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What's new in Java SE Embedded?

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September 29, 2014

Safe Harbor Statement

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Program Agenda

1. Java SE Embedded Overview
2. Java SE Embedded 8
3. Java SE Embedded 8u6
4. Java SE Embedded 9?
5. Q & A

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Java Embedded (ME & SE)

Multi-function
Embedded Devices

Personal Devices

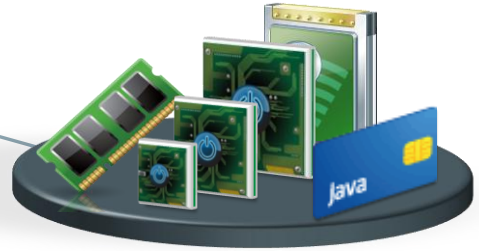
Communications

Industrial controls &
Network Appliances

Smart Appliances &
Consumer Electronics

Connected Vehicles

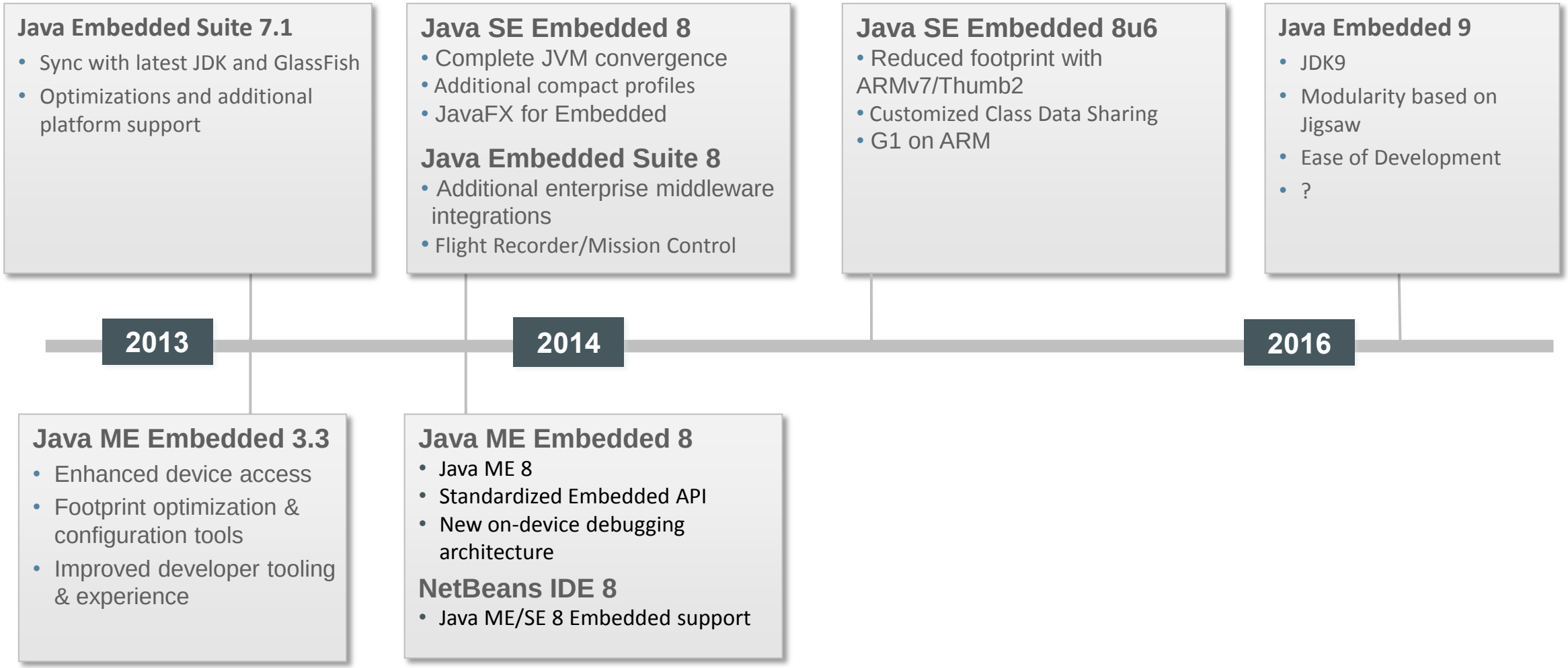
Smart Energy & mHealth



Sensors & Micro controllers

Oracle Java Embedded Offering Today

Roadmap



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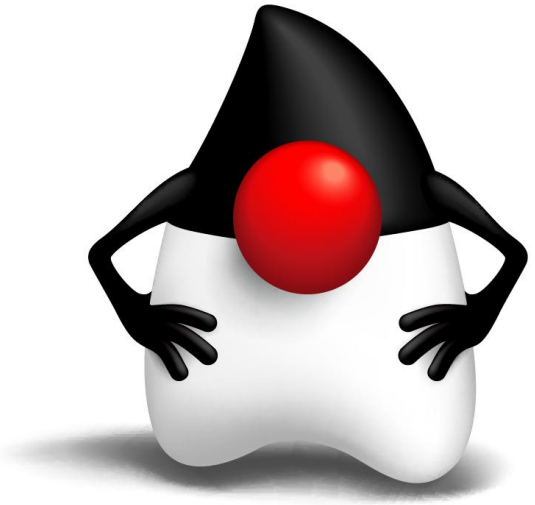
Java SE 8 – Evolving the Java Platform

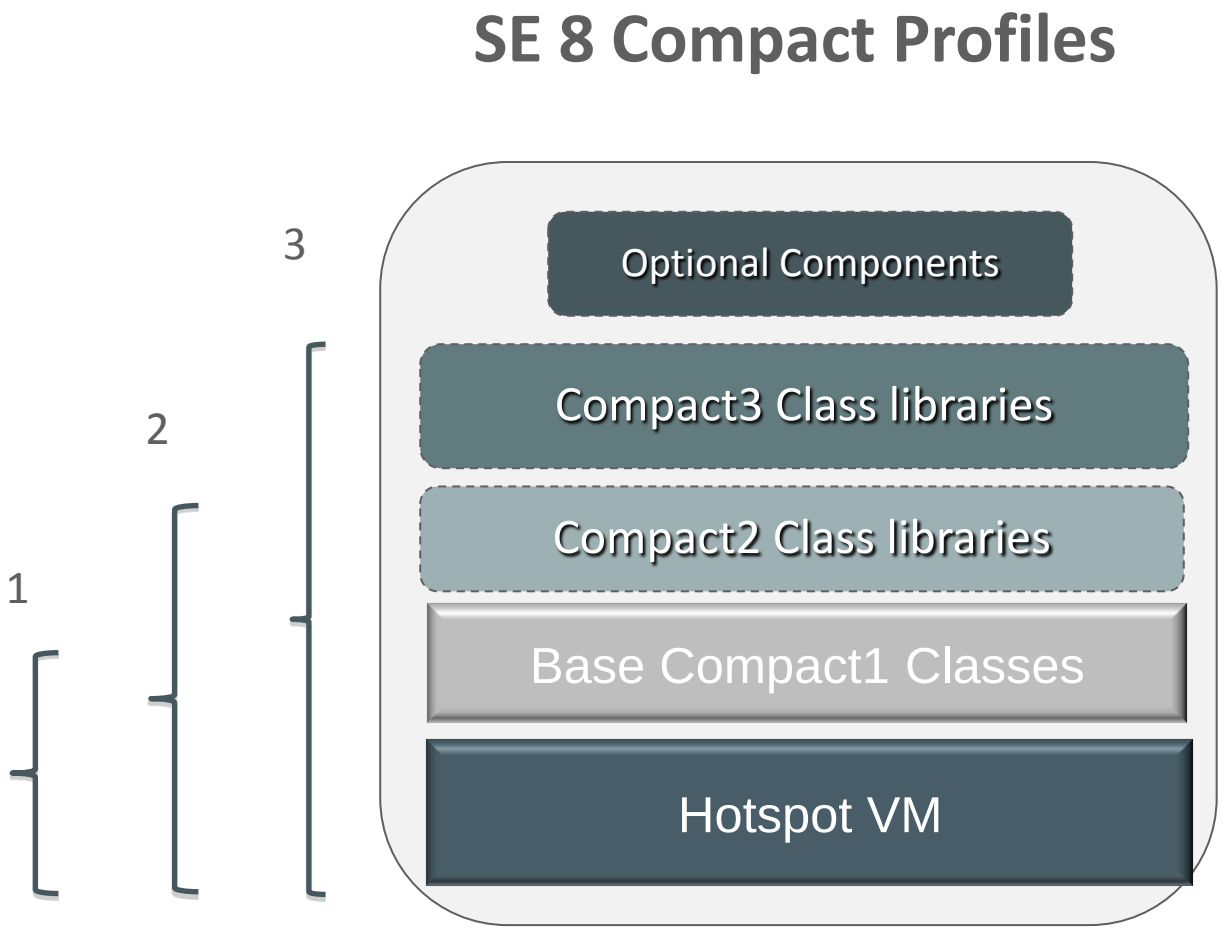


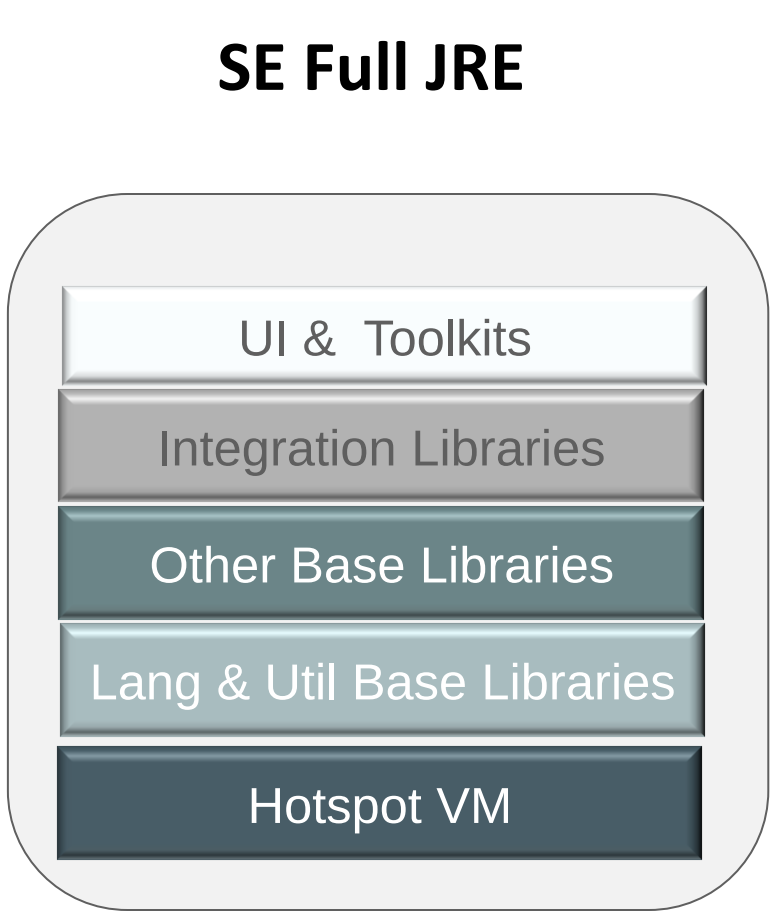
- Language evolution:
  - Lambdas & Default methods
- Library evolution
  - Streams framework for parallel computing
  - New Date/Time API's
- Hotspot evolution
  - PermGen removal; JSR-292 enhancements, Native Memory Tracking
  - Minimal VM
- Configuration evolution
  - Compact Profiles

Compact Profiles and SE Embedded

- Three new Java SE Runtimes (Compact Profiles) in JDK 8
  - Well-defined Java SE compatible subsets
  - Described in Java Enhancement Proposal 161 (http://openjdk.java.net/jeps/161)
- Benefits
  - Significantly smaller base Java runtime
  - Platform for smaller FX only graphical UI stack
  - New tool for Java SE Embedded which allows selection of runtime options
  - Developers select an appropriate runtime for their target hardware
- Basis for Java ME / CDC Converged product
  - Similar to Foundation profile & optional packages
    - Enables migration of CDC headless applications

Java SE 8 Compact Profiles





Java SE 8 API Subsets for Compact Profiles

SE Embedded 8 Features

- Java Flight Recorder (JFR) support
  - But no Mission Control and requires full JRE
- Hotspot minimal VM
  - Reduced footprint client VM with all optional services stripped out
    - 3.5MB or smaller, static footprint
  - Serial GC only; no JVMTI, NMT, CDS, Flat Profiler, JFR, Management APIs
- General performance improvements on ARM/PPC
  - Code cache management
- Optimized vector operations on ARM:
  - Leverage ARM Advanced SIMD (NEON™) in server JIT compiler

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SE Embedded 8u6

- First release post JDK 8
  - Independent of SE release (8u20)
  - Incorporates 8u5 CPU release
- Key features for SE Embedded
  - Reduced static footprint
  - Increased performance on server platforms
  - ARM specific enhancements
  - Additional Java FX support on i.MX6 platform

Reduced Static Footprint

- ARMv7 builds using Thumb-2 ISA mode
  - Reduces binary size
  - Supports JNI compiled in both ARM/Thumb-2
- Link-Time Optimization (LTO) used with minimal VM
  - Improves visibility between independently compiled object files
  - Reduces static footprint as well as runtime dynamic footprint
  - Further info: http://gcc.gnu.org/wiki/LinkTimeOptimization

Tiered Compilation for Server VM

- Tiered compilation combines C1 (client) and C2 (server) JIT compilers into one binary
- Initial C1 compilation gives benefit of C1's faster startup
- C1 inserts profiling probes to determine when to invoke C2
- C2 compiles to higher optimization level to improve long running performance
- Feature is disabled by default:
  - Use –XX:+TieredCompilation to enable it

Tiered Compilation Benchmark Results

- The benchmarks were run on a server class system to satisfy the minimum of 4 cores requirement
- DaCapo benchmark on first iteration showed on average an 11% improvement
- Linpack showed a 33% improvement in time measurement and 100% improvement in Mflops/sec measurement
- **Caveat**: as with all performance improvements, results will be application and platform dependent

Provide G1 for JDK on ARM

- G1 (Garbage First):
- One of the garbage collectors in Java SE, still evolving.
  - Refer to SE documents for details, tools and tips
- Developed and tuned for big heaps
  - Explicitly deactivated for all SE Embedded builds
- Ported to ARM for 8u6
  - JDK on ARM only
  - Technology preview release and thus is **not officially supported**

Customized Class Data Sharing (CDS)

- CDS dumps an archive of boot classes that can be preloaded by the JVM:
  - Reduces dynamic footprint when shared by multiple JVM instances
  - Reduces startup time even when used by a single JVM instance
  - List of boot classes to dump is ‘hard-wired’ in SE
- SE Embedded 8u6 allows customization of the archive for each application
  - -XX:DumpLoadedClassList=<classlist_file>
    - Dumps a list of all classes loaded from the bootclasspath when application exits
  - -XX:SharedClassListFile=<classlist_file>
    - Allows user to specify their own classlist when creating archive via –Xshare:dump
  - -XX:SharedArchiveFile=<archive_file>
    - Allows user to specify the location of the shared archive file to dump or use

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Java SE Embedded 9?

- What will it look like?
  - Jigsaw adds modularity to the platform
  - jlink allows you to configure a JRE with what you need
  - No need for compact profiles or embedded images
- ??? … to be continued …

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