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Presenting with



ARM: Eight Billion Served "Want That Java Superoptimized?"

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Bertrand Delsart, Oracle Corporation

MAKE THE
FUTURE
JAVA



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The development, release, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.

Program Agenda

- ARM Processor Roadmap
- ARM Key features for Embedded Market
- Key Java Features & Optimizations for ARM CPUs
- Java SE [Embedded] on ARM
- Future Optimizations
- Demonstration
- Q & A



Brief Business Facts

Processors shipped in 2011 : ~8Bu (+2Bu from '10)

Processors shipped in total : >30Bu

Processor licenses : 850+

Semiconductor partners : 290+

Process technology : 20 – 250 nm

Connected community members : 950+



Connected Community 950+

Silicon Partners



Design Support Partners



Software, Training and Consortia Partners



ARM

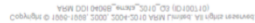
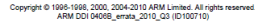


ARM Terminology

Architecture

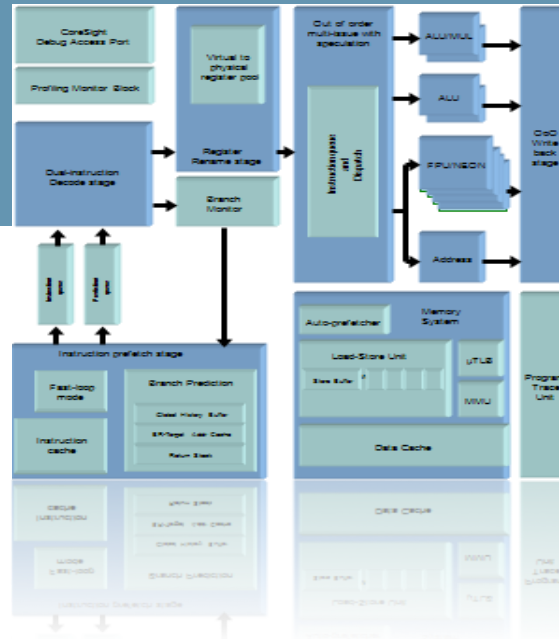
“ARMv7A”

ARM® Architecture
Reference Manual
ARMv7-A and ARMv7-R edition

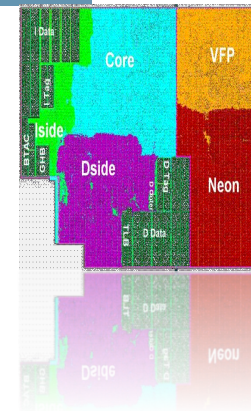
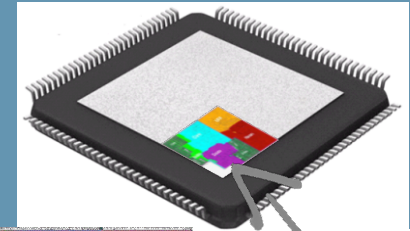


Processor Micro-Architecture

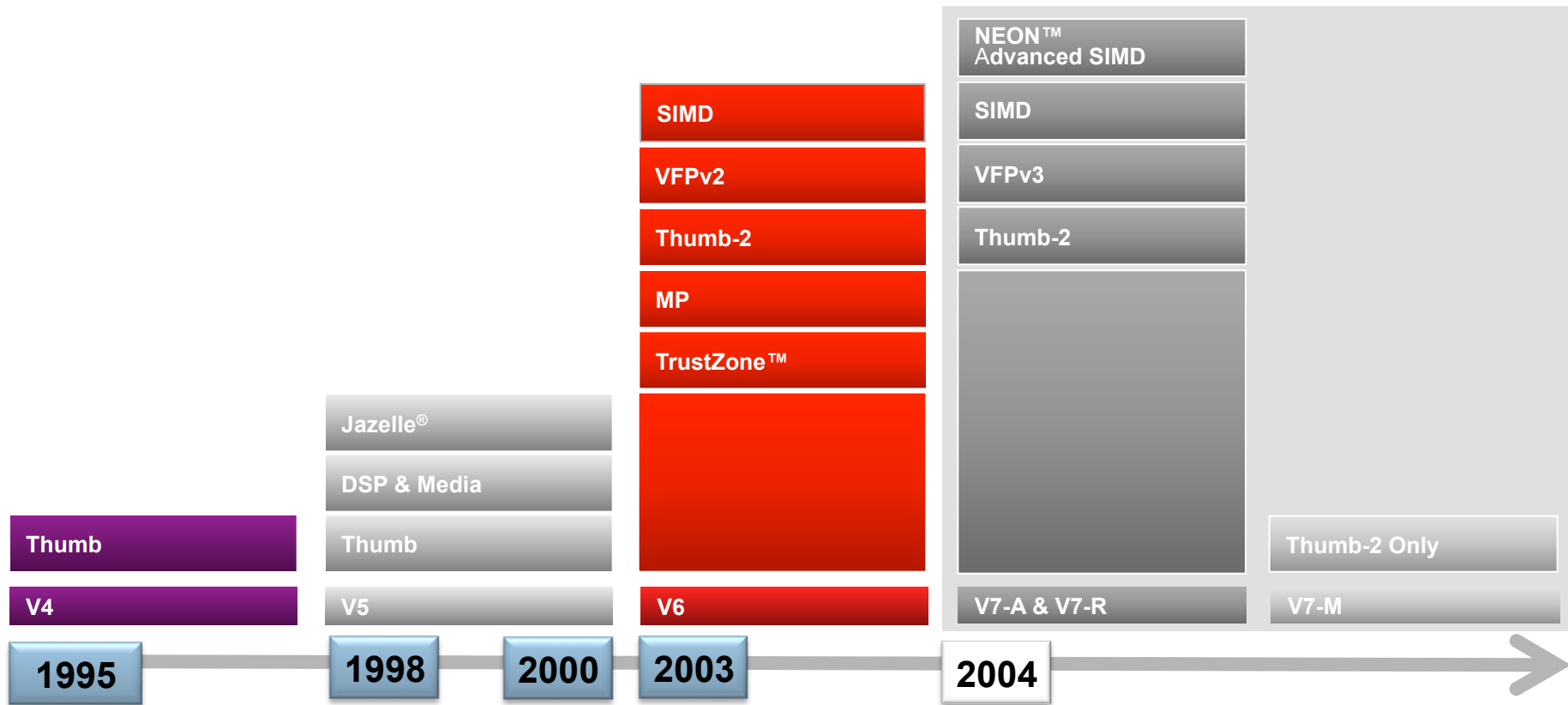
“Cortex-A15”



Processor Hard-Macro Implementation



ARM Architecture : Evolution



Architecture: Progression Details



32-bit Architecture
32-bit VA & PA
Supports SMP 1-4 cores
TrustZone – Security
ARM & Thumb1/2 ISA
NEON & VFP
L1 D-Cache Coherency

ARMv7-A

2004



Full HW Virtualization
40-bit PA
Hypervisor State
2 levels PTT

32-bit Architecture
32-bit VA & PA
Supports SMP 1-4 cores
TrustZone – Security
ARM & Thumb1/2 ISA
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ARMv7-A – extensions

2010



64-bit Architecture
64-bit wide registers
32-bit instructions
30 registers

Full HW Virtualization
40-bit PA
Hypervisor State
2 levels PTT

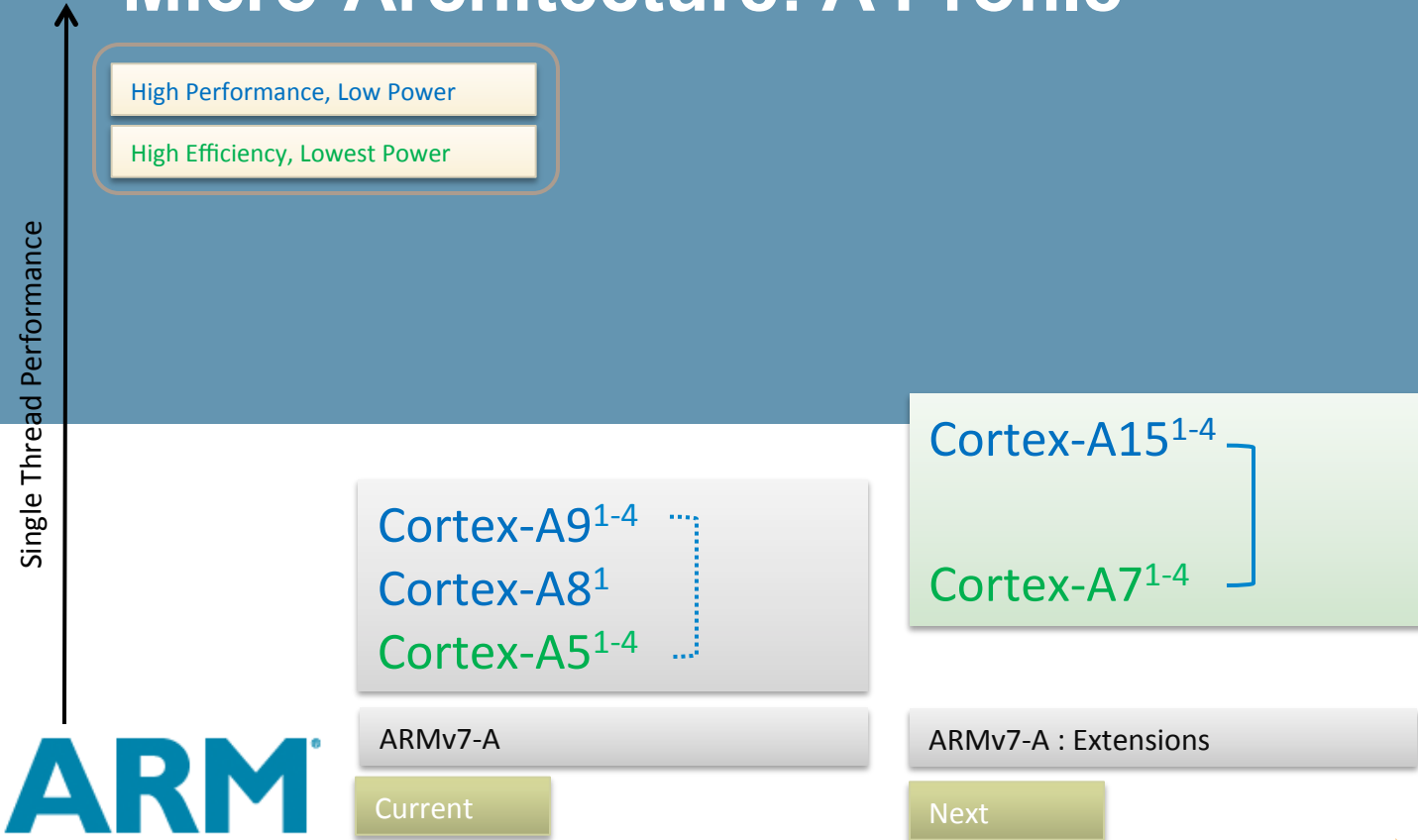
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ARMv8

2011



Micro-Architecture: A Profile



Cortex-A15

Support for virtualization

- Complements ARM TrustZone security technology
- Provides robustness, resource control, safety
- Helps manage virtual machine software complexity
- Enables power-efficient high-performance

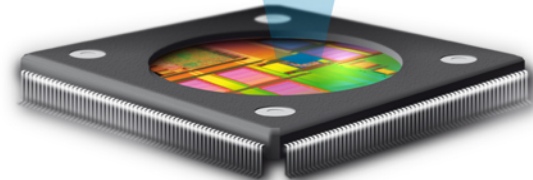
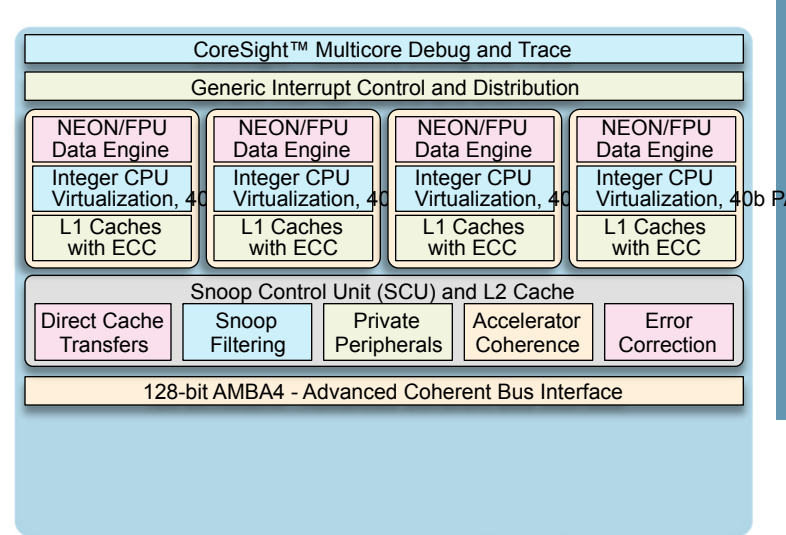
Support for larger memory

- Support for 1 TB of addressable physical memory
- Virtualized OS, advanced application payloads

- Commercial datasets, complex analysis
- Rich content generation, editing, mashing

Support for soft-fault recovery

- Built-in capability for detection and correction of soft-faults
- Corrects single-bit and detects double-bit faults

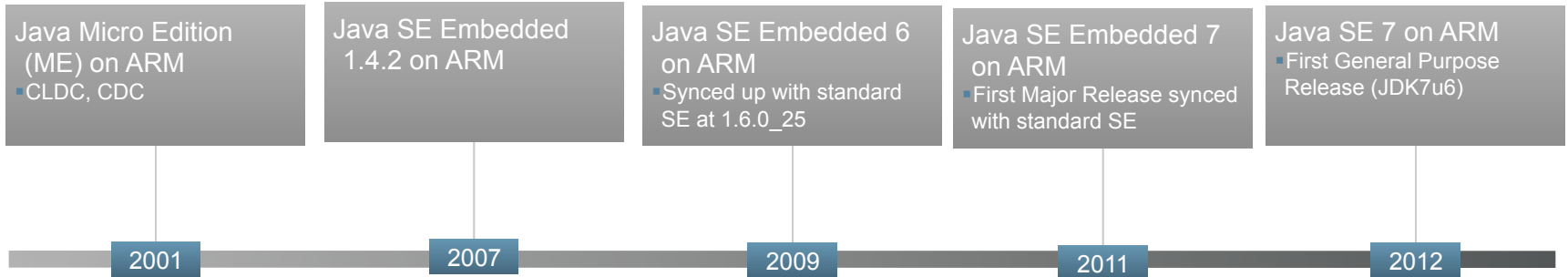


Key Java Optimizations on ARM CPUs

Currently available

ARM Architecture	Optimization
All	Hand coded memcpy, array copy routines Dynamic floating point detection VFPv3 D16, D32 Software floating point support for non VFP CPUs
armv5	Literal pools for 32 bit pointer loads Atomic ops require call to kernel helper
armv6	Idrex/strex for Java level locking Avoids call into kernel helper routine
armv7 (cortex-a8)	movt/movw combination used for pointer loads
armv7 (cortex-a9)	Memory barriers dynamically added for MP support Multi-Core support added

History of Java on ARM



Java SE Embedded 7 on ARM

- Releases on sync with desktop/server version since July 2011
- Full set of features and APIs of Java SE 7 supported on ARM including:
 - Multi-core features
 - InvokeDynamic (JSR 292) – support for dynamically typed languages (Jruby...)
 - Project Coin language enhancements
 - Updated APIs (New NIO.2 APIs, JDBC 4.1, updated XML, ECC)
- Embedded Specific Improvements
 - Reduce static and dynamic footprint
 - Power usage
 - Oracle Java Embedded Suite 7.0
 - CON6590, “Easy Middleware for Your Embedded Device”



Java SE on ARM

- Starting with 7u6, releasing General Purpose Linux-ARM binaries
 - JDK targeted at the ARM server market
 - BeagleBoard, PandaBoard, Raspberry Pi ...
 - 32 bit binary for armv6 and armv7
 - Same licensing terms as Oracle Java for other platforms
- Serviceability
- Server compiler (C2)
- Oracle and ARM are working together to enhance Java on ARM processors



Server (C2) JIT for ARM

No longer experimental

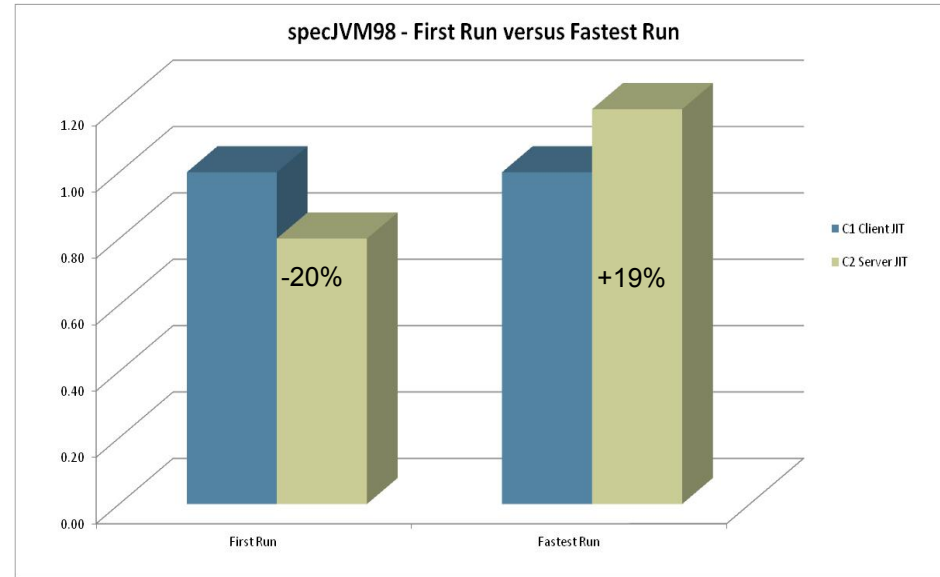
- Background – Java SE has 2 JIT' s (C1 and C2)
 - Client (C1)
 - Quicker startup due to fewer code optimization
 - Server (C2)
 - Faster throughput, slower startup due to more advanced optimizations
 - Improves scalability due to optimized locking implementations
- Server (C2) For ARM
 - High performance (JIT) Just-In-Time compiler for long running deeply embedded applications
 - Measurements show 19% to 40% performance improvement



Comparing VM JIT Characteristics

Client VM or Server VM

- Client VM
 - Quicker startup due to fewer code optimizations
 - Best use is for Desktop, GUI and short run embedded applications
- Server VM
 - Faster throughput but slower startup
 - Best for long running performance critical applications
 - Better for multi-threaded applications
- Tiered Compilation system provides the best of both JITs
 - Improve startup by using Client JIT initially
 - Server JIT will optimize post startup



Future ARM Optimizations

In progress / under consideration

- ARMv7 specific enhancements for C2
- HardFloat ABI Binaries
- Thumb2 compiled binaries
 - Reduces the size of the binaries by 21%
 - JIT still dynamically generates ARM instructions
- Tiered compilation
- G1 Garbage Collector (Garbage First)
 - Low Pause collector, currently targeted for big heaps
- 64-bit architectures



Future SE [Embedded] Optimizations

In progress / under consideration

- Startup-Time
 - Compiled Code Caching
- Footprint (Dynamic and Static)
 - Modularity
- CDC/SE Convergence
 - CON4538, “Java Embedded Goes Modular...”
- Embedded FX
 - CON6094, “JavaFX on Smart Embedded Devices”
 - CON5348, “Do You Like Coffee for Your Embedded Device”



Demonstrations

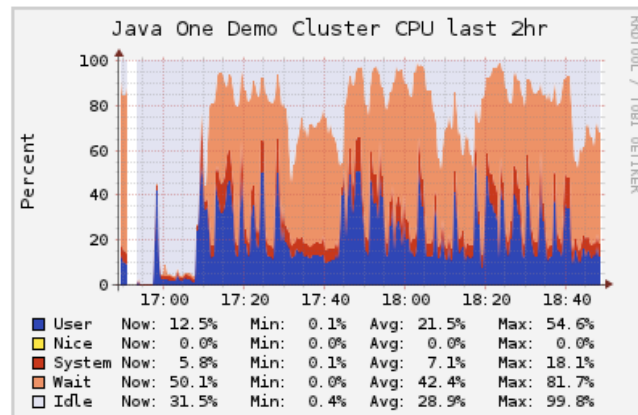
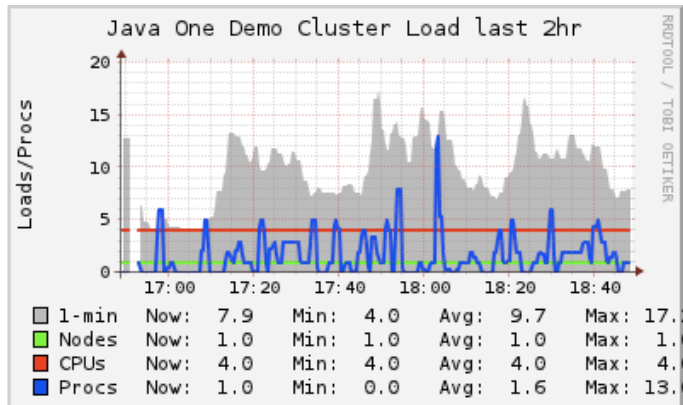
Go to the Exhibition Hall and Look for Other Sessions !

- Exhibition Hall at the Hilton, Grand Ballroom
 - JavaSE Embedded ARM related demos on Oracle booths
 - JavaFX, Embedded Suite 7
 - ...
 - ...
- Java Embedded @ JavaOne (25 sessions, Wednesday - Thursday)
- Search “Java SE Embedded” or “ arm “ sessions
 - Today:
 - TUT10155 – Getting up to Speed on Oracle Java SE Embedded Performance: Tuning Tips and Tricks – Oct 1, 12:30 PM
 - HOL7889 – Java SE Embedded Development Made Easy – Oct 1, 7:30 PM

Demonstration

Gary Collins

- i.MX6 quad-core 1GHz ARM Cortex-A9
- Linaro 11.10 Linux
- Java SE 7u6 for ARMv7 running server JIT
- Hadoop 1.0.3 running Terasort benchmark



Q&A

For more information on Java Embedded go to:
<http://www.oracle.com/technetwork/java/embedded/>

