From 'Java Sucks' to 'Java...Eh, Not Bad'

How Vert.x & Java 21 Made Me Stop Complaining

Thomas Gebert

Who Am I?

• Software Engineer in New York City.

Who Am I?

- Software Engineer in New York City.
- There is nothing else interesting about me.

• If you are at this conference, you probably have an opinion of Java

- If you are at this conference, you probably have an opinion of Java
- Likely very negative.

- If you are at this conference, you probably have an opinion of Java
- Likely very negative.

• Java is bloated and verbose.

- Java is bloated and verbose.
- Encourages bad practices.

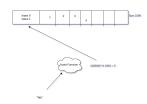
- Java is bloated and verbose.
- Encourages bad practices.
- Java progammers…

IO is blocking by default

- IO is blocking by default
- synchronized is evil.

- IO is blocking by default
- synchronized is evil.







• A metric ton of well-tested and supported libraries and guides online.

- A metric ton of well-tested and supported libraries and guides online.
- Relatively portable, even still.

- A metric ton of well-tested and supported libraries and guides online.
- Relatively portable, even still.
- Lots of great tooling around the language in the form of IDEs and benchmarking tools available.

- A metric ton of well-tested and supported libraries and guides online.
- Relatively portable, even still.
- Lots of great tooling around the language in the form of IDEs and benchmarking tools available.
- (Can be) fast.

Storytime.

Storytime.



ColdFusion Programming Language

• You should use Clojure if you can!

- You should use Clojure if you can!
- Java is inescapable.

- You should use Clojure if you can!
- Java is inescapable.
- A lot of companies still have tens of thousands of lines of Java that already exist.

- You should use Clojure if you can!
- Java is inescapable.
- A lot of companies still have tens of thousands of lines of Java that already exist.
- Many companies will find it infeasible to migrate to a better language, and would rather spend infinitely more money hiring dozens of engineers to write a million incrementatal patches to a Java codebase.

- You should use Clojure if you can!
- Java is inescapable.
- A lot of companies still have tens of thousands of lines of Java that already exist.
- Many companies will find it infeasible to migrate to a better language, and would rather spend infinitely more money hiring dozens of engineers to write a million incrementatal patches to a Java codebase.
- Many of us are stuck in this hell.

• In 2024 I took a job doing Java full-time.

- In 2024 I took a job doing Java full-time.
- They were unreceptive to my plees to use Clojure, no matter how much I complained.

- In 2024 I took a job doing Java full-time.
- They were unreceptive to my plees to use Clojure, no matter how much I complained.
- Eventually, I realized that I wasn't going to win this fight and instead I should at least figure out what Java 21 had to offer.

- In 2024 I took a job doing Java full-time.
- They were unreceptive to my plees to use Clojure, no matter how much I complained.
- Eventually, I realized that I wasn't going to win this fight and instead I should at least figure out what Java 21 had to offer.
- Much to my astonishment, I actually enjoyed it!

- In 2024 I took a job doing Java full-time.
- They were unreceptive to my plees to use Clojure, no matter how much I complained.
- Eventually, I realized that I wasn't going to win this fight and instead I should at least figure out what Java 21 had to offer.
- Much to my astonishment, I actually enjoyed it!

 Since Java 8 and Java 11, there has been a much higher emphasis on functional programming concepts and updated syntax to facilitate it.

- Since Java 8 and Java 11, there has been a much higher emphasis on functional programming concepts and updated syntax to facilitate it.
- Java programmers have finally joined the 21st century and will occasionally use non-blocking IO.

- Since Java 8 and Java 11, there has been a much higher emphasis on functional programming concepts and updated syntax to facilitate it.
- Java programmers have finally joined the 21st century and will occasionally use non-blocking IO.
- Concurrency is an even bigger part of the language, and a lot of the features from concurrent-first languages have been brought over.

- Since Java 8 and Java 11, there has been a much higher emphasis on functional programming concepts and updated syntax to facilitate it.
- Java programmers have finally joined the 21st century and will occasionally use non-blocking IO.
- Concurrency is an even bigger part of the language, and a lot of the features from concurrent-first languages have been brought over.

Virtual Threads.

 Virtual Threads are what should have been in Java twenty years ago.

- Virtual Threads are what should have been in Java twenty years ago.
- Roughly analogous to goroutines in Go.

- Virtual Threads are what should have been in Java twenty years ago.
- Roughly analogous to goroutines in Go.
- Allow you to have blocking code inside the thread without it breaking the pool.
 - The JVM will park the thread upon seeing a blocking call. . . .
- Extremely lightweight, hundreds of thousands can easily be spun up guilt-free.

- Virtual Threads are what should have been in Java twenty years ago.
- Roughly analogous to goroutines in Go.
- Allow you to have blocking code inside the thread without it breaking the pool.
 - The JVM will park the thread upon seeing a blocking call. . . .
- Extremely lightweight, hundreds of thousands can easily be spun up guilt-free.
- Implements the same interfaces as regular threads and thus are drop-in replacement.

- Virtual Threads are what should have been in Java twenty years ago.
- Roughly analogous to goroutines in Go.
- Allow you to have blocking code inside the thread without it breaking the pool.
 - The JVM will park the thread upon seeing a blocking call. . . .
- Extremely lightweight, hundreds of thousands can easily be spun up guilt-free.
- Implements the same interfaces as regular threads and thus are drop-in replacement.
- TODO Example.

* (Actually a Java 15 feature that I wasn't aware of until Java 21)

ZGC

* (Actually a Java 15 feature that I wasn't aware of until Java 21)

ZGC

Low-latency garbage collector.

* (Actually a Java 15 feature that I wasn't aware of until Java 21)

ZGC

- Low-latency garbage collector.
- Pause times are generally sub-millisecond and almost never exceed ten milliseconds.

* (Actually a Java 15 feature that I wasn't aware of until Java 21)

ZGC

- Low-latency garbage collector.
- Pause times are generally sub-millisecond and almost never exceed ten milliseconds.
- Configurable, can be enabled or disabled per-project.

Records

• Much simpler than a class.

- Much simpler than a class.
- Doesn't require its own dedicated file.

- Much simpler than a class.
- Doesn't require its own dedicated file.
- Can be pattern-matched.

- Much simpler than a class.
- Doesn't require its own dedicated file.
- Can be pattern-matched.
- TODO Example.

* (Actually a Java 17 feature that I wasn't aware of until Java 21)

• Basically Algebraic Data Types

- Basically Algebraic Data Types
- Can be recursive.

- Basically Algebraic Data Types
- Can be recursive.
- Can be pattern matched.

- Basically Algebraic Data Types
- Can be recursive.
- Can be pattern matched.

Pattern Matching

Pattern Matching

• FINALLY! FINALLY!

Pattern Matching

- FINALLY! FINALLY!
- Can be done inside if statements and switch cases.

Pattern Matching

- FINALLY! FINALLY!
- Can be done inside if statements and switch cases.
- TODO Example.

Java NIO

• Java New IO.

- Java New IO.
- Gives fine-grained control over IO, both blocking and non-blocking.

- Java New IO.
- Gives fine-grained control over IO, both blocking and non-blocking.
- Not new at all, but underutilized.

- Java New IO.
- Gives fine-grained control over IO, both blocking and non-blocking.
- Not new at all, but underutilized.
- TODO Basic Node.js pipes example.

• (In a hand-wavey way) a port of Node.js to Java.

- (In a hand-wavey way) a port of Node.js to Java.
- High performance.

- (In a hand-wavey way) a port of Node.js to Java.
- High performance.
- Provides constructs to handle local and distributed concurrency transparently.

Verticle

Verticle

Units of deployment and concurrency

Verticle

- Units of deployment and concurrency
- Two types: StandardVerticle (blocking) and WorkerVerticle (non-blocking optional)

Verticle

- Units of deployment and concurrency
- Two types: StandardVerticle (blocking) and WorkerVerticle (non-blocking optional)
- Deployed with vertx.deployVerticle(...)

Event Loop

Event Loop

Single or multi-threaded, async task execution

Event Loop

- Single or multi-threaded, async task execution
- Based on Netty

Event Loop

- Single or multi-threaded, async task execution
- Based on Netty
- Designed for minimal context switching and high throughput

Event Bus

Lightweight messaging system

- Lightweight messaging system
- Supports publish/subscribe, point-to-point, and request-response

- Lightweight messaging system
- Supports publish/subscribe, point-to-point, and request-response
- Accepts JSON, POJOs (with codec), and buffers

- Lightweight messaging system
- Supports publish/subscribe, point-to-point, and request-response
- Accepts JSON, POJOs (with codec), and buffers

Future & Promise

Asynchronous result handling

- Asynchronous result handling
- Future<T> is the result placeholder

- Asynchronous result handling
- Future<T> is the result placeholder
- Promise<T> is the result provider

- Asynchronous result handling
- Future<T> is the result placeholder
- Promise<T> is the result provider
- Supports chaining with .compose(...) and .map(...)

- Asynchronous result handling
- Future<T> is the result placeholder
- Promise<T> is the result provider
- Supports chaining with .compose(...) and .map(...)

Context

• Execution environment for a Verticle

- Execution environment for a Verticle
- Ensures thread-affinity

- Execution environment for a Verticle
- Ensures thread-affinity
- Helps avoid shared-state concurrency bugs

- Execution environment for a Verticle
- Ensures thread-affinity
- Helps avoid shared-state concurrency bugs

Buffer

• Efficient binary data container

- Efficient binary data container
- Higher-level alternative to Netty's ByteBuf

- Efficient binary data container
- Higher-level alternative to Netty's ByteBuf
- Used in I/O and message passing

- Efficient binary data container
- Higher-level alternative to Netty's ByteBuf
- Used in I/O and message passing
- WebClient / HttpClient

- Efficient binary data container
- Higher-level alternative to Netty's ByteBuf
- Used in I/O and message passing
- WebClient / HttpClient
- Non-blocking HTTP clients

- Efficient binary data container
- Higher-level alternative to Netty's ByteBuf
- Used in I/O and message passing
- WebClient / HttpClient
- Non-blocking HTTP clients
- Built-in connection pooling and retry logic

- Efficient binary data container
- Higher-level alternative to Netty's ByteBuf
- Used in I/O and message passing
- WebClient / HttpClient
- Non-blocking HTTP clients
- Built-in connection pooling and retry logic
- Supports JSON, form data, and streaming

- Efficient binary data container
- Higher-level alternative to Netty's ByteBuf
- Used in I/O and message passing
- WebClient / HttpClient
- Non-blocking HTTP clients
- Built-in connection pooling and retry logic
- Supports JSON, form data, and streaming
- Timer / Periodic Tasks

- Efficient binary data container
- Higher-level alternative to Netty's ByteBuf
- Used in I/O and message passing
- WebClient / HttpClient
- Non-blocking HTTP clients
- Built-in connection pooling and retry logic
- Supports JSON, form data, and streaming
- Timer / Periodic Tasks
- Use setTimer(...) for delayed execution

- Efficient binary data container
- Higher-level alternative to Netty's ByteBuf
- Used in I/O and message passing
- WebClient / HttpClient
- Non-blocking HTTP clients
- Built-in connection pooling and retry logic
- Supports JSON, form data, and streaming
- Timer / Periodic Tasks
- Use setTimer(...) for delayed execution
- Use setPeriodic(...) for recurring tasks

- Efficient binary data container
- Higher-level alternative to Netty's ByteBuf
- Used in I/O and message passing
- WebClient / HttpClient
- Non-blocking HTTP clients
- Built-in connection pooling and retry logic
- Supports JSON, form data, and streaming
- Timer / Periodic Tasks
- Use setTimer(...) for delayed execution
- Use setPeriodic(...) for recurring tasks
- Executes on the event loop thread

- Efficient binary data container
- Higher-level alternative to Netty's ByteBuf
- Used in I/O and message passing
- WebClient / HttpClient
- Non-blocking HTTP clients
- Built-in connection pooling and retry logic
- Supports JSON, form data, and streaming
- Timer / Periodic Tasks
- Use setTimer(...) for delayed execution
- Use setPeriodic(...) for recurring tasks
- Executes on the event loop thread
- SharedData

- Efficient binary data container
- Higher-level alternative to Netty's ByteBuf
- Used in I/O and message passing
- WebClient / HttpClient
- Non-blocking HTTP clients
- Built-in connection pooling and retry logic
- Supports JSON, form data, and streaming
- Timer / Periodic Tasks
- Use setTimer(...) for delayed execution
- Use setPeriodic(...) for recurring tasks
- Executes on the event loop thread
- SharedData
- Minimal shared-state coordination mechanism

- Efficient binary data container
- Higher-level alternative to Netty's ByteBuf
- Used in I/O and message passing
- WebClient / HttpClient
- Non-blocking HTTP clients
- Built-in connection pooling and retry logic
- Supports JSON, form data, and streaming
- Timer / Periodic Tasks
- Use setTimer(...) for delayed execution
- Use setPeriodic(...) for recurring tasks
- Executes on the event loop thread
- SharedData
- Minimal shared-state coordination mechanism
- Offers maps, locks, and counters

- Efficient binary data container
- Higher-level alternative to Netty's ByteBuf
- Used in I/O and message passing
- WebClient / HttpClient
- Non-blocking HTTP clients
- Built-in connection pooling and retry logic
- Supports JSON, form data, and streaming
- Timer / Periodic Tasks
- Use setTimer(...) for delayed execution
- Use setPeriodic(...) for recurring tasks
- Executes on the event loop thread
- SharedData
- Minimal shared-state coordination mechanism
- Offers maps, locks, and counters
- Supports clustered and local modes

- Efficient binary data container
- Higher-level alternative to Netty's ByteBuf
- Used in I/O and message passing
- WebClient / HttpClient
- Non-blocking HTTP clients
- Built-in connection pooling and retry logic
- Supports JSON, form data, and streaming
- Timer / Periodic Tasks
- Use setTimer(...) for delayed execution
- Use setPeriodic(...) for recurring tasks
- Executes on the event loop thread
- SharedData
- Minimal shared-state coordination mechanism
- Offers maps, locks, and counters
- Supports clustered and local modes

Vert.x Backpressure.

Vert.x Backpressure.

• TODO Placeholder

Vert.x Backpressure.

• TODO Placeholder

Vert.x basic concurrency example

Vert.x basic concurrency example

• TODO placeholder

Vert.x basic concurrency example

• TODO placeholder

Vert.x more complicated concurrency example.

Vert.x more complicated concurrency example.

• TODO placeholder

Vert.x more complicated concurrency example.

• TODO placeholder

Vert.x distributed concurrency example

Vert.x distributed concurrency example

• TODO placeholder

Vert.x distributed concurrency example

• TODO placeholder

RxJava

RxJava

• TODO Placeholder

RxJava

• TODO Placeholder

RxJava Example

RxJava Example

• TODO Placeholder.

RxJava Example

• TODO Placeholder.

• Java 21 isn't that bad.

- Java 21 isn't that bad.
- Convince your employers to upgrade if you want to reclaim your sanity.
- Blah . . .
- Use libraries like Vert.x and Disruptor to make life simpler.

- thomas@gebert.app
- blog.tombert.com

