



Chang Ahead

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Specified Only for Embedded Salon



World's Smallest ARM Computer?



Wireless Sensor Network

Sensors, timers

Cortex-M0 +16KB RAM 65nm
UWB Radio antenna

10 kB Storage memory ~3fW/bit

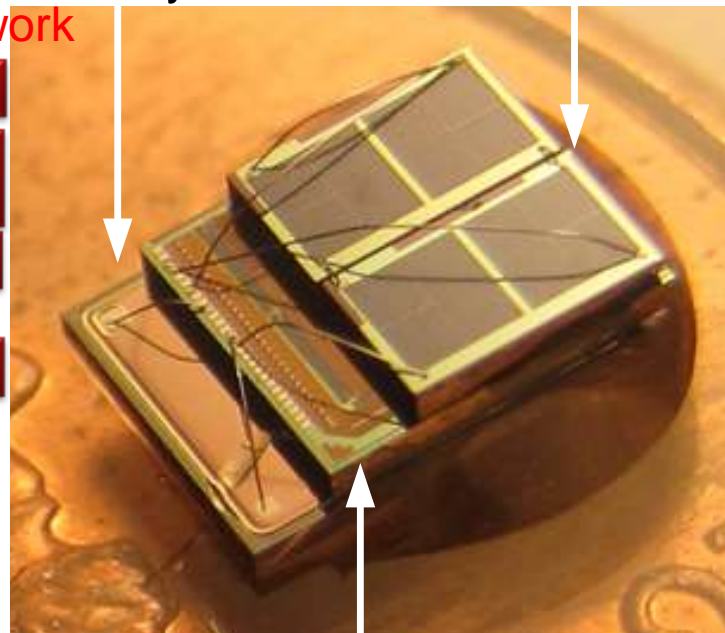
12 μ Ah Li-ion Battery

A

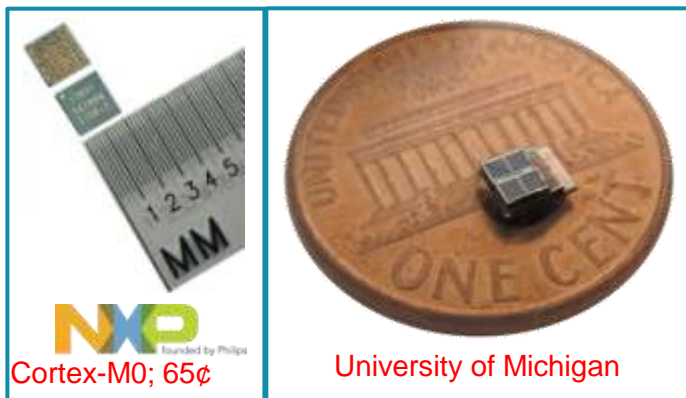
B

Battery

Solar Cells



Processor, SRAM and PMU



Wirelessly networked into large scale sensor arrays

World's Largest ARM Computer?



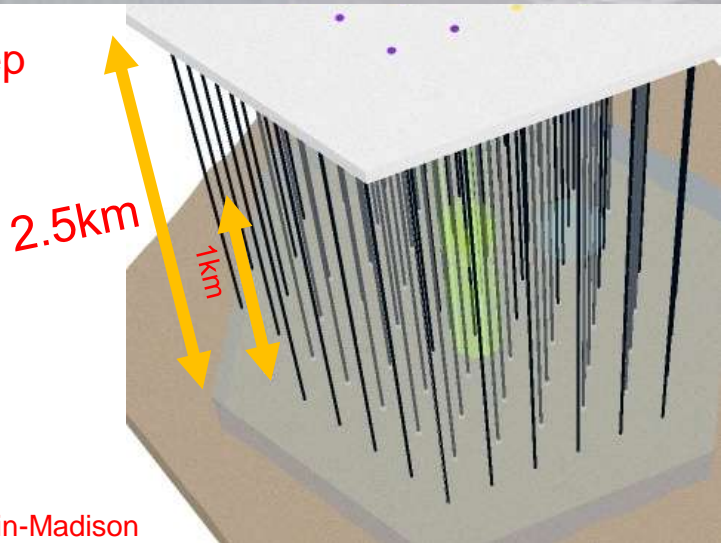
4200 ARM powered
Neutrino Detectors



70 bore holes 2.5km deep

60 detectors per string
starting 1.5km down

1km³ of active telescope

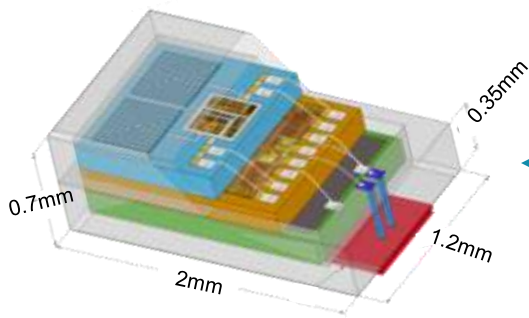


Work supported by the National Science Foundation and University of Wisconsin-Madison

Complex Low Power IOT Device



ARM: from 1mm³ to 1km³?



1mm³

1km³



10¢

\$1000

Mobile Embedded Mobile Consumer Home Enterprise Mobile Computing PC Server HPC

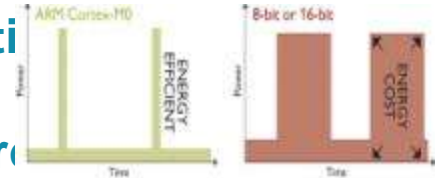
The Architecture for the Digital World

Cortex-M processor solution

■ Energy efficiency

- Lower energy costs

Low power implementation
Sleep mode support
Wake-up Interrupt Controller
Increased intelligence at node



■ Ease of use

- Lower software costs

Broad tools and OS support
Binary compatible roadmap
CMSIS support
Pure C target



■ High performance

- Competitive products

32-bit RISC architecture
High efficiency processor cores
Integrated Interrupt Controller (NVIC)



■ Reduced system cost

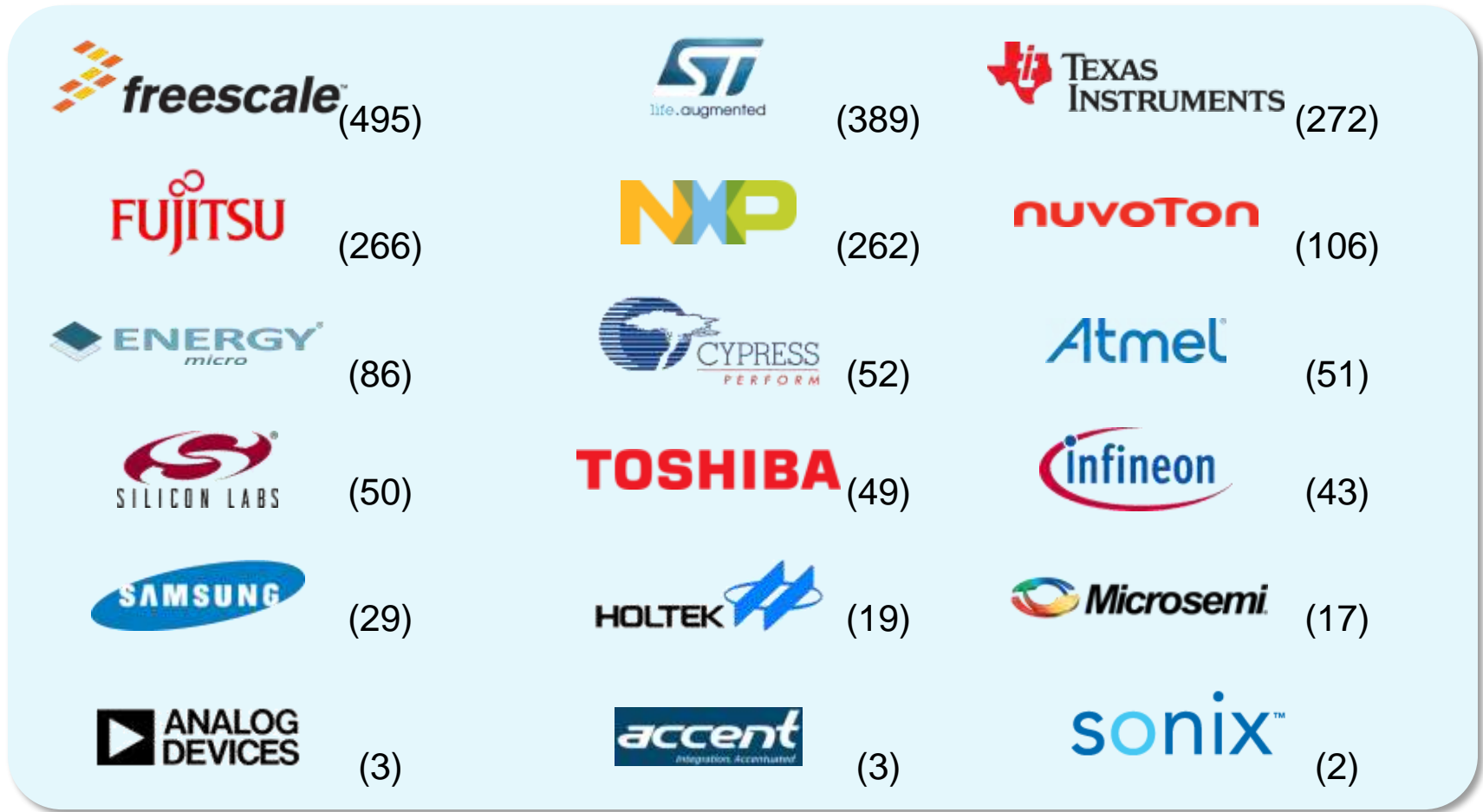
- Lower silicon costs

Thumb[®]-2 code density
Area optimised designs
CoreSight support



The widest MCU platform portfolio

- Chose from 2,194 products – and the list keeps growing



Listed parts on partners web as of end of November 2012

The Cortex-M Microcontroller Processors



Coherent architecture across all applications

Cortex-M0

“8/16-bit” applications

Lowest cost

Cortex-M0+

“8/16-bit” applications

Lowest power

Outstanding Energy efficiency

Cortex-M3

“16/32-bit” applications

Performance efficiency

Feature rich connectivity

Cortex-M4

“32-bit/DSP” applications

MCU plus DSP

Accelerated SIMD, FP & SP

Cortex-M

Energy Efficient Configurable Deterministic
Ease of Use Low Silicon Area

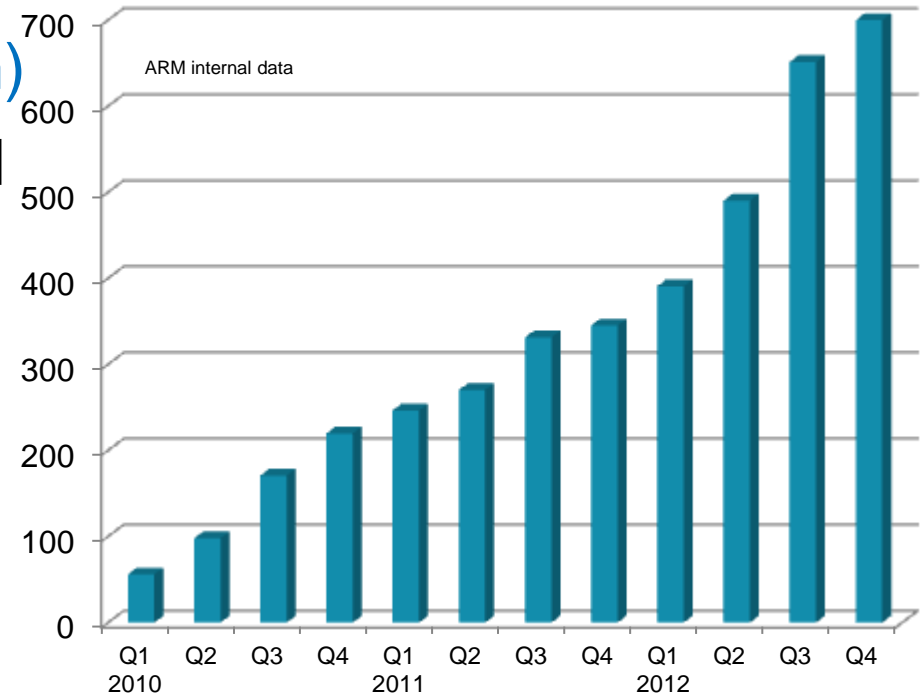
WIDELY
ADOPTED
MARKET
PROVEN

HIGH VOLUME

ARM Cortex-M Reaching Beyond MCU

- Total Cortex-M volume
 - 2010 = 376M
 - 2012 = 2.2Bn (~6x growth)
- Cumulatively >3.5B Cortex-M processors shipped
- >160 Licensees
- Wireless, SoCs, Automotive
- Emerging markets
 - Sensors
 - MEMS
 - Power Management IC (PMIC)
 - Touch controllers
 - Connectivity - *Internet of Things (IoT)*

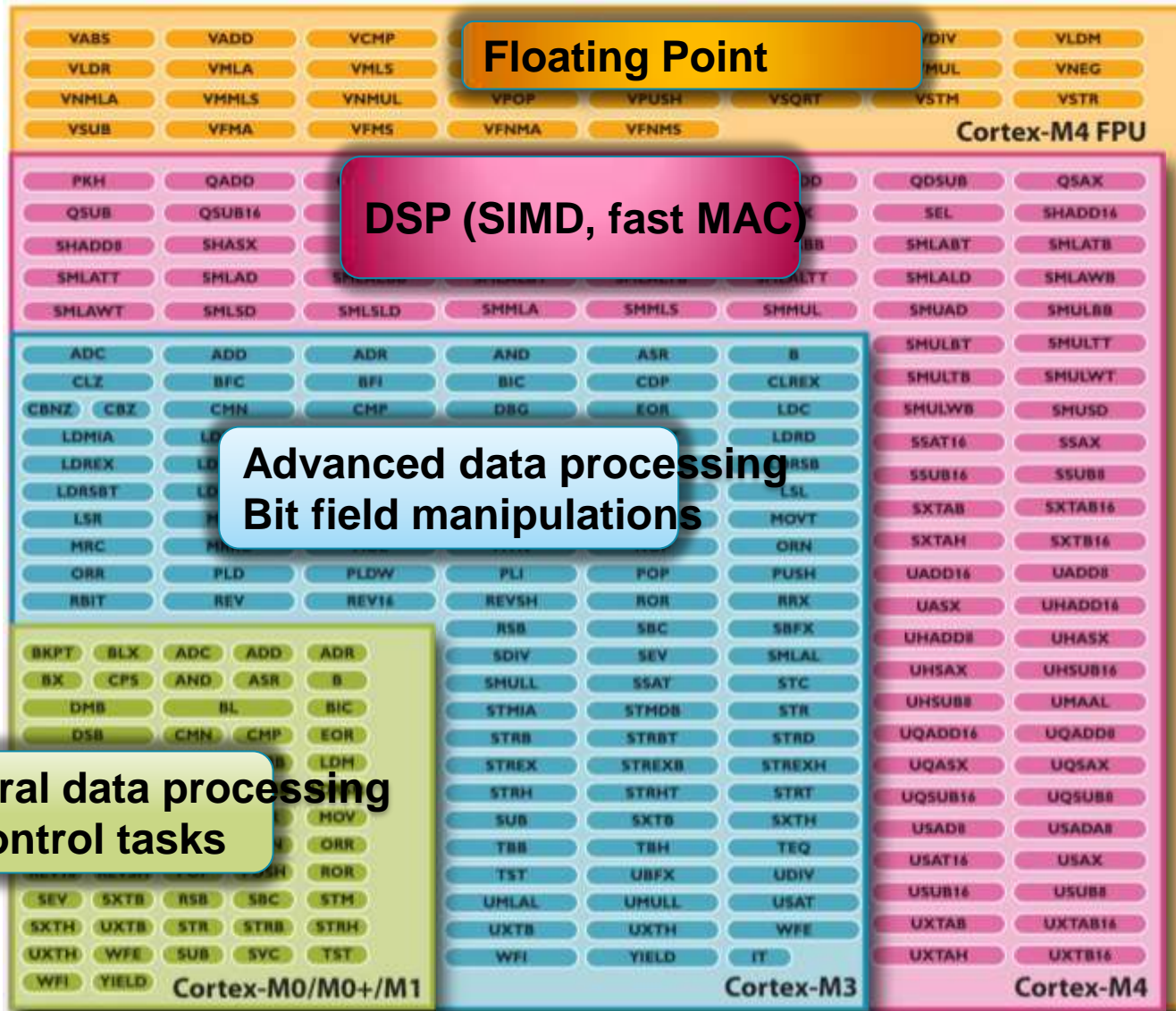
Total Cortex-M Shipments
(Million Units)



ZigBee®
Control your world



Powerful & scalable instruction set



Cortex-M feature set comparison

	ARM7TDMI	Cortex-M0	Cortex-M0+	Cortex-M3	Cortex-M4
Instruction set architecture	ARM, Thumb	Thumb, Thumb-2 System Instructions	Thumb, Thumb-2 System Instructions	Thumb + Thumb-2	Thumb + Thumb-2, DSP, SIMD, FP
DMIPS/MHz	0.72 (Thumb), 0.95 (ARM)	0.84	0.93	1.25	1.25
CoreMark/MHz		1.99	2.15	3.32	3.40
Bus interfaces	1	1	1 (+1 opt.)	3	3
Integrated NVIC	No	Yes	Yes	Yes	Yes
Number interrupts	2 (IRQ and FIQ)	1-32 + NMI	1-32 + NMI	1-240 + NMI	1-240 + NMI
Interrupt priorities	None	4	4	8-256	8-256
Breakpoints, Watchpoints	2 Watchpoint Units	4-0, 2-0	4-0, 2-0	8/2/0, 4/1/0	8/2/0, 4/1/0
Memory Protection Unit (MPU)	No	No	Yes (Option)	Yes (Option)	Yes (Option)
Integrated trace option (ETM or MTB)	ETM (Option)	No	MTB (Option)	ETM (Option)	ETM (Option)
Single Cycle Multiply	No	Yes (Option)	Yes (Option)	Yes	Yes
Hardware Divide	No	No	No	Yes	Yes
WIC Support	No	Yes	Yes	Yes	Yes
Bit banding support	No	System option	System option	Yes (Option)	Yes (Option)
Single cycle DSP/SIMD	No	No	No	No	Yes
Floating point hardware	No	No	No	No	Yes
Bus protocol	Use AHB bus wrapper	AHB Lite	AHB Lite	AHB Lite, APB	AHB Lite, APB
CMSIS Support	No	Yes	Yes	Yes	Yes










Cortex Microcontroller Standard (CMSIS)

- Abstraction layer for all Cortex-M processor based devices
 - CMSIS-CORE : API for Cortex-M processor and core peripherals
 - CMSIS-DSP : DSP Library with 61 function types for Cortex-M
 - CMSIS-SVD : XML system view description for peripherals
 - CMSIS-RTOS : API for RTOS integration
- Benefits to the embedded developer
 - Consistent software interfaces for silicon and middleware vendors
 - Simplifies re-use across Cortex-M processor-based devices
 - Reduces learning curve, development costs, and time-to-market



ARM Tools for the Entire Design Flow

- A summary of all ARM development tool products
- All are compatible with the Cortex-M family of processors

	ASICs and ASSPs	MCUs and Smartcards
Software Tools	DS-5 	MDK-ARM 
Models	Fast Models  	µVision Simulator 
Debug Adapters	DSTREAM & VSTREAM 	ULINK2, ULINKpro 
Development Boards	Versatile & Versatile Express 	Eval boards and MPS 

Cortex-M Tools Ecosystem

- ARM has an exceptionally broad ecosystem of 3rd parties supporting the Cortex-M profile processor family.
- Real-time Operating Systems
 - 26+ of the **world's leading** vendors
- IDEs and C/C++ compilers
 - 13+ of the **world's leading** vendors
- Debugger vendors
 - 21+ of the **world's leading** vendors
- ... and these numbers are growing all the time



Change
Just Ahead

ARM University Program

Students



Educators



Researchers



The ARM University Program –
Preparing Today's Students for
Tomorrow's Technology



www.arm.com/university

Enabling Coursework and Research in SoC design, Computer Architecture, Embedded Systems Design, Microprocessors/controllers, Assembly Programming, Operating Systems, Application Development, Robotics, and Mechatronics

The World's Leading
Semiconductor IP Supplier



Flagship offering: Lab-in-a-Box (LiB)

- LiB package based on Varieties of Silicon Vendors' boards
 - Efficient Embedded Systems Design and Programming (ARM Cortex M)
 - Package contains certain number of boards, 100 MDK Pro licences, in addition to a complete teaching material from ARM or inspection copy of textbook



ARM University Program Lab-in-a-Box
with Freescale Freedom hardware

This Lab-in-a-Box contains:

- 100 x floating licenses of ARM/Keil MDK-ARM Pro software tools
- 10 x ARM Cortex-M0+-based Freescale Freedom boards

Please find a full suite of teaching, labs, and lecture material on the included CD-ROM to fully support this Lab-in-a-Box

ARM University Program: www.arm.com/university

Freescale information and documentation: www.freescale.com/frdm-kl25z

KEIL
Tools by ARM

freescale

The advertisement features a silhouette of a person sitting on a globe, reading a book. Below the globe is a stack of books. The background is a blue gradient with abstract light patterns.

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The graphic features a blue background with a silhouette of a person sitting on a globe, holding a tablet. Several floating tablets with the ARM logo are positioned above the person. In the foreground, there are stacks of books and papers. The text is white and yellow, providing details about the Lab-in-a-Box package.

ARM University Program Lab-in-a-Box

The Lab-in-a-Box contains:

- 100 x floating licenses of ARM/Keil MDK-ARM Pro software tools
- 10 x ARM Cortex-M3-based NXP LPC1768 mbed boards
- 1 x inspection copy of the textbook "Fast and Effective Embedded Systems Design –Applying the ARM mbed" by Toulson and Wilmshurst

Please visit www.arm.com/university/mbed to get information on how to access a full suite of teaching, labs, and lecture material to fully support this Lab-in-a-Box.

ARM University Program: www.arm.com/university
mbed community and documentation: www.mbed.org

KEIL
Tools by ARM

NXP mbed

ARM MPD Lab-in-a-box

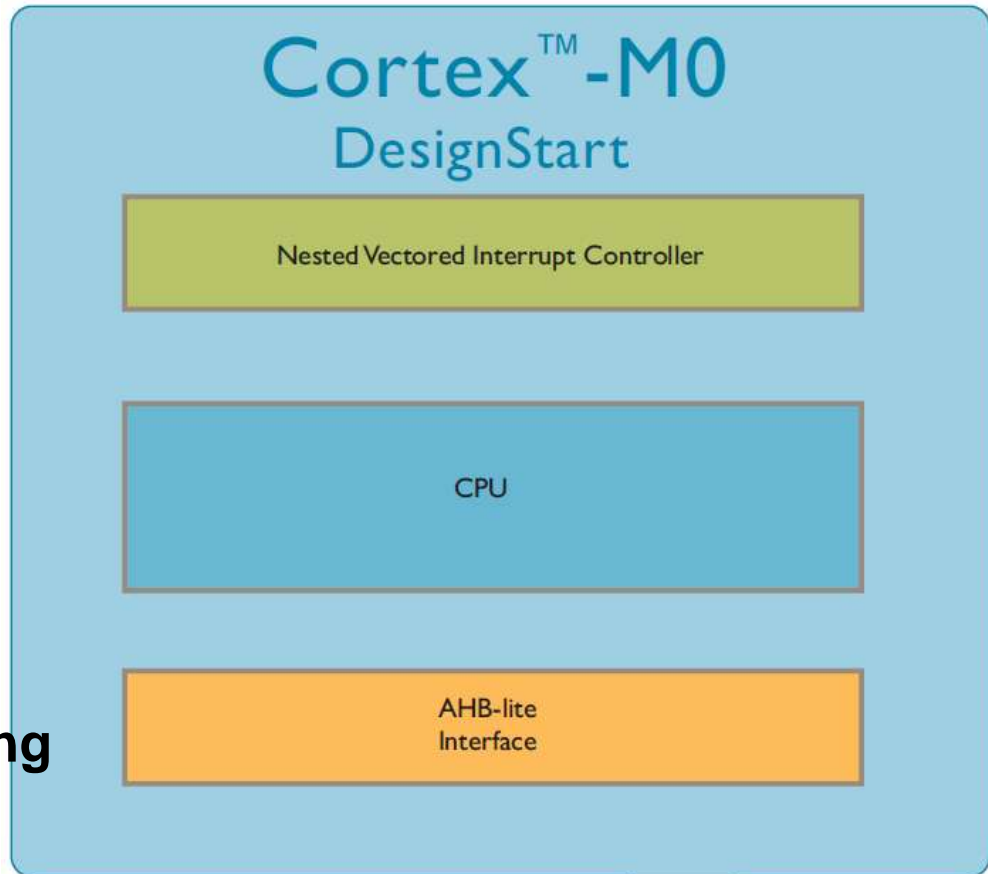
ARM MPD Lab-in-a-box project

Undergraduate Students

- 12 tutorials for lab-in-a-box project – to complete and start promoting by April 2014 to Computer Sciences and Gaming Development Universities worldwide.
- The tutorials are based on Khronos standard OpenGL ES2.0 APIs for ARM Mali GPU devices:
 1. Build your 1st Android Application
 2. Graphics Set Up
 3. Render a Triangle
 4. Intro to Shaders I
 5. Intro to Shaders II
 6. 3D and the Camera
 7. Textures
 8. Fonts
 9. Lighting
 10. Particle effects
 11. Shadows
 12. Bump mapping
- Wrap up module
 - Unity Game Engine for Mali GPUs



Cortex-M0 DesignStart Processor IP



- A real ARM core for teaching and research!
- Labs based on FPGA board

ARM University Program (AUP) Partners

Workshops &
Events

Educational
Videos

ARM University
Program Partners

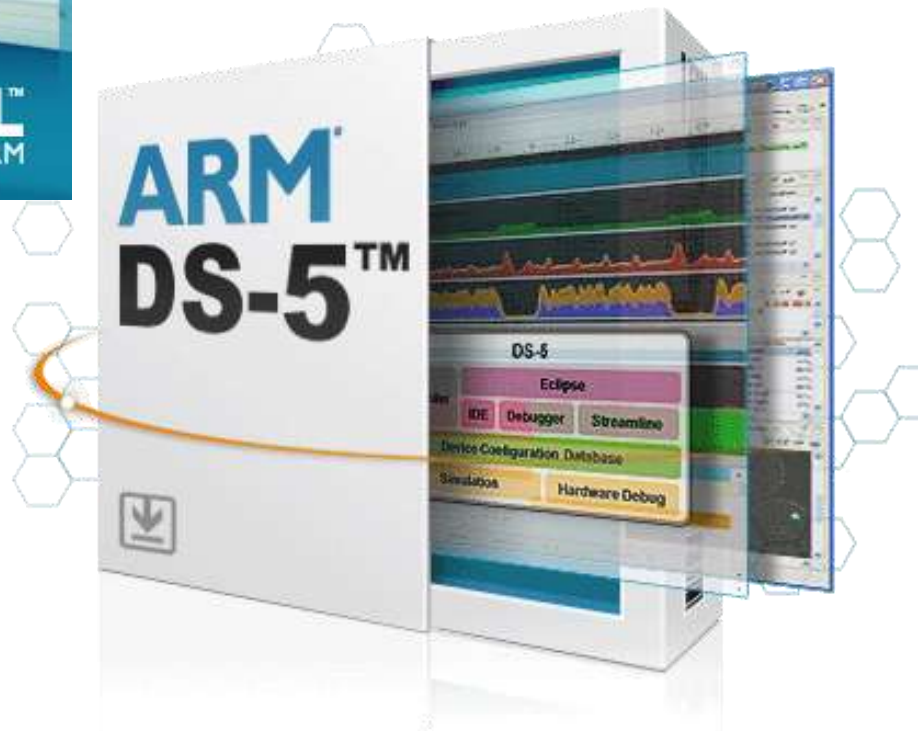
The ARM University Program officially partners with the following companies to enable their ARM processor-based technology in academia:



Software Tools for Universities



- Optimised programming tools from ARM



Teaching Materials and Textbooks



- Free **textbook** evaluation copies from publishers
- **Teaching and Lab materials** at www.arm.com/university.



AUP Activities – Faculty Workshops



AUP Activities – Seminars/Conferences



AUP Activities – Students Contests

2013 第四届 Android 应用开发
中国大学生挑战赛



本次活动旨在推广 Android 应用开发，丰富校园文化，提升大学生的动手能力和创新意识。大赛面向全国在校大学生，分为本科组和高职高专组。大赛主题不限，鼓励创新和实用性相结合。大赛赛程如下：初赛（线上提交作品）、复赛（线下答辩）、决赛（线下答辩）。大赛奖项设置如下：一等奖：20000 元现金 + ARM 开发板 + 荣誉证书；二等奖：10000 元现金 + ARM 开发板 + 荣誉证书；三等奖：5000 元现金 + ARM 开发板 + 荣誉证书。还有其它丰厚奖品，赶快加入赛队一起创新吧！

报名截止日期：2013 年 10 月 8 日
官方网站：www.google.com/daxue

Google ARM

中国主要芯片设计公司支持单位

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ARM-STM32 校园创新大赛

最高奖金 **¥20,000** + 获奖证书

ARM-CYPRESS PSoC 4 大学生挑战赛

2013年6月29日—11月16日

活动流程

- 工程师 → 参加巡回免费Workshop/参加PSoC4创意设计大赛 → 获得PSoC4工具
- 高校师生
 - 可参加大学生挑战赛 → 获得PSoC4工具
 - 可参加巡回免费Workshop (但不能获得PSoC4工具)
- 工程师/高校师生 → 在21ic Cypress论坛发表使用心得 → 参与评奖

AUP Registration

- To keep up with AUP offerings and ARM developments overall, register to the ARM University Programme online:

ARM University Program

Preparing Students Today for Tomorrow's Technology

The ARM University Program enables educational use of ARM technology. University courses and labs, student projects, and academic research in embedded systems, microprocessors/controllers, mechatronics, SoC design, computer architecture, and other areas all benefit from using ARM. The program provides a variety of teaching materials, hardware platforms, software development tools, IP, and other resources for educators, students, and researchers.



- Tell us about your ARM-based activities and feedback on our various offerings

The Future in Our Hands

