ARM® Processors

Enabling our semiconductor Partners to develop products from under $1 to over 1Ghz

Cortex™
Intelligent Processors by ARM®

Texas Instruments

A Brief History…..

"..I gave them two things which National, Intel and Motorola had never given their design teams:

The first was no money;

The second was no people.

The only way they could do it (ARM) was to keep it really simple."

-- Hermann Hauser

A barn, energy, expertise and belief :

"We're going to be the Global Standard"

Acorn

ARM Advanced RISC Machines

1983 **1987** **1990** **2009**

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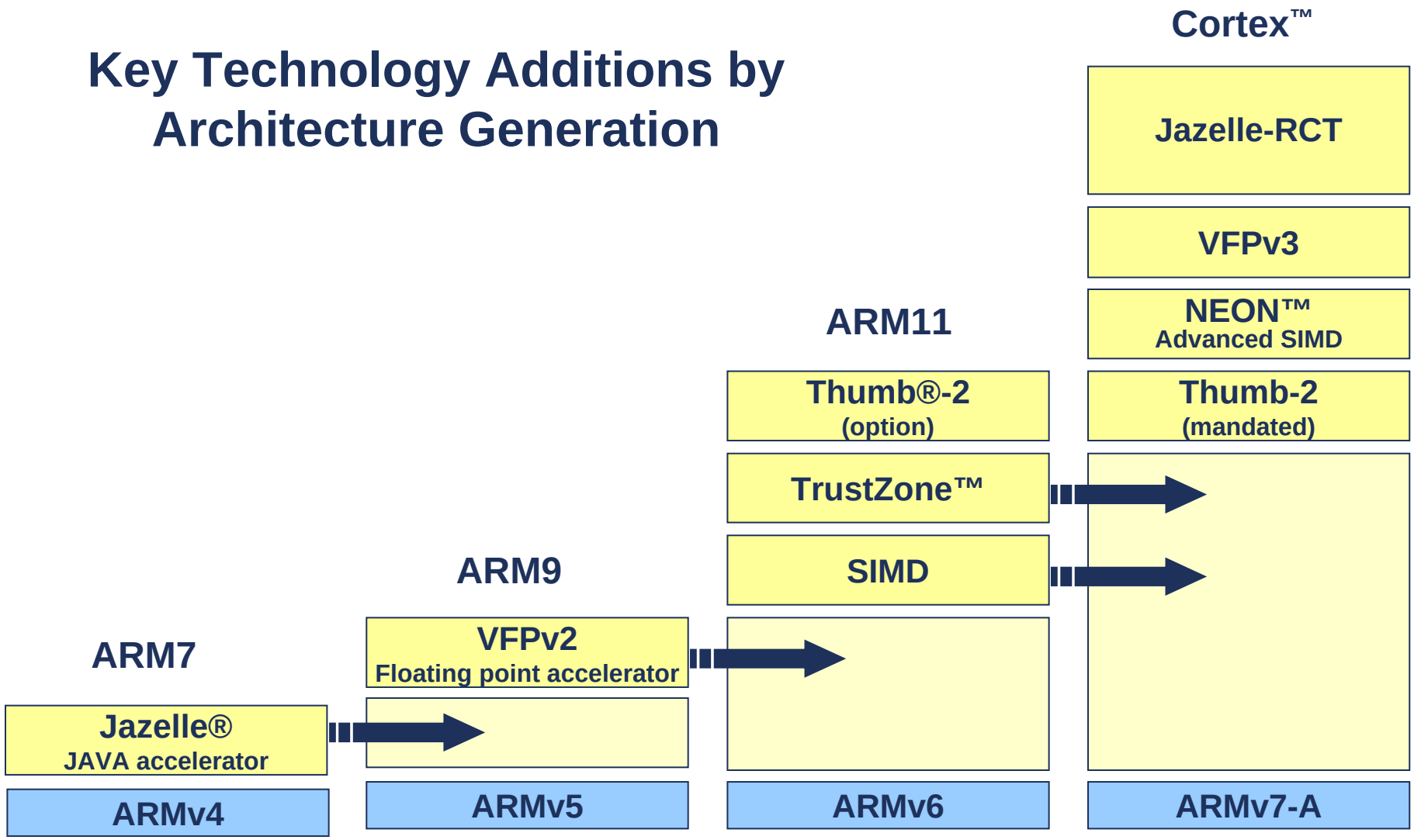
ARM Architecture Evolution

Key Technology Additions by Architecture Generation



Cortex Profiles – Segmenting the Architecture

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Processors Across Applications

Cortex™-A9 → 4X

Cortex-A8

ARM11™ MPCore™ → 4X

ARM1176J(F)-S™

ARM926EJ-S™

A

Applications

Cortex-R4(F) → Cortex-R4X

ARM1156T2(F)-S™

ARM946E-S™

ARM968E-S™

ARM7TDMI®

R

Real-Time

Embedded

Cortex-M0

Cortex-M1

Cortex-M3

ARM7TDMI

ZigBee™

Bluetooth®

M

MCU & FPGA

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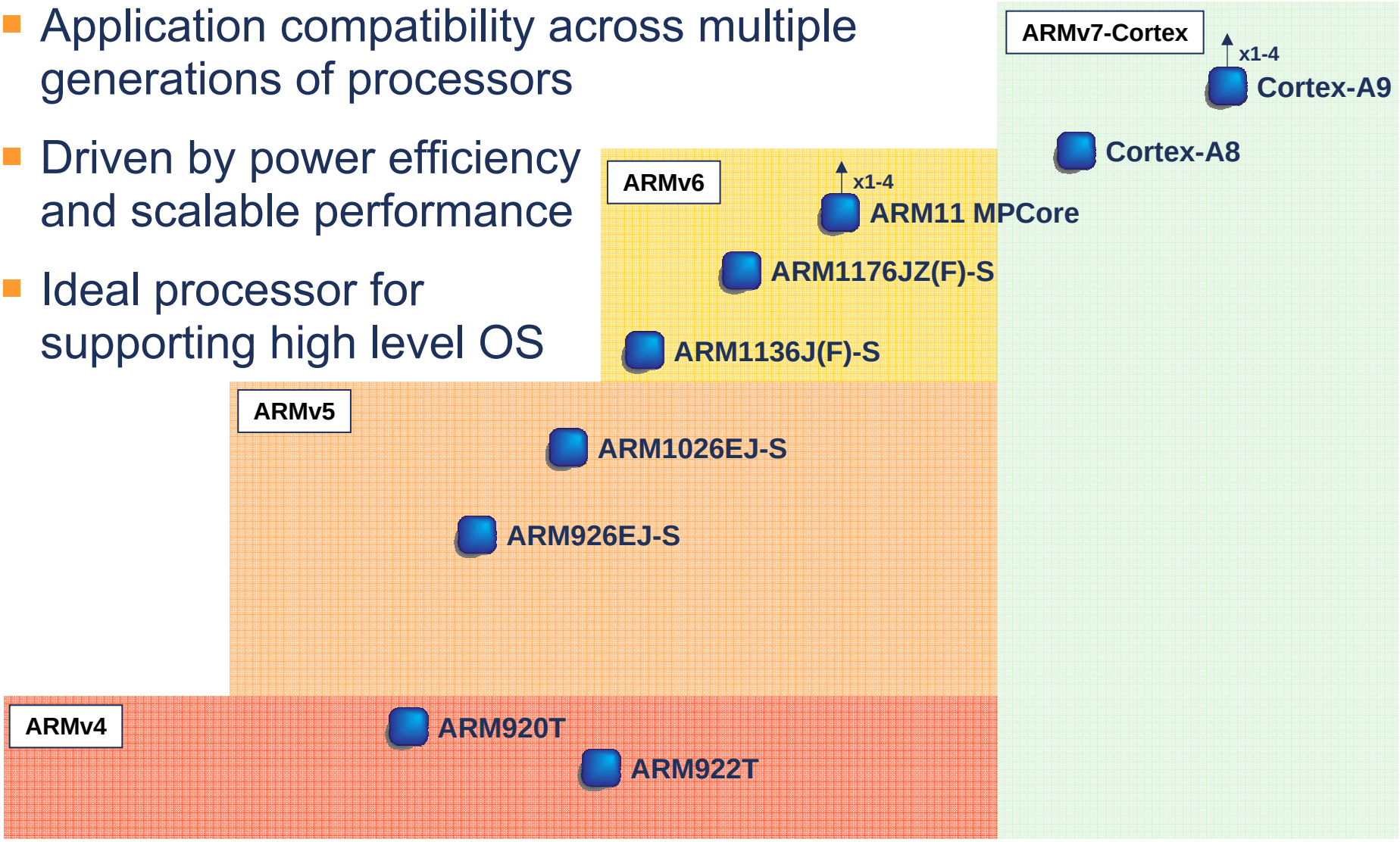
Applications Processors

- Application compatibility across multiple generations of processors
- Driven by power efficiency and scalable performance
- Ideal processor for supporting high level OS



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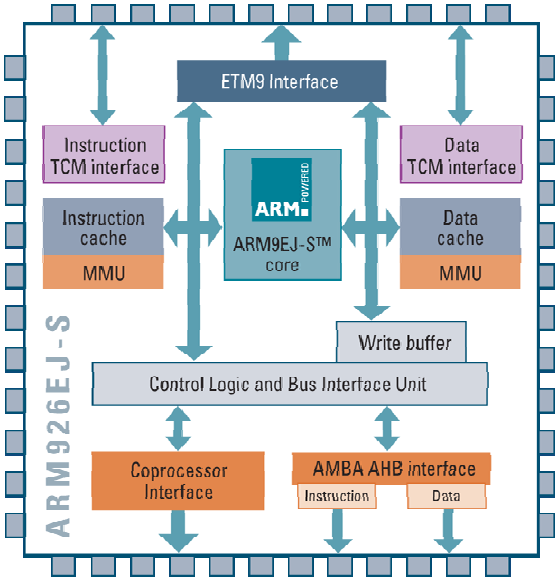
ARM926EJ-S Processor Overview

- Most widely licensed ARM processor ever
- Available through Foundry Program and Design Start
- Excellent software ecosystem
  - Large number of software tools and RTOS
  - Wide availability of audio/video codecs
- Technical Features
  - MMU to support platform Operating Systems
  - Synthesis configurable I & D caches
  - Instruction and data TCM interfaces
  - Separate instruction and data AMBA® AHB™ buses



ARM926EJ-S	0.13um process		90nm process	
	Speed Opt	Area Opt	Speed Opt	Area Opt
Standard Cells	SAGE-HS	SAGE-X	Advantage-HS	Metro
Memories	HSHD	HSHD	Advantage	Metro
Frequency (MHz)	276	238	470	250
Area with cache (mm2)	2.78	2.39	1.4	0.85
Area without cache (mm2)	1.61	1.45	1.01	0.5
Cache size	8K/8K	8K/8K	8K/8K	8K/8K
Typical mw/MHz with cache	0.685	0.48	0.235	0.14
Typical mw/MHz w/o cache	0.561	0.36	0.2	0.11

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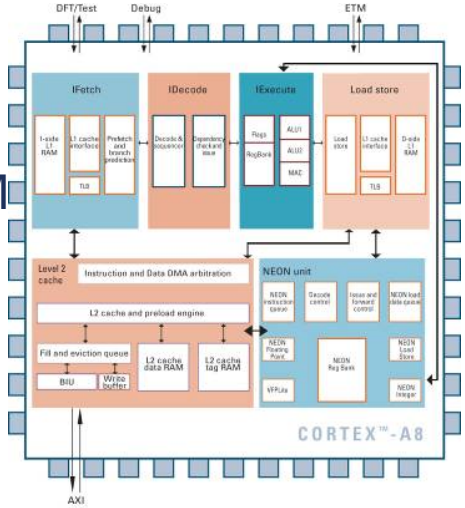
Cortex-A8 Processor Overview

- Highest performance Cortex-A processor proven in silicon mass production today
  - Superscalar pipeline delivers 2 DMIPS/MHz
  - Thumb-2 ISA for performance **and** code density
  - TrustZone® extensions for secure transactions and DRM
  - NEON multimedia and signal processing unit delivers over 2x performance of ARMv6 SIMD
  - Integrated L2 Cache with configurable size and ECC



- Maximum implementation flexibility
  - Synthesizable RTL –or– optimized with customs
  - Same verilog code base

- Ecosystem in place
  - Tools
  - Middleware
  - OS support

PPA	65nm LP process		65nm G+ process	
	Optimized	Synthesized	Optimized	Synthesized
Standard Cells	Advantage-CE	Advantage-HS	Advantage-CE	Advantage-HS
Memories	Custom	Advantage**	Custom	Advantage**
Frequency (MHz)	660-700	500-550	1.1 GHz+	800+
Area with cache (mm²)	3.86	4.2	3.86	4.2
Area without cache (mm²)	2.79	3.1	2.79	3.1
Cache size	32K/32K	32K/32K	32K/32K	32K/32K
Power with cache (mW/MHz)	0.58	0.75	0.43	0.55
Power w/o cache (mW/MHz)	-	-	-	-

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** Optimized instances of Advantage RAMS
Area includes L1 RAMS, L2 control. Excludes NEON, ETM, L2 RAMS

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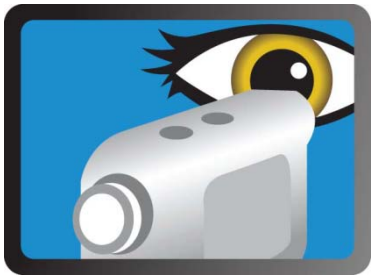
NEON - Enhancing User Experiences

Watch any video in any format

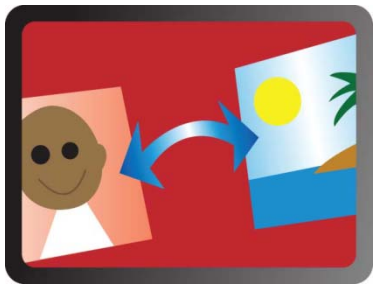


Edit & Enhance captured videos

Browse any website

Handle future User Interfaces

State of the art game play



Process megapixel photos quickly

Voice recognition

Advanced multi-channel audio processing

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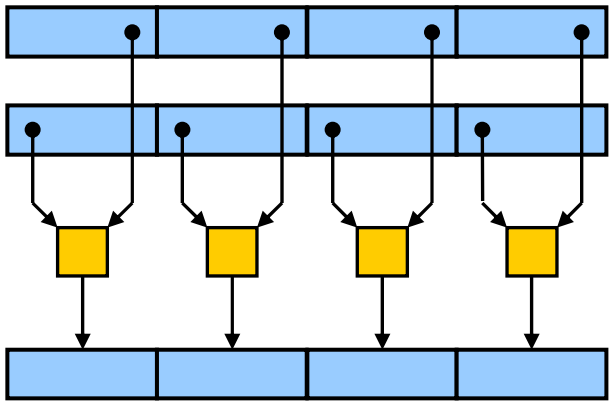
NEON – A hybrid SIMD architecture

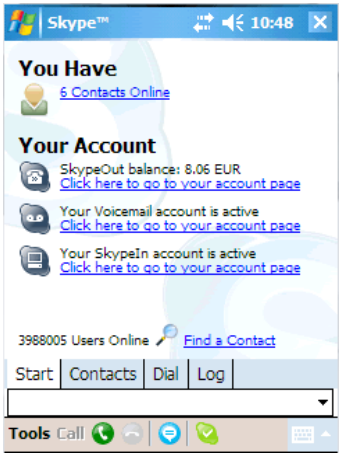
NEON™ is a 64/128-bit vector architecture

- Accelerates the performance of multimedia and signal processing applications
- Designed to be targeted by advanced compilers
- NEON uses standard ARM instructions for loop control and Scalar programming
  - Smaller than a dedicated hardware accelerator as scalar pipe is not duplicated
  - Simpler programming model



ARM NEON Multimedia Technology

- NEON provides **flexible, generic** multimedia acceleration
  - Higher power than a dedicated hardware video or audio CODEC
  - Supports **emerging** standards – Not intended to replace standards-based HD CODECs

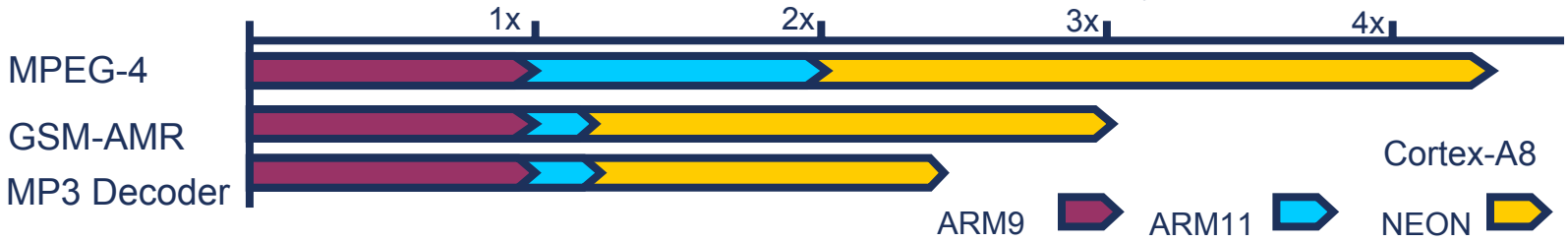


VoIP Communications

Portable media player for streaming from home DVR

Free video player supporting formats not including with bundled video players

Voice encryption for mobile handsets



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NEON Third-party Partnership

ingenient technologies	H.264, VC1, MPEG-4
on2 technologies	VP6, Sorenson Spark, H.264 (used for Flash video)
Ittiam	MPEG-4, MPEG-2, H.263, H.264, WMV9, VC1
ARICENT	MPEG-4, H.263, H.264, WMV9
TATA ELXSI Engineering Creativity	H.264, VC1
SPIRIT DSP Embedded Voice Experience	TEAMSpirit voice & video
VisualOn	H.264, MPEG-4, H.263, WMV
ACTIMAGINE	MobiClip
Fraunhofer Institut Integrierte Schaltungen	Codecs
DOLBY	Multichannel audio processing
Adobe	Flash products

- Working closely with all major codec vendors and opensource
- Initial results very encouraging

Other NEON Partners

DOLBY, QSoundLabs, WIPRO Applying Thought, sasken Make the Right Connection, Algorithm Specialist TMC, W&W Communications, MindTree, 时代飞腾, ipera, CouthIT, National Source Coding Center 联合信源

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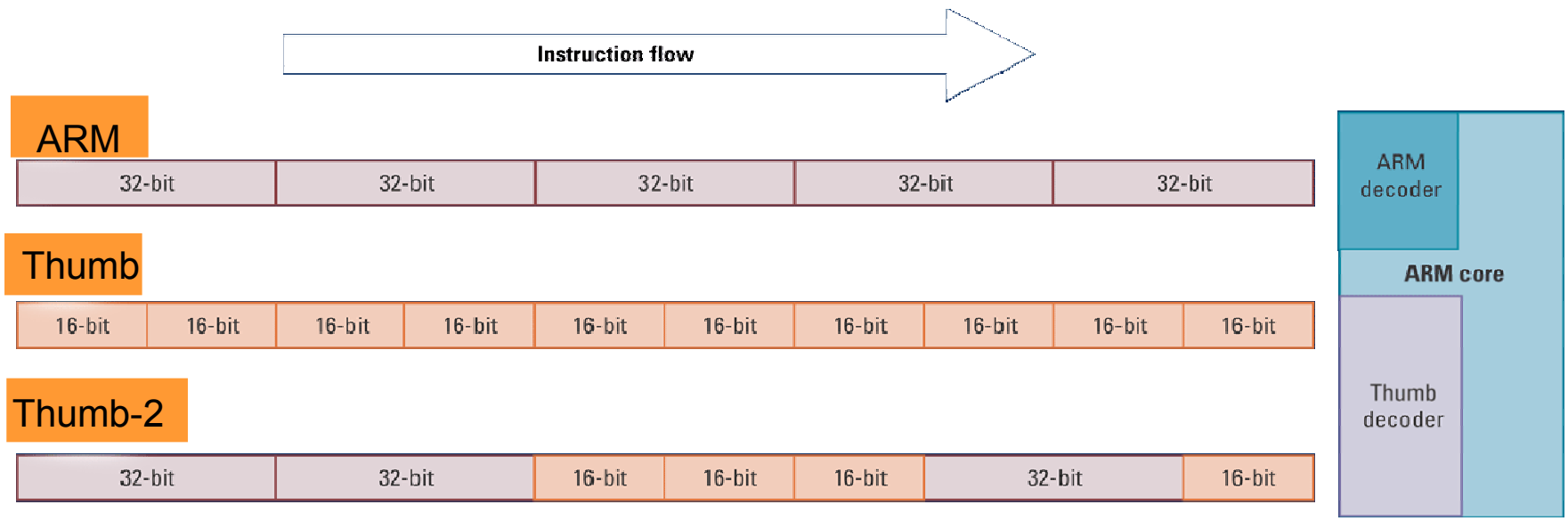
Thumb-2 Technology

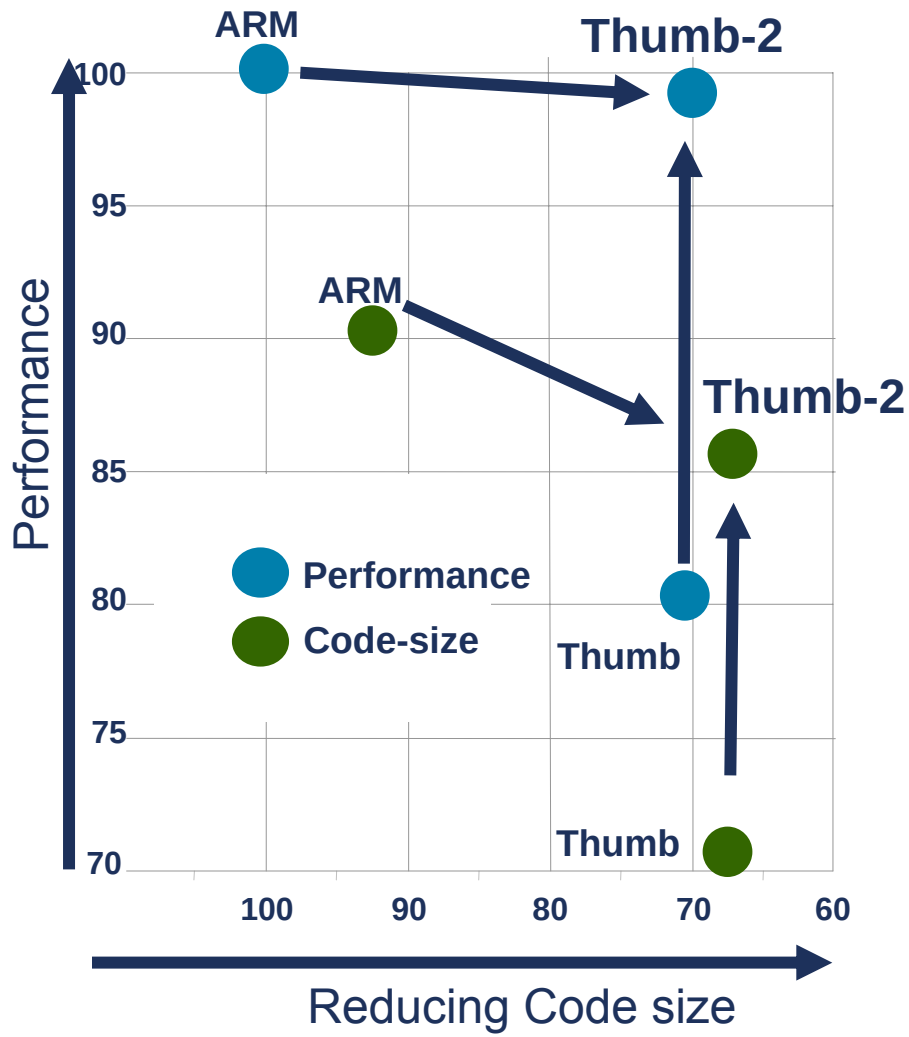
- Thumb-2 technology is an enhancement to the ARMv6 architecture
- Thumb-2 technology consists of:
  - New 16-bit Thumb instructions for improved program flow
  - New 32-bit Thumb instructions for improved performance and code size. One ‘new’ 32-bit instruction can replace multiple 16-bit opcodes



Thumb-2 Instruction Set

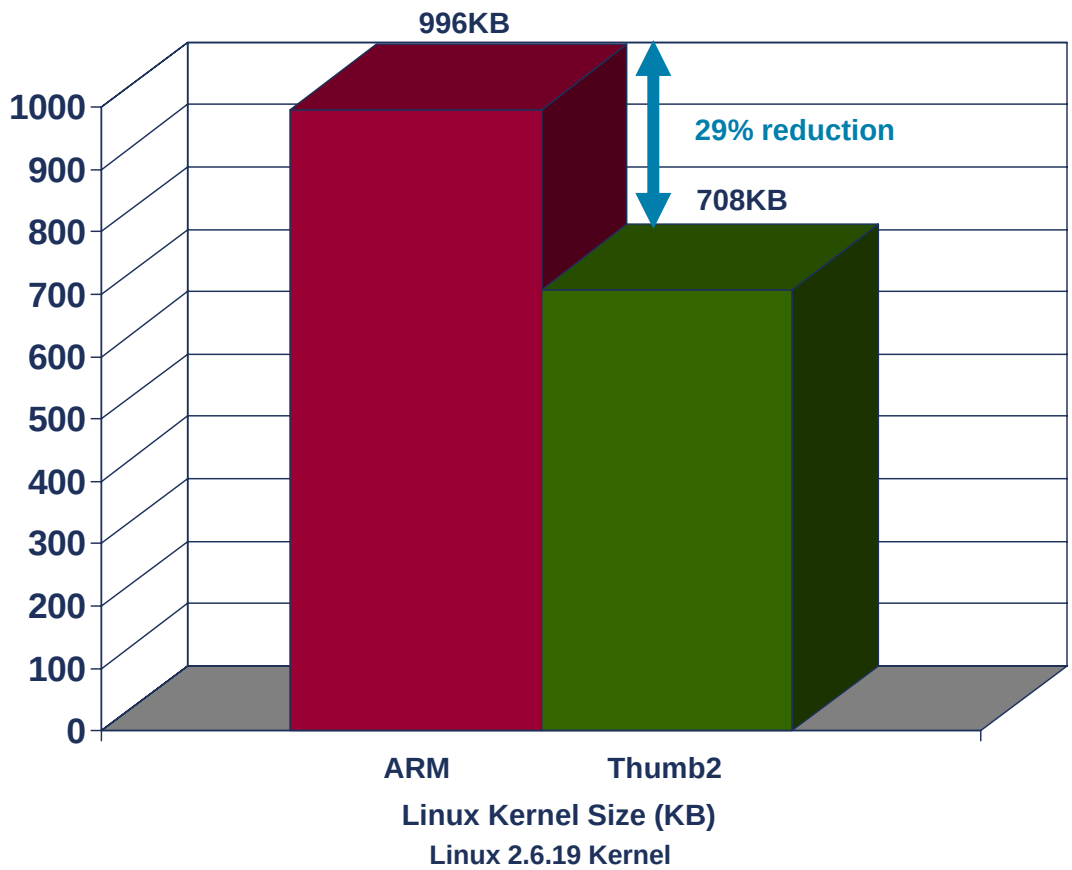
Thumb-2 : ARM performance, Thumb code-density

- Access to all registers (unlike Thumb)
- No mode switching requirement
  - Exception in either ARM or Thumb state
- IF…THEN instruction
  - Substitutes for lack of conditional execution
  - From 1 to 4 instructions are conditional
- Table Branch Instruction
  - Implements C **switch**…**case** in hardware
- Bit Manipulation
  - Bit-field insert/extract/clear
  - Bit reverse
- Full set of 'ARMv6 SIMD' instructions



Linux Kernel Memory Requirement

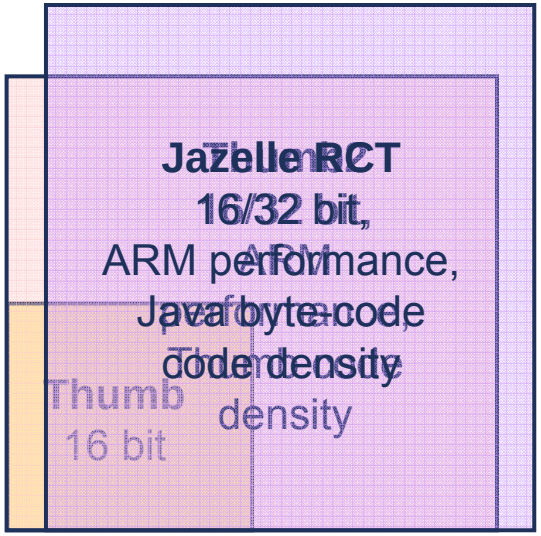
ARM has ported the Linux kernel to the **Thumb-2** instruction set.
The Linux kernel patches including the Thumb-2 patches are downloadable from the ARM website at: http://www.arm.com/products/os/linux.html



Jazelle RCT Technology

- Jazelle RCT is designed as an ideal target for VMs using DAC, JIT or AOT compiler technology
  - Reduced code-size and increased performance for compiled Java
  - Also useful for Microsoft .NET, Perl, and Python
- Jazelle RCT is an open architecture in the ARMv7 ARM
  - Assembly level support in RVDS 3.0 and later
- Jazelle RCT is a new instruction set based on Thumb-2
  - aka Thumb2 Execution Environment
  - A small modification to Thumb-2 - <8K additional gates
  - Variety of new 16-bit instructions added
  - Behaviour of some instructions **changed**
  - 16-bit LDMIA and STMIA removed
- 16-bit instructions for common AOT/JIT compilation operations
  - Results in reduced code footprint
- Null-pointer check and array index check
  - Required in Java – Results in faster and smaller code

"Thumb2EE is a VM-designers dream"



Thumb-2 is a **superset** of **Thumb**

Thumb-2 runs all Thumb code

Thumb-2EE is **not** a strict **superset**

Thumb-2EE **cannot** run either:
Thumb or Thumb2 code

DAC : Dynamic Adaptive Compiler
JIT : Just In Time Compiler
AOT : Ahead of Time Compiler

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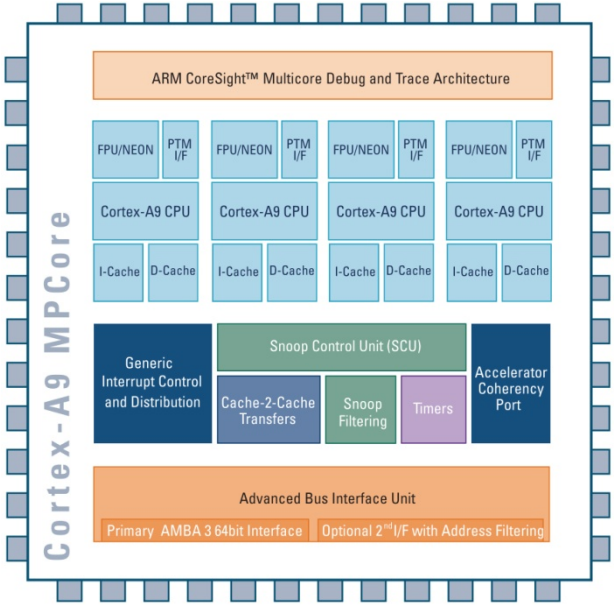
Cortex-A9 Processor Overview

- Optimized Cortex-A processor enabling breakthrough performance and power scalability
  - Second generation 1-4X SMP technology
  - Delivered as Uniprocessor and 1-4X MP
  - Advanced pipeline delivering ~25% more DMIPS/MHz over Cortex-A8 (2.5)
  - Comparable F_{MAX} to fully synthesized Cortex-A8 in same configuration
  - Optimized floating-point unit; NEON engine



- New system-level integration features for design optimization
  - Accelerator coherence port
  - Advanced bus interface unit for maximum throughput
  - Generalized interrupt control and distribution system
- Announced to be part of OMAP 4

"Symbian and ARM Cooperate in Bringing Symmetric Multi Processing (SMP) to Future Phones Enabling High-End PC Capabilities to Consumers' Pockets"
– http://www.symbian.com 10/07

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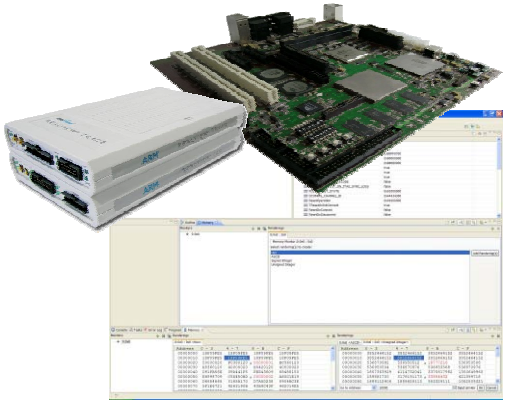
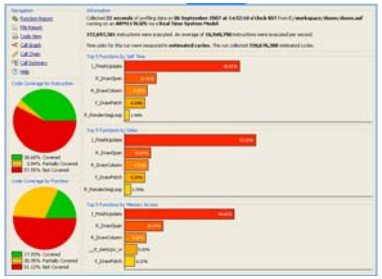
ARM Development Tools Solutions

- Leading support for all ARM-processor IP
  - Tools co-developed with the ARM processor IP
  - Leading support for all ARM processors
  - Extensive support for CoreSight™, enabling debug of today's complex devices



- Get the best out of your ARM processor-based device
  - Best code with the ARM RealView® Compiler
  - Unrivalled performance analysis with the RealView Profiler
  - Specialized tools for MCUs, ASSPs and SoCs



- Enable your developers with Virtual platforms
  - Ultra fast Instruction accurate ARM models
    - Model performance up to 250MHz
  - Models of ARM processors validated using the ARM processor validation Suite

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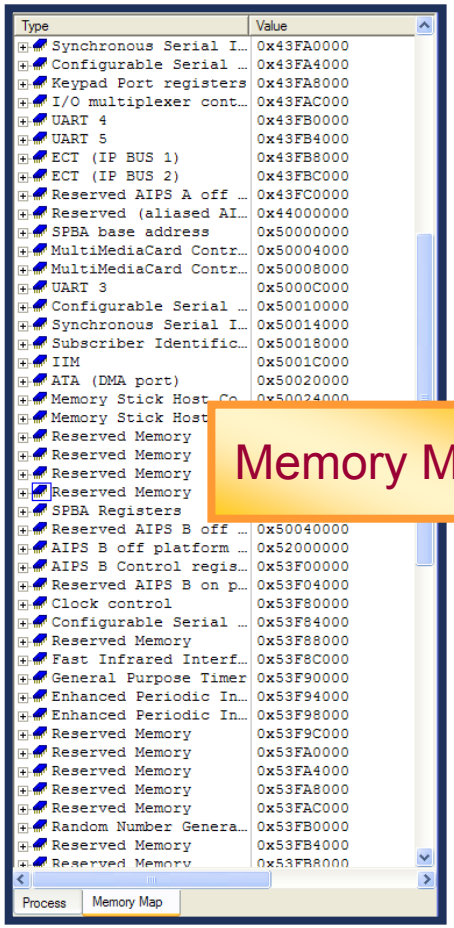
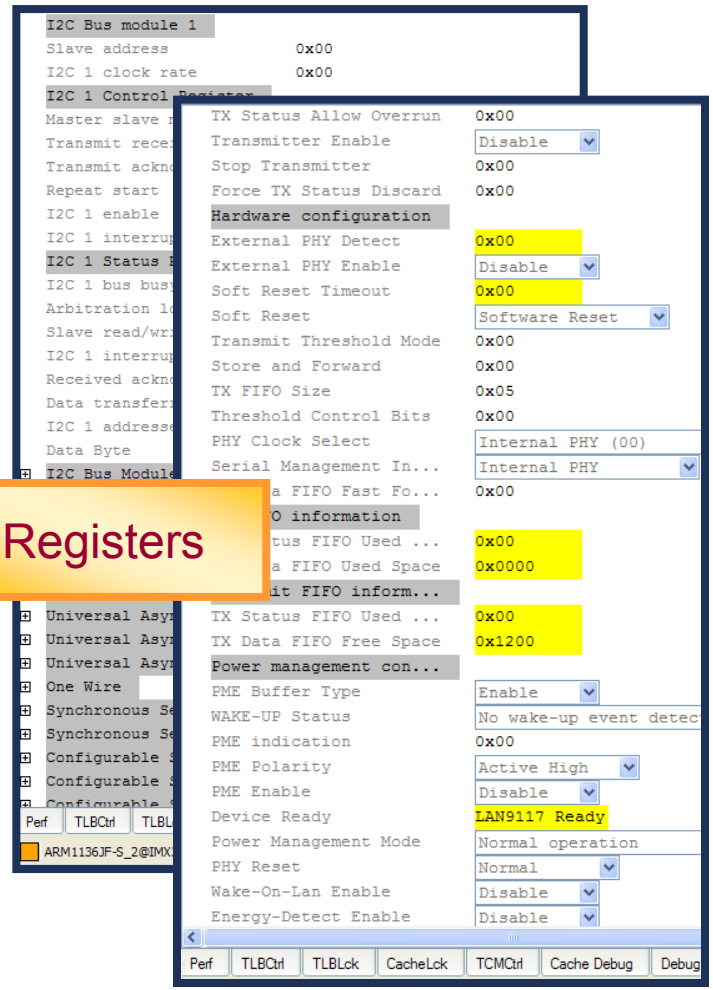
ARM Debugger - Target Visibility

- Board Configuration files for RealView Debugger for OMAP 35xx & 34xx & DM355
- Visibility of all registers and memory mapped peripherals
- Flash Method algorithm for flash programming



Memory Map

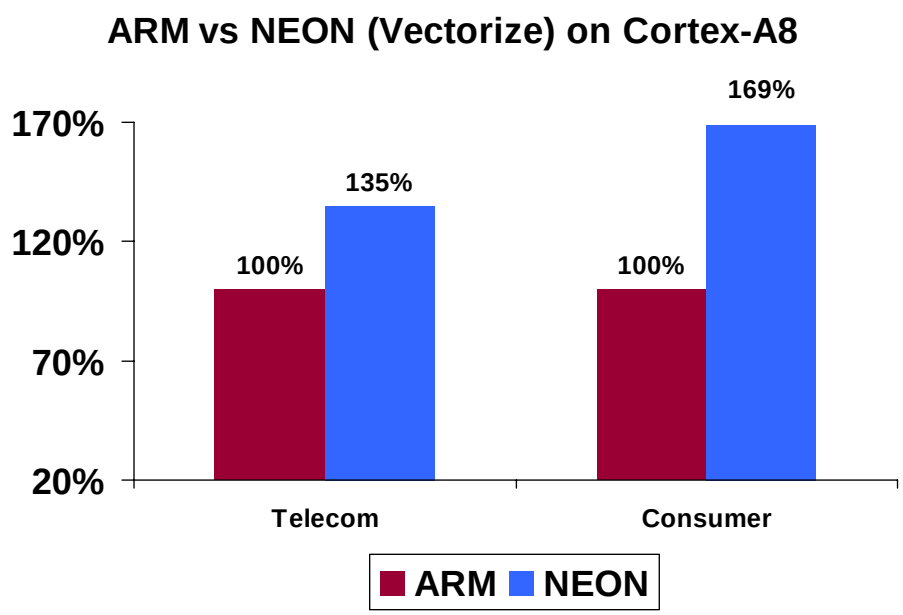
Registers



ARM Vectorizing Compiler

- RVDS 4.0 professional includes auto-vectorizing armcc
  - armcc --vectorize --cpu=Cortex-A8 x.c

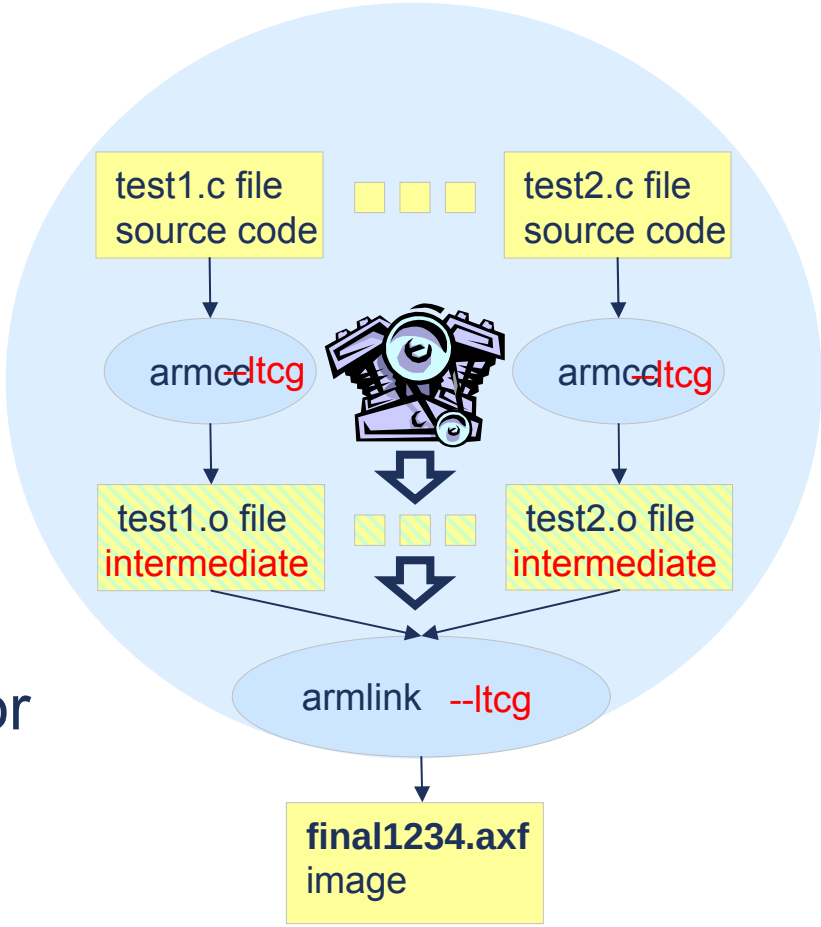
- Up to 4x performance increase for benchmarks, with no source code changes (no source code changes are permitted for benchmarking)



- Simple source code changes can yield significant improvements above this
  - Use C '__restrict' keyword to work around C pointer aliasing issues
  - Make loops clearly multiple of 2^n (e.g. use 4*n as loop end) to aid vectorization

Link-time Code Generation

- Move compilation to link-time
- Enables global optimization
  - Up to 5% smaller code size
  - Up to 5% more performance
  - Applies optimizations across files
    - Inlining and specializing, shared literals, cross-jumping
- Fits into normal build process
- Ability to use on partial systems, for instance:
  - Optimize MP3 module
  - Optimize camera module



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Profile-Driven Compilation

Build

Source Code

Compiler

Run

RTSM

Hardware

Analyse

Address	Opcode	CPI	?	Disassembly
0x00003d18	e2522001	54		SUBS
0x00003d1c	e0660080	13		ADD
0x00003d20	e1d000b0	3		LDRH
0x00003d24	e0cc00b4	48		STRH
0x00003d28	e0ce00b4	44		STRH
				STRH
				STRH
				BNE
				LDRB

Top 5 Functions by Self Time

I_FinishUpdate 14.97%

__aeabi_idivmod 9.38%

Totals

Function Name	Coverage	Self Time
I_FinishUpdate	100.00%	446,927,510
R_DrawColumn	100.00%	68,167,434
R_DrawSpan	100.00%	39,738,319
R_RenderSegLoop	99.65%	20,349,976
__arm_div12	100.00%	12,538,311
__arm_div4	78.30%	10,293,647
TryRunTics	50.00%	9,820,850
__aeabi_idivmod	100.00%	8,574,971

Analysis Data

Auto-Optimise

Automatic Compiler Optimisations

Function-specific compiler optimizations

Identify further inlining

Automatic loop unrolling

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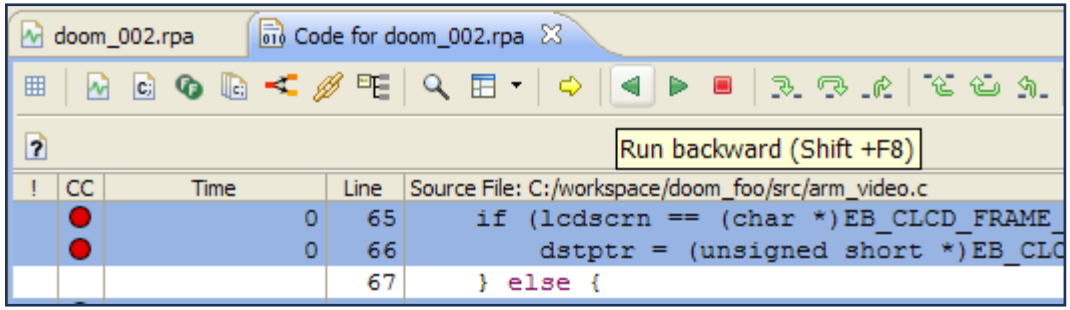
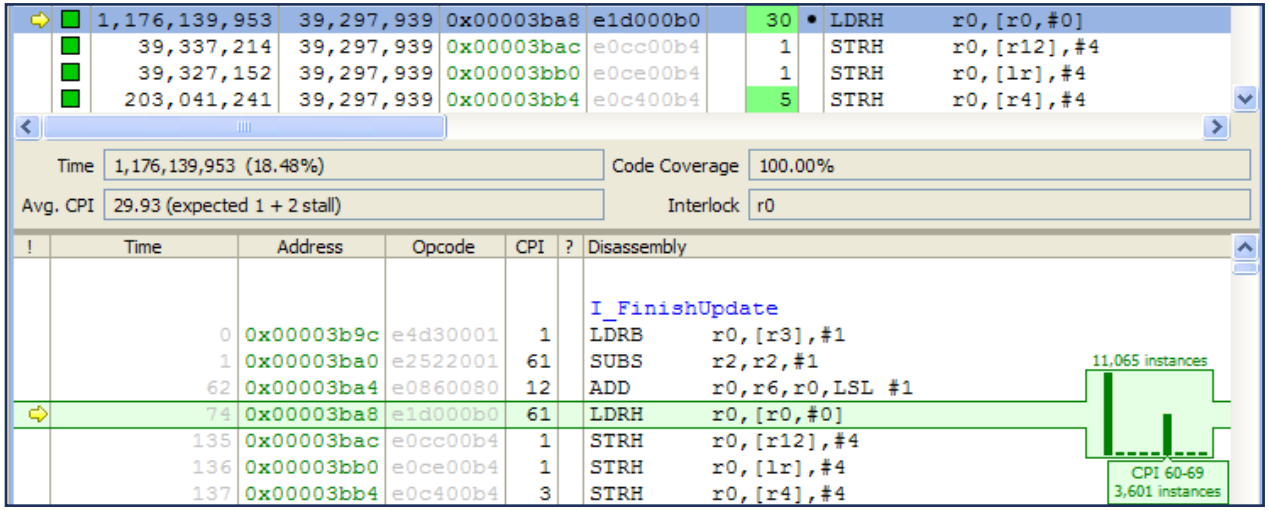
Trace Replay

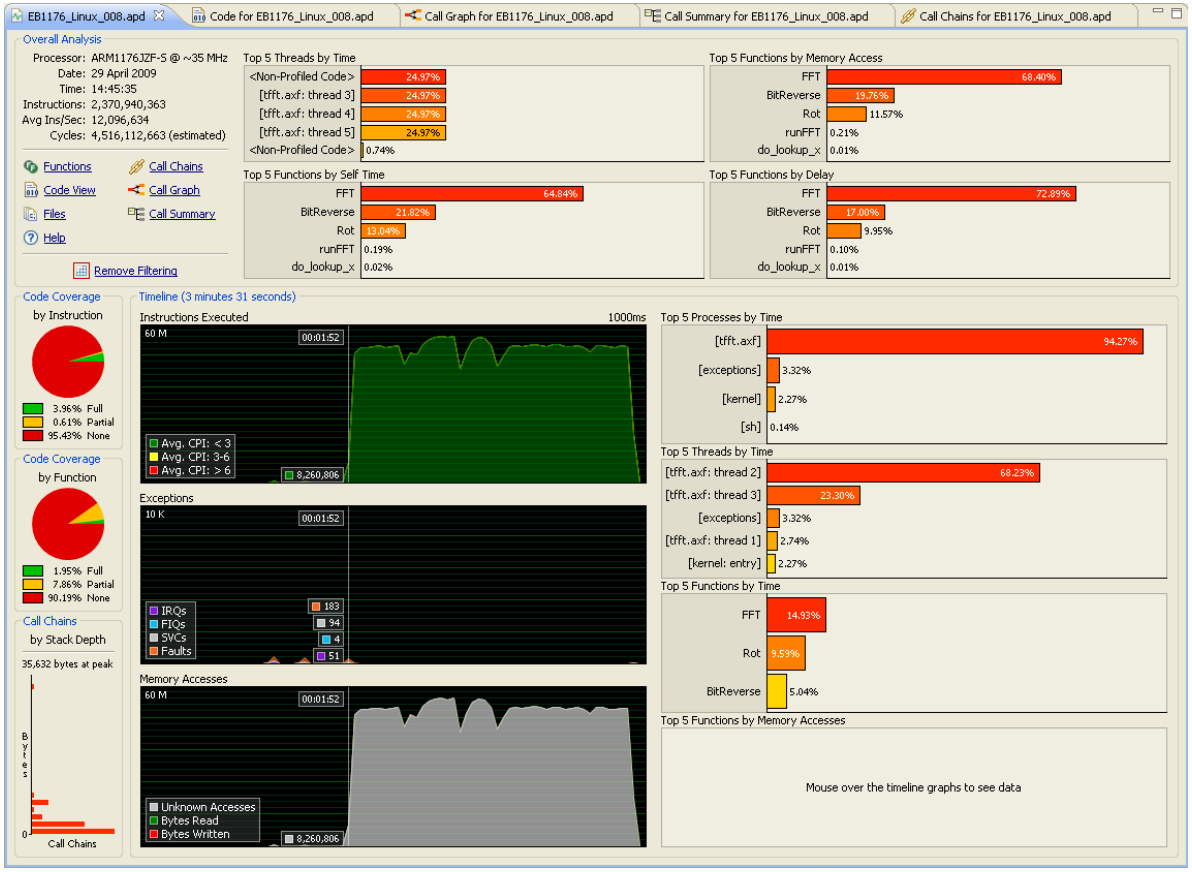
- Decompression of streaming trace directly to host PC
  - Collect unlimited trace – limited only by free space on harddrive
  - (1 Terabyte = 1 – 10 days of application behaviour)
- Trace Replay
  - Run forward/backward
  - Step forward/backward
  - Run to breakpoint





Linux Application Profiling

- Linux Application Profiling
  - Supports GCC and ARMCC
  - Patch to Linux kernel 2.6.28 included
- Top 5 Processes
- Top 5 Threads
- Top 5 Functions
- Timeline view
- New Device support
  - TI OMAP 3530
- Release: June 09



ARM Connected Community

Texas Instruments is one of the 500 + companies which participate to the ARM Connected Community

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Conclusion

- World-class, market-proven processor portfolio
  - 20+ processors, 200+ partners, 500+ licenses, 15Bu+ shipped
  - Unparalleled ecosystem – everything you need
- Compelling economic benefits to all participants
- Broad set of complimentary ARM IP, tools, services
- Commitment to market-driven investment in ongoing innovation
  - Increasing performance and power efficiency, decreasing die size
  - New features and functionality enabling new user experiences, applications
  - Industry standard open architecture underpinned by business stability
- Success built upon track record of partnership

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Please join us on our booth for further discussion about ARM technology.

See a demonstration of the advanced software development tools targeting Texas Instruments OMAP devices.

Get a discount Voucher for ARM Tools

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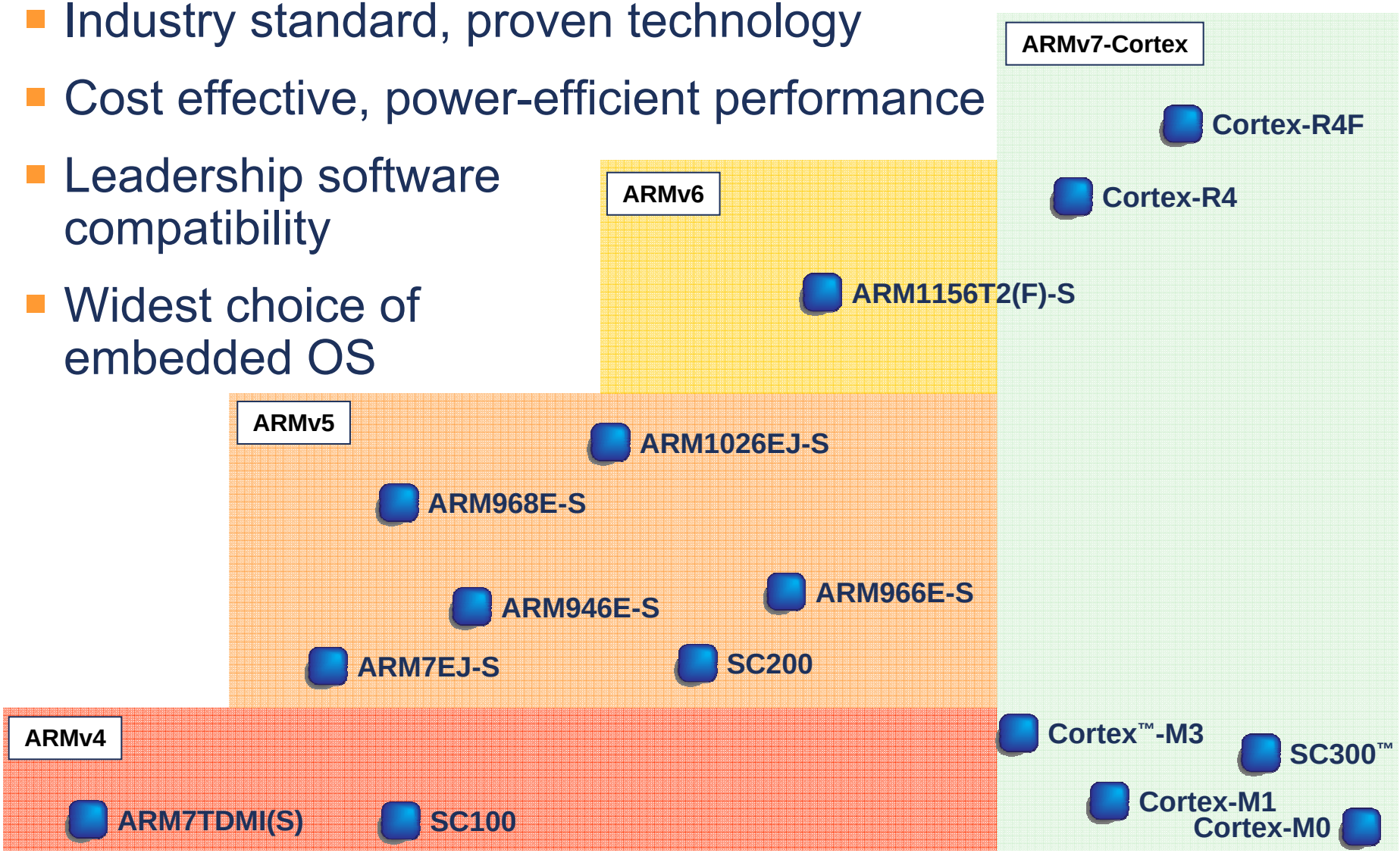
END

Supplementary Information
Embedded Processors

Embedded Processors

- Industry standard, proven technology
- Cost effective, power-efficient performance
- Leadership software compatibility
- Widest choice of embedded OS



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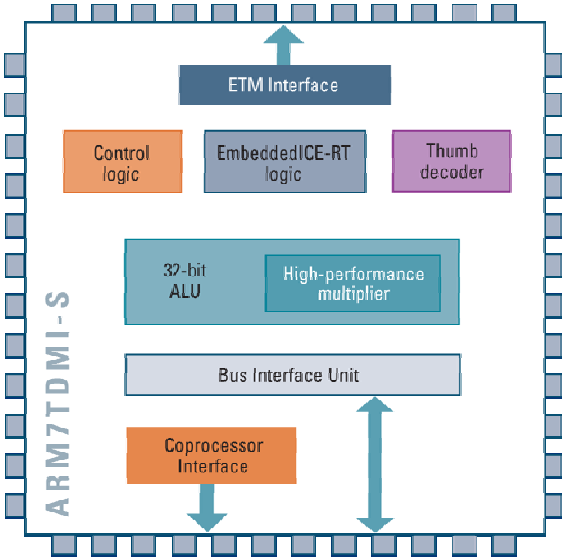
ARM7TDMI Processor Overview

- The most successful embedded processor in the world
  - Billions of ARM7TDMI(S) based devices in the market today
- Available through Foundry Program and Design Start
- T-Thumb, D-Debug, M-Multiplier, I-ICE
- Low power consumption
- Standard AMBA AHB interface
- Optional ETM for full data and intruction trace
- Largest software tools ecosystem in the industry



> *"By now, engineers at many companies can design an ARM7TDMI processor-based chip with their eyes closed. And their programmers can go home early, because the finished silicon will be compatible with existing software"*
>
> **Tom Halfhill, Senior Editor & Senior Analyst**
> **Microprocessor Report, March 14, 2005**

ARM7TDMI-S (Synthesizable)	0.18um	0.13um		90nm	
	Spd Opt	Spd Opt	Area Opt	Spd Opt	Area Opt
Standard Cells	-	SAGE-HS	SAGE-X	Advantage-HS	Metro
Frequency (MHz)	100	184	106	245	120
Area (mm2)	0.62	0.35	0.24	0.21	0.1
Power (mW/MHz)	0.28	0.18	0.1	0.09	0.06

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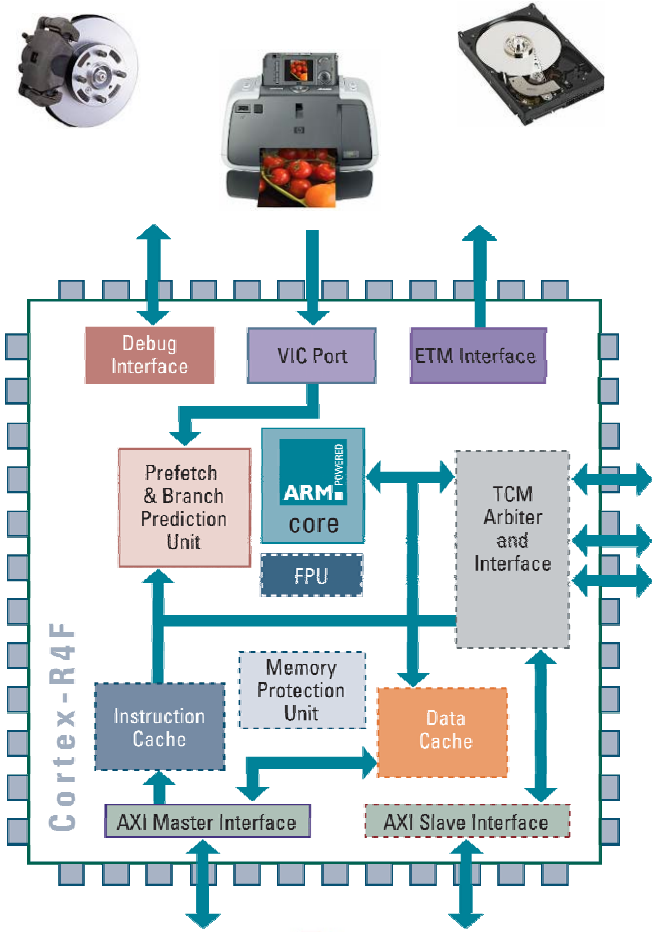
Cortex-R4(F) Processor Overview

- High-performance processor optimized for deeply embedded signal-processing and control applications
  - 8-stage superscalar pipeline delivers up to 400MHz+ @ 1.6DMIPS/MHz on 90nm
  - Thumb®-2 technology, hardware divide
  - State-of-the-art ECC support in all memories
  - AMBA 3 AXI slave port for DMA to TCMs

- Fit-for-purpose configurability
  - Separately configured L1 caches: 0kB, 4-64kB
  - 0 to 3 TCMs of up to 8MB each
  - 8 or 12 regions in MPU, or no MPU
  - 2 – 8 Breakpoints, 1 – 8 Watchpoints
  - Parity or ECC can be optionally included
  - Optional SP-optimised FPU (full IEEE754)
  - Optional slave port



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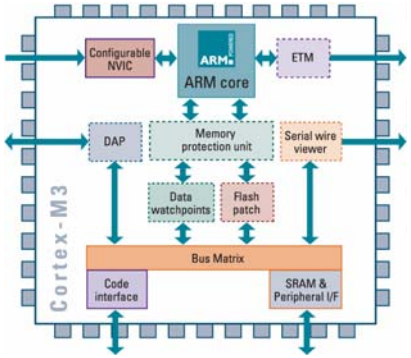
Cortex-M3 Processor Overview

- An ARM7TDMI-S for the 21st century
  - For extreme cost and power-sensitive complex applications
  - Comparable or better F_{MAX} and gate count with r2p0 min config
  - 30% more DMIPS, 28% more geomean EEMBC
  - 85% more DMIPS per mW

"…. the Cortex-M3 processor will propel us again towards a breakthrough in performance, ease of use and quality, while also providing a competitive cost structure for our products. We feel that the Cortex M3 processor will play an important role in accelerating the convergence of the MCU market…"

– Jim Nicholas, GM Microcontroller Division, ST

- State-of-the-art functionality
  - Code ***everything*** in C
  - Thumb-2 ISA → 6X code density, 10X perf. v 8051
  - Integrated Nested Vectored Interrupt Controller (NVIC) with lowest interrupt latency of any ARM
  - Configurable/optional memory protection, debug, trace
  - uA device stand-by enabled with integrated sleep modes, ULL libraries, state retention



- Broad adoption within Microcontroller industry

ARM

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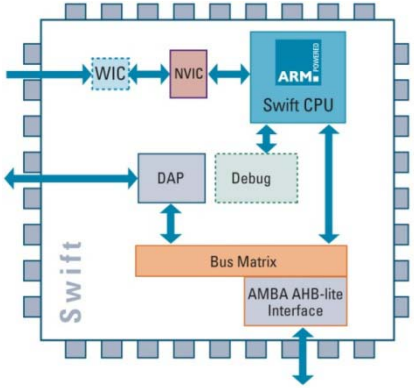
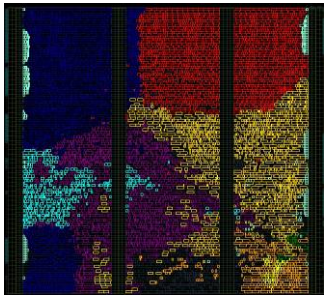
Cortex-M0 – Small, Smaller, Smallest

- Extending the breadth of the ARM architecture even further with our smallest processor
  - From only 12K gates: less than half the size of ARM7TDMI, less than half the power of ARM7TDMI, with comparable total Thumb performance
  - Bringing ARM technology to new markets and applications
  - Lowest cost MCUs, mixed signal, SoC state machines



- Streamlined, elegant processor design
  - Simple to integrate and program in pure C
  - Deterministic instruction and interrupt operation
  - Offering performance headroom beyond 8- or 16-bit devices
  - Upward software compatibility with the Cortex-M roadmap
  - World class support and user community



Trial implementation
0.25um 3LM

- Released March 2009

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TI Embedded Processors
ARM Based Platforms
Roadmap & Overview – May 2009

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TI Embedded Processing Portfolio

Microcontrollers			ARM-Based		DSP
16-bit	**32-bit Real-time**	**32-bit ARM**	**ARM+**	**ARM + DSP**	**DSP**
MSP430	**C2000™**	**ARM**	**ARM9 Cortex A-8**	**C64x+ plus ARM9/Cortex A-8**	**C647x, C64x+, C674x, C55x**
Ultra-Low Power	Fixed & Floating Point	Industry Std Low Power	Industry-Std Core, High-Perf GPP	Industry-Std Core + DSP for Signal Proc.	Leadership DSP Performance
Up to 25 MHz	Up to 300 MHz	<100 MHz	Accelerators	4800 MMACs/ 1.07 DMIPS/MHz	24,000 MMACS
Flash 1 KB to 256 KB	Flash 32 KB to 512 KB	Flash 64 KB to 1 MB	MMU	MMU, Cache	Up to 3 MB L2 Cache
Analog I/O, ADC LCD, USB, RF	PWM, ADC, CAN, SPI, I²C	USB, ENET, ADC, PWM, SPI	USB, LCD, MMC, EMAC	VPSS, USB, EMAC, MMC	1G EMAC, SRIO, DDR2, PCI-66
Measurement, Sensing, General Purpose	Motor Control, Digital Power, Lighting, Sensing	Host Control	Linux/WinCE User Apps	Linux/Win + Video, Imaging, Multimedia	Comm, WiMAX, Industrial/ Medical Imaging
$0.49 to $9.00	$1.50 to $20.00	$2.00 to $8.00	$8.00 to $35.00	$12.00 to $65.00	$4.00 to $99.00+

Software & Dev. Tools

CORTEX A8 based Platform : OMAP3x

TI's OMAP35x Applications Processors are ideal for:

Applications such as

Low Power PC / Web Tablet

Point of Service Terminals

Digital Signage

Industrial Panel PC/ HMI

Patient Monitoring

Portable Infotainment

Portable Industrial / SDR

Design requirements

- Laptop like performance levels
- Advanced graphical user interfaces
- Fast, full Web browsing experience
- Multimedia, up to 720p video decode
- Green low power computing
- Connectivity
- Powerful on-board DSP for off-loading ARM processor

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OMAP35x scalable platform of devices for complete product portfolio

In Production	Applications Software Compatibility	Shared Peripheral Set	2D/3D Graphics Compatibility	DSP Processing & Multimedia Software Compatibility
OMAP™ OMAP3530 Texas Instruments	ARM Cortex™-A8 600 MHz	Peripherals	Graphics Open GL ES 2.0 POWERVR SGX™	C64x+ DSP & video accelerator
OMAP™ OMAP3525 Texas Instruments	ARM Cortex™-A8 600 MHz	Peripherals		C64x+ DSP & video accelerator
OMAP™ OMAP3515 Texas Instruments	ARM Cortex™-A8 600 MHz	Peripherals	Graphics Open GL ES 2.0 POWERVR SGX™	
OMAP™ OMAP3503 Texas Instruments	ARM Cortex™-A8 600 MHz	Peripherals		

Pin to Pin Compatible

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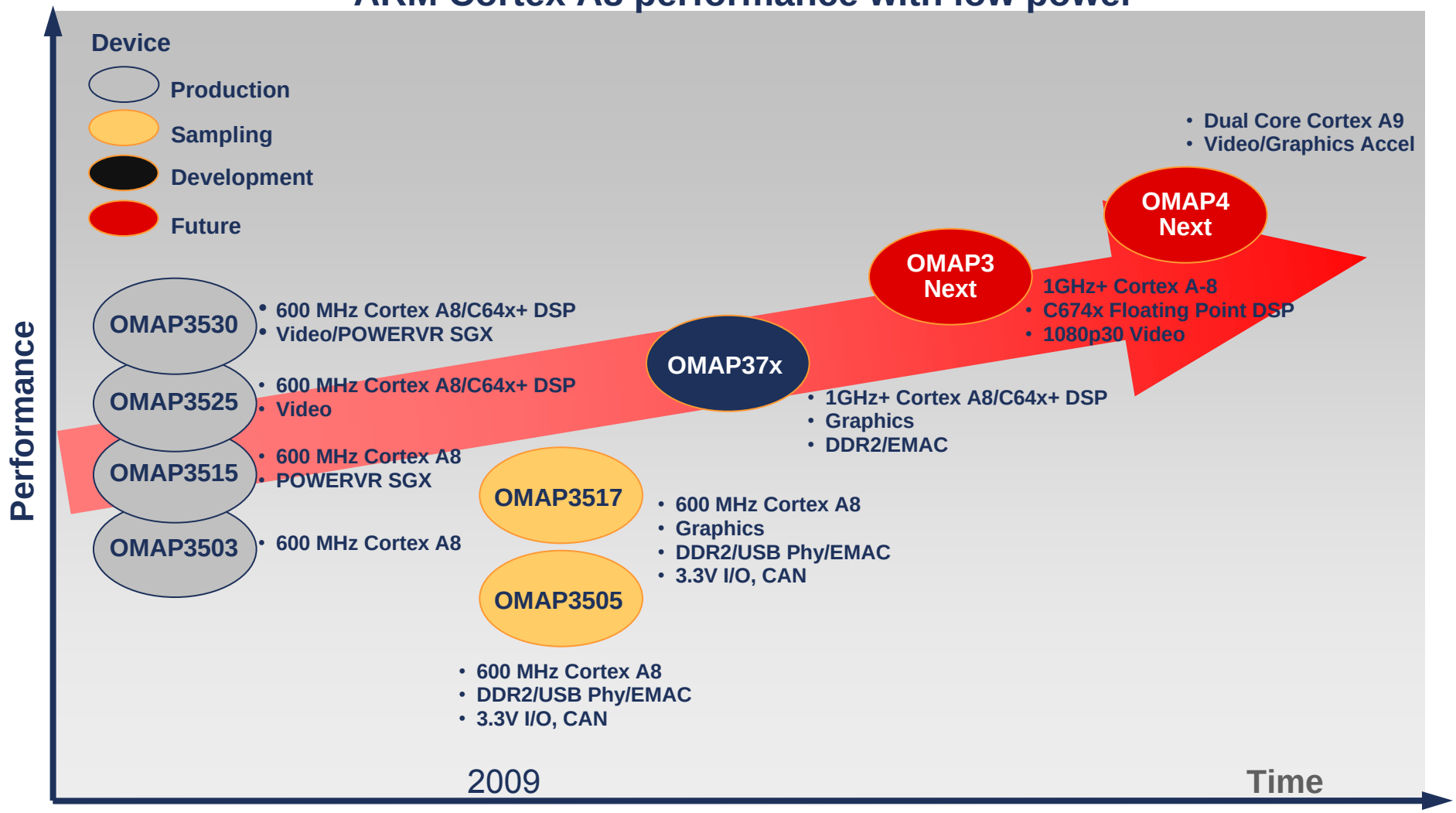
TI's OMAP35x Application Processors roadmap

ARM Cortex A8 performance with low power



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OMAP35x processor

Laptop like performance at handheld power level

Performance

- High-performance Superscalar ARM® Cortex™-A8 featuring NEON co-processor with immersive 2D/3D Graphics accelerator
- HD video decode utilizing TMS320C64x+ DSP and video hardware accelerators
- Low power utilizing TI's SmartReflex™ technology with option for integrated and discrete Power Management ICs

Features

Cores

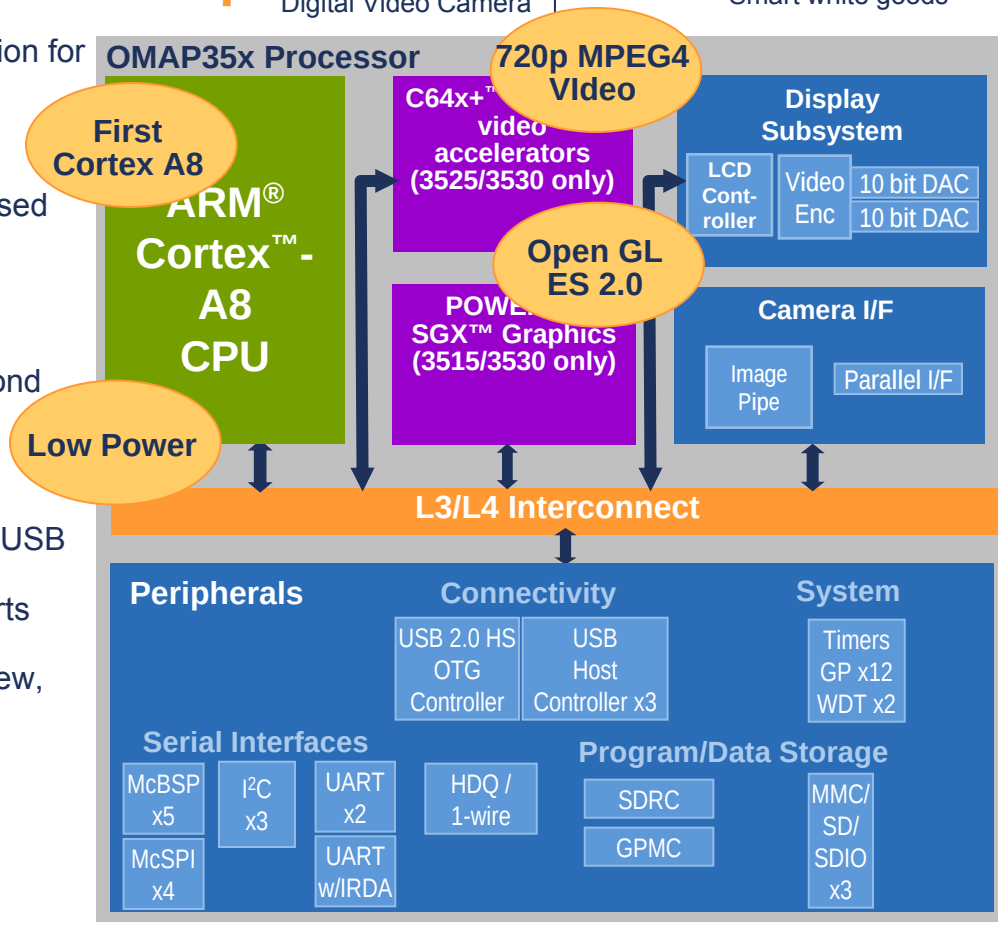
- Cortex A-8 with NEON™ SIMD Coprocessor / DSP-based TMS320C64x+ DSP and video accelerators (max performance only)
  - 600 MHz / 430 MHz @ 1.35V *(operating limits apply)*
  - 550 MHz / 400 MHz @ 1.27V
- 2D/3D Graphics Engine - Up to 10M polygons per second

Peripheral Highlights

- Support for LPDDR
- Support for NOR, NAND, SRAM, Pseudo SRAM
- USB 2.0 HS Compliant OTG Controller w/ 2 additional USB Host Controllers
- Display subsystem with LCD and TV interface. Supports PIP, color space conversion, resize and rotation.
- Camera I/F with CCD controller and Image-pipe (Preview, Resize, Statistics

Applications include:

- Automotive Infotainment
  - In-dash navigation
- Consumer
  - PND
  - PMP
  - Digital Video Camera
- Medical
  - Patient monitoring
  - Portable ultrasound
- Industrial
  - Point of sale
  - Smart white goods



Note: Peripheral limitations may apply among different packages

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TEXAS INSTRUMENTS

POWERVR SGX™ 3D engine is licensed from Imagination Tech. Ltd.

ARM 9 based Platforms :
OMAP L1x
DM3x

OMAP-L1x/C674x Low Power Processors

Up to 2400 MMACs

New product generation

OMAP-L1x

7mW – 490mW*

Highly Integrated SoC

Unique peripheral combinations

Low power for portable apps

Application processing

Supports various high- level OS's

- Linux, WinCE, VxWorks

ARM9 Plus Floating- & Fixed-Pt DSP

~1/2 MB On-chip Memory

New product generation

C674x

7mW – 470mW*

High Performance
Up to 2400MMACs

High Precision and low power

Industry's lowest power floating/fixed-point DSP

Floating & Fixed-pt in a single core

>65% Reduction in Total Power (Flt-Pt)

20X lower standby power

* For typical use case scenarios

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OMAP-L1x/C674x Roadmap

Battery operated

7mW Standby

In Production

Sampling

In Development

Future

OMAP-L1x
FUTURE

Apps Proc

OMAP-L138
- 300 MHz ARM926
- 300 MHz C674x (C64x+/C67x+) DSP

OMAP-L118
- 300 MHz ARM926
- Audio CoP

OMAP-L108
- 300 MHz ARM926

Additional Key Features:
- *DVFS*
- *mDDR/DDR2/SDRAM*
- *SATA*
- *VPIF*
- *uPP*
- *McBSP*

OMAP-L137
- 300 MHz ARM926
- 300 MHz C674x (C64x+/C67x+) DSP

Key Features:
- *SDRAM*
- *10/100 Ethernet MAC*
- *USB2.0 HS PHY*
- *USB1.1 FS PHY*
- *McASP*
- *LCD Controller*

60mW Standby

C674x
Next

Fix/Flt-pt DSP

C6748/6/2
DSP
- DSP-Only
- Lowest power C6000 DSPs

C6747/5
DSP
- DSP-Only
- BGA & TQFP

C6743
DSP
- DSP-Only

C67x

Lowest power Floating-point DSPs in the industry

Time

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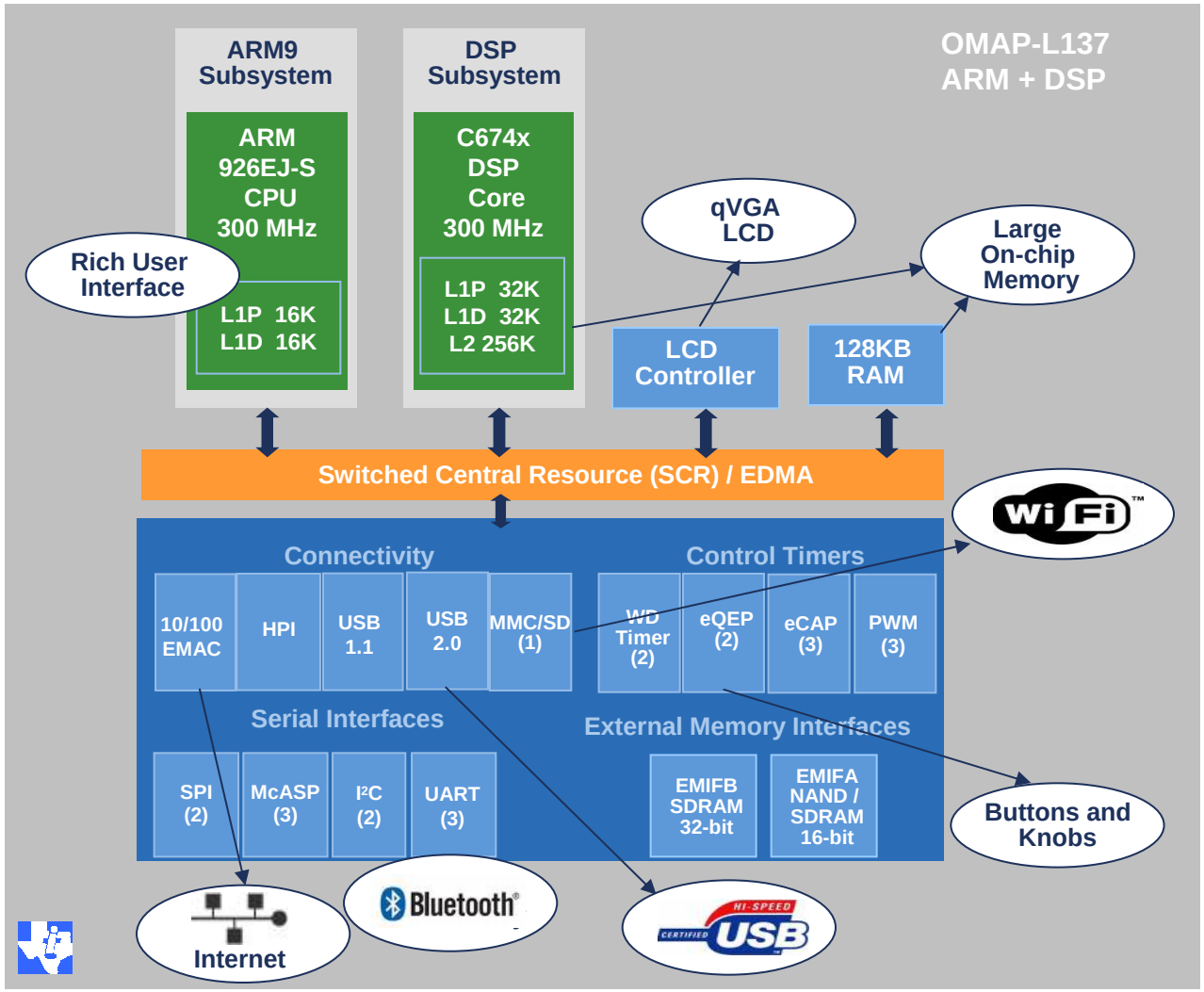
Generic OMAP-L137/C6747 Block Diagram (Superset)

Schedule: TMX – Now; TMS – 3Q09

- **CPU Cores**
  - ARM926EJ-S™ (MPU) upto 300 MHz
  - C674x DSP Core upto 300MHz
- **Peripherals (1.8/ 3.3V IOs)**
  - EMIFB – Supports 133 MHz SDRAM (16/32-bit)
  - EMIFA – Supports Async/NAND Flash (8/16 bit)
- **Package**
  - 17 x 17mm BGA (1.0mm pitch) ~256pins
  - Extended Temperature Grade Options
    - Commercial (0C to 70C)
    - Industrial (-40C to 85C)
    - Automotive(-40C to 125C)
  - Pin to pin compatible processors: OMAP-L137, C6747/3
- **Power (1.2V Core, 3.3V IOs)**
  - Active < 490 mW @ 300MHz/1.2V/70C (estimate)
  - Standby < 60 mW @ 300MHz/1.2V/25C (estimate)
- **Applications**
  - Power Protection Systems, Test and Measurement, Portable Communications, Portable Medical, Portable Audio

Starter Kit (TMDXOSKL137BET) Available Now



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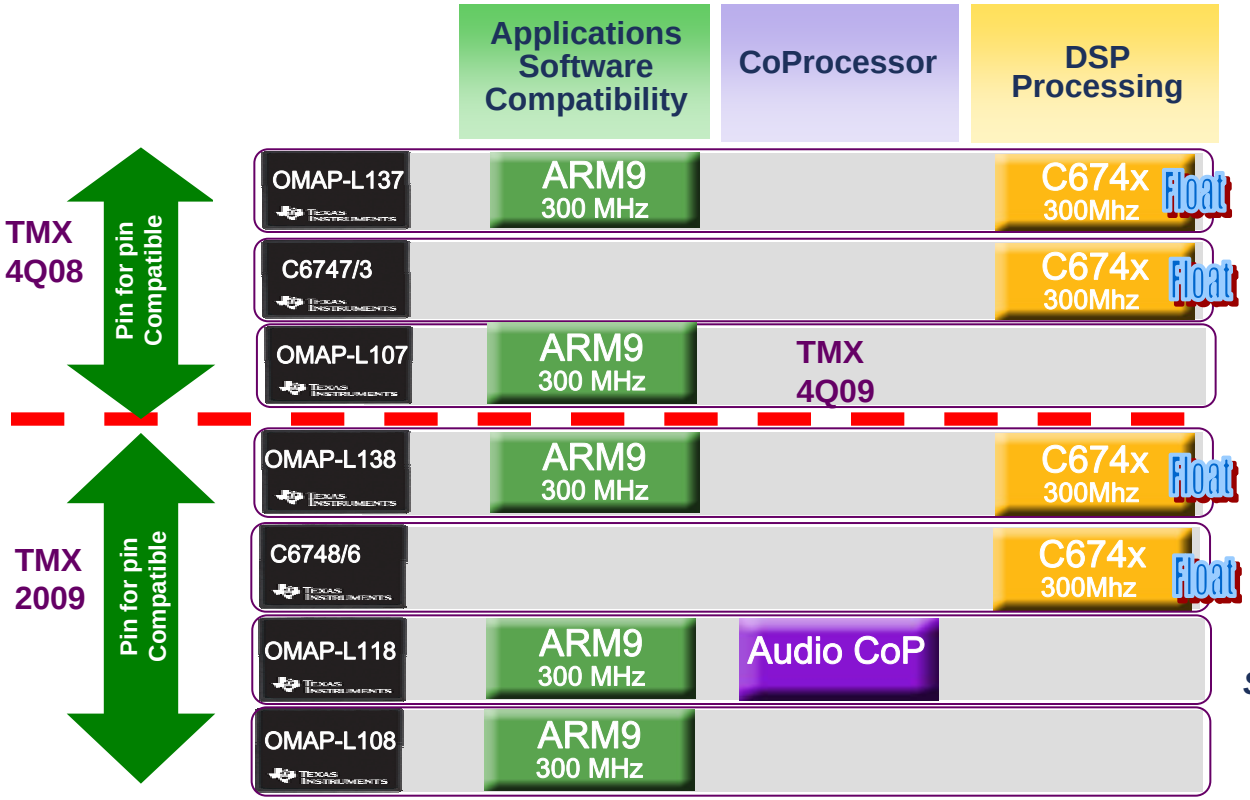
Architecture, Software and Pin for Pin Compatibility



SDRAM, McASP

Low Price <$15 (10ku)
Standby Power – 60mW
Total Power – up to 490mW

mDDR/DDR2, McASP/McBSP, SATA,UPP, VPIF
- DVFS -
Standby Power – 11mW
Total Power – up to 440mW

Note:

C6745 and C6743 are in a QFP package and are pin for pin compatible.

OMAP-L137/ C6747/ C6743 are in a BGA package and are pin for pin compatible.

OMAP-L13x – Fixed & Float DSP
OMAP-L11x – ARM + CoP
OMAP-L10x – ARM only

TI's Digital Media Video Processors are ideal for:

Applications such as

High Performance Client/Infrastructure

- HD Set Top Box
- Video conferencing
- Medical imaging
- IPTV, VOD, and MRFP server
- Mid-grade professional broadcast equipment

SD Client Video

- SD IP STBs
- SD Digital Media Adapters
- SD Video Conferencing
- High-end Digital Photo frames
- SD Video Phone

Vision/Multichannel

- Automotive Vision
- Machine Vision
- Digital video recorders
- Video analytic servers

Portable Video

- Portable media players
- Digital cameras
- Web cam
- Baby Monitors
- Video doorbells
- Portable medical
- Surveillance IP Cameras

Design requirements

- Up to 1080p encode/decode/transcode
- Multi-Channel SD Support
- DSP Headroom to add real-time video & imaging applications (i.e. custom codecs / filters / etc…)

- SD encode/decode
- Overlay Graphics/Video
- System BOM Integration

- Multi-Channel SD encode /decode
- DSP Headroom to add real-time video & imaging applications (i.e. Vision, Analytics, etc…)
- High-End Imaging

- Upto 720p support
- Portability/Mobility
- Low-cost video
- Fixed function video support

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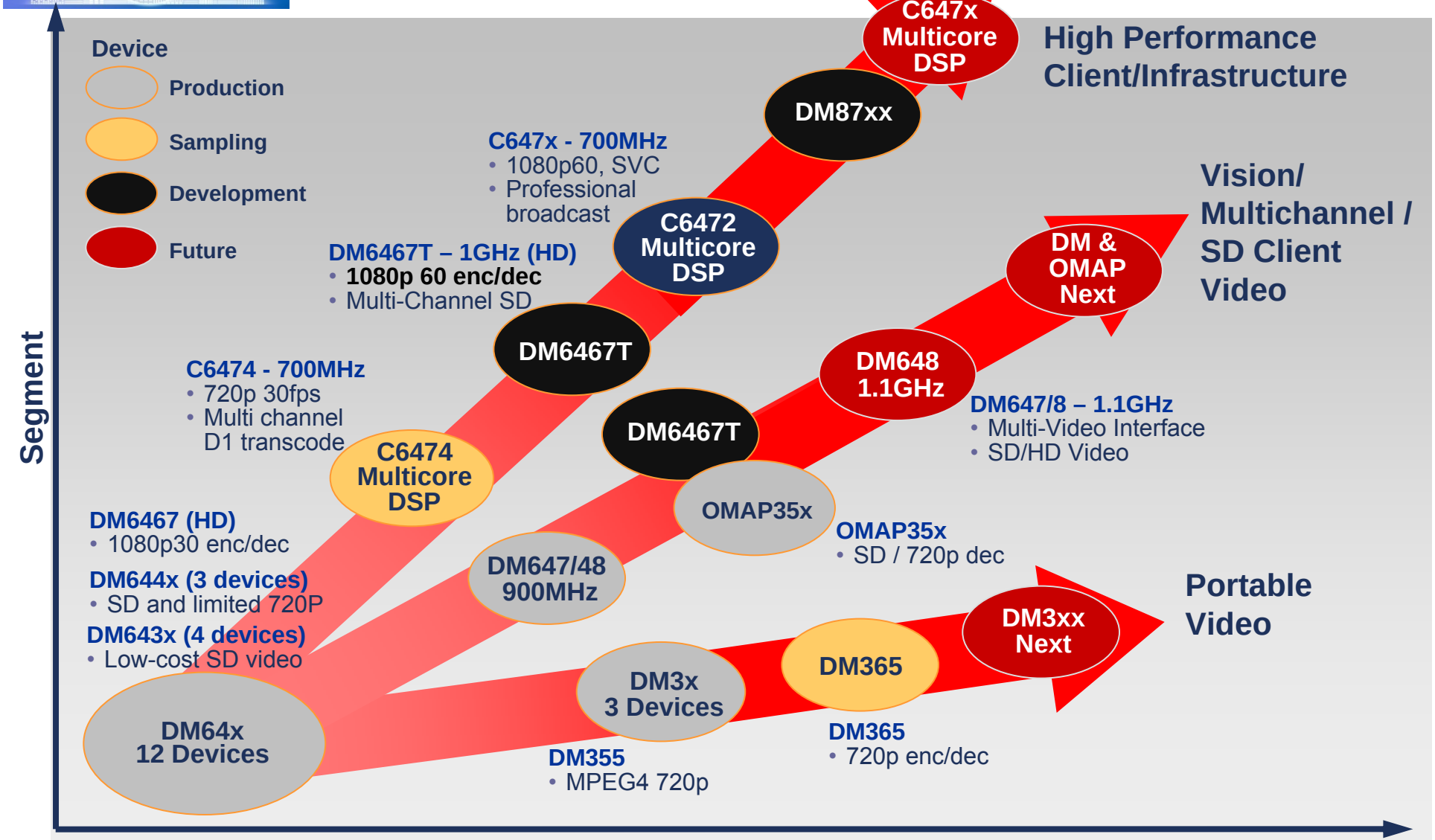
TI's Digital Media/Video Processors roadmap – programmable video solutions



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DM365 Crystal Clear H.264 HD Video Flexibility

Multi-format HD video with H.264 up to 1080p

- 1080p H.264 at 10 fps optimized for video surveillance
- 1080p MPEG-4 at 20 fps
- 720p H.264, MPEG-4 at 30 fps

H.264, MPEG-4, MPEG-2, MJPEG & VC1

Flexibility without complexity

- Integrated Image Signal Processing (ISP)
- Multi-format, multi-rate, multi-stream, multi-channel
- Production-ready codec bundles

Face detection
Noise filtering
Video stabilizer
Auto white balance
Auto focus
Auto exposure
Edge enhancement

Up to 25% system cost savings

- Peripheral integration
- ISP eliminates use of expensive optics

EMAC, USB 2.0, RTC, DDR2 . . .

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TMS320DM365 processor

Multi-format Video - HD H.264 / WMV Video

Performance

- 720P 30fps (encode/universal decode)
  - H.264 HP
  - MPEG4 SP
  - MPEG2 MP@ML
  - WMV9/ VC-1 AP
- JPEG encode/decode at 50 MPixels/second

Features

- Core
  - ARM926EJ-S™ Core, 250 MHz
  - H.264 Coprocessor (HCP)
  - MPEG-4 & JPEG Coprocessor (MJCP)
  - Video Processing Subsystem
- Memory
  - ARM: 16KB I-Cache; 8KB D-Cache; 8KB ROM; 32KB program/data
- Peripheral Highlights
  - USB 2.0 HS OTG device and mini-host w/ PHY
  - External Memory Interface (EMIF)
    - Mobile DDR/DDR2
  - EMAC 10/100
  - HPI
  - Keyscan/ADC
  - Audio Voice Codec
- Half power consumption in key modes

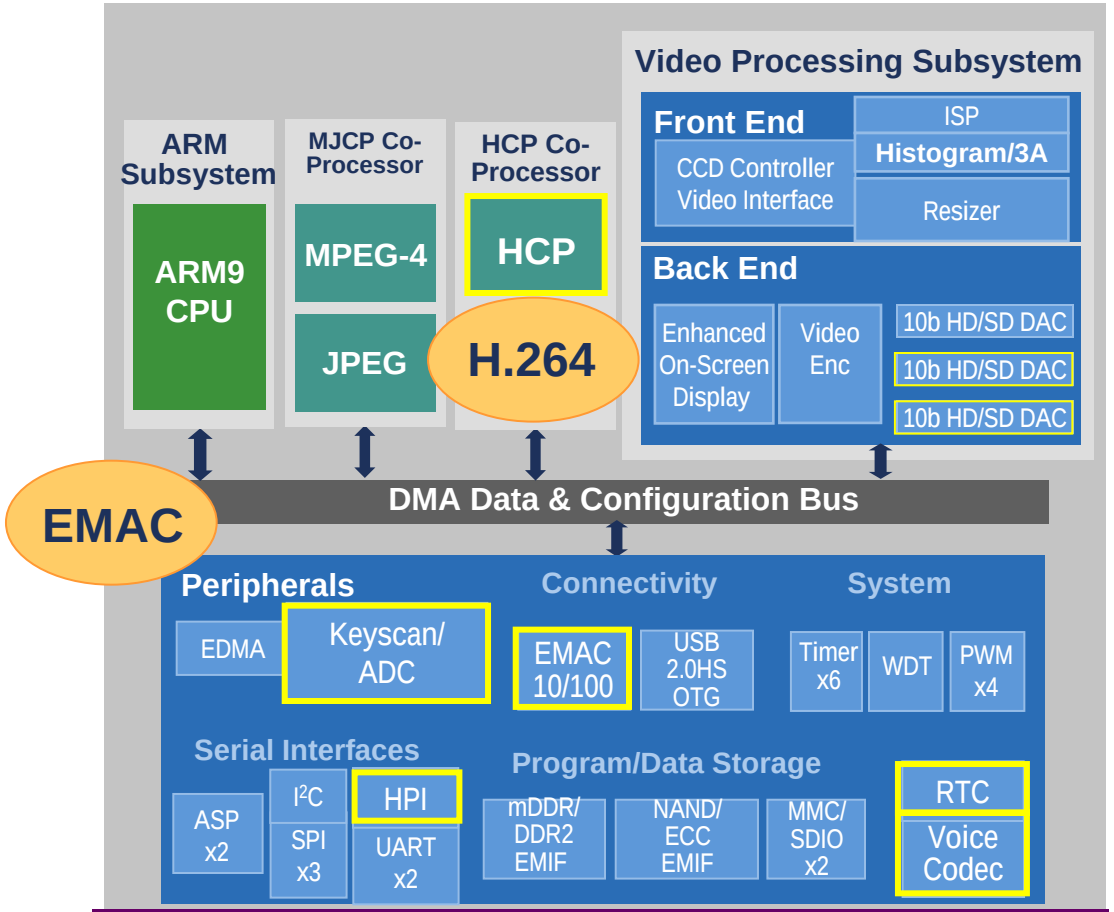
Package: 13x13, 0.65mm pitch

Samples: December 2008

Targeted RTP: 2Q09

Applications include:

- Digital camera, IP based security, Digital picture frame, Low end STB, Home and industrial automation and more!



Those in yellow box are key additions to the DM365 from the DM355

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Customers can focus on adding value with TI platform software

Operating Environ-ment Pre-Ports

- Microsoft WinCE
- Commercial Linux
- Community Linux
- TI DSP/BIOS Link, NDK

Customer added value

Customer & 3rd Party End Application Software

Ecosystem of Open Source and 3rd Party Middleware & Application Software

Consistent framework across all DaVinci™ devices
Complete set of Device Drivers for TI SOCs
+ H/W Reference Platforms

Hardware Abstraction Layer

SOC Interconnect

TI SOC

- ARM Subsystems
- DSP Subsystems
- Hardware Accelerators
- Memory Subsystems
- Peripherals
- TI Hardware Reference Platforms

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Cortex M3 based Platform

Stellaris Roadmap

Sandstorm class
- 64K flash
- 8K SRAM
- Motion control
- 1Msps ADC

Fury class
- 256K flash
- 64K SRAM
- Motion control
- Ethernet MAC+PHY
- CAN 2.0
- Ethernet+CAN

DustDevil class
- 128K flash
- 64K SRAM
- Motion control enhancements
- USB 2.0 Host/Device & OTG
- 32ch DMA

Tempest class
- Higher performance
- Low power
- Ethernet+CAN+USB
- External bus capability

Future
- Advanced analog
- Wireless communications
- Larger memory
- Display support

Blizzard class
- Small form factor
- Low pin count

2006 2007 2008 2009 2010

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Stellaris Family Technology

ARM® Cortex™-M3 v7-M Processor Core
- Up to 100 MHz
- Up to 125 MIPS (at 100 MHz)

On-chip Memory
- 256 KB Flash; 96 KB SRAM
- ROM loaded with Stellaris DriverLib, BootLoader, AES tables, and CRC

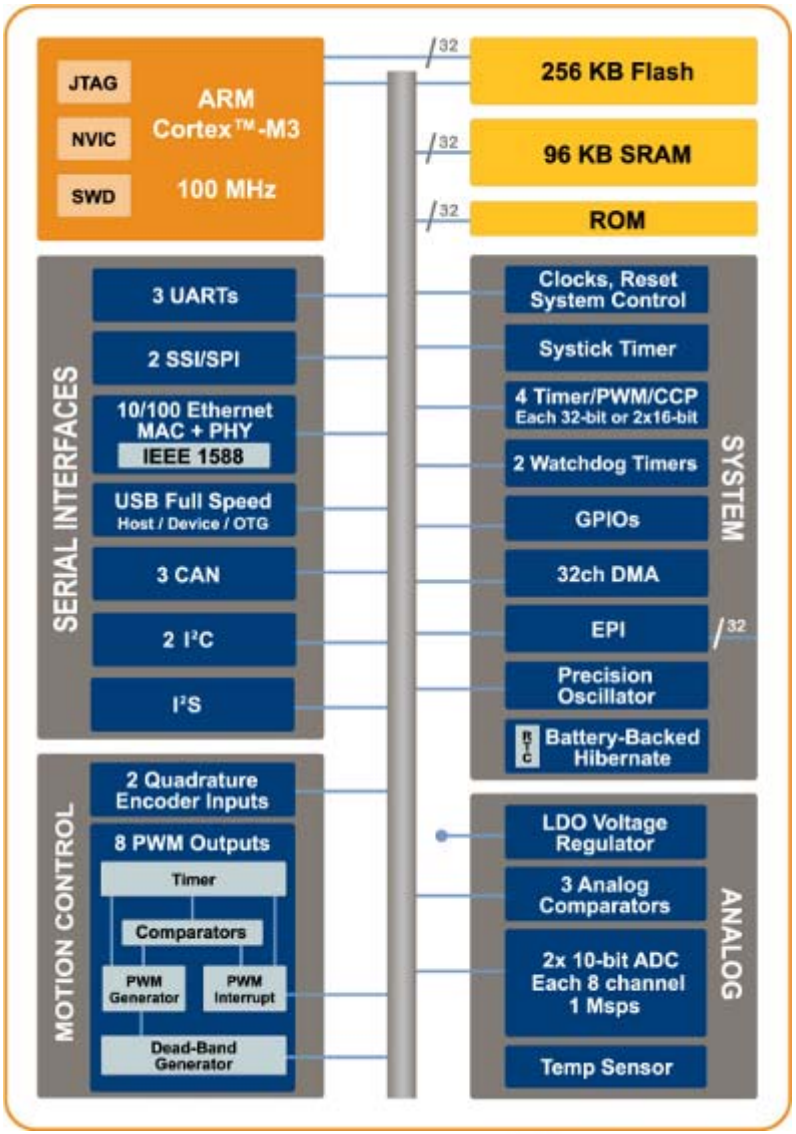
External Peripheral Interface (EPI)
- 32-bit dedicated parallel bus for external peripherals
- Supports SDRAM, SRAM/Flash, M2M

Advanced Serial Integration
- 10/100 Ethernet MAC and PHY
- 3 CAN 2.0 A/B Controllers
- USB (full speed) OTG / Host / Device
- 3 UARTs with IrDA and ISO 7816 support*
- 2 I^2Cs
- 2 Synchronous Serial Interfaces (SSI)
- Integrated Interchip Sound (I^2S)

System Integration
- 32-channel DMA Controller
- Internal Precision 16MHz Oscillator
- Two watchdog timers with separate clock domains
- ARM Cortex Systick Timer
- 4 32-bit timers (up to 8 16-bit) with RTC capability
- Lower-power battery-backed hibernation module
- Flexible pin-muxing capability

Advanced Motion Control
- 8 advanced PWM outputs for motion and energy applications
- 2 Quadrature Encoder Inputs (QEI)

Analog
- 2x 8-ch 10-bit ADC (for a total of 16 channels)
- 3 analog comparators
- On-chip voltage regulator (1.2V internal operation)



*** One UART features full modem controls**

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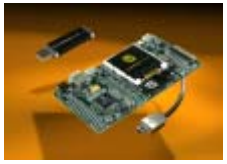
Stellaris Evaluation Kits: “Zero-to-32bits” in 10 minutes

- Each feature-rich evaluation kit includes:
  - everything a developer needs to get up and running in 10 minutes or less, for a superb "out-of-the-box" experience.
  - evaluation board(s), all required cables, a choice of evaluation tools suites for popular development tools, documentation, the Stellaris Driver Library, and applications notes
- Each kit spans the design spectrum from evaluation to prototyping to application-specific design by functioning both as an evaluation platform and as a serial in-circuit debug interface for any Stellaris microcontroller-based target board.

EK-LM3S811
Low pin count
49 USD

EK-LM3S1968
High pin count
59 USD

EK-LM3S2965
CAN Functionality
79 USD



EK-LM3S3748
USB Host/Device
109 USD

EK-LM3S6965
Ethernet MAC+PHY
69 USD

EK-LM3S8962
Ethernet+CAN
89 USD

EK-LM3S9B90
Ethernet+USB OTG
99 USD

EK-LM3S9B92
Ethernet+OTG+MC
99 USD

Four versions of each kit:

- EKK-LM3Sx
  - ARM RealView Microcontroller Development Kit tools with 32KB address Limit
- EKI-LM3Sx
  - IAR Embedded Workbench KickStart with 32KB address limit
- EKC-LM3Sx
  - CodeSourcerySourcery G++ GNU with 30-day evaluation license
- EKT-LM3Sx
  - Code Red Technologies Red Suite with full evaluation license locked to board

Conclusion: Stellaris is The ARM Solution

- **We extend to you the benefits of ARM's Cortex-M3!**
  - Over 140 Cortex-M3-Based Stellaris MCUs in the family
  - On fourth generation of experience
  - Code compatibility from $1 to 1GHz
  - Quick time-to-market with fabulous StellarisWare software
  - Exceptional worldwide support and presence
- **Exclusive Stellaris Features in the ARM Cortex architecture:**
  - Ethernet MAC+PHY
  - Multiple CAN 2.0 Type A/B MACs
  - USB OTG and Host/Device
  - IEEE 1588 PTP hardware assist support
  - Eight channels of motion control PWM
  - Fault conditioning capability for multiple motors
  - 256K Single-cycle Flash up to 50 MHz/ 64K Single-cycle SRAM
  - Analog Comparators and QEIs
  - Cortex-M3 Memory Protection Unit
- **Stellaris Family Advantages:**
  - Performance with Single-cycle Flash, Faster internal bus for I/O
  - Robust, real-time connectivity with USB, CAN, Ethernet MAC+PHY, and IEEE 1588 PTP
  - Augmented analog capability
  - Superior motion control technology
- **Conclusion: Stellaris is <u>the</u> industrial connectivity solution!**

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