

# GRAAL: HOW TO USE THE NEW JVM JIT COMPILER IN REAL LIFE



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# WHAT IS GRAAL?

- Java Virtual Machine Just-in-Time (JIT) compiler
- Actively developed by Oracle Labs
- <http://openjdk.java.net/projects/graal/>
- <https://github.com/oracle/graal>
- Uses JVMCI (JEP 243)
- Written in Java



**WRITTEN IN  
JAVA!!!**

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# WHERE DO I GET IT?



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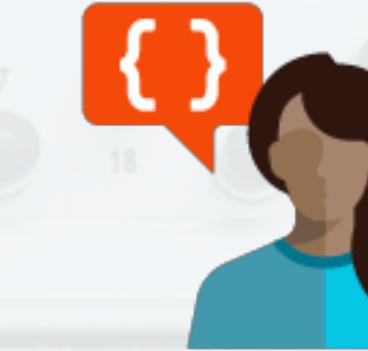
- JEP 295: Ahead-of-Time Compilation
- <http://openjdk.java.net/jeps/295>



# WHERE DO I GET IT?

- JEP 295: Ahead-of-Time Compilation
  - <http://openjdk.java.net/jeps/295>
- JEP 317: Experimental Java-Based JIT Compiler
  - <http://openjdk.java.net/jeps/317>
  - JDK 10: <http://jdk.java.net/10>





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# Get it demo

<https://cloud.oracle.com>



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# Oracle Groundbreaker Ambassador

## ABOUT ME...

- Working on JVMs for over 14 years
- Sun Microsystems/Oracle HotSpot compiler team
- JSR 292: Supporting Dynamically Typed Languages on the JavaTM Platform
- JEP 243: Java-Level JVM Compiler Interface
- JEP 295: Ahead-of-Time Compilation
- Twitter VM team



**CHRIS**

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currently [@Twitter](#) // former [@Oracle](#),  
[@SunMicrosystems](#) // Oracle  
Groundbreaker Ambassador  
[@groundbreakers](#) // [@LavaOneConf](#)  
organizer // [@HawaiiJUG](#) leader

📍 Haleiwa, HI

# WHY THIS TALK?

- The main purpose of my talks is to get people to try Graal
  - Save money, fix bugs, improve Graal



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- Sometimes they send me emails
  - Mostly complaining about benchmark numbers



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  - Save money, fix bugs, improve Graal
  - Also, people come up to me and ask...
  - Is it safe to use it? How do I use it? Where do I get it?
- Sometimes they send me emails
  - Mostly complaining about benchmark numbers
  - ...and that it SUCKS!

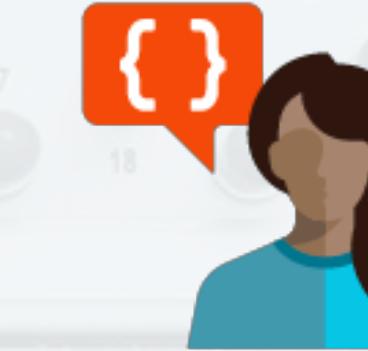


# WANNA KNOW MORE ABOUT SAVING MONEY?

- Lots of details in my talk (available on YouTube):

TWITTER'S QUEST FOR A  
WHOLLY GRAAL RUNTIME





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# Back to demo



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# HOW DO I USE IT?

- Get a JDK with Graal (`jdk.internal.vm.compiler`)



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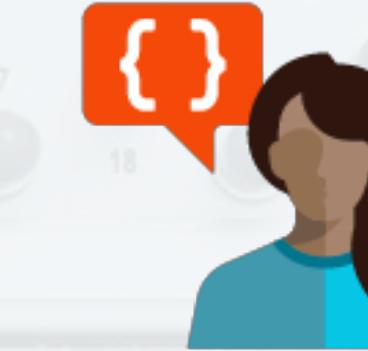
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# HOW DO I USE IT?

- Get a JDK with Graal (`jdk.internal.vm.compiler`) 
- Turn it on!





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# Use it demo



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# WHAT IS BOOTSTRAPPING?

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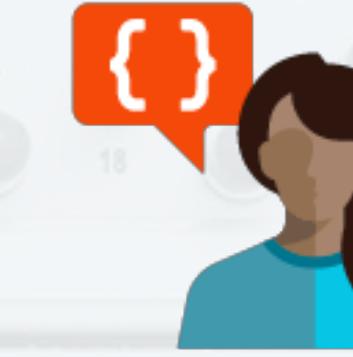
- Graal is just another Java application running in your JVM
  - It loads Java classes
  - Has Java methods



# WHAT IS BOOTSTRAPPING?

- Graal is just another Java application running in your JVM
  - It loads Java classes
  - Has Java methods
  - Which (at some point) need to be compiled, obviously





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# Bootstrap demo



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# WHAT WE LEARNED

- Bootstrapping compiles a lot of methods
  - tiered: about 2,500
  - non-tiered: about 4,800
- Either upfront or on-demand during runtime
- By default on-demand compiles Graal with C1 only



# JAVA HEAP USAGE

- Graal is...



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# JAVA HEAP USAGE

- Compiling application methods will use Java heap memory
- Graal methods possibly too
- Remember `CompileGraalWithC1Only?`





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# Java heap demo



# WHAT WE LEARNED

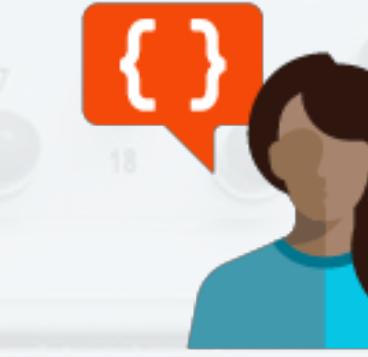
- Graal uses Java heap memory
  - There is no heap isolation (yet)
  - Most Graal memory usage during startup
    - Usually when application isn't fully up yet
  - Memory is used anyway
    - Either malloc or Java heap



# RUNNING BLEEDING EDGE

- Get Graal from GitHub
  - <https://github.com/oracle/graal>
  - <https://github.com/graalvm/mx>





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# Build Graal demo

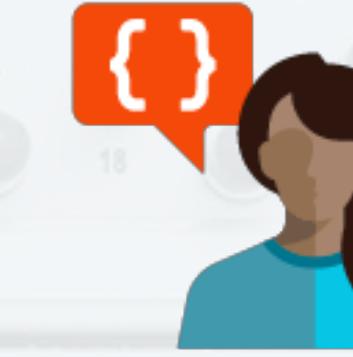


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# RUNNING IN PRODUCTION

- The bootstrapping overhead is usually negligible
  - Additional time (mostly) disappears in the startup noise
  - Free CPU cores are used for compilation





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# Production demo



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# Scalademo



# SUMMARY



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`-XX:+UnlockExperimentalVMOptions -XX:+EnableJVMCI -XX:+UseJVMCICompiler`



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