jChampions

Conference 2024

Virtual Everywhere

January 29, 2024

Are You Game? Mobile Development With Modern Java, JavaFX, and GraalVM

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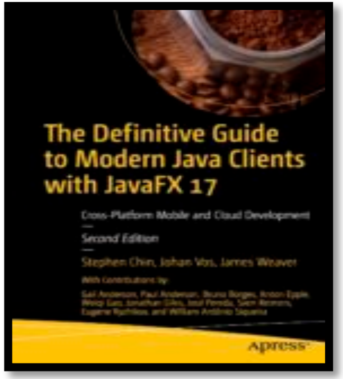
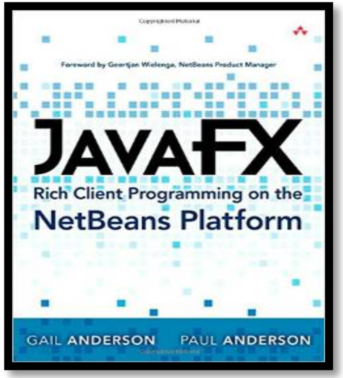
asgteach.com

So Who Are We?

- Training Company
  - Java, JavaFX Courses
- Books
  - Definitive Guide to Modern Java Clients with JavaFX 17, Second Edition
  - JavaFX Rich Client Programming on the NetBeans Platform
- Affiliations
  - Java Champions
  - Oracle Ace Members


The Definitive Guide to Modern Java Clients with JavaFX 17
Cross-Platform Mobile and Cloud Development
Second Edition
Stephen Chin, Johan Vos, James Weaver
With Contributions by
Gail Anderson, Paul Anderson, Bruno Borges, Anton Epple, Weiqi Gao, Jonathan Giles, José Pereda, Sven Reimers, Eugene Ryzhikov, and William Antônio Siqueira
Apress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Foreword by Geertjan Wielenga, NetBeans Product Manager
JAVAFX
Rich Client Programming on the
NetBeans Platform
GAIL ANDERSON
PAUL ANDERSON

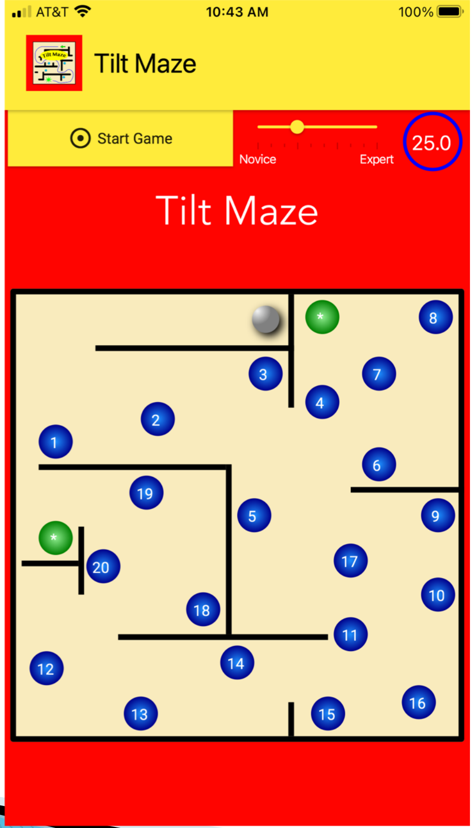
Agenda

- Why JavaFX on Mobile?
- Mobile App Demo
  - TiltMaze – The Accelerometer
  - Design – FXML and Scene Builder
- GraalVM and Gluon Substrate
- GluonFX Plugin, Gluon Attach
- JavaFX Binding and Animation Loop
- IOS and Android Deployments
- Summary, Q & A

Why JavaFX on Mobile?

- Critical Goal
  - Platform independent source code
  - “Write Once, Install Everywhere”
- Design Approach
  - Gluon tools and GraalVM platform
  - Lets you build native images
- JavaFX Advantages
  - Java UI, scene graph, nodes, FXML views, charts
  - Properties, listeners, binding, event handlers
  - JavaFX is Java, so you get a modern language

TiltMaze


AT&T
10:43 AM
100%
Tilt Maze
Start Game
Novice
Expert
25.0
Tilt Maze
8
3
7
4
2
1
6
19
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9
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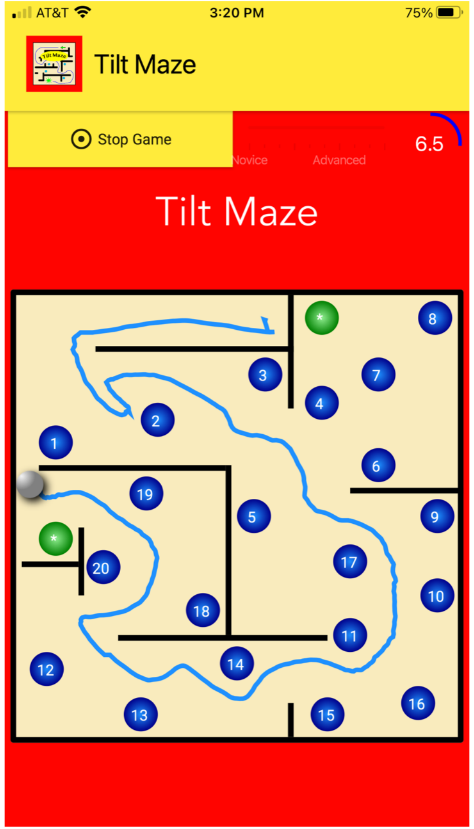
AT&T
3:20 PM
75%
Tilt Maze
Stop Game
Novice
Advanced
6.5
Tilt Maze
8
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19
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15

TiltMaze

- App Stores
  - [TiltMaze on Google Play]
  - [TiltMaze on Apple App Store]
- Features
  - Access device accelerometer in Animation loop
  - Gluon Mobile for mobile-friendly controls (licensed)
  - FXML to keep View and Controller separate
  - Collision detection to control game
  - Property binding to keep UI in sync

FXML and Scene Builder

- Scene Builder
  - Generates FXML
  - Use drag and drop to design view
  - Customize for extended controls and Font Library
- TiltMaze Design
  - Gluon Mobile Glisten UI Controls
  - JavaFX Pane, StackPane Layout Controls
  - JavaFX HBox and VBox Layout Controls

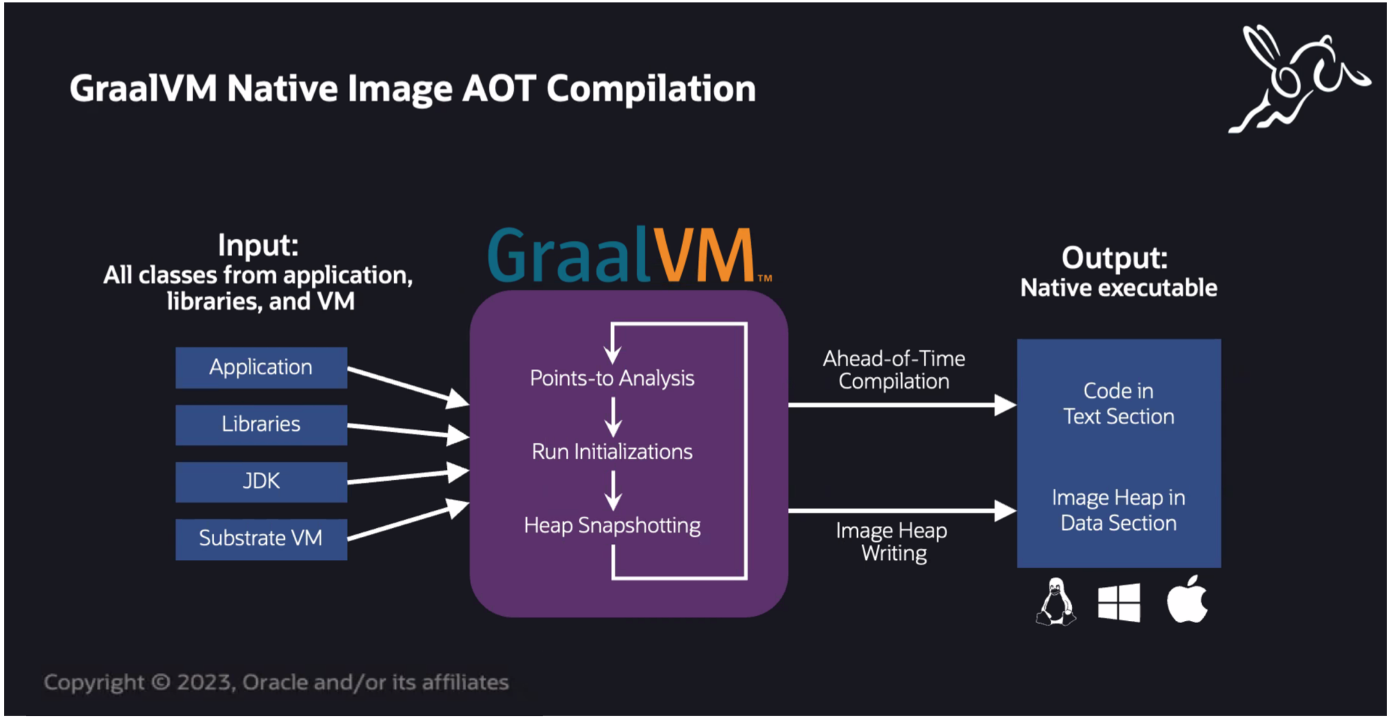
The Accelerometer

- What is a Accelerometer?
  - Sensor that measures velocity changes in 3D
  - Detects horizontal, vertical, up down movements
  - Very sensitive!
- Design Approach
  - Collects X and Y readings, ignores Z readings
  - Coordinate system matches JavaFX for X readings
  - Must multiply Y readings by –1 to match JavaFX

Mobile Devices

- Scaling to Device Size
  - Mobile devices can vary in size
  - Must scale the maze so aspect ratio is constant
  - Orientation is portrait mode only
- Mouse Events
  - Development cycle longer for native mobile targets
  - Better to simulate maze program on the desktop
  - Use mouse events instead of accelerometer

What is GraalVM?



GraalVM Native Image AOT Compilation

Input:
All classes from application, libraries, and VM

- Application
- Libraries
- JDK
- Substrate VM

GraalVM™

Points-to Analysis → Run Initializations → Heap Snapshotting

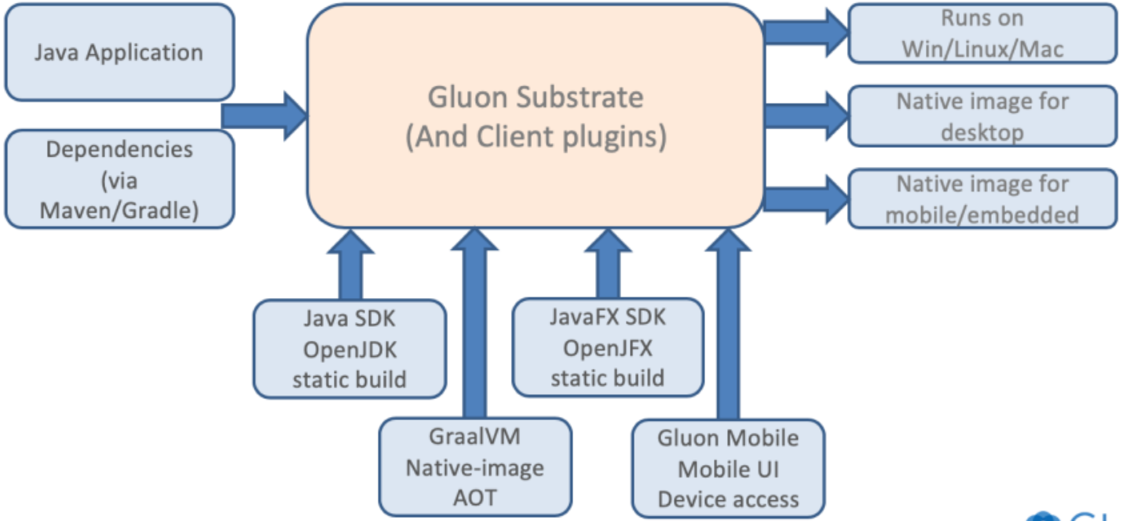
Ahead-of-Time Compilation

Image Heap Writing

Output:
Native executable

- Code in Text Section
- Image Heap in Data Section

Gluon Substrate and GraalVM



Java Application

Dependencies (via Maven/Gradle)

Gluon Substrate (And Client plugins)

Runs on Win/Linux/Mac

Native image for desktop

Native image for mobile/embedded

Java SDK OpenJDK static build

GraalVM Native-image AOT

JavaFX SDK OpenJFX static build

Gluon Mobile Mobile UI Device access

GLUON

Gluon Attach

- Features
  - Lets you access hardware on mobile devices
  - Open source and free under GPL license
  - Add a dependency to your build script to use
- Supported Services (partial list)
  - Accelerometer, Audio, Barcode Scan, Battery
  - Bluetooth, Compass, Dialer, Display, Position
  - Orientation, Status Bar, Storage, Vibration, Video

GluonFX plugin for Maven

- Starter Page + GraalVM download
  - https://start.gluon.io/
  - https://github.com/gluonhq/graal/releases/tag/gluon-22.1.0.1-Final
- Samples on github
  - https://github.com/gluonhq/gluon-samples
  - Starter projects you can download and study
- Tutorial from Idea to App Store
  - https://foojay.io/today/creating-mobile-apps-with-javafx-part-1/

JavaFX Property Binding

- Property Binding
  - Properties depend on values of other properties
  - Succinct, less error prone, consistent game state
  - Avoid writing listeners
  - Bindings library APIs
- TiltMaze Controls
  - Button, timer label
  - Speed slider, progress indicator

JavaFX Animation Loop

- AnimationTimer Class
  - Abstract class with `handle(long now)` method
  - System invokes this method once per frame
  - Lets you define tasks to perform in animation loop
- TiltMaze
  - Controls actions in the game environment
  - Reads accelerometer and updates maze
  - Performs collision detection, checks if timer expired

Run on Desktop

- Create and Run JVM Image
  - Uses GraalVM JIT Compiler

```
$ mvn gluonfx:run
```

- Create and Run Native Image
  - Uses GraalVM AOT Compiler

```
$ mvn gluonfx:build
$ mvn gluonfx:nativerun
```

IOS Target Setup

- Mac with MacOS
  - Xcode development tools
  - Native libraries
  - GraalVM JDK
- Other Requirements
  - Apple provisioning
  - Icon images
  - Feature configuration

IOS Native Target

- Build and Package
  - Uses GraalVM AOT Compiler
  - Package dependencies, native libraries, certificates

```
$ mvn -Pios gluonfx:build
$ mvn -Pios gluonfx:package
```

- Install and Run
  - Install app on connected device and run

```
$ mvn -Pios gluonfx:install
$ mvn -Pios gluonfx:nativerun
```

Android Target Setup

- Linux, Virtual Linux OS, or GitHub Actions
  - Development tools
  - Native libraries
  - GraalVM JDK
- Other Requirements
  - Java signing
  - Icon images
  - Feature configuration

Android Native Target

- Build and Package
  - Uses GraalVM AOT Compiler
  - Package dependencies, native libraries, certificates

```
$ mvn -Pandroid gluonfx:build
$ mvn -Pandroid gluonfx:package
```

- Install and Run
  - Install app on connected device and run

```
$ mvn -Pandroid gluonfx:install
$ mvn -Pandroid gluonfx:nativerun
```

Summary

- JavaFX on Mobile
  - Java and JavaFX code base for development
  - TiltMaze Demo App with Accelerometer
  - Gluon Substrate, GluonFX Plugin, Gluon Attach
  - GraalVM for native images on IOS/Android
- Java, JavaFX Benefits
  - Modern Java and JVM
  - FXML and Scene Builder
  - Property Bindings, Animation Loop

Q & A

- Thanks for Attending!

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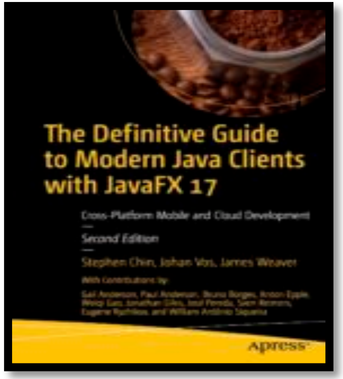

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- GitHub Source Code

  https://github.com/gailasgteach/TiltMaze/