



Oracle GraalVM Enterprise Edition Faster. Smarter. Leaner.

Businesses are under increasing pressure to be smarter, faster and more agile at providing services to their clients and customers.

[Oracle GraalVM Enterprise Edition](#) is the industry's best solution for building applications on premise and in the cloud, offering superior performance, enhancing competitiveness, and driving business innovation while reducing costs. It represents more than a decade of research into optimizing compiler and virtual machine technology that provides significant [application performance](#) and efficiency improvements. [Microservices](#) running on GraalVM consume less memory and CPU which significantly reduces cloud computing costs.

WHAT IS GRAALVM ENTERPRISE?

GraalVM Enterprise is a high-performance JDK that yields significant improvements in application performance and efficiency. It provides a platform for innovation to enhance competitiveness and accelerate application modernization. It is the best solution for building microservices on premise and in the cloud.

GraalVM Enterprise is comprised of:

- GraalVM Optimizing Compiler
- Native Image Compiler for Linux/X86, MacOS/X86, and Windows/X86, LLVM Interpreter
- Ideal Graph Visualizer monitoring agent

ORACLE GraalVM

Key Features

- A high-performance runtime for modern microservices
- Leverages new optimization algorithms to improve performance of enterprise applications
- Compiles Java applications ahead of time into native images to improve startup and memory footprint
- Extends applications with libraries from other supported languages without performance penalties
- Runs native languages like C/C++ in a safe mode on the JVM
- Can be embedded in database.
- Supported on x86 and ARM processors including on Oracle Cloud Infrastructure Ampere A1 Compute

Related Products

- GraalVM Enterprise is an entitlement included in the [Oracle Java SE Subscription](#)

- Oracle Premiere Support (MOS) 24x7 from the GraalVM team
- Built on enterprise-class Oracle Java SE

HIGH PERFORMANCE

Oracle GraalVM Enterprise Edition’s optimizing compiler operates in 2 modes, Just-in-Time (JIT) compilation and Ahead-of-Time (AOT) compilation.

In Just-in-Time compilation mode, GraalVM Enterprise runs inside of the Java SE runtime environment and acts like a high-performance, 100% compatible, compiler.

GraalVM Enterprise’s optimizing compiler and virtual machine technology represents more a decade of research and development. The optimizing compiler has 27 patented optimizing technologies that result in about a 50% increase in application performance on average, and as much as a 4x in some cases with no code changes (Chart 1).

Additionally, GraalVM Enterprise aggressive inlining, polymorphic inlining, and partial escape analysis, increases optimization opportunities, provides for faster virtual method calls, and eliminates or delays object allocations. This provides for lower CPU used on the same code, and fewer objects created resulting in less garbage collection and higher throughput.

Key Business Benefits

- Speeds up application performance by an average of 55% without any code changes
- Starts up native image compiled applications up to 100x faster and consumes 5x less memory
- Improves developer productivity
- Enables faster innovation in the cloud and on premise
- Reduces costs through higher efficiency of memory and CPU utilization
- Leverages popular libraries and frameworks from any supported language

Additional Resources

- [Oracle GraalVM Enterprise Edition](#)
- [GraalVM Enterprise documentation at Oracle Help Center](#)
- [GraalVM Enterprise blogs](#)
- [GraalVM developer blogs](#)
- [Supported Platforms and Operating Systems](#)

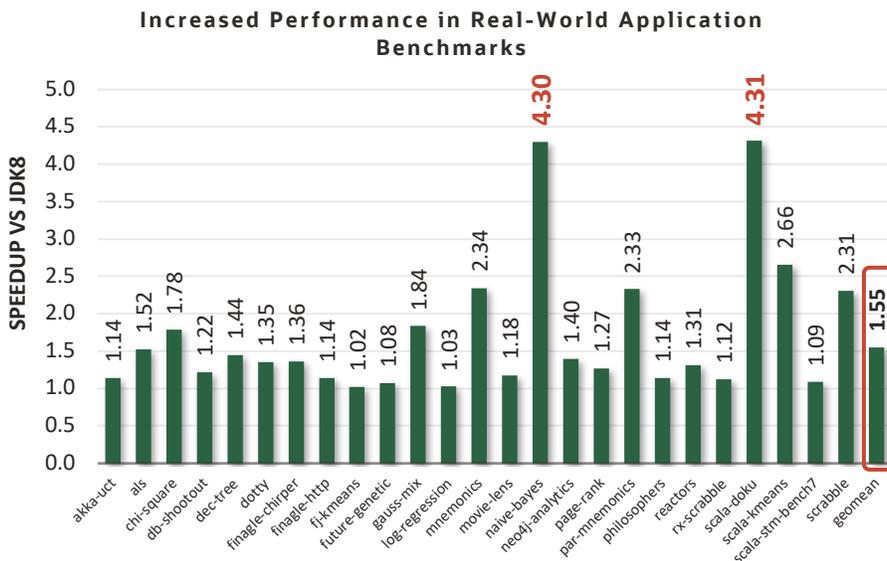


Chart 1: Measured performance of GraalVM Enterprise JIT compiler vs JDK8.

Twitter

Twitter adopted the GraalVM JIT compiler for their Scala-based infrastructure and saw an 8-11% decrease in CPU consumption and a 20% increase in throughput. This resulted in 5-12% decrease in the number of physical machines required for each service as it was moved to use GraalVM.

Oracle Cloud Infrastructure

Oracle Cloud Infrastructure moved to utilizing GraalVM Enterprise as the JIT compiler and runtime environment for its own infrastructure. In doing so, it saw a 25% reduction in garbage collection time, a 10% increase in transactions/second and has had 0 issues with 10s of millions of core hours of runtime since the migration.



“Being able to see 8–11 percent performance improvements on the same hardware without having to change the underlying code is a once-in-a-lifetime event, leading to substantial cost savings and future flexibility for Twitter.”

Chris Thalinger,
Staff Engineer, Twitter

IDEAL FOR MICROSERVICES AND THE CLOUD

Oracle GraalVM Enterprise Edition's Ahead-of-Time compiler, called Native Image, allows your Java and JVM-based applications to be compiled ahead of time into a binary that runs natively on the system, improving startup and memory footprint.

GraalVM Enterprise Native Image can decrease startup times of microservices up to 100x (Chart 2) and decrease memory usage by approximately 5x (Chart 3).

The major application frameworks, including Springboot, are all compatible with GraalVM Enterprise.

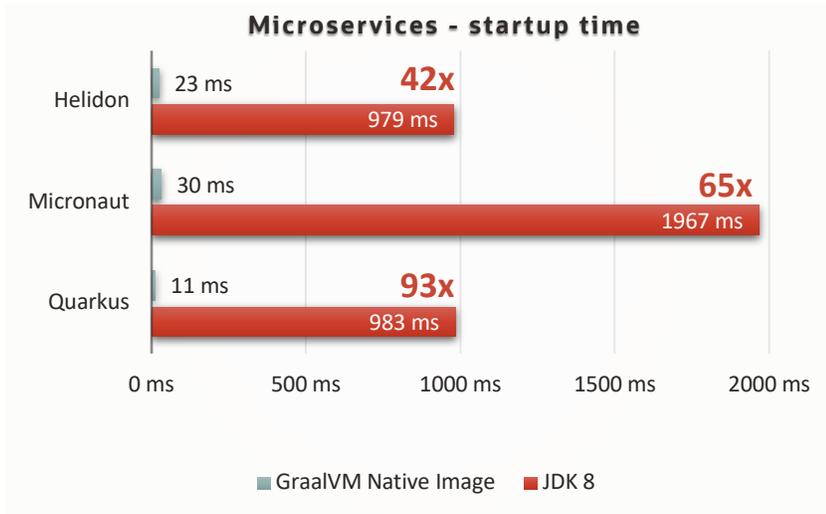


Chart 2: Startup time of microservices with GraalVM Enterprise Native Image vs. JDK8.

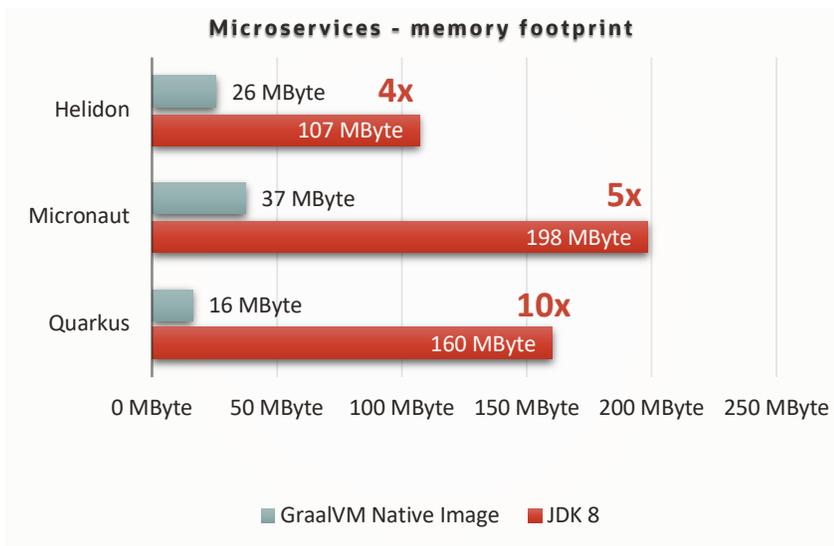


Chart 3: Memory footprint of microservices with GraalVM Enterprise Native Image vs. JDK8.

THE FLEXIBILITY TO WORK WITH DIFFERENT LANGUAGES

GraalVM Enterprise allows developers the flexibility to build applications in different languages without the traditional overhead. Objects created in one language can be used directly in another language as if they are native to that language. This removes the traditional marshalling code required normally, simplifying the application,

reducing memory and CPU usage, and allows getting the product to market more quickly.

Developers can utilize libraries from many popular languages including, Java, JavaScript, node.js, Python, Ruby, R, and the various JDK-based languages like Kotlin and Scala.

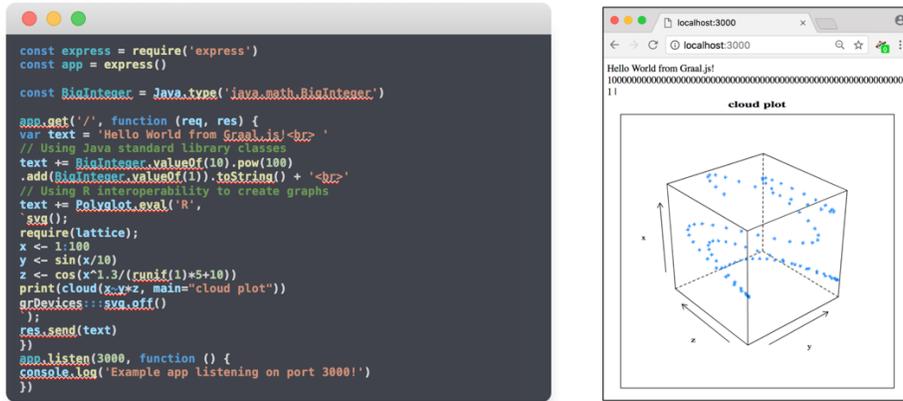


Chart 4: A simple JavaScript application with Java and R language calls.

GraalVM Enterprise can also be extended to add additional languages with its Language Implementation Framework. This is how many of the currently supported languages are implemented.

Goldman Sachs

Goldman Sachs uses GraalVM to overcome the challenges of working with a complex dynamic type system in their in-house Slang programming language, interfacing with C native functions, and trying to evolve its existing applications. Used the GraalVM Language Implementation Framework to allow GraalVM to generate an optimizing compiler for Slang which is used for its critical pricing and risk applications.

They overcame the challenge of evolving an existing system with 150 million lines of code of typically mission critical applications with GraalVM.



EASE OF MANAGEMENT AND DEBUGGABILITY

GraalVM Enterprise provides a set of tools for developers, integrators and IT administrators to debug and monitor deployed applications or the GraalVM platform itself. The tools are ready to diagnose single or multi language programs. It provides simple command line tools for runtime and memory profiling to help users analyze and optimize their code.

With a single runtime to patch, GraalVM Enterprise provides access to predictable performance, stability, and security updates for all your Java and JVM based applications.

“You can profile across those boundaries, you can debug across those boundaries, that’s just a huge efficiency win”

Zach Fernandez – Goldman Sachs

GRAALVM ENTERPRISE AVAILABILITY

GraalVM Enterprise is an entitlement with Java SE Subscription for on-premise environments. GraalVM Enterprise features include:

- Oracle Premier Support (24x7x365)
- Access to Performance, Stability and Security Updates
- MOS (My Oracle Support)
- Annual 1 Year Term Licensing

GraalVM Enterprise use and support is included in Oracle Cloud subscriptions at no additional cost.

CONCLUSION

GraalVM Enterprise is a high-performance JDK backed by a decade of research. It is the industry's best solution for building microservices applications for on premise and in the cloud deployments.

Find out how it can offer superior performance, enhance competitiveness, and drive business innovation while reducing costs in your enterprise today.

GET STARTED WITH GRAALVM ENTERPRISE

- GraalVM Enterprise is available for evaluation from the [Oracle Technology Network](#).
- GraalVM Enterprise is available as an entitlement with Java SE Subscription at no additional cost today. It is also included in Oracle Cloud subscriptions available *on both x86 and ARM processor architectures including Ampere A1 Compute*
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- GraalVM Enterprise is also built into the Oracle Cloud Developer Image, which includes the latest tools, OCI SDKs, Terraform templates, database connectors, and more.
- The [full documentation](#) for GraalVM Enterprise is available on the [Oracle Help Center](#).

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