Java 25 Unleashed: New Features, AOT Compilation, and Project Leyden

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Who am I?

- Proud father of a wonderful daughter ❤️

- Started developing software in 1995
 (30 years of coding journey!)

- Staff Engineer at Sportradar
 (Quants, Vienna)

- 10+ years of experience in Java & backend systems

- Love sharing knowledge in meetups & workshops

- More info about me : **https://mohsen.fyi**

Content

- **History**
- **What's New in Java 25** 🚀
- **Focus: AOT & Project Leyden**
- **Demo / Examples** 💻
- **Q&A** 🎯

Left table:
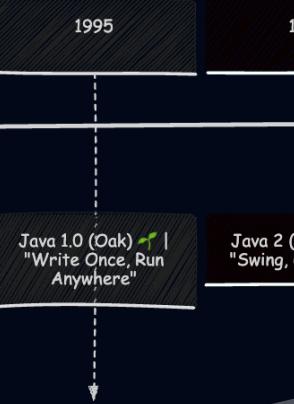
Release	Released	Premier Support	Extended Support	Latest
17 (LTS)	4 years ago (14 Sep 2021)	Ends in 11 months (30 Sep 2026)	Ends in 3 years and 11 months (30 Sep 2029)	17.0.16 (15 Jul 2025)
16	4 years and 7 months ago (16 Mar 2021)	Ended 4 years ago (14 Sep 2021)	Unavailable	16.0.2 (20 Jul 2021)
15	5 years ago (15 Sep 2020)	Ended 4 years and 7 months ago (16 Mar 2021)	Unavailable	15.0.2 (19 Jan 2021)
14	5 years and 7 months ago (17 Mar 2020)	Ended 5 years ago (16 Sep 2020)	Unavailable	14.0.2 (14 Jul 2020)
13	6 years ago (17 Sep 2019)	Ended 5 years and 7 months ago (17 Mar 2020)	Unavailable	13.0.2 (14 Jan 2020)
12	6 years ago (19 Mar 2019)	Ended 6 years ago (17 Sep 2019)	Unavailable	12.0.2 (16 ...)
11 (LTS)	7 years ago (25 Sep 2018)	Ended 2 years ago (30 Sep 2023)	Ends in 6 years (31 Jan 2032)	11.0.28 (15 Jul 2025)
10	7 years ago (20 Mar 2018)	Ended 7 years ago (25 Sep 2018)	Unavailable	10.0.2 (17 Jul 2018)
9	8 years ago (21 Sep 2017)	Ended 7 years ago (20 Mar 2018)	Unavailable	9.0.4 (16 Jan 2018)
8 (LTS)	11 years ago (18 Mar 2014)	Ended 3 years and 6 months ago (31 Mar 2022)	Ends in 5 years (31 Dec 2030)	8u461 (15 Jul 2025)
7 (LTS)	14 years ago (11 Jul 2011)	Ended 6 years ago (31 Jul 2019)	Ended 3 years ago (19 Jul 2022)	7u351 (19 Jul 2022)

Release	Released	Premier Support	Extended Support	Latest
25	3 weeks and 4 days ago (16 Sep 2025)	Ends in 4 years and 11 months (30 Sep 2030)	Ends in 7 years and 11 months (30 Sep 2033)	25 (16 Sep 2025)
24	6 months and 3 weeks ago (18 Mar 2025)	Ended 3 weeks and 4 days ago (16 Sep 2025)	Unavailable	24.0.2 (15 Jul 2025)
23	1 year ago (17 Sep 2024)	Ended 6 months and 3 weeks ago (18 Mar 2025)	Unavailable	23.0.2 (21 Jan 2025)
22	1 year and 6 months ago (19 Mar 2024)	Ended 1 year ago (17 Sep 2024)	Unavailable	22.0.2 (16 Jul 2024)
21 (LTS)	2 years ago (19 Sep 2023)	Ends in 2 years and 11 months (30 Sep 2028)	Ends in 5 years and 11 months (30 Sep 2031)	21.0.8 (15 Jul 2025)
20	2 years and 6 months ago (21 Mar 2023)	Ended 2 years ago (19 Sep 2023)	Unavailable	20.0.2 (18 Jul 2023)
19	3 years ago (20 Sep 2022)	Ended 2 years and 6 months ago (21 Mar 2023)	Unavailable	19.0.2 (17 Jan 2023)
18	3 years and 6 months ago (22 Mar 2022)	Ended 3 years ago (20 Sep 2022)	Unavailable	18.0.2.1 (18 Aug 2022)
17 (LTS)	4 years ago (14 Sep 2021)	Ends in 11 months (30 Sep 2026)	Ends in 3 years and 11 months (30 Sep 2029)	17.0.16 (15 Jul 2025)

8 years

8 years

6 years

13 years

16 years

1995

Java 1.0 (Oak) | "Write Once, Run Anywhere"

Java 2 (J2...) "Swing, C...

Hi...

What's New in Java 25 🚀

- 🧠 **Language & Syntax**
- 📚 **Core Libraries & APIs**
- ⚙️ **Runtime & Performance**

🧠 Language & Syntax

- Primitive Types in P...

- Module Import Decl... module)

- Flexible Construct...

- Compact Source Files... Main Methods

```
...ges from java.sql module

javac --enable-preview --release 25 Main.java
java  --enable-preview Main

...mports
...ection("jdbc:h2:mem:test")) {
...base: " + connection);
```
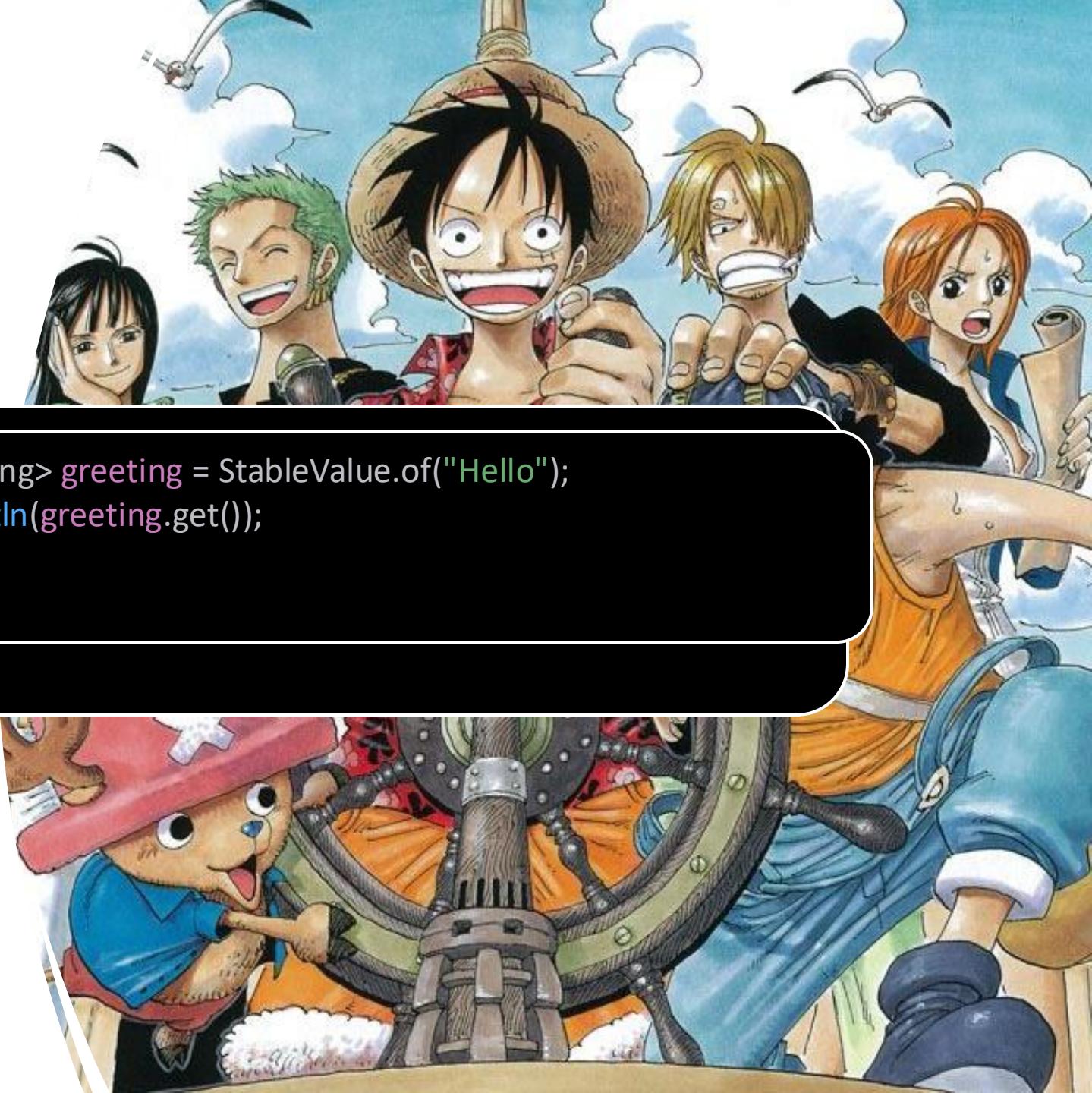
📚 Core Libraries & APIs

- Scoped Values (light a ... to ThreadLocal)
- Stable Values (preview ...
- Key Derivation Functio ...
- PEM Encoding for Cry ... Objects

```java
StableValue<String> greeting = StableValue.of("Hello");
System.out.println(greeting.get());
```

⚙️ Runtime & Performance

- **AOT Compilation**
- **Project Leyden**
- Compact Object Headers
- Flight Recorder (JFR) Enhancements
- Generational Shenandoah GC

```
java -XX:+UseCompactObjectHeaders -jar app.jar
java -XX:+UseShenandoahGC App
```

Benchmark Battle

⚙ *Benchmark Setup – Comparing Java Versions and AOT*
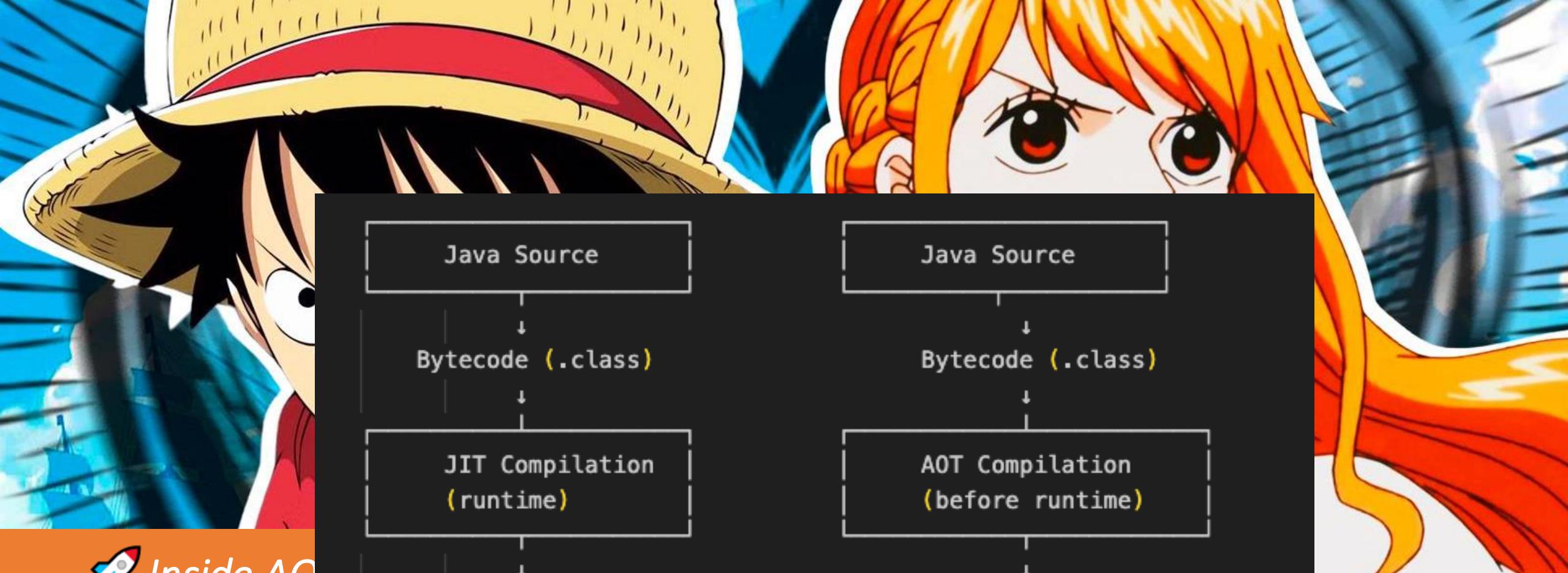
- Best Performance Java pure
  - Java 17.0.8-amzn: avg 108 ms per run
  - Java 21.0.8-amzn: avg 112 ms per run
  - **Java 25-amzn: avg 110 ms per run**

- Performance Java 25
  - Without AOT total: 5515 ms (avg 110 ms per run)
  - **With AOT total: 4568 ms (avg 91 ms per run)**
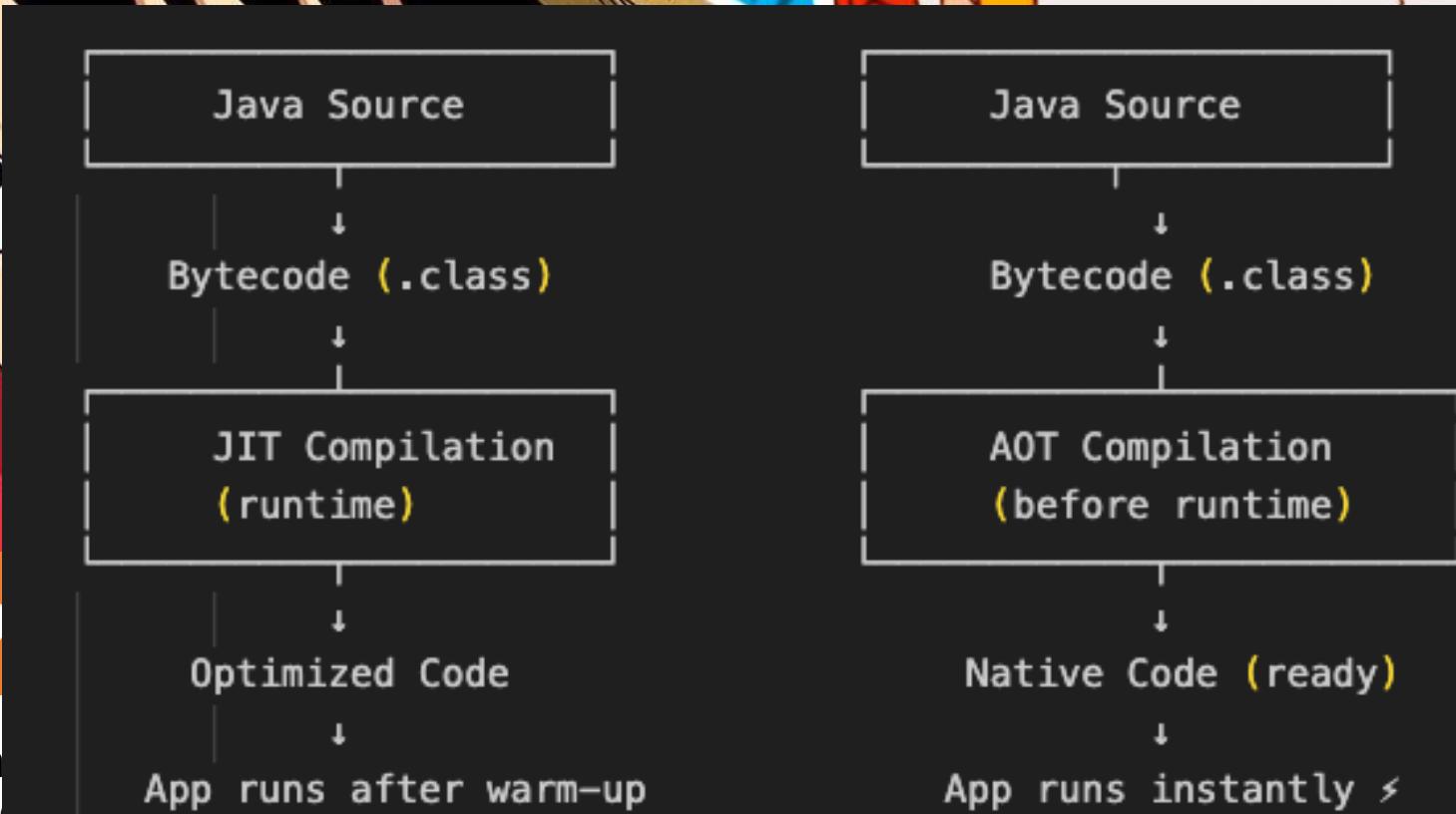
```
tching to Java 25
ing 50 runs WITHOUT AOT...
ut AOT total: 6650 ms (avg

g 50 runs WITH AOT...
OT total: 5606 ms (avg 112 m

         AOT: 6650 ms
         t:      5606 ms
        faster by 1044 ms total (~20

        t 50 times...
        .8-amzn: total 7581 ms | avg

        to Java 21.0.8-amzn
        t 50 times...
        0.8-amzn: total 7951 ms | avg

        ng to Java 25-amzn
         aot 50 times...
        5-amzn: total 6708 ms | avg 1
```

🚀 *Inside AOT*

- JIT compiles **wh**
- AOT compiles **b**
- Project Leyden a [...] d state.
- Works great for [...]

Java Source → Bytecode → JIT (runtime compile)
↘ AOT (pre-compile)

"JIT = Just-In-Time"
"AOT = Ahead-Of-Time"
"Leyden = Build-time optimized static image"

Java Source

↓

Bytecode (.class)

↓

JIT Compilation (runtime)

↓

Optimized Code

↓

App runs after warm-up

Java Source

↓

Bytecode (.class)

↓

AOT Compilation (before runtime)

↓

Native Code (ready)

↓

App runs instantly ⚡
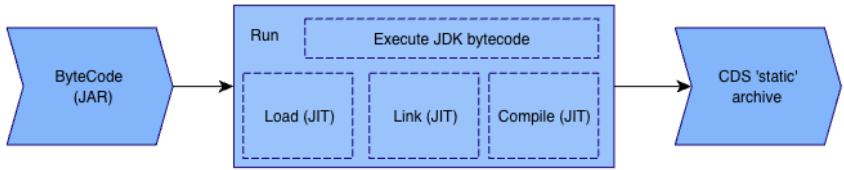
Fast Startup for Everyone

- CDS = Class Data Sharing

- Saves parsed & verified class metadata into an archive (.jsa)

- Reuses that archive next time → faster startup, less memory

- Works with core JDK classes and your app classes (AppCDS)

- Production-ready and safe to enable everywhere
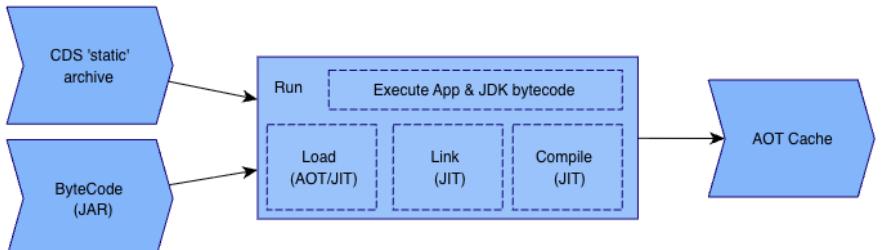
Leyden Workflow
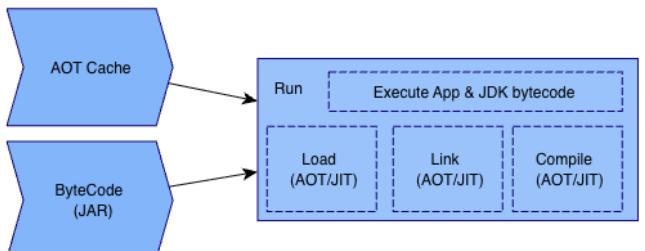
Bootstrap JVM to generate 'static' CDS archive

ByteCode (JAR) → Run
- Execute JDK bytecode
- Load (JIT) | Link (JIT) | Compile (JIT)

→ CDS 'static' archive

Run training version of the App

CDS 'static' archive → Run
ByteCode (JAR) →
- Execute App & JDK bytecode
- Load (AOT/JIT) | Link (JIT) | Compile (JIT)

→ AOT Cache

Run App

AOT Cache → Run
ByteCode (JAR) →
- Execute App & JDK bytecode
- Load (AOT/JIT) | Link (AOT/JIT) | Compile (AOT/JIT)

CRaC — A Solution Until Leyden Arrives

🧊 CRaC — Coordinated Restore at Checkpoint

• Snapshot a warm JVM → restore instantly ⚡

• Removes class loading & JIT warm-up

• Perfect for containers & serverless

• Already available on AWS Lambda setup 🚀

• Bridge to Project Leyden

QA
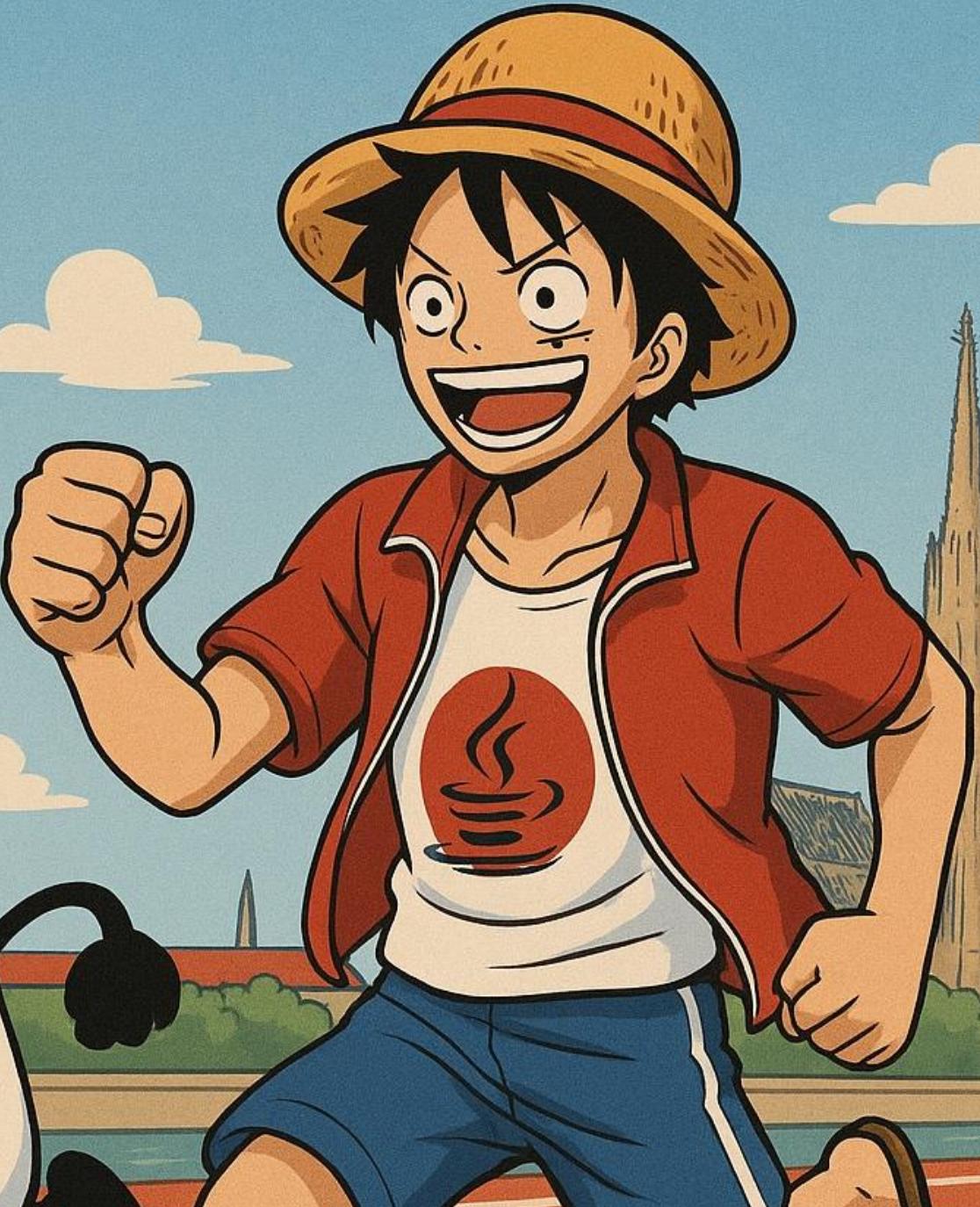
Thanks!
Let's talk
☕ Java

Thank you for attention