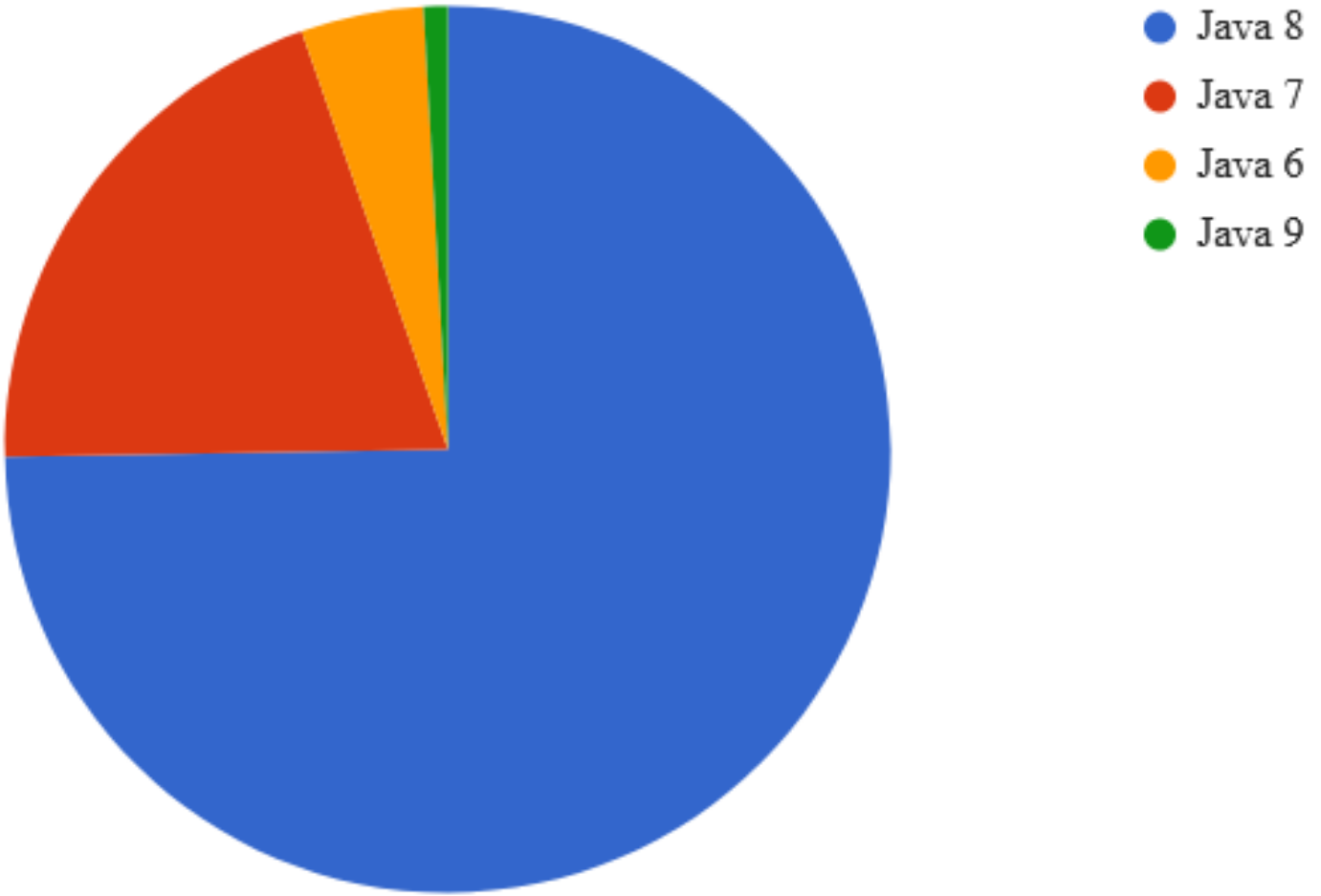
Java 8 Adoption as of October 2017 (Survey by Baeldung)



Java 8+ Baseline in Spring Framework 5.0

- **Entire framework codebase is Java 8 based**
  - internal use of lambda expressions and collection streams
  - efficient introspection of constructor/method parameter signatures
- **Framework APIs can expose Java 8 API types**
  - Executable, CompletableFuture, Instant, Duration
  - java.util.function interfaces: Supplier, Consumer, Predicate
- **Framework interfaces make use of Java 8 default methods**
  - existing methods with default implementations *for convenience*
  - new methods with default implementations *for backwards compatibility*

ObjectProvider API Design with java.util.function

- `@Autowired ObjectProvider<MyBean> myBeanProvider`

- **Original ObjectProvider methods (dating back to 4.3)**
  - `T getIfAvailable()`
  - `T getIfUnique()`

- **Overloaded variants with java.util.function callbacks (new in 5.0)**
  - `T getIfAvailable(Supplier<T> defaultSupplier)`
  - `void ifAvailable(Consumer<T> dependencyConsumer)`
  - `T getIfUnique(Supplier<T> defaultSupplier)`
  - `void ifUnique(Consumer<T> dependencyConsumer)`

Programmatic Bean Registration with Java 8

```
// Starting point may also be AnnotationConfigApplicationContext
GenericApplicationContext ctx = new GenericApplicationContext();
ctx.registerBean(Foo.class);
ctx.registerBean(Bar.class,
        () -> new Bar(ctx.getBean(Foo.class)));

// Or alternatively with some bean definition customizing
GenericApplicationContext ctx = new GenericApplicationContext();
ctx.registerBean(Foo.class, Foo::new);
ctx.registerBean(Bar.class,
        () -> new Bar(ctx.getBean(Foo.class)),
        bd -> bd.setLazyInit(true));
```

Functional Web Endpoints with Method References

```
RouterFunction<?> router =
    route(GET("/users/{id}"), handlerDelegate::getUser)
    .andRoute(GET("/users"), handlerDelegate::getUsers);


public class MyReactiveHandlerDelegate {
    ...

    public Mono<ServerResponse> getUser(ServerRequest request) {
        Mono<User> user = Mono.justOrEmpty(request.pathVariable("id"))
            .map(Long::valueOf).then(this.repository::findById);
        return ServerResponse.ok().body(user, User.class);
    }

    public Mono<ServerResponse> getUsers(ServerRequest request) {
        Flux<User> users = this.repository.findAll();
        return ServerResponse.ok().body(users, User.class);
    }
}
```

Functional Web Endpoints in Lambda Style

```
UserRepository repository = ...;

RouterFunction<?> router =
    route(GET("/users/{id}"),
        request -> {
            Mono<User> user = Mono.justOrEmpty(request.pathVariable("id"))
                .map(Long::valueOf).then(repository::findById);
            return ServerResponse.ok().body(user, User.class);
        })
    .andRoute(GET("/users"),
        request -> {
            Flux<User> users = repository.findAll();
            return ServerResponse.ok().body(users, User.class);
        });
```

Java 8+ Open Source Frameworks in Q1 2018

- JUnit 5
- Reactor 3
- Tomcat 9
- Jetty 9.3 & 9.4
- Undertow 2.0
- Hibernate ORM 5.2 & 5.3
- Hibernate Validator 6.0

(certainly more to follow in the course of this year)

JDK 9+

JDK 9: Not Just Jigsaw

- **Many general JVM improvements**
  - Compact Strings, G1 by default, custom JVM distributions (jlink)
- **TLS stack ready for HTTP/2 out of the box**
  - e.g. for Tomcat 9 to enable HTTP/2 without JVM modifications
- **Jigsaw – module path as structured alternative to class path**
  - symbolic module names and requires/exports metadata for jar files
- **JDK 9 is GA as of late September 2017**
  - Spring 5 is fully aligned in terms of JDK 9's policies and constraints

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JDK 9's Modular Nature

- **JDK 9 itself comes decomposed into several modules (as jmod files)**
  - java.base, java.sql, java.activation, java.logging, java.naming, java.xml.bind
  - Common Annotations deprecated (for JDK inclusion) in a separate module
- **Custom JVM distributions via jlink**
  - custom runtime image with selected modules plus dependencies
  - JAXB etc easily replaceable with standalone implementations
- **Frameworks have to revisit their dependency assumptions**
  - JUL, JNDI, JAXB, Common Annotations to be considered as optional
  - no unnecessary hard API references in framework APIs & SPIs

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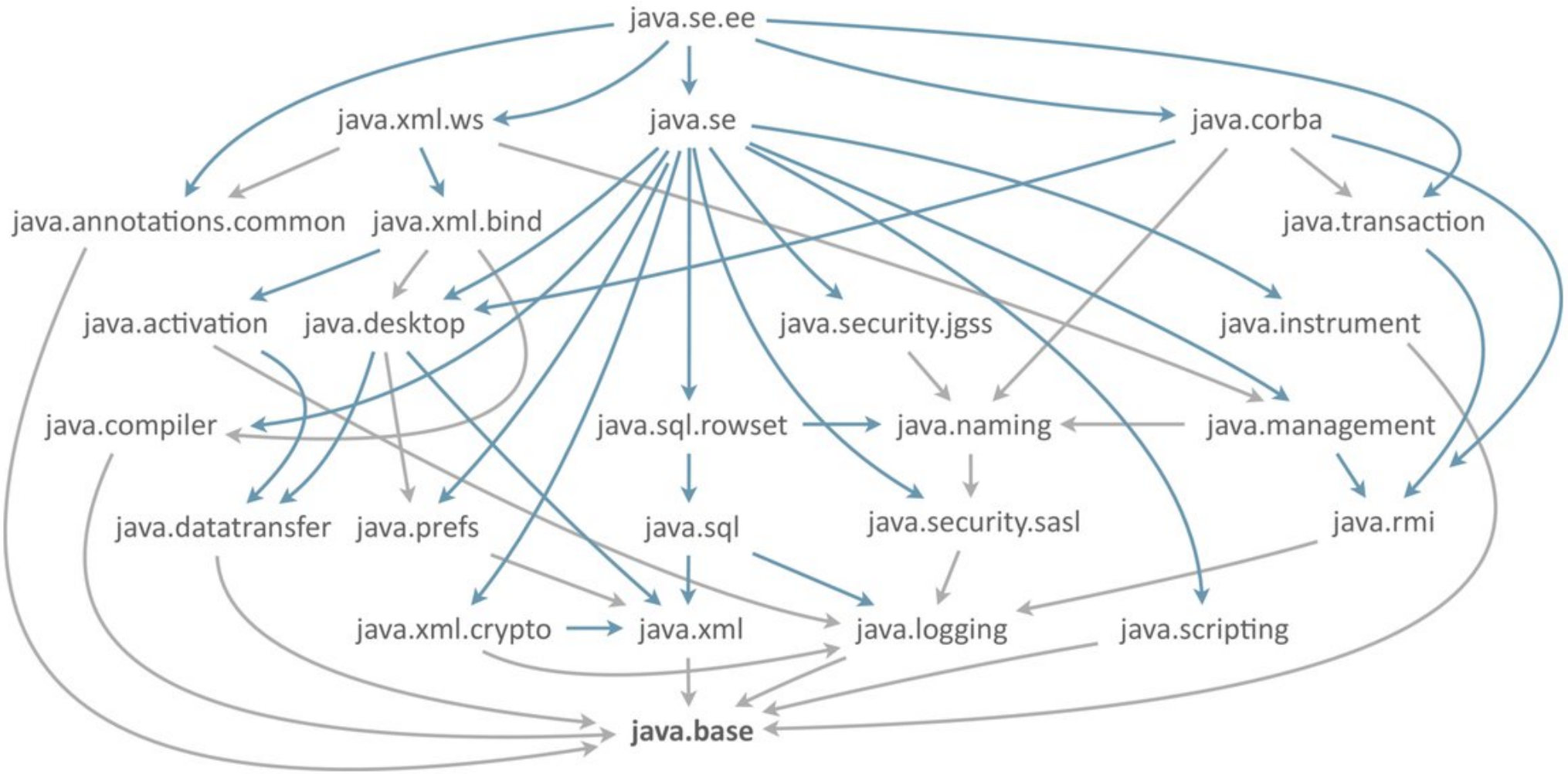
JDK 9 Module Graph



Jigsaw for Application Modules

- **Effectively just a jar file with extra metadata**
  - coherent content with clean separation
  - no split packages, no cyclic dependencies
- **Explicit module with module-info descriptor**
  - required modules for dependencies (by module name)
  - exported and opened packages (by package name)
- **Automatic module**
  - “Automatic-Module-Name” manifest (or default name derived from jar file)
  - dependencies automatically resolved at runtime + all packages exported

Using Jigsaw with Spring

- **Framework jars as Jigsaw-compliant modules on the module path**
  - automatic modules with stable manifest module names (Spring 5, JUnit 5)
  - spring.context, spring.jdbc, spring.webmvc, spring.webflux

- **An application's module-info.java may refer to framework modules**

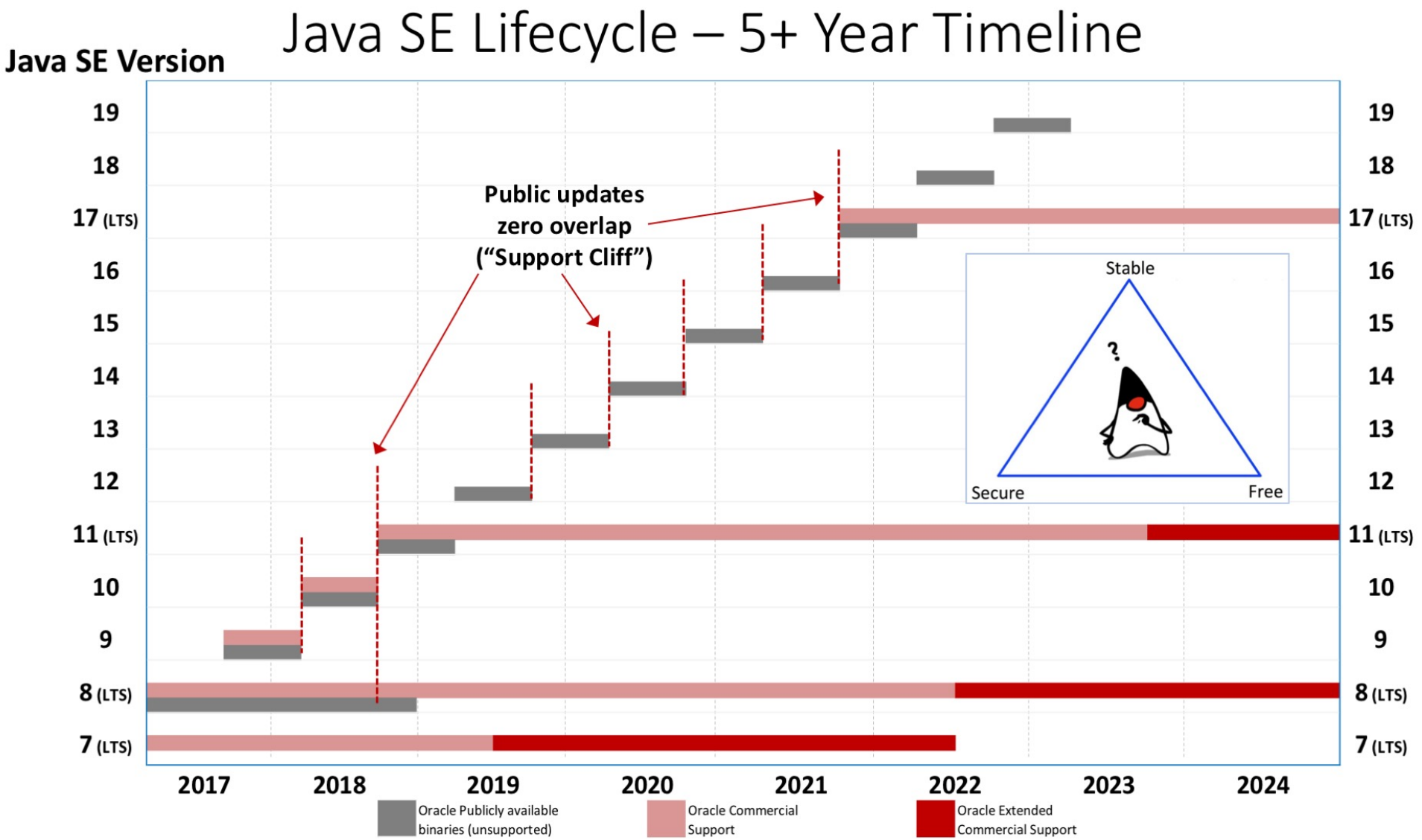
```
module my.app.db {
    requires java.sql;
    requires spring.jdbc;
    requires spring.context;

    exports my.app.db.service;
    exports my.app.db.util;
}
```

Reflection into Module-Contained Classes

- **Modules choose to 'export' all or selected packages**
  - 'export' means public types only
  - no access to internals, not even via reflection!
- **Application modules may choose to 'open' certain packages**
  - allowing for deep reflection through frameworks
  - accessing private field state, invoking non-public methods
- **For Spring purposes, application modules do NOT have to be 'open'**
  - as long as all relevant constructors and handler methods are public
  - 'open' declarations only needed for interaction with non-public artifacts

Long-Term Support: Oracle versus Azul



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Preparing for JDK 10 & 11

- **JDK 11 (GA in Sep 2018) will be the next long-term support release**
  - JDK 9 & 10 are effectively just intermediate releases on the way to 11
- **Limited technology support options towards 2019**
  - immediate upgrade to JDK 11, 12, 13, etc for free
  - commercial long-term support for JDK 8 (until 2025!!)
  - commercial long-term support for JDK 11 (until 2026)
- **The Spring Framework project (5.0.5+) is buildable on JDK 8, 9, 10**
  - Gradle build and default dependencies work on all three JDKs
  - same setup expected to work for JDK 11

Upgrade Considerations

- **Consider staying on the JVM classpath**
  - Spring 5 runs fine in classpath mode as well as on the module path
  - however, other libraries may not work in a module setup quite yet
  - Tomcat and co run in a custom class loader arrangement anyway

- **Consider staying at Java 8 bytecode level**
  - Spring 5's ASM 6.0 fork accepts Java 8 as well as Java 9+ bytecode level
  - ASM 5.x (very common) rejects unknown bytecode levels beyond Java 8
  - compiling your code with target 1.8 reduces the risk of such tools breaking

- **Build against JDK 8, run against JDK 9 / 10 / 11?**

Spring Framework 5.0

Q3 2017

JDK 8 baseline
support for JDK 9
prepared for JDK 10

integration with Java EE 8 APIs
functional style with Java & Kotlin
reactive web stack on Reactor

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Spring Framework 5.1

Q3 2018

full support for JDK 11
shipping with ASM 6.1
shipping with Reactor 3.2

new JDK 11 HttpClient API
Lookup.defineClass on JDK 9+
support for Hibernate ORM 5.3

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