ARM[®] Cortex[®]-M and Java[™] in the Internet of Things

Asim Chaudhry Field Applications Engineer, ARM





ARM's Mission

Deploy energy-efficient ARM-based technology, wherever computing happens...





What does ARM do?

ARM designs and licenses processor technology that lies at the heart of advanced consumer and embedded products From Sensors to Servers Computing **Consumer Devices** Embedded **Microcontrollers**

ARM Partnership: Building for the Long Term





ARM Broad market penetration





ARM[®] Cortex[®] Processors across the Embedded Market



ARM Cortex-M: Trusted Choice for Embedded Intelligence



Cortex-M processors serving all applications



Introduction to the Cortex-M Family





Powerful and scalable instruction set

VABS VADD VCMP VCMP VCVT VCVTR VCVTR VCVTR PKHBT PKHTB QADD QADD15 QADD8 QASX QDADD QDSUB VFNS VCVTN VCVTN VCVTN VCVTN VCVTN VCVTN VCVTN VCVTN VCVTN PKHBT PKHTB QADD QADD15 QADD8 QASX QDADD QOSUB VFNS VCVTN VCVTN SHLADD3 SHLAD3 SHLAD3 SHLAD3 SHLAD4 SHLAD3 SHLAD3 SHLAD3 SHLAD3 SHLAD3 SHLAD3 SHLAD3 SHLAD3 SHLAD4 SHLATT VLDA VFNMS V				Floating	Point	VCVTA
PKHBT PKHTB QADD QADD16 QADD8 QASX QDADD QDSUB VFM3 VCVTP QSAX QSUB QSUB16 QSUB8 SADD16 SADD8 SASX SEL VFM3 VCVTP QSAX QSUB SHBAT SHLAT SHLADX SHLADX<	VABS		VCVT VCVTR	VCVTB VCVTB	VTT VDIV	VCVTN
PKHBT PKHTB QADD QADD16 QADD8 QASX QDADD QDSUB VFMS VCVTM QSAX QSUB QSUB6 QSUB8 SADD16 SADD8 SASX SEL VFMA VMAXMM SHADD16 SHADD8 SHASX SHSAX SHSAX SMLABT VENNS VVINNS VVINS VVINNS VVINS VVINS VVINS VVINS VVINS VVINS					VFMA	VCVTP
QSAX QSUB QSUB16 QSUB8 SADD15 SADD8 SASX SEL VFNMA VMAXMM SHADD16 SHADD8 SHASX SHSAX SHSAX SMLAD1 SMLAD1 SMLAD1 SMLAD1 SMLAD1 SMLAD1 SMLAD1 SMLAD2 SMLAD1 SMLAD2 SMLAD1 SMLAD2 SMLAD2 SMLAD2 SMLAD1 SMLAD2 SMLAD1 SMLAD2 SMLAD2 SMLAD2 SMLAD2 SMLAD2 SMLAD2 SMLAD2 SMLAD2 SMLAD2 SMMLAD2 VMLA VRINT VRIAD2 VRINT VRIAD2 VRIAD2 VRIAD2 VRIAD2 VRIAD2 VRIAD2 VRINT VRINT VRIAD2 VRINT VRIAD2 VRINT VRIAD2 VRINT VRIAD2 VRINT VRINT VRINT VRINT VRINT<	РКНВТ РКНТВ	QADD QADD16	QADD8 QASX	QDADD QDSU	IB VFMS	VCVTM
SHADD16 SHADD8 SHASX SHSAX DSP (SIMD, fast MAC) SMLABT VENMS VIDM SMLALD SMLALDX SMLADX SMLADX SMLADX SMLALDX SMLABT VIDM	QSAX QSUB	QSUB16 QSUB8	SADD16 SADD8	SASX SEI	VFNMA	VMAXNM
SMLATB SMLADX SMLADX SMLADX SMLADX SMLADX SMLADX VIINTA SMLAD SMLALDX SMLAND SMLAND SMLALDX SMLAND SMLAND SMLADX VIINTA ADC ADD ADR AND ASR B SMMLAR SMMLAR VIINTA VIINTA ADC ADD ADR AND ASR B SMMLS SMMLAR VIINTA VIINTA ADC ADD ADR AND ASR B SMMLS SMMLR VIINTA VIINTA CLREX CLZ CMN CMP DBG EOR SMULB SMULB VMINTA VIINTA LDC LDC2 LDMIA LDMDB LDREM LDREM LDREM SMULB SMULB SMULB VIINTA LDRHT LDREX LDREXE LDREXE LDREXE LDREXE SMULB SMULB VIINTA VIINTA MILS MOV NVN NOP ORN ORR SSMJSD VINNLA VSEL SBFX SDIV SEV <td>SHADD16 SHADD8</td> <th>SHASX SHSAX</th> <td></td> <td>SMLA</td> <td>BT VENMS</td> <td>VMINNM</td>	SHADD16 SHADD8	SHASX SHSAX		SMLA	BT VENMS	VMINNM
SMLALD SMLALDX SMLANB SMLANT DOT (GHT ID, HASCT IFAC) SMLSLDX VLDR VRINT ADC ADD ADR AND ASR B SMMLAR VMLA VRINT ADC ADD ADR AND ASR B SMMLS SMMLR VMLS VRINT BFC BFI BIC CBNZ CBZ CDP CDP2 SMULB SMUAD VMOV VRINT CLREX CLZ CMN CMP DBG EOR SMUAD SMUAD VMOV VRINT LDC LDC2 LDMIA LDMDB LDR LDRB SMULB SMULBT VMSR VRINT LDRBT LDRD LDREX LDREXH LDRH SMULB SMULBT VMAL VSEL LDRHT LDRS Advanced data processing bit field manipulations MLS SMLSD VMMLA VSEL MRC2 MUL MVN NOP ORN ORR SSUB5 SSUB8 VNMUL PLD PLI POP PUSH RBIT REV	SMLATB SMLATT	SMLAD SMLADX	DSP (SIMD fast		TT VLDM	VRINTA
ADC ADD ADR AND ASR B SMMLAR VMLA VRINTP BFC BFI BIC CBNZ CDP CDP2 SMMUL SMMULR VMOV VRINTP CLREX CLZ CMN CMP DBG EOR SMULD SMULD SMULDX VRINT VRINT LDC LDC2 LDMIA LDMDB LDR LDRB SMULB SMULBT VMSR VRINT LDRBT LDRD LDREX IDREXH LDREXH LDRH SMULB SMULT VMUL VRINT LDRBT LDRD LDREXH LDREXH LDRH SMULB SMULHT VMUL VSEL LDRHT LDRS Advanced data processing MLA SMULT SMULN VSEL VSEL MRC2 MUL MVN NOP ORN ORR SSUB16 SSUB8 VNMUL PLD PLI POP PUSH RBIT REV SSAT16 VSRT SBFX SDIV SEV SMLAL SMULL SSAT1 UAD	SMLALD SMLALDX	SMLAWB SMLAWT		SMLSI	DX VLDR	VRINTN
ADCADDADRANDASRBSMMLSVMLSVRINTMBFCBFIBICCBNZCBZCDPCDP2SMMULSMMULRVMOVVRINTXCLREXCLZCMNCMPDBGEORSMUADSMUADVMRSVRINTXLDCLDC2LDMIALDMDBLDRLDRBSMULBBSMULBTVMSRVRINTXLDRBTLDROLDREXLDREXLDREXHLDRHSMULBBSMULTVMSRVRINTXLSRMCRMarced data processingMLASMUSDSMUSDXVMMLAVSELMLSMOVbit field manipulationsMRRCSSAT16SSUB8VMMULPLDPLIPOPPUSHRBITREVSSTAB6SSUB8VMMULSBFXSDIVSEVSMLALSMULLSSATUADD36VPOPADCADRANDASRBSTMDBSTRSTRBUMAALUQADD16VSTR				STUTLA SMML	AR VMLA	VRINTP
BFC BFI BIC CBNZ CBZ CDP CDP2 SMMUL SMMULR VMOV VRINX CLREX CLZ CMN CMP DBG EOR SMUAD SMUADX VMSS VRINX LDC LDC2 LDMIA LDMDB LDR LDRB SMULB SMULB VMSR VRINX LDRBT LDRD LDREX LDREXH LDRH SMULB SMULT VMUL VSEL LDRHT LDRS Advanced data processing bit field manipulations MRC SSATI6 SSAX VNMLA VSEL MLS MV NOP ORN ORR SSUB16 SSUB8 VNMUL VSEL PLD PLI POP PUSH RBIT REV SSTAB SXTAB16 VPOP REV16 REVSH ROR RRX RSB SBC SXTAH UADD16 VPUSH SBFX SDIV SEV SMLAL SMULL SSAT UADD8 UASX VSQRT ADC ADD ADR AND AST STMDB	ADC ADD	ADR AND	ASR B	SMMLS SMML	SR VMLS	VRINTM
CLREX CLZ CMN CMP DBG EOR SMUAD SMUADX VMRS VRINTZ LDC LDC2 LDMIA LDMDB LDR LDRB SMULBB SMULBT VMSR VRINTZ LDRBT LDRD LDREX LDREXB LDREXH LDRH SMULBB SMULTT VMUL VSEL LDRHT LDRS Advanced data processing bit field manipulations MRC SMUSD SMUSDX VNMLA VSEL MRC2 MUL MVN NOP ORN ORR SSUB16 SSUB8 VNMUL PLD PLI POP PUSH RBIT REV SSTAB STAB VPOP SBFX SDIV SEV SMLAL SMULL SSAT UADD8 UASX VSQRT ADC ADD ADR AND ASR B STMDB STR STRB UMAAL UQADD16 VSTR	BFC BFI	BIC CBNZ CBZ	CDP CDP2	SMMUL SMMU	LR VMOV	VRINTX
LDC LDC2 LDMIA LDMDB LDR LDRB SMULBB SMULBT VMSR VRINTR LDRBT LDRD LDREX LDREXH LDRHH LDRH SMULBB SMULTT VMUL VSEL LDRHT LDRS Advanced data processing bit field manipulations MLA SMULW VNMLA VMUL VSEL MRRC2 MUL MVN NOP ORN ORR SSUB16 SSUB8 VNMUL VNMLS PLD PLI POP PUSH RBIT REV SSTAB SXTAB SXTAB16 VPOP REV16 REVSH ROR RRX RSB SBC SXTAH UADD16 VPUSH ADC ADD ADR AND ASR B STMDB STR STRB UMAAL UQADD16 VSTR	CLREX CLZ	CMN CMP	DBG EOR	SMUAD SMUA	DX VMRS	VRINTZ
LDRBT LDRD LDREX LDREXB LDREXH LDRH SMULTB SMULTT VMUL VSEL LDRHT LDRS Advanced data processing bit field manipulations MLA SMULWB SMULWT VNMLA MLS MOV MVN NOP ORN ORR SSAT16 SSAX VNMLS PLD PLI POP PUSH RBIT REV SSXTAB SXTAB16 VPOP REV16 REVSH ROR RRX RSB SBC SXTAH UADD16 VPUSH ADC ADD ADR AND ASR B STMDB STR STR UMAAL UQAD16 VSTR	LDC LDC2		LDR LDRB	SMULBB SMUL	BT VMSR	VRINTR
LDRHT LDRS Advanced data processing bit field manipulations LSL SMULWB SMULWT VNEG MLS MOV Mov NOP MRC SSA16 SSAX VNMLA MRC2 MUL MVN NOP ORN ORR SSUB VNMUL PLD PLI POP PUSH RBIT REV SSTAB SSTAB VNMUL REV16 REVSH ROR RRX RSB SBC SSAT VUADD16 VPOP SBFX SDIV SEV SMLAL SMULL SSAT UADD8 UASX VSQRT ADC ADD ADR AND ASR B STMDB STR STRB UMAAL UQADD16 VSTR	LDRBT LDRD	LDREX LDREXB	LDREXH LDRH	SMULTB SMUL	TT VMUL	VSEL
LSR MCR bit field manipulations MLA SMUSD SMUSDX VNMLA MLS MOV bit field manipulations MRRC SSAT16 SSAX VNMLS MRRC2 MUL MVN NOP ORN ORR SSUB16 SSUB8 VNMUL PLD PLI POP PUSH RBIT REV SXTAB SXTAB16 VPOP REV16 REVSH ROR RRX RSB SBC SXTAH UADD16 VPUSH SBFX SDIV SEV SMLAL SMULL SSAT UADD8 UASX VSQRT ADC ADD ADR AND ASR B STMDB STR STRB UMAAL UQADD16 VSTR		lvanced data proces	ssing CISL	SMULWB SMUL	WT VNEG	
MLSMOVDit freid frampulationsMRCSSAT16SSAXVNMLSMRC2MULMVNNOPORNORRSSUB16SSUB8VNMULPLDPLIPOPPUSHRBITREVSSAT16SSTAB16VPOPREV16REVSHRORRRXRSBSBCSXTABSXTAB16VPOPSBFXSDIVSEVSMLALSMULLSSATUADD8UASXVSQRTADCADDADRANDASRBSTMDBSTRSTRBUMAALUQAD16VSTR	LSR MCR	hit field manipulation		SMUSD SMUS	DX VNMLA	
MRRC2 MUL MVN NOP ORN ORR SSUB16 SSUB8 VNMUL PLD PLI POP PUSH RBIT REV SXTAB SXTAB16 VPOP REV16 REVSH ROR RRX RSB SBC SXTAH UADD16 VPUSH SBFX SDIV SEV SMLAL SMULL SSAT UADD8 UASX VSQRT ADC ADD ADR AND ASR B STMDB STR STRB UMAAL UQADD16 VSTR	MLS MOV	sit neid manipulatio		SSAT16 SSA	X VNMLS	
PLD PLI POP PUSH RBIT REV SXTAB SXTAB16 VPOP REV16 REVSH ROR RRX RSB SBC SXTAH UADD16 VPUSH SBFX SDIV SEV SMLAL SMULL SSAT UADD8 UASX VSQRT ADC ADD ADR AND ASR B STMDB STR STRB UMAAL UQADD16 VSTR	MRRC2 MUL	MVN NOP	ORN ORR	SSUB16 SSU	8 VNMUL	
REV16 REVSH ROR RRX RSB SBC SXTAH UADD16 VPUSH SBFX SDIV SEV SMLAL SMULL SSAT UADD8 UASX VSQRT ADC ADD ADR AND ASR B STR STRB UMAAL UQADD16 VSTR	PLD PLI	POP PUSH	RBIT REV	SXTAB SXTAI	16 VPOP	
SBFX SDIV SEV SMLAL SMULL SSAT UADD8 UASX VSQRT ADC ADD ADR AND ASR B STMDB STR STRB UHADD16 UHSUB8 VSTM	REV16 REVSH	ROR RRX	RSB SBC	SXTAH UADD	16 VPUSH	
ADC ADD ADR AND ASR B STMDB STR STRB UMAAL UQAD16 VSTR	SBFX SDIV	SEV SMLAL	SMULL SSAT	UADD8 UAS	X VSQRT	
ADC ADD ADR AND ASR B STMDB STR STRB UMAAL UQADD16 VSTR		STC	STC2 STMIA	UHADD16 UHSU	B8 VSTM	
	ADC ADD ADR AND	ASR B STMDB	STR STRB	UMAAL UQADI	VSTR	
BIC BKPT BL BLX BX STRBT STRD STREX UQADD8 UQASX VSUB	BIC BKPT BL	BLX BX STRBT	STRD STREX	UQADD8 UQAS	X VSUB	
CMN CMP CPS DMB EOR STREXB STREXH STRH UQSAX UQSUB16	CMN CMP CPS DMB	EOR STREXB	STREXH STRH	UQSAX UQSU	16	
DSB ISB LDMIA LDR STRHT STRT SUB UQSUB8 USAD8	DSB ISB	DMIA LDR STRHT	STRT SUB	UQSUB8 USAI	8	
Conoral data processing LSR SXTB SXTH TBB USADA8 USAT16	noral data processi		SXTH TBB	USADA8 USAT	16	
General data processing MUL TBH TEQ TST USAX USUB16	illeral data processi		TEQ TST	USAX USUB	16	
I/O control tasks REV UBFX UDF UDIV USUB8 UXTAB	I/O control tasks	UBFX UBFX	UDF UDIV	USUB8 UXT/	B	
REVIO REVOIT ROL SOC SEV UMLAL UMULL USAT UXTABIG UXTAH	REVIO REVII ROR ROB	SEV UMLAL	UMULL USAT	UXTAB16 UXT	н	
STMIA STR STRB STRH SUB SVC UXTB UXTH WFE UXTB16	STMIA STR STRB STRH	SUB SVC UXTB	UXTH WFE	UXTB16		
SXTB SXTH TST UDF UXTB UXTH WFI YIELD IT Cortex-M4 Cortex-M4 Cortex-M4	SXTB SXTH TST UDF	UXTB UXTH WFI	YIELD IT	Corte	x-M4 Cortex-M4	Cortex-M7
WFE WFI YIELD Cortex-M0+ Cortex-M3 Cortex-M7 FPU F	WFE WFI YIELD C	ortex-M0+	Cortex-M3	Corte	x-M7 FPU	FPU



Cortex-M3 – Industry Standard 32-bit CPU for microcontrollers

- ARM's flagship 32-bit energy efficient processor
 - Largest ecosystem for software and tools
- Rich, unified Thumb-2 high performance instruction set
 - Smallest code size and reduced memory requirements
- Advanced instructions for data manipulation
 - Single Cycle Multiply, Hardware Division, Bit Field Manipulation
- 3.34 CoreMark / MHz
- Currently supported in Java ME Embedded 8.X











Cortex-M4 – ARM's Powerful Digital Signal Controller

- ARM's 32-bit MCU with powerful DSP capabilities
 - SIMD, single-cycle MAC, saturating arithmetic (DSP extensions)
 - Optional floating point unit
- Rich DSP Library available free-of-charge from ARM website
 - Highly optimised commonly used DSP functions
- 3.40 CoreMark / MHz
- Also currently supported in Java ME Embedded 8.X



rtex®-	M4			
Nested Vectored Interrupt Controller CPU (with DSP Extensions)		Wake Up Interrupt Controller Interface FPU		
Bus	Flash Patch & Breakpoint	Port		
	tored ntroller ensions)	ensions) Bus		

Serial

Wire

Trace Port

ITM Trace

ETM Trace

Matrix

Unit

SRAM &

Peripheral

Interface



Cortex-M3/M4 Development Boards for Java ME 8.X

Freescale K70F120M



- Kinetis K70 running at 120Mhz
- 128K SRAM
- Up to IMB Flash

Freescale FRDM-K64F



- Kinetis K64F running at 120Mhz
- 256K SRAM
- IMB Flash

STM STM32429I-EVAL



- STM32F4 running at 180Mhz
- 256K SRAM
- 2MB Flash



Cortex-M7: Built for Performance

Performance

- Achieving 5 CoreMark/MHz 2000 CoreMark^{*} in 40LP
- Typical 2x DSP performance of Cortex-M4

Versatility

- Highly flexible system and memory interfaces
- Designed for functional safety implementations
- Scalability and compatibility
 - Enables simple migration from any Cortex-M processor
 - Widest third-party tools, RTOS, middleware support



* CoreMark 1.0 : IAR Embedded Workbench v7.30.1 --endian=little --cpu=Cortex-M7 -e -Ohs --use_c++_inline --no_size_constraints / Code in TCM - Data in TCM



High performance embedded compute now shipping

- Delivering highest performance in a Cortex-M processor
 - 2.14 DMIPS/MHz, 5.01 CoreMark/MHz

	Typical Applications	
Automotive	Factory Automation	Camera Drones
Motor Control	Sensor Hub	Embedded Audio



- Proven and shipping in mass-market silicon
- Supported by ARM's broad ecosystem: software, tools and RTOS
- Now available



Cortex-M7 Key Features (I)

High performance core with DSP capabilities

- Six-stage dual-issue pipeline
- Powerful DSP instructions and SP/DP Floating Point
- Best-in-class core for high-end MCU, or replace MCU+DSP with Cortex-M7

Flexible, memory system

- Tightly-coupled memories for real-time determinism
- 64-bit AXI AMBA4 memory interface with I-cache and D-cache for efficient access to external resources
- Build MCU with access to large external memories and powerful peripherals





Cortex-M7 Key Features (2)

ARMv7-M architecture

- I00% binary forwards compatibility from Cortex-M4
- Key Cortex-M family processor characteristics: Ease of use, excellent interrupt latency
- Fast interrupt response for real-time systems, reuse code and system design from existing products to reduce development costs

ARM[®] Cortex[®]-M7 Nested Vectored Debug Interrupt Controller WIC FPU ETM ECC CPU ARMv7-M MPU D Data Instr TCM TCM Cache Cache AXI-M AHB-P AHB-S

Safety features

- Memory ECC (SEC-DED), MPU, MBIST, lock-step operation, full data trace, safety manual
- Enables entry into safety-critical markets.



Cortex-M7 Target Applications



- Powerful processor for advanced audio/visual sensor hub processing
- Power-efficient local processor for IoT devices such as an edge router
- Flexible and reliable processor for industrial and motor control



Enabling Smarter Systems Without the Complexity



Helping Drive Richer Audio Experiences



Cortex-M7 in Automotive

Trends and challenges:

- Safety certification mandated in more regions
- Convergence of functionality into fewer MCUs/ASSPs
- Increasing user requirements and expectations

Typical Applications

- Dashboard in medium-range cars
- Voice recognition (for Multimedia control functions)
- Character recognition (eg Kanji)
- "Convenience" features
- Chassis, electric power steering, "steer-by-wire"
- Automotive audio



Cortex-M7 Advantages:

- High performance core with fast DSP
- Safety features built in and safety manual
- Determinism with high performance
- Full trace via ETM



Cortex-M7 in Industrial Control

Trends and challenges

- High performance control functions
- Safety, reliability and conformance will become mandatory
- 80-90% of cost is software, Cortex-M offers scalability and protects software investment

Typical applications:

- Factory Automation
 - Inverters, Servos
 - Programmable Logic Controllers
 - High-speed comms
- Intelligent motor control





Cortex-M7 Advantages:

- Increased DSP performance for control functions
- Safety features built-in
- In-order pipeline gives performance with predictability
- TCMs and low interrupt latency: Interrupt response within 100ns required
- Scalability from Cortex-M3 through Cortex-M7 up to Cortex-A53



Cortex-M7 in Sensor Fusion

Trends and challenges

- Increased sophistication of fusion algorithm
- Increase in number and variety of sensors
- Image sensors / processing



Typical applications:

- Sensor fusion hubs
- Sensor control and sensor signal fusion



Cortex-M7 Advantages:

- Increased DSP performance for fusion and control operations
- Software support by the top three fusion algorithm developers



ARM Cortex-M7: Built for Performance

- Fast compute for demanding embedded applications
 - Six-stage superscalar pipeline with branch prediction
 - Single and double precision floating point unit
- Flexible memory system
 - 64-bit AXI AMBA4 interconnect
 - I-cache and D-cache for efficient memory operation
- Ultra-fast responsiveness for control
 - I2 cycles interrupt latency
 - Tightly coupled memories for real-time determinism

Highest core performance combined with the efficiency of Cortex-M



Cortex-M7: Unlock and Unleash Software Productivity

- Focus on application development
 - Exploit optimally tuned range of processors
 - Utilize richer variety of peripherals
 - Harness advanced proven runtime environments
- Spend less time on code optimization
 - More capable hardware resources
 - Optimized and proven libraries
- Develop and deploy software faster



IoT: Connecting the Physical and Digital Worlds



Sensors and Devices

Wireless Networks

Cloud









ARM Cortex-M0+ 16K RAM / 64K ROM

Requires gateway Disposable, Swallowable RTOS or bare metal

ARM Cortex-M0+/3 32-64K RAM / 128-256K ROM

Direct to Internet via CoAP End-to-end DTLS security Remote management MBED OS support ARM Cortex-M3/4/7 128K RAM / 512K ROM



ARM Cortex-A7 64MB RAM / 512MB ROM Java SE



The Big Picture

What?

- ARM mbed Device Platform consisting of:
 - mbed OS: free operating system for ARM Cortex-M devices
 - mbed Device Server: to connect devices to services

Why?

- To accelerate the pace of IoT by enabling innovators to focus on value-add features
- Pull from silicon and cloud partners for a standards-based software to create IoT solutions

How?

 By providing the necessary building blocks to be able to create standards-based connected IoT solutions for a broad set of market segments



ARM®mbed[™] IoT Device Platform



End-to-end **software solutions** for IoT applications



ARM[®]mbed[™]

IoT Device Platform

mbed Ecosystem

- Partners
- Developers
- Enabled Services
- Enabled Products

mbed Device Server

- Freemium model to enable startups
- Application data and device management
- Growth market access for cloud platforms
 and operators

mbed OS

- Free for use on ARM architecture
 - Leading connectivity standards
 - Productivity, minimized costs
 - Built-in management
 - Security

ARM Cortex[®]-M

-based MCU

mbed progress in 2015





Little Data Enables Big Data



End-to-End Security, Web, Data Objects & Management

Little Data

BIG DATA



mbed OS

	Minimize time-to-market	Application	s Community Libraries
			C++ APIs
	Low-power by design	Event Framework	Communication Management
		Tasks	CoAP, HTTP, MQTT, LWM2M
A		Device Management:	TLS, DTLS
	Complete security solution	Bootstrap, Security, FOTA	IPv4, IPv6 6LoWPAN
		Crypto & Device Security	🚯 WIFI 🚸 GLOWPAN 🕜
	Top connectivity standards	CMSIS	Drivers
	Ruilt-in device management	ARM Cortex®- -based MCU	-M Sensors Radio
34	Dunt-in device management	тппт	ARM

mbed Device Server





Lightweight management

Common OS and Connectivity Across Markets





mbed Platform Roadmap









Scaling Embedded SW with Java and mbed

Goal: drive platform consistency, developer productivity, and software intelligence

- **Reduce** embedded platform fragmentation and time-to-market
- Enable Java Embedded on a growing range of mbed-enabled devices
- **Combine** the strengths of the mbed and Java communities and partners

ORACLE ARM mbed freescale Site.augmented





The new mbed Partner Ecosystem: Join Us!





ARM at JavaOne

- Come visit the ARM booth # 5616!
- Demo of mbedOS and mbed Device
 Server running on a Nespresso Coffee
 Machine



ARM[®]**mbed**[®] IoT Device Platform

- Conference Sessions:
 - **'Accelerating IoT with ARM'** by Vrajesh Bhavsar
 Tuesday 5:30pm, Hilton Ballroom 7/8/9
 - 2. 'Project Kona: Java Networking Technologies for IoT' by Zach Shelby Tuesday 7:00pm Hilton Ballroom 7/8/9
 - 3. 'Data Center Java Developers, Start Your ARMv8 Engines!' by Jeff Underhill Tuesday 11:00am Parc55 – Market Street



Thank you – Questions?

