*Node4J*

# Running **Node.js** in a Java World

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# Java and JavaScript

- Java a successful server side language
- JavaScript is a client side language
- **SWT** brought performant Java UIs to the desktop
- **Node.js** brought JavaScript to the server
- Java and JavaScript are two of the most popular programming languages

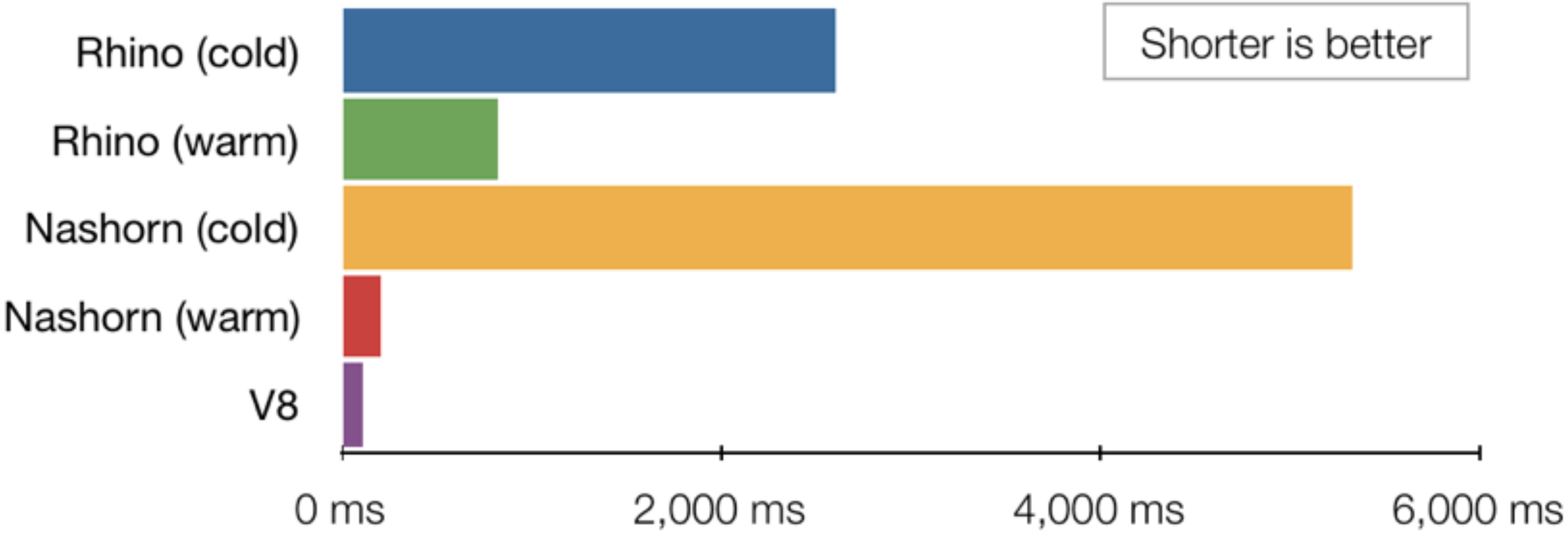
# Polyglot Systems

- Single language systems are rarely an option
    - **Legacy** code
    - New frameworks and technologies
    - Evolving enterprises
- JEE will be here for another ~~20~~, ~~30~~, 50 (?) years

# Bridging Java and JavaScript

- Three common Java technologies enable JS embedding
- **Rhino**
  - Available since JDK 6
- **Nashorn**
  - Replacing Rhino since JDK 8
  - More performant
- V8 as a **separate process**, String based messages

# Performance



- 30 Runs of the **Esprima parser and tokenizer**
- Nashorn compiles to **bytecode**
- V8 compiles to **native assembly**
- Best choice for raw JavaScript execution

# J2V8

# J2V8

- A set of **bindings** that bring V8 to Java
- Inspired by SWT
  - Create a thin **JNI layer**
  - Expose (some) **V8 API** in Java
  - Complicated logic lives in Java

# J2V8 Goals

- Efficient JavaScript on **Android**
- Make **JavaScript** shine in an enterprise **Java** World
- **Standard** Java APIs
- **Efficient** Java / JavaScript bindings

# J2V8 — History

- 1.0 Released in November 2014
- 2.0 Released in February 2015
- First presented at EclipseCon 2015
- 3.0 Released at EnterJS — Summer 2015

# J2V8 Design

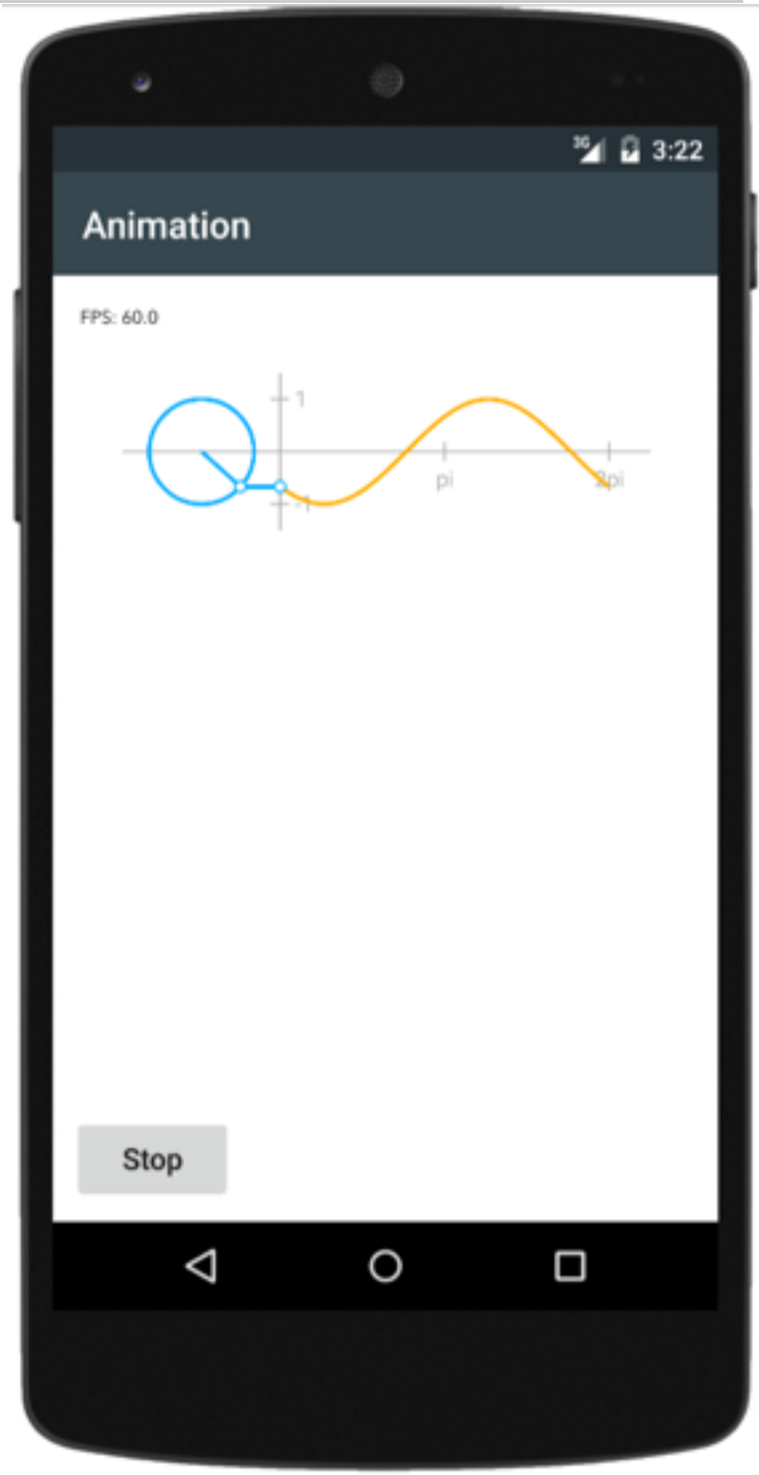
- Each V8 Object can be referenced using a **Handle**
- Each Object is stored in a **V8 Persistent Object Store**
- Objects must be **explicitly freed**
- **Primitives** where possible (no wrappers)
- Single **Thread** per isolate

# Two-way binding

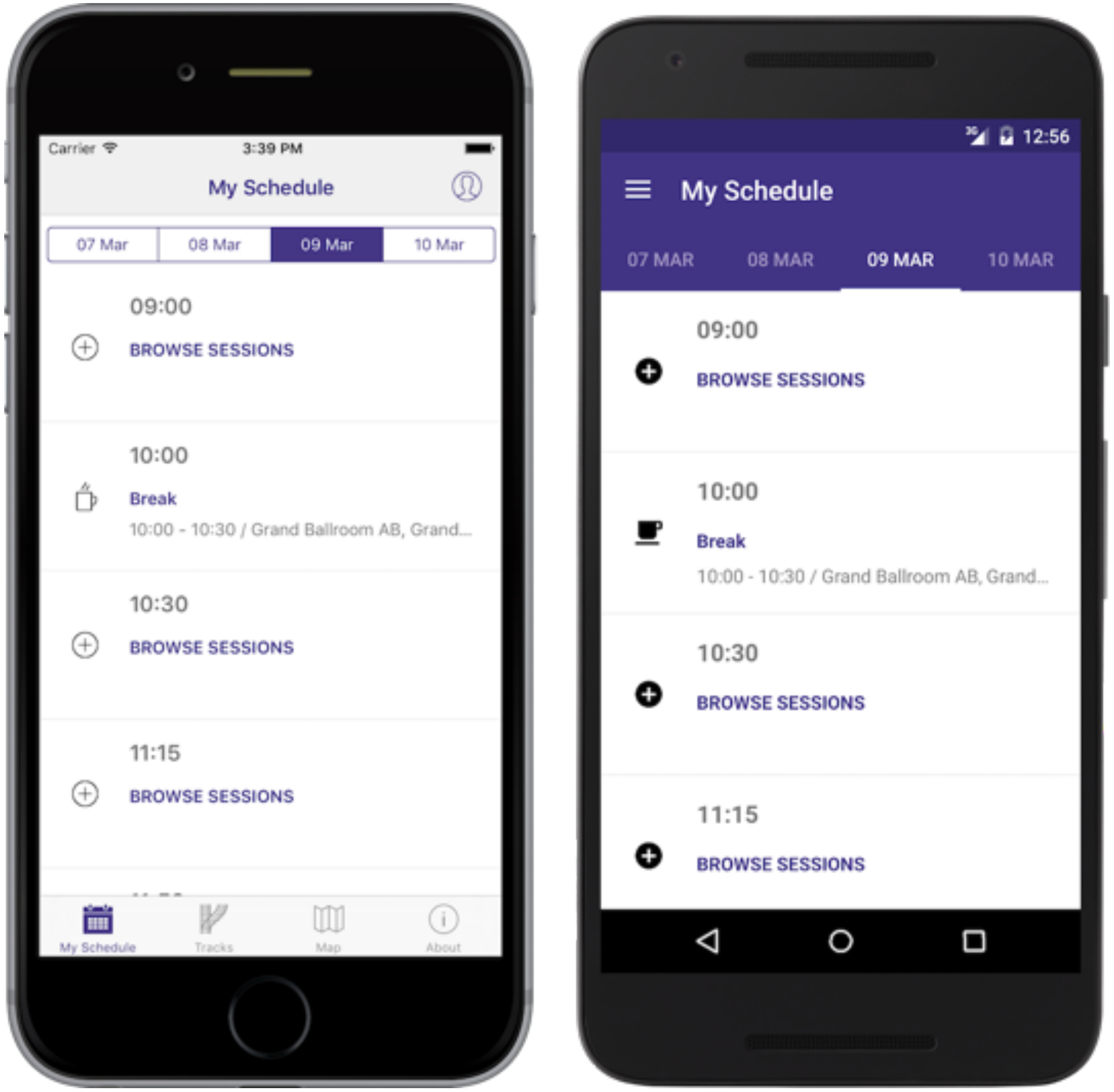
- **JS functions** and **scripts** can be invoked from Java
- **Java methods** can be called from JavaScript
- Data can be passed back and forth using **V8Objects**

# J2V8 In Action — Tabris.js

- Mobile framework
- Apps written in **JavaScript**
- Native **iOS** and **Android** Apps
- Bindings to **native** UI components



# Shameless Plug



Carrier 3:39 PM

My Schedule

07 Mar | 08 Mar | 09 Mar | 10 Mar

09:00
BROWSE SESSIONS

10:00
Break
10:00 - 10:30 / Grand Ballroom AB, Grand...

10:30
BROWSE SESSIONS

11:15
BROWSE SESSIONS

12:56

My Schedule

07 MAR | 08 MAR | 09 MAR | 10 MAR

09:00
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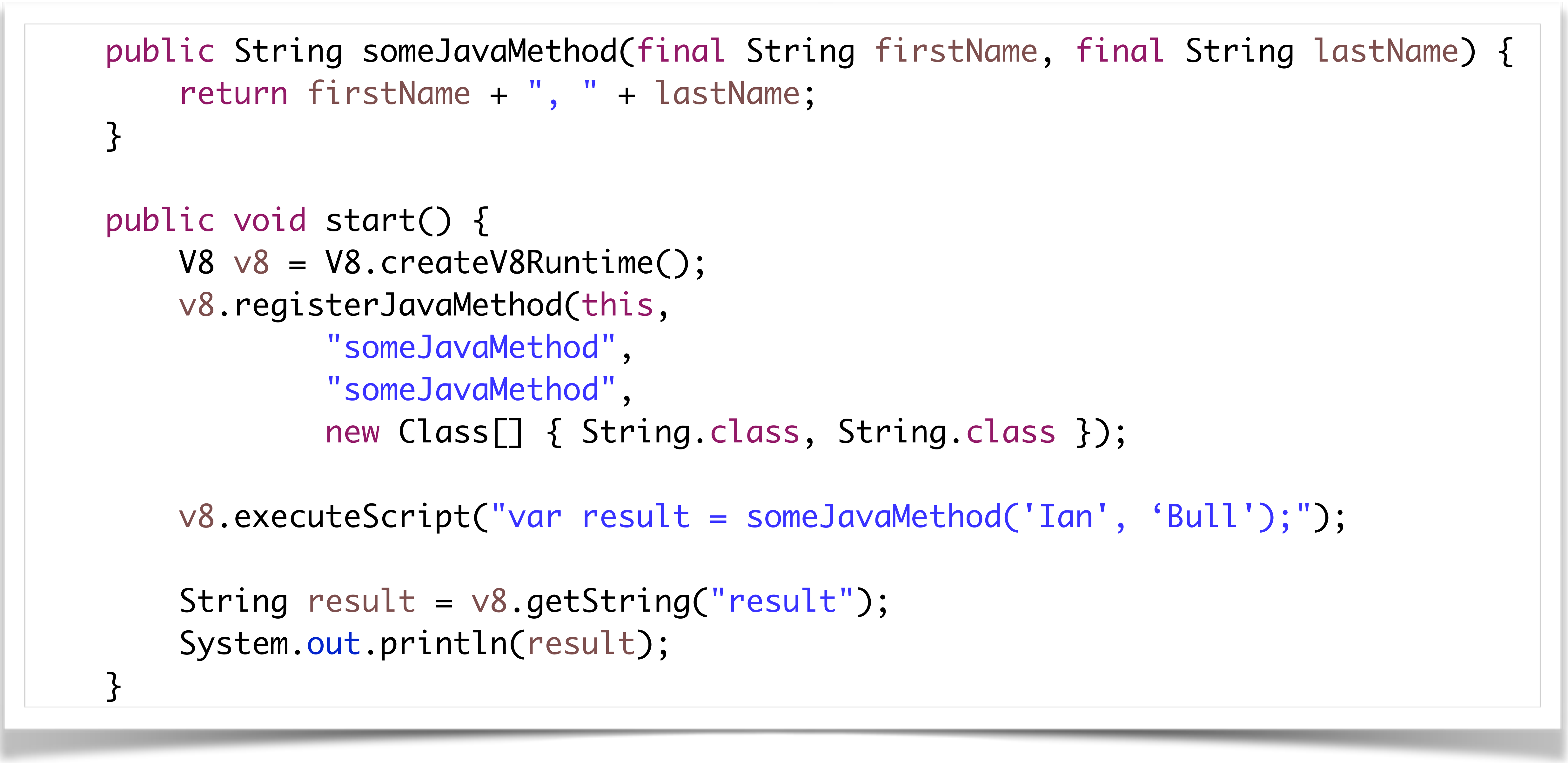
10:30
BROWSE SESSIONS

11:15
BROWSE SESSIONS

# Example



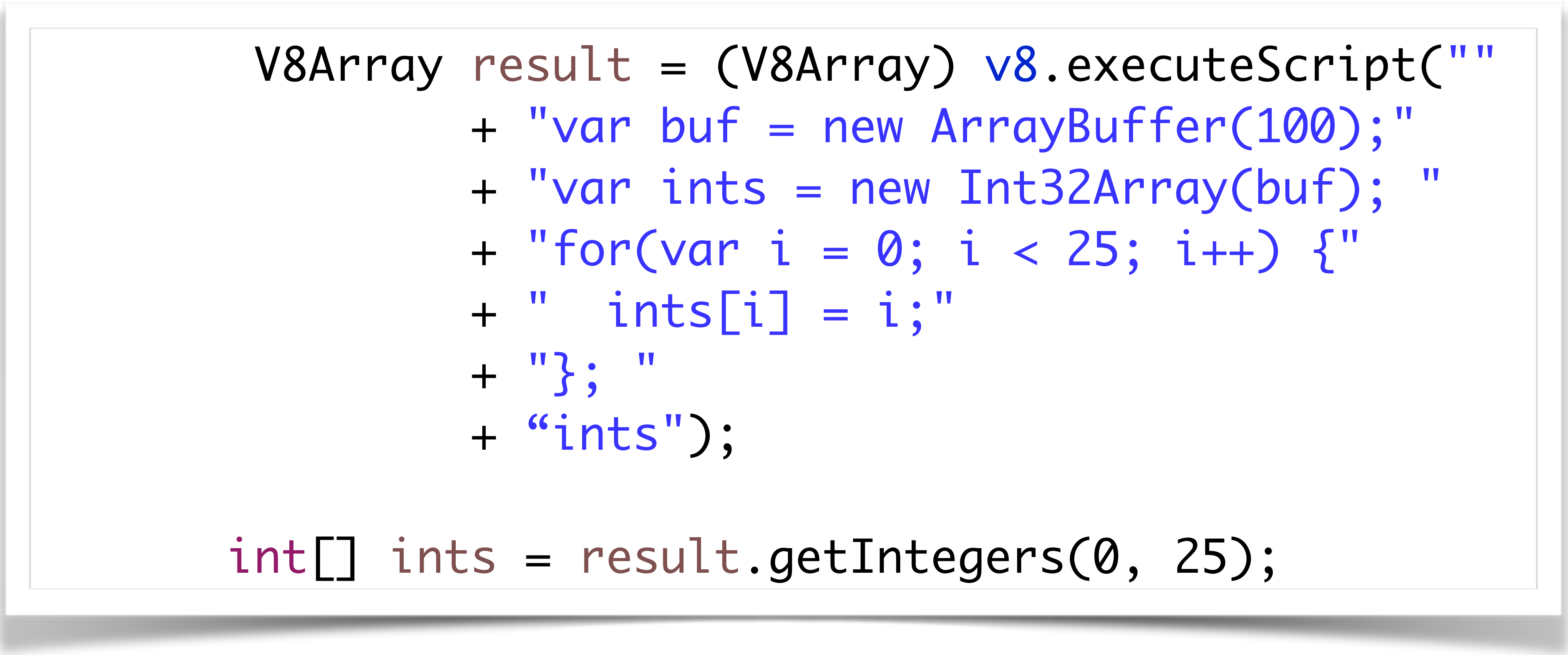
```java
public String someJavaMethod(final String firstName, final String lastName) {
    return firstName + ", " + lastName;
}

public void start() {
    V8 v8 = V8.createV8Runtime();
    v8.registerJavaMethod(this,
            "someJavaMethod",
            "someJavaMethod",
            new Class[] { String.class, String.class });

    v8.executeScript("var result = someJavaMethod('Ian', ‘Bull');");

    String result = v8.getString("result");
    System.out.println(result);
}
```

# J2V8 —What’s New

- Typed Arrays
- Threads & Workers
- ES 6
- ChromeDev Tools
- NodeJS Support

# Typed Arrays

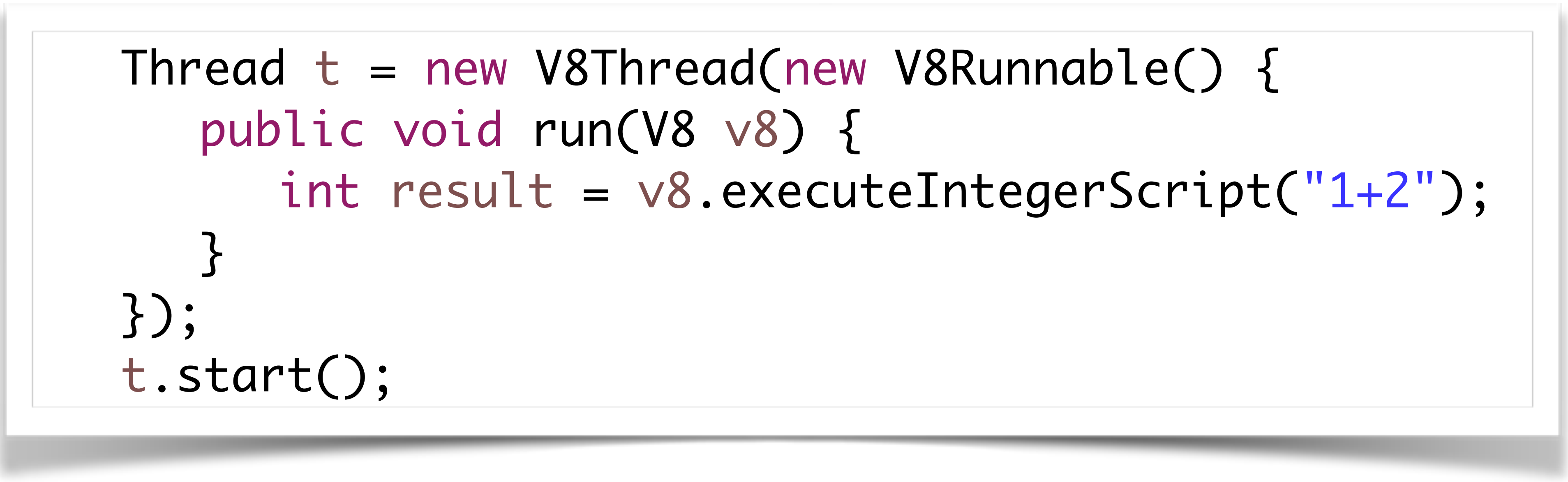
- Native support for JS **Typed Arrays**
- **Access** the values **efficiently** from Java



```
 V8Array result = (V8Array) v8.executeScript(""
         + "var buf = new ArrayBuffer(100);"
         + "var ints = new Int32Array(buf); "
         + "for(var i = 0; i < 25; i++) {"
         + "  ints[i] = i;"
         + "}; "
         + “ints");

int[] ints = result.getIntegers(0, 25);
```

# Threads

- Every thread can have it’s own ***Isolate*** (Isolated V8 Instance)
- V8Thread is a Java Thread with an associated Isolate
- Provide an easy way to execute JavaScript



```
Thread t = new V8Thread(new V8Runnable() {
   public void run(V8 v8) {
      int result = v8.executeIntegerScript("1+2");
   }
});
t.start();
```

# Executors

- Long running V8Thread with a **message queue** and event loop
- Threads can communicate via **message passing**
- Useful for implementing Web Workers / Service Workers

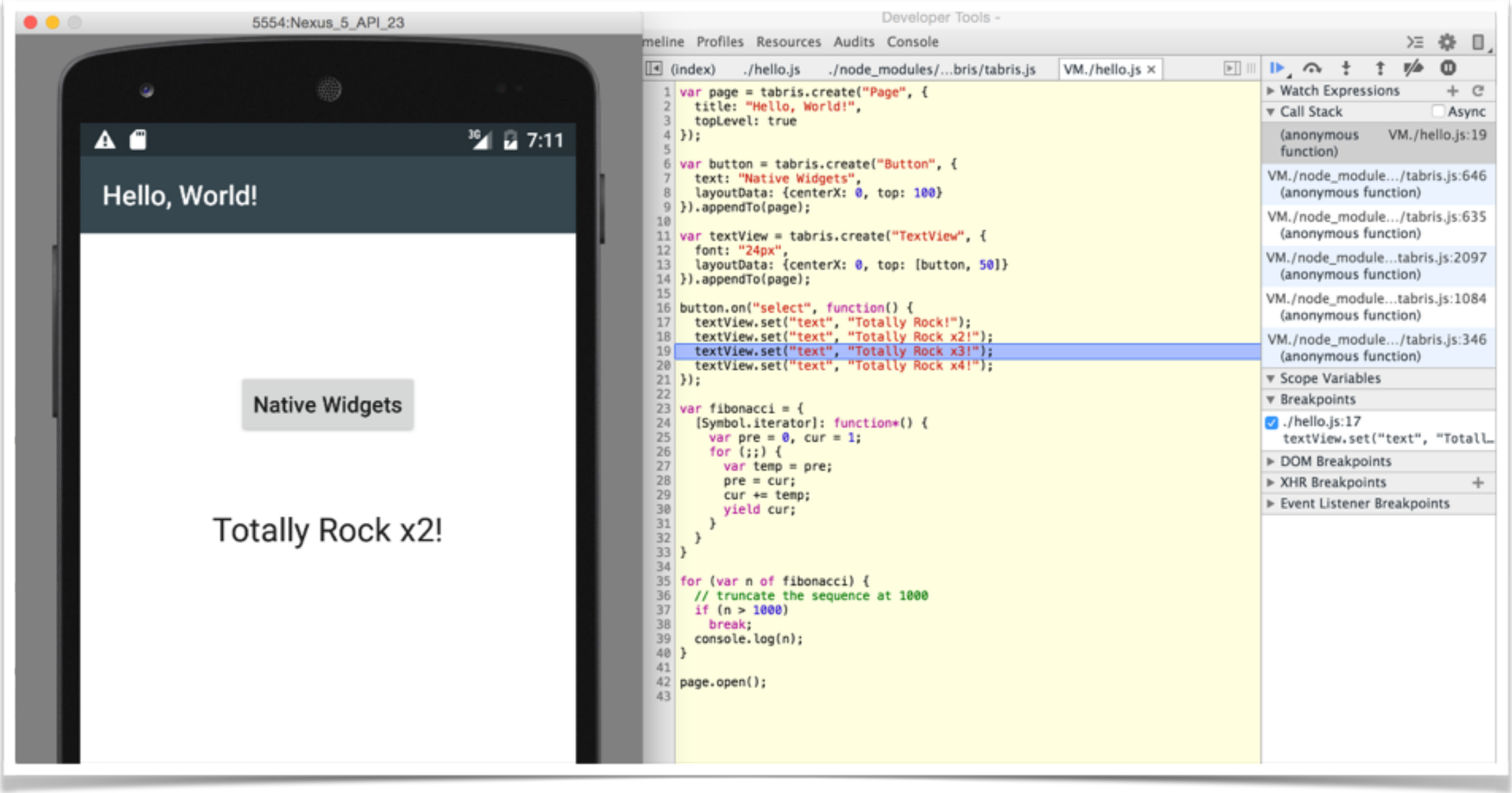
# ES 6

- Snapshot builds of J2V8 support **V8 4.10** & **ES 6**
  - Arrows
  - Classes
  - Let / Const
  - Interators + For..Of
  - Generators
  - …

# Debug Support

- V8 (and now J2V8) no longer supports the ***Debug Agent***
- JavaScript based Debug API is available instead
- J2V8 exposes this API in Java
- Integrated with the **Stetho** tool & **Chrome Dev Tools**

# Debug Support Demo


5554:Nexus_5_API_23
7:11
Hello, World!
Native Widgets
Totally Rock x2!
Developer Tools -
meline
Profiles
Resources
Audits
Console
(index)
./hello.js
./node_modules/...bris/tabris.js
VM./hello.js ×
Watch Expressions
Call Stack
Async
(anonymous function) VM./hello.js:19
VM./node_module.../tabris.js:646 (anonymous function)
VM./node_module.../tabris.js:635 (anonymous function)
VM./node_module...tabris.js:2097 (anonymous function)
VM./node_module...tabris.js:1084 (anonymous function)
VM./node_module.../tabris.js:346 (anonymous function)
Scope Variables
Breakpoints
☑ ./hello.js:17
textView.set("text", "Totall...
DOM Breakpoints
XHR Breakpoints
Event Listener Breakpoints

```
var page = tabris.create("Page", {
  title: "Hello, World!",
  topLevel: true
});

var button = tabris.create("Button", {
  text: "Native Widgets",
  layoutData: {centerX: 0, top: 100}
}).appendTo(page);

var textView = tabris.create("TextView", {
  font: "24px",
  layoutData: {centerX: 0, top: [button, 50]}
}).appendTo(page);

button.on("select", function() {
  textView.set("text", "Totally Rock!");
  textView.set("text", "Totally Rock x2!");
  textView.set("text", "Totally Rock x3!");
  textView.set("text", "Totally Rock x4!");
});

var fibonacci = {
  [Symbol.iterator]: function*() {
    var pre = 0, cur = 1;
    for (;;) {
      var temp = pre;
      pre = cur;
      cur += temp;
      yield cur;
    }
  }
}

for (var n of fibonacci) {
  // truncate the sequence at 1000
  if (n > 1000)
    break;
  console.log(n);
}

page.open();
```

# Node.js

*Node.js® is a **JavaScript** runtime built on Chrome's V8 JavaScript engine. Node.js uses an **event-driven**, non-blocking I/O model that makes it lightweight and efficient.*

- JavaScript **Virtual Machine** (V8)
- **Modules**
  - Native
  - JavaScript
- Event Loop

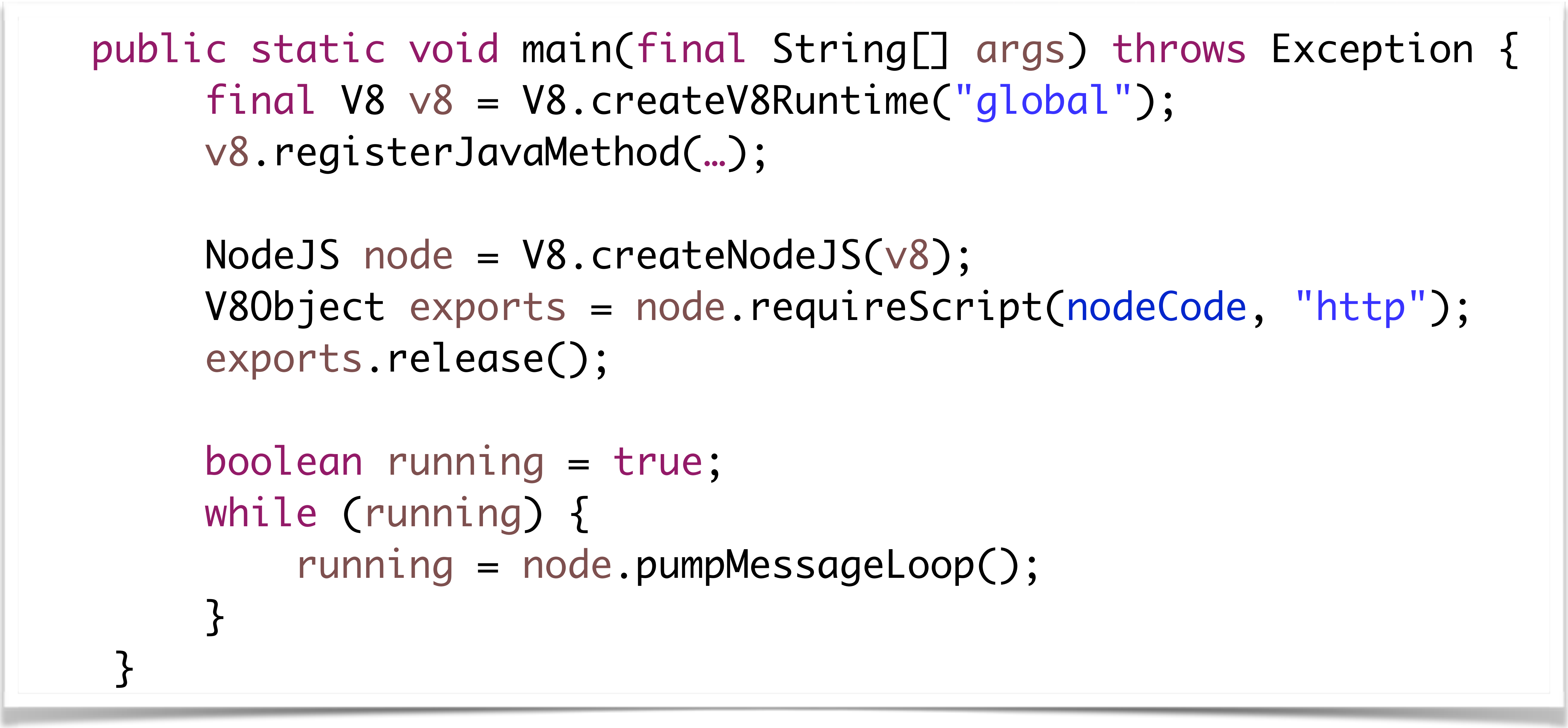
# Bridging to Node.js

- **Out of process** Node & REST Services
- **Vert.x**
- Node engine on Nashorn / Rhino?

# Node4J

- Dynamically link **Node.js** to the **JVM**
- Access Node.js context via **JNI**
- Execute Node.js **modules** (require)
- **Callbacks** to Java
- Process Node.js **message queue**

# Node4J Demo



```
public static void main(final String[] args) throws Exception {
    final V8 v8 = V8.createV8Runtime("global");
    v8.registerJavaMethod(…);

    NodeJS node = V8.createNodeJS(v8);
    V8Object exports = node.requireScript(nodeCode, "http");
    exports.release();

    boolean running = true;
    while (running) {
        running = node.pumpMessageLoop();
    }
 }
```

# Performance Considerations

- **Minimize** callbacks from JavaScript to Java
  - ~4000 Per Second on my MBP
- Use bulk array copy to move **primitives** from JS to Java
- **60fps** in our animation demo

# Resources

- Getting started with J2V8
- Registering Java Callbacks with J2V8
- Implementing WebWorkers with J2V8
- Multithreaded JavaScript with J2V8
- Using J2V8 with Heroku
- All linked from our GitHub Page

# Future Work

- Advanced **exception handling** between Java and JS
- Improved debug support
- **Typed array** access in Java
- **You tell me?**

# Using J2V8

- J2V8 is available in **Maven Central**
- Currently **5 variants** are available:

  com.eclipsesource.j2v8.j2v8_win32_x86:3.1.6
  com.eclipsesource.j2v8.j2v8_macosx_x86_64:3.1.6
  com.eclipsesource.j2v8.j2v8:3.1.6 (aar)
  com.eclipsesource.j2v8.j2v8_android_armv7l:3.1.6
  com.eclipsesource.j2v8.j2v8_android_x86:3.1.6

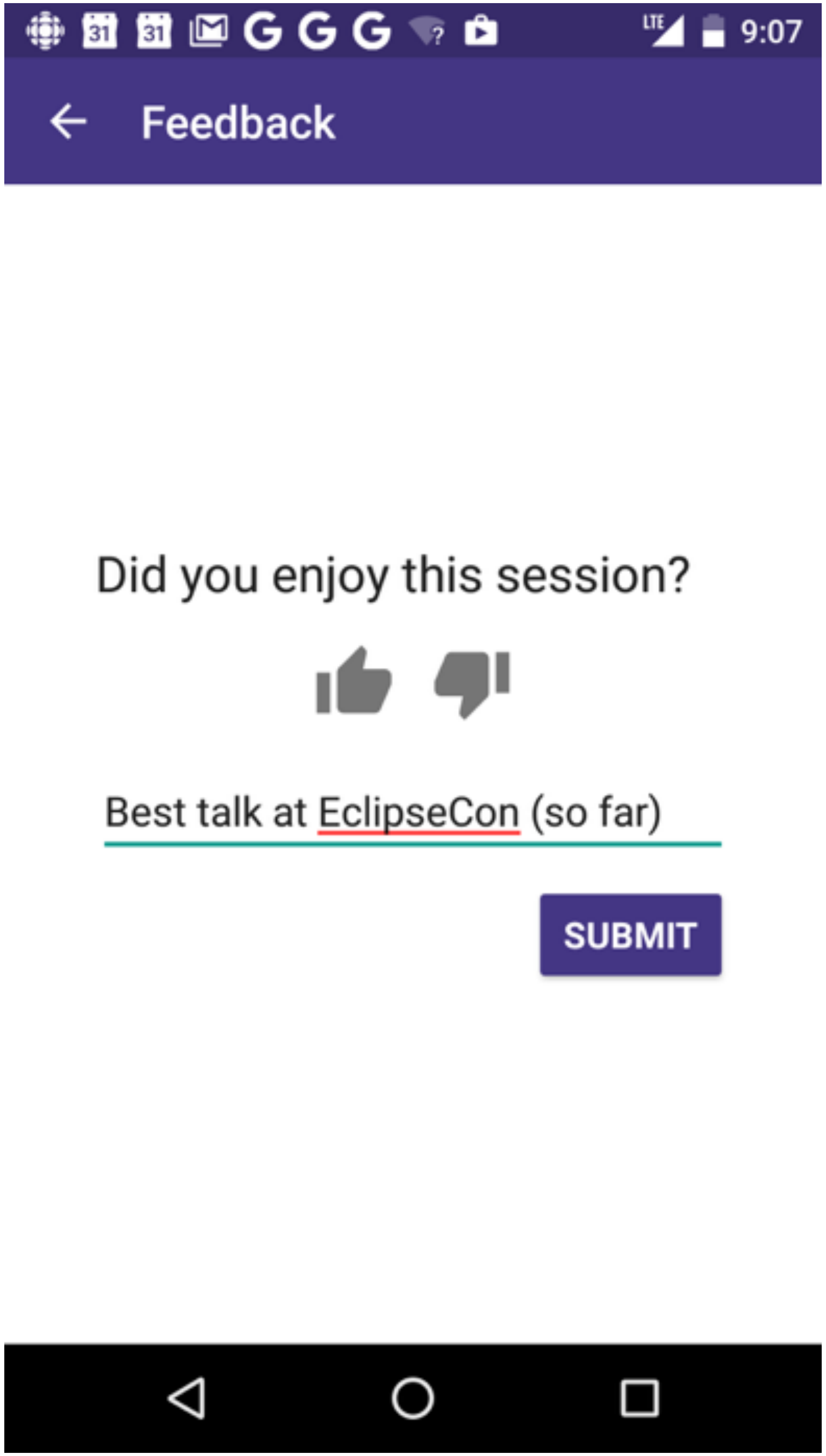
- j2v8:3.1.6 (aar) contains both **x86** and **armv7l**

# 4.0!

# Thank-you

- Open Source **Java** bindings for **V8**
- Node4J extensions bring **Node.js** to Java
- Licensed under the **EPL**
- For J2V8 news, follow me on Twitter ***@irbull***

**https://github.com/eclipsesource/j2v8**



Feedback

Did you enjoy this session?

Best talk at EclipseCon (so far)