Cortex
Intelligent Processors by ARM®

Enabling Competitive Edge in MCU Market

促进微控制器市场的竞争优势

谭 军

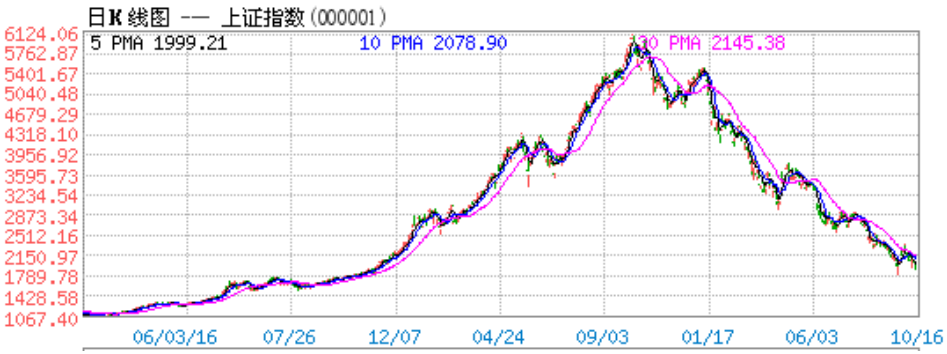
ARM中国 总裁

2008年10月23日，深圳。

Turbulence, Disruption and Opportunity (动荡，混乱，机遇)

- Short term macroeconomic challenges
- Longer term energy supply and demand imbalance
  - Focus on reducing power consumption, server to set top box
  - Government mandatory purchasing guidelines require voluntary code compliance
- ARM has always been at the heart of low power
- Our advantage is the ARM Partnership
  - Choice, innovation and trust
  - Implementation experience – best performance, power and features
- Web is our opportunity
  - Today more smart-phones ship than laptops
  - Browser and plug-in investments deliver the Internet on ARM
- Only China GDP still grows at 9%!

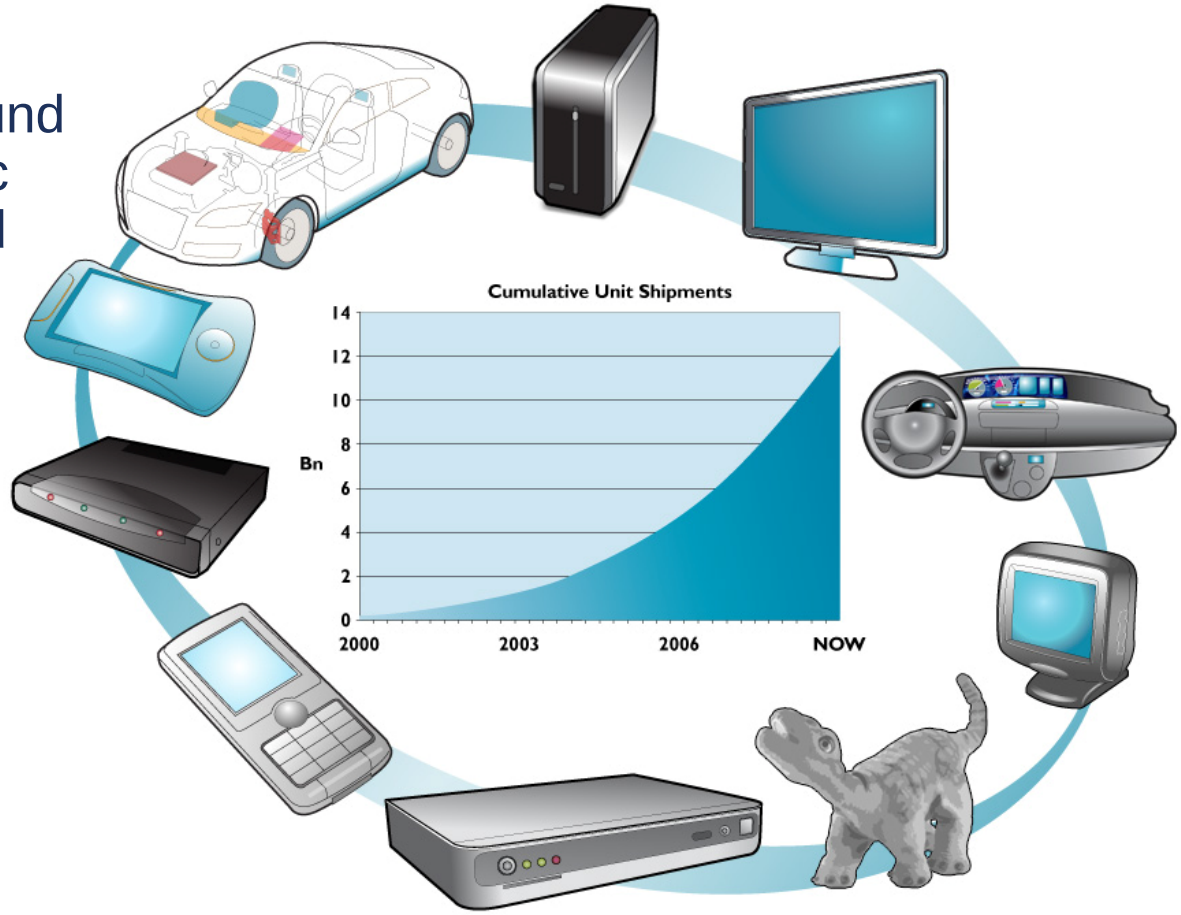
Oct/07



Shanghai Composite Index

The Architecture for the Digital World®

- ARM established 1990
  - 3 financial crisis: 1997, 2001, now
- In 2007, ARM Partners were at the heart of around a quarter of all electronic devices sold in the world
- ARM Partners shipping ~10m units / day
- Roadmaps alignment
  - HW/SW Investment
  - TTM, TT$
  - Reduced Risks



Q2 2008 Processor Royalties

- Revenue up 27% to $51m from Q2/07 on Q2/08

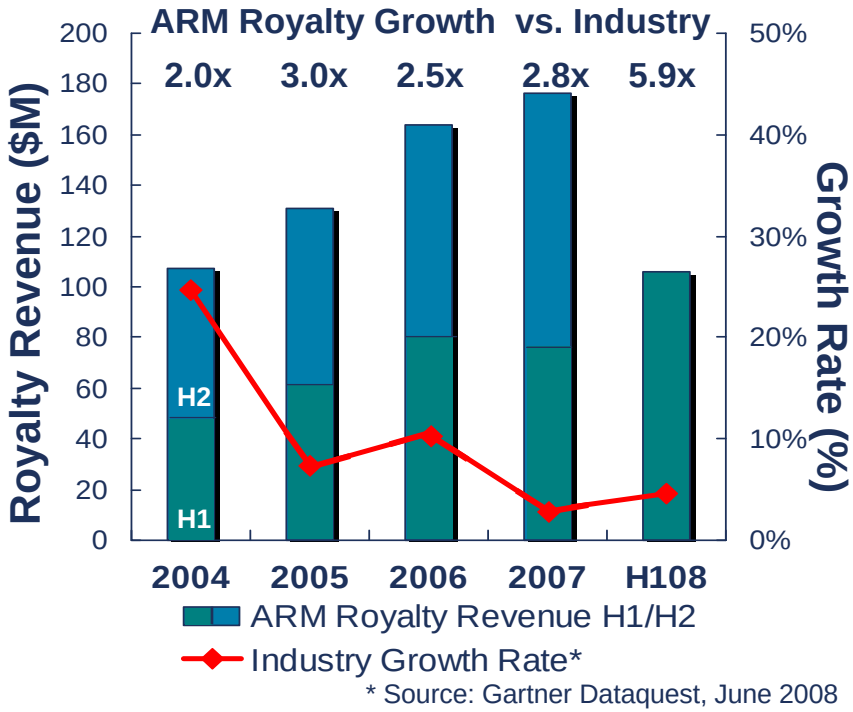
Record 892m units up 37%

SoC/ASSP

- **Mobile devices up ~35%**
  - Driven by increasing sophistication per device
- **Enterprise up ~30%**
  - Driven by WiFi, storage and networking
- **Home up ~30%**
  - Driven by consumer entertainment devices such as DTV, STB and DVD

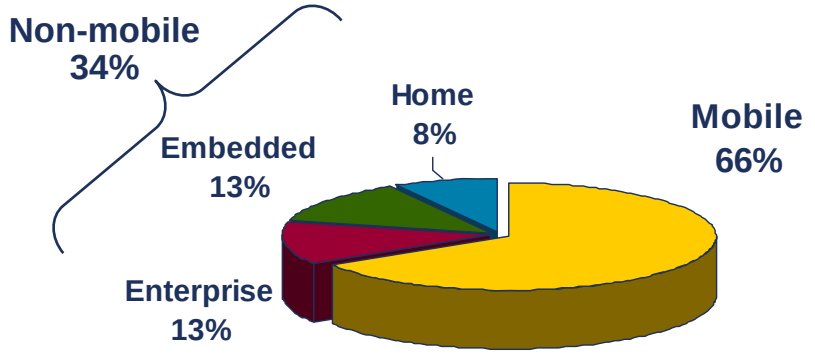
MCU

- **Embedded up ~55%**
  - Driven by microcontrollers and increasing sophistication in automotive



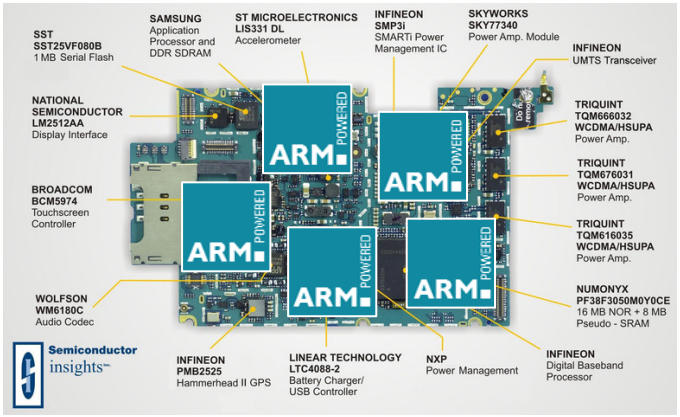
* Source: Gartner Dataquest, June 2008

Q2 2008 Royalty Unit Split

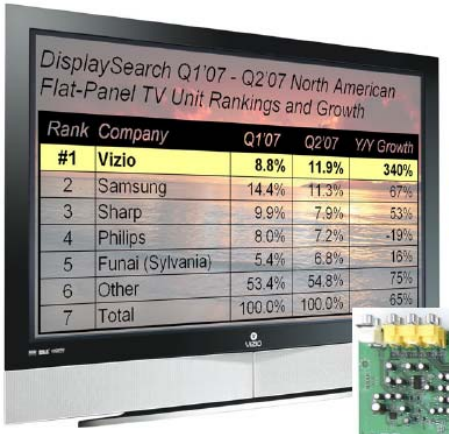


Driving Growth in Mobile/Home/Enterprise

- 37% year-on-year unit growth of ARM in mobile devices
  - Rapid growth of ARM content in smartphones – increased volume & value
  - First Cortex-A8 royalties received
  - More ARM cores in the 3G handsets
  - Most are ARM-based SoC or ASSP



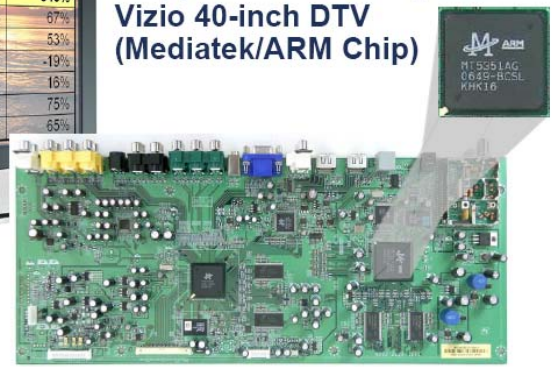
Home



VIZIO

聯發科技 MediaTek Inc.

iSuppli Teardown Report
Vizio 40-inch DTV
(Mediatek/ARM Chip)



MARVELL

Marvell 88F5180
ARM9E™ family processor-based communications processor

TOP DOG WINNER

Marvell 88W8361
ARM9E family processor-based MAC/Baseband SoC

INNOVATIONS 2007

CES Innovations 2007 Award Winner
Category – Home Networking

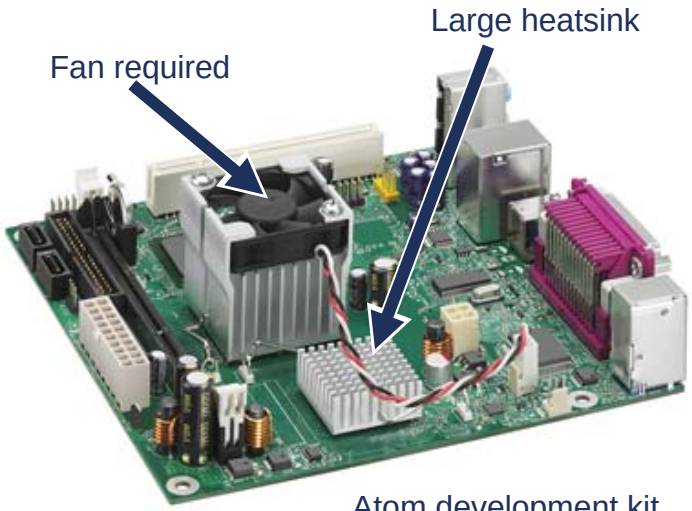
Enterprise

Driving Growth in Embedded Mobile Computing

- Over the last few months …
  - Qualcomm announced mini-laptop designed with Inventec
  - NVIDIA announced Tegra for netbooks based on 800MHz ARM11
  - JoinTech announced ARM9 based netbook
  - “Beagleboard” development board released, based on TI OMAP 35x (Cortex-A8)
- More ARM-based mobile computer announcements expected soon

JoinTech netbook from $99
Based on ARM9 chip from Samsung

600MHz Cortex-A8 based Beagleboard
No fan or heat sink required.



Atom development kit

PERSONAL COMPUTER WORLD

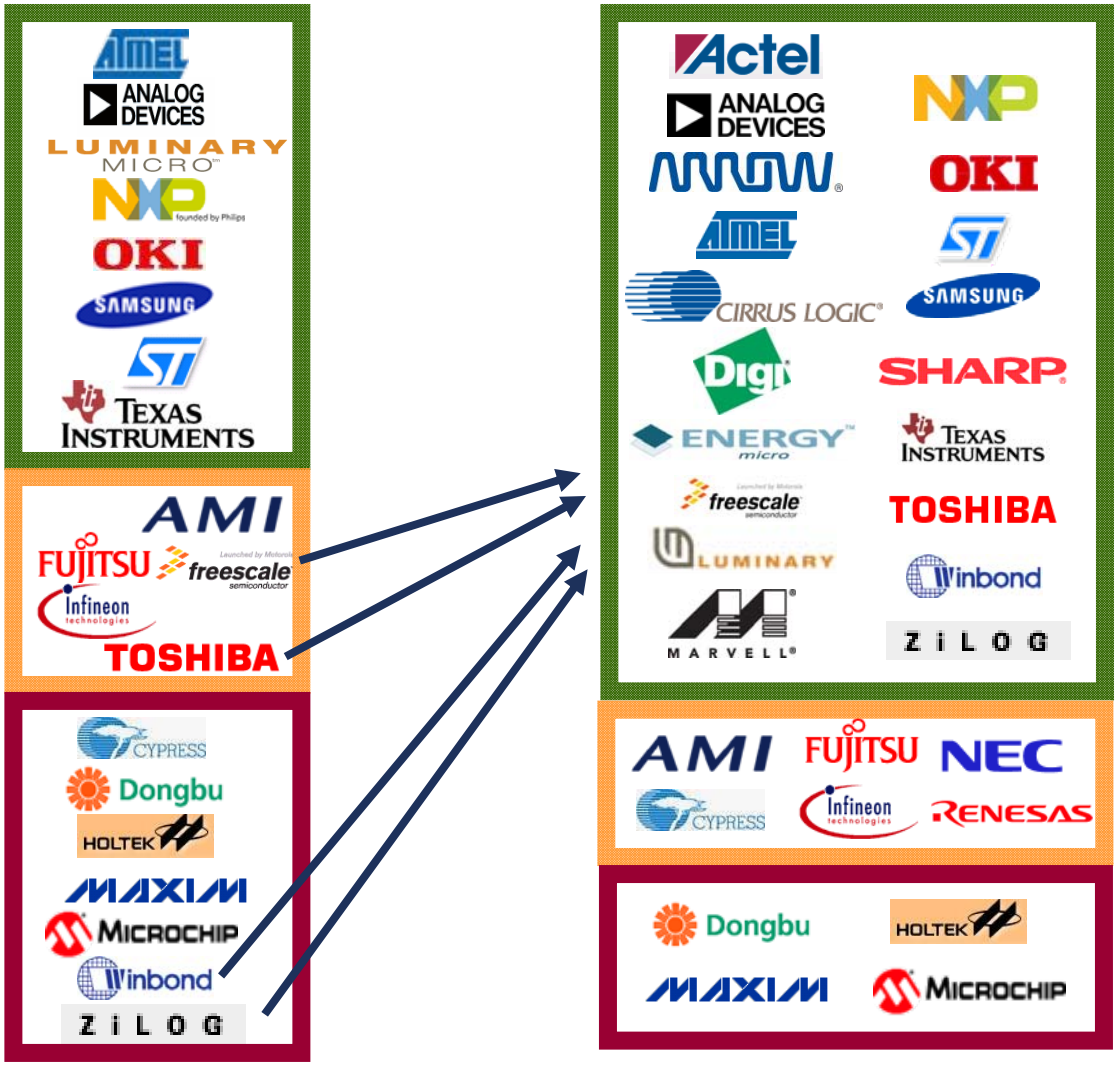
Beating ARM will take years, says Intel's Gelsinger

He asked: "Will IA displace ARM? It would be decades before that is a consideration because of the momentum [ARM] has.

Driving Growth in Microcontrollers

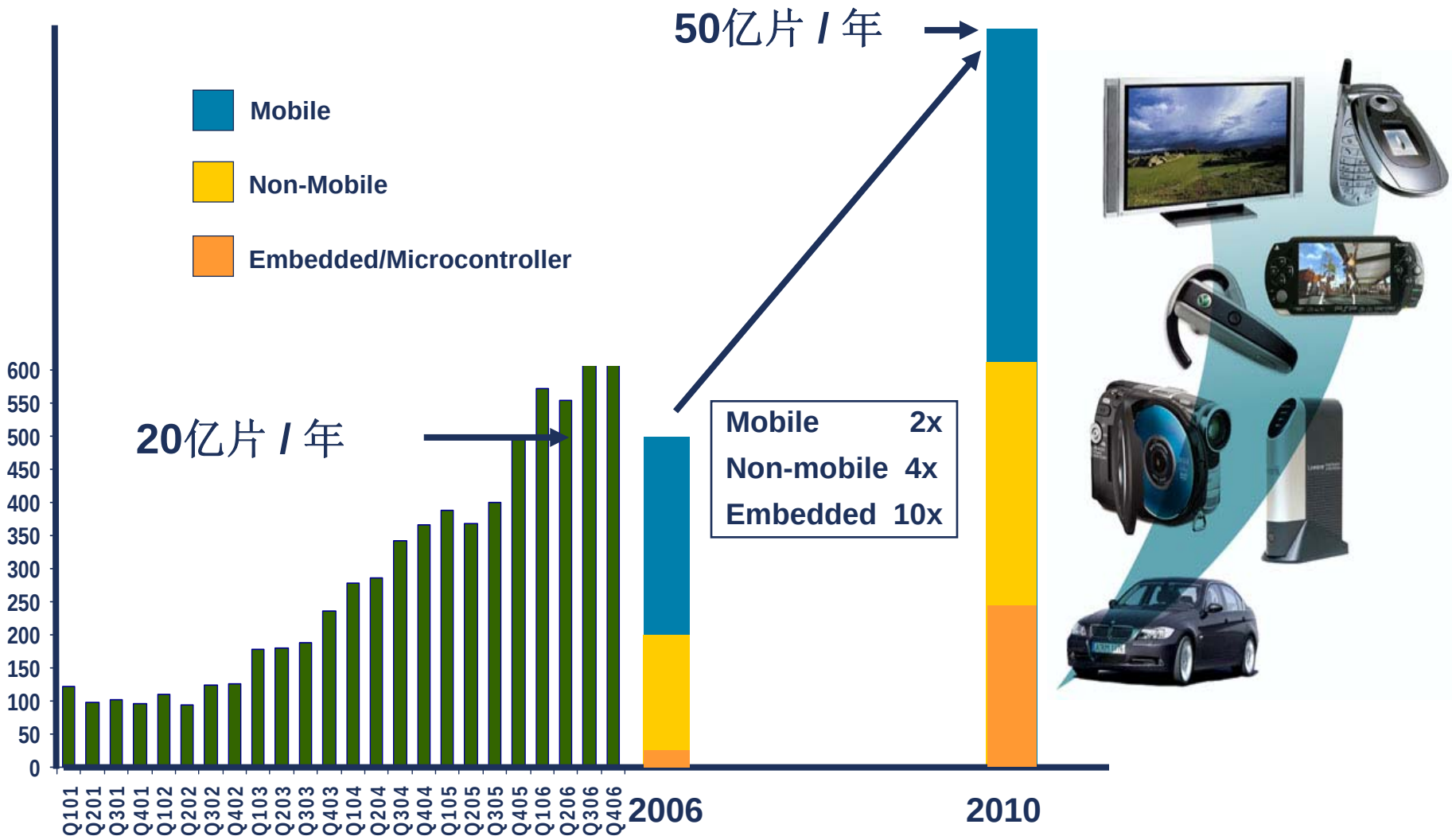
Analyst Day 2007

Today



- ARM increasingly adopted as the standard 32-bit MCU architecture
- Over 20 vendors offer ARM based MCUs
- Winbond and Zilog recently adopted ARM
- Arrow licenses Cortex-M3 to develop their own silicon
- More MCU announcements expected in H2 2008

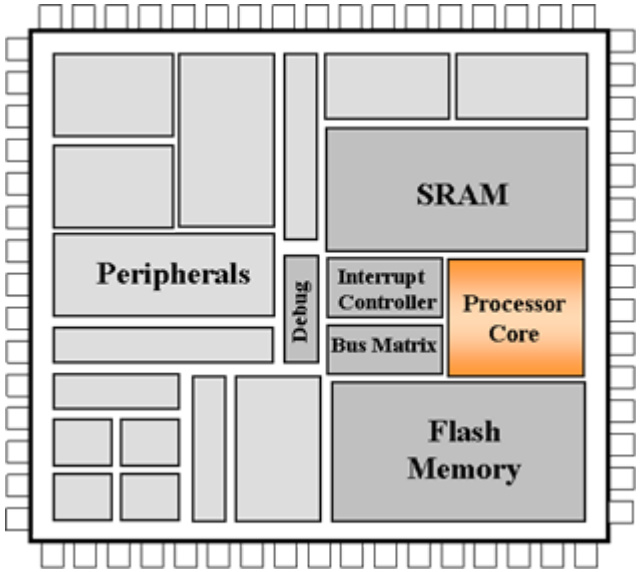
基于ARM体系结构的处理器出货量高速增长

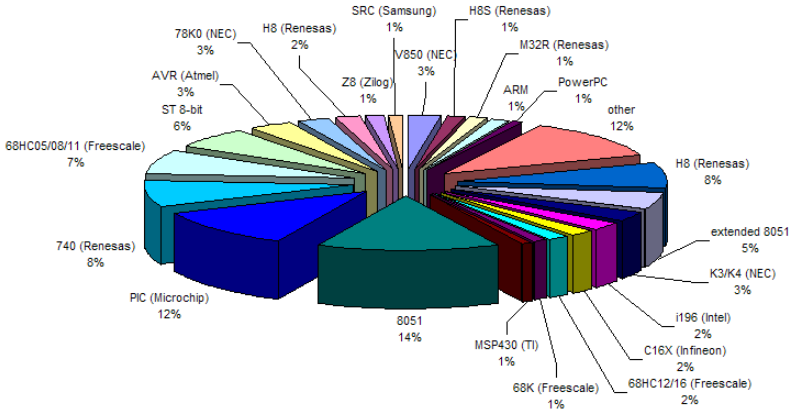


微控制器市场现状

- Microcontrollers First started to appear in the 1970's
- Integrate a lot of components onto a single chip
  - Processor, Memory and Peripherals
- Unlike some other parts of the microcontroller, the processor shrinks each time new silicon processing technologies improve
  - Moore' s Law suggests it will shrink to half it's size every two years.

    http://en.wikipedia.org/wiki/Moore's_law
- Market today is very fragmented with incompatible software architectures from many different vendors





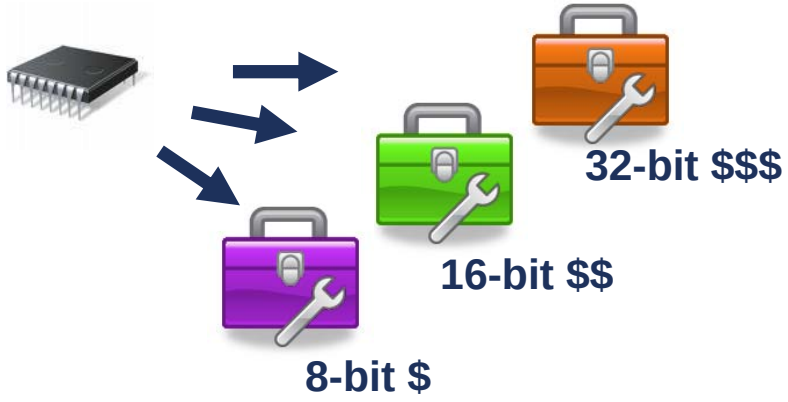
Source: Strategy Analytics and iSuppli

“支离破碎”的微控制器市场正在影响创新

- **Traditional MCU market very fragmented**
  - 100’s of silicon vendors
  - Many different incompatible architectures
  - Many vendors have multiple architectures which are incompatible
  - Tools support varies widely
  - No other ecosystem encompasses such wide geographic and technical areas.

- **Traditional application development can become difficult and expensive**
  - Incompatible architectures across organization reduces engineer efficiency
  - Multiple tools chains required to support different architectures increasing costs
  - Poor code portability leads to continual re-invention of software

ARM：重新改写微控制器市场游戏规则

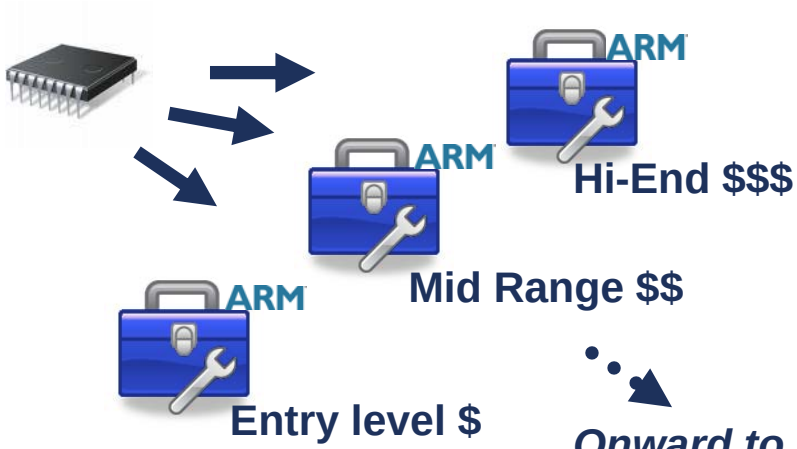


Traditional microcontroller company approach

Each different processor needs different tools

Software oriented approach

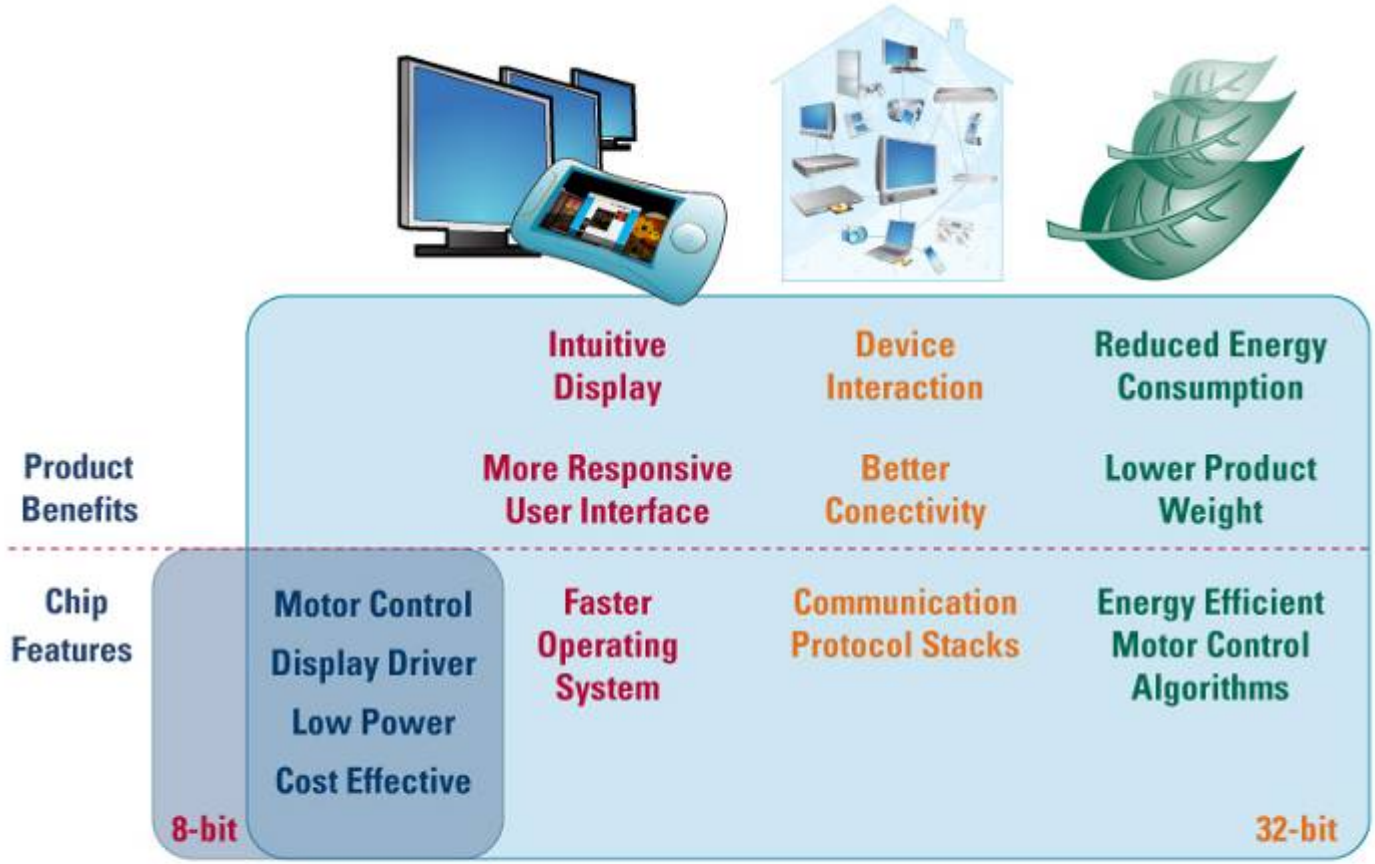
Processor consolidated to one software engine for all products



- **No longer categorize Microcontrollers into 8, 16 or 32-bit price bands**
  - Processor is consistent across all products
  - Pricing depends on features like Memory and Peripherals
- **This consolidated approach allows Software to be reused**
  - Similar to x86 architecture in the PC world
  - ‘Computer’ rather than ‘Calculator’ in each chip

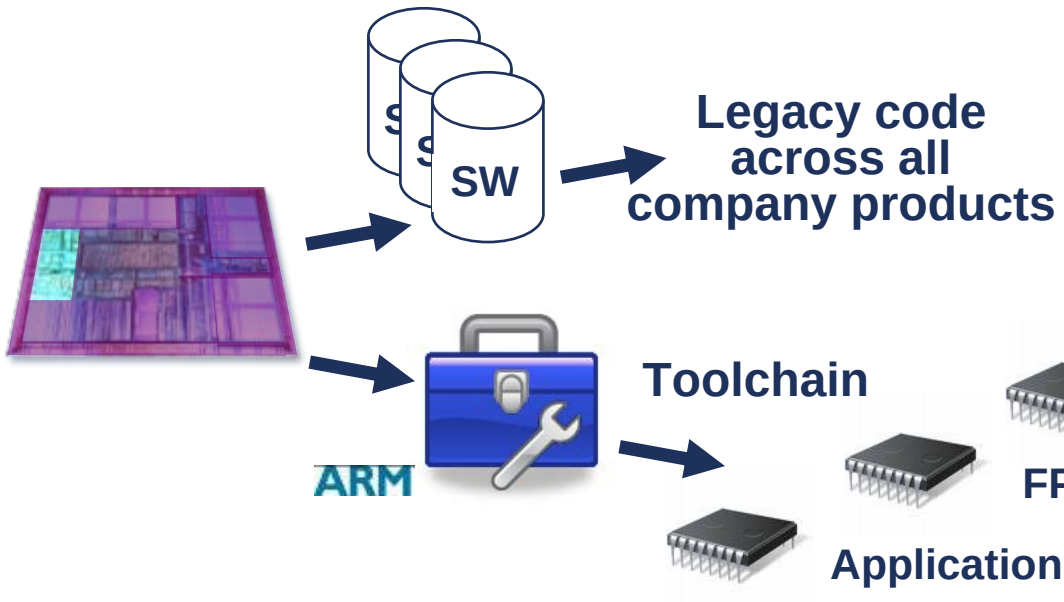
Focus on Software in Embedded 32bit MCU

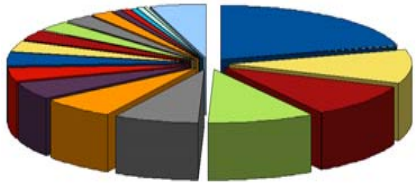
- What can “32-bit” really mean to the end customer



Silicon advances have enabled low power, cost-effective 32-bit Microcontrollers but what truly differentiates these new products is their capability to run more powerful software

Software Advantage with ARM

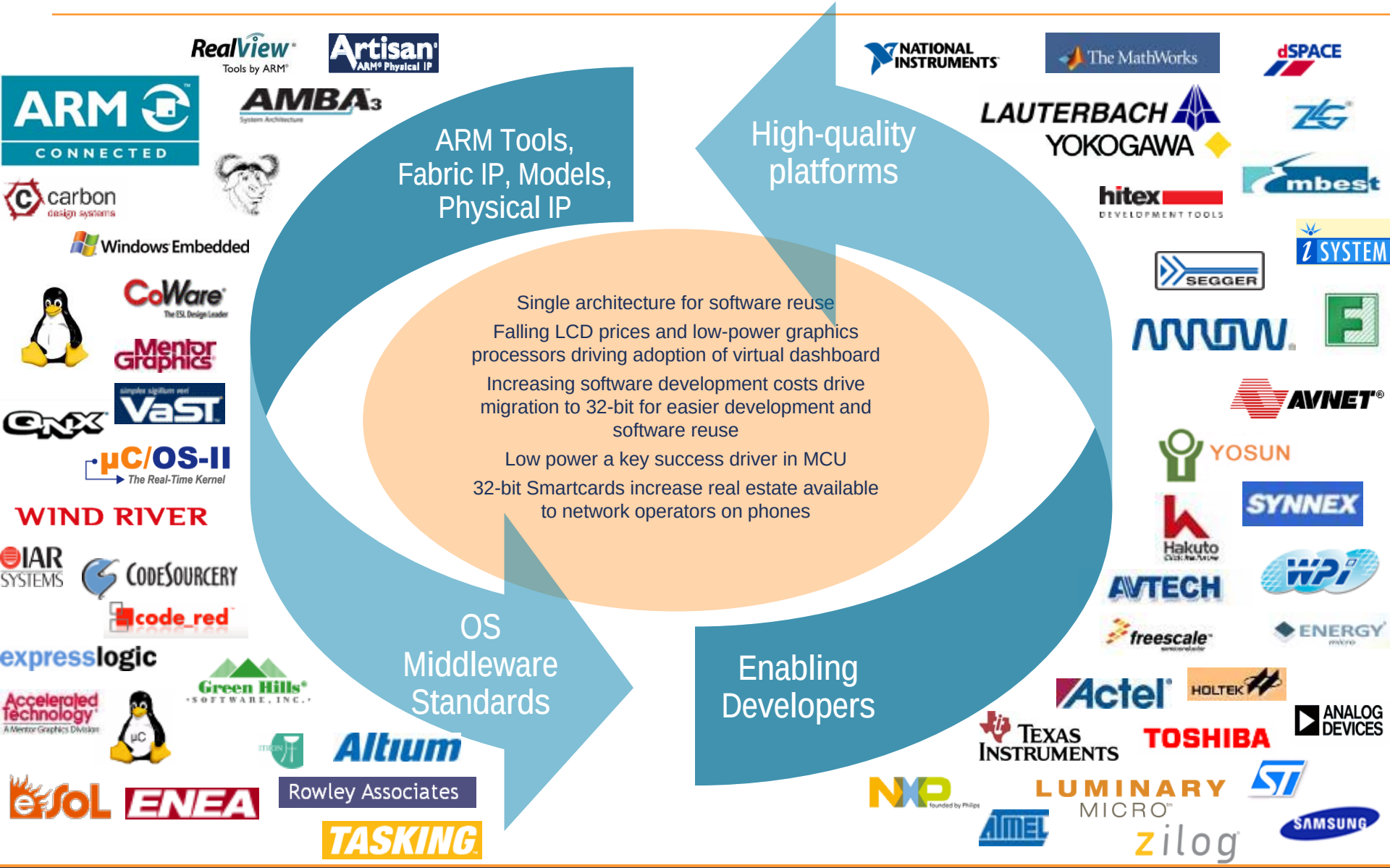




Fragmentation in the 8-Bit MCU market (Different Architectures by Revenue: Gartner 2006)

- **Enabling a standard platform for embedded development**
  - Protecting investment in software design
  - Forget traditional 8/16/32-bit perceptions, think of it as a 'Software Engine'
  - Enable reuse, not just from MCU to MCU but onto other digital solutions

The ARM Embedded Ecosystem

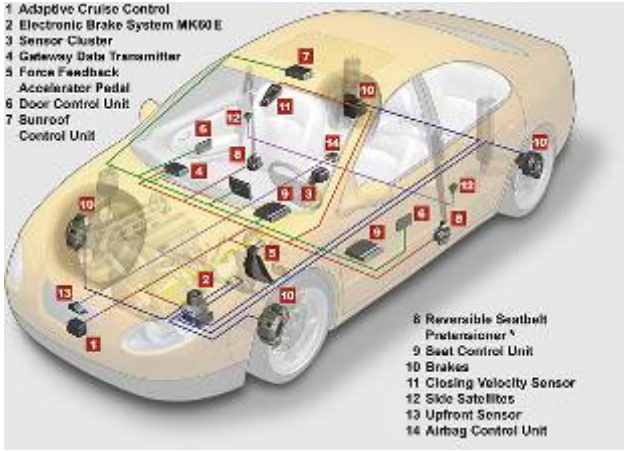


成功的市场案例

汽车电子

ARM in Technology that Sells Cars

- Safety and Driver Assistance
  - ARM in over 65% of EBS and 40% of airbag
  - Fault Robust technology enabled
  - Integration with modeling tools for Driver Assistance and Active/Passive Safety Integration



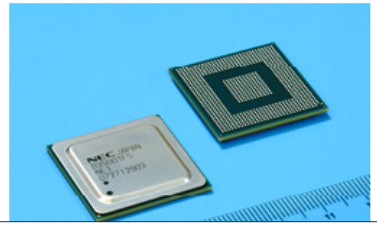
- Navigation and Car Multimedia
  - Convergence with PND market
  - Driver Information: LCD prices driving adoption of virtual dashboard
  - ARM Ecosystem enables strategic platforms opportunities such as Ford + Microsoft Sync

GARMIN MAGELLAN mio explore more NAVIGON tomtom

ARM Automotive Use Cases

NEC ELECTRONICS

NEC Electronics Introduces NaviEngine®1 Multicore Platform for Car Navigation Systems



KAWASAKI, Japan, October 2, 2007

NEC Electronics today unveiled NaviEngine®1, th
most powerful single-chip system LSI solution o
car navigation systems. Based on four high-spe
cores using the ARM® MPCore™ technology wit
multi-processing (SMP), NaviEngine1 is capable
simultaneously processing multiple streams of i
needed for car navigation systems, including ve
location, driving directions, and navigation funct
chip delivers high-speed parallel processing per

FUJITSU THE POSSIBILITIES ARE INFINITE

Malaysia

Home

Home > News > Press Releases > Fujitsu Launched New LSI for Vehicle Navigation System and Digita

Fujitsu Microelectronics Asia Pte Ltd

Fujitsu Launched New LSI for Vehicle Navigation System and Digital Dashboard

The world's first graphics controller equipped with ARM core for next-generation automotive application

Singapore, April 10, 2007 — Fujitsu Microelectroni
the availability of a system LSI chip, MB86R01 that in

Garmin adopts ST's Cartesio SoC

Anne-Francoise Pele

EE Times Europe

03/06/2008 3:48 PM

PARIS — Navigation device maker Garmin International, Inc. announced it has selected STMicroelectronics' Cartesio automotive-grade application processor system-on-chip (SoC) with embedded GPS for integration in portable navigation systems, including the nüvi 205.

STMicroelectronics NV (Geneva, Switzerland) explains the Cartesio SoC is a derivative of its Nomadik application processor platform. It integrates a 32-bit ARM CPU core with a high-sensitivity 32-channel GPS subsystem and a

TEXAS INSTRUMENTS ENHANCES AUTOMOTIVE SAFETY WITH FIRST IEC 61508 COMPLIANT PROCESSOR SOLUTION

Meeting the Industry's Most Stringent Safety Standards Allows Manufacturers to Further Reduce System Complexity and Cost

HOUSTON (November 7, 2006) – Accelerating the trend towards safer, but less complex automotive chassis control applications, Texas Instruments Incorporated (TI) (NYSE: TXN) today introduced a new symmetrical dual-core microcontroller (MCU). The TMS570 MCU is the first automotive processor solution to support a certification according to the International Electrotechnical Commission (IEC) 61508 SIL3 standard – the highest level of safety that is designated for automotive applications. Co-developed with Robert Bosch GmbH, a leading global supplier of automotive technology, the TMS570 MCU will be implemented in next generation braking, steering and chassis control applications.

ARM® Cortex™ at the Core of TMS570 MCUs

freescale semiconductor

News Release

Automotive infotainment market gets injection with Freescale auto-quality i.MX applications proc

Ford's 2008 model-year cars with SYNC communication and entertainment system utilize Freesc

Auto-grade i.MX31 processor

TOKYO - Sept. 11, 2007 - Freescale Semiconductor today announced two auto-grade versions of the
(AEC) Q-100 qualification, the processors provide automotive original equipment manufacturers (OE

global sources

EE Times Asia

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News & Trends

Toshiba picks Cortex-M3 for car apps

Posted : 18 Jul 2007

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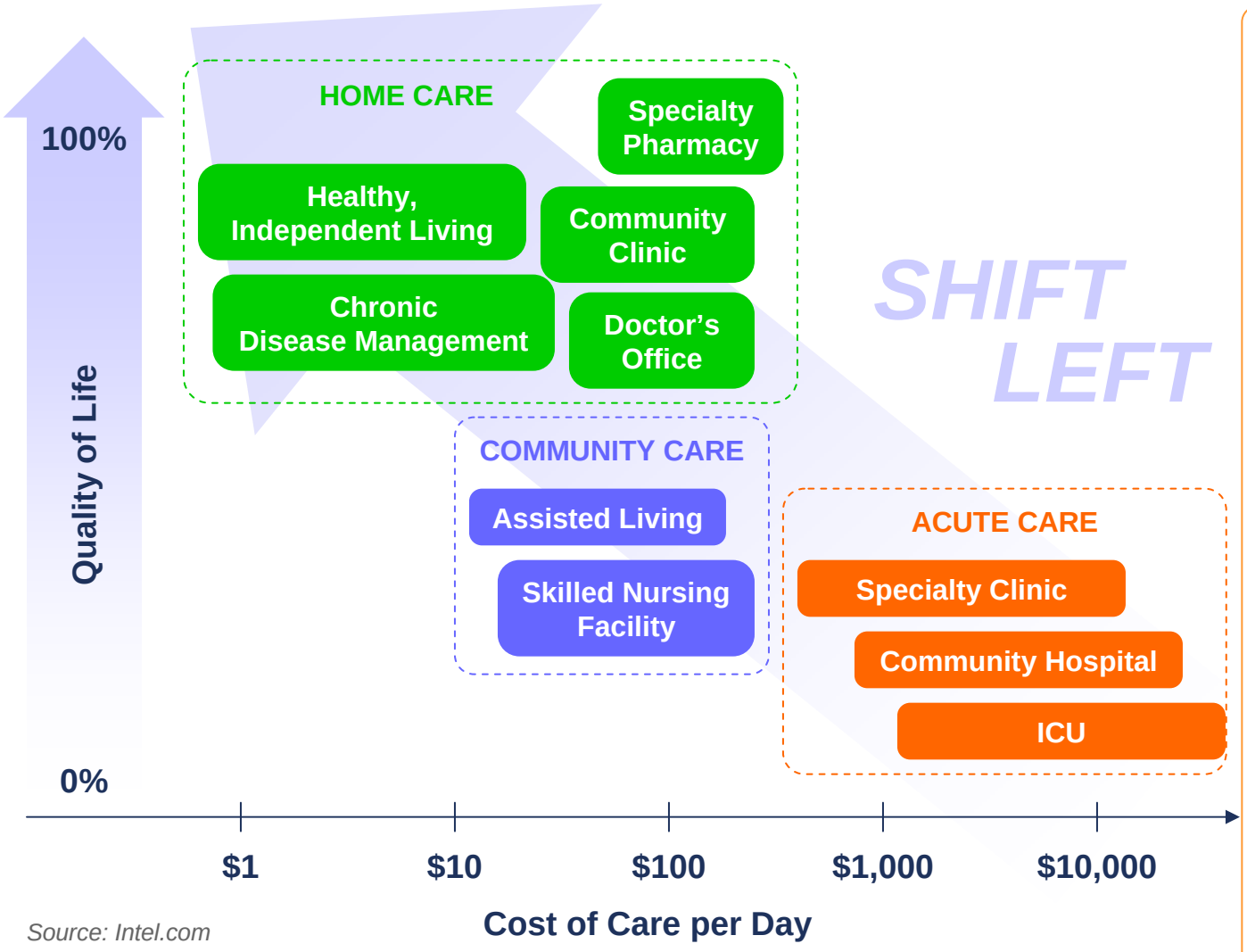
ARM Holdings plc revealed that Toshiba Corp. has licensed its Cortex-M3 MCU for use in its automotive applications.

发展中的市场案例

医疗电子

Health: Advances Require a “Shift Left”



Source: Intel.com

Personal Medical Device Market; Embedded Controller Opportunity:

- $614M 2005
- $1906M 2015

Key Requirements;

- Low Power
- Fast Math
- Performance Analog
- Connectivity

Source: IMS Research, GE Medical + Estimates

Personal Health Eco-system: Connectivity is Key

变化中的市场案例

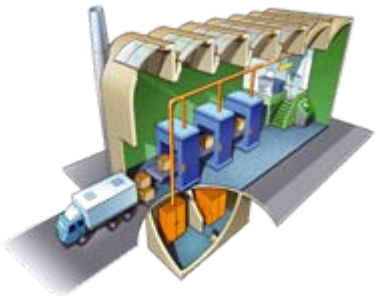
软件编程方法及功耗

New Software Methods

- One example of new software methods is the consideration of DPWS (Devices Profile for Web Based Services) in Industrial Control
- Traditional Factory Automation uses a mixture of ‘ladder logic’ and HLL to control machinery
- Moving to Web Based Services (XML) allows direct integration with Business Management Software
  - EG. ‘Paint low’ flag on production floor paint dispenser automatically initiates an order from the procurement office
- Socrades consortium to enable smart embedded devices

Key Market Drivers for Energy Conservation

- Commercial & Residential Buildings: the biggest consumer
  - Consume over 40% of total energy*
  - Key areas : HVAC, lighting, Refrigeration
- But…
  - Consumer electronics (CE) will account for 45% of domestic electricity usage by 2020**
    - electronics must become more efficient
- Motor Control a key target
  - Motors consume 60% of electricity usage***



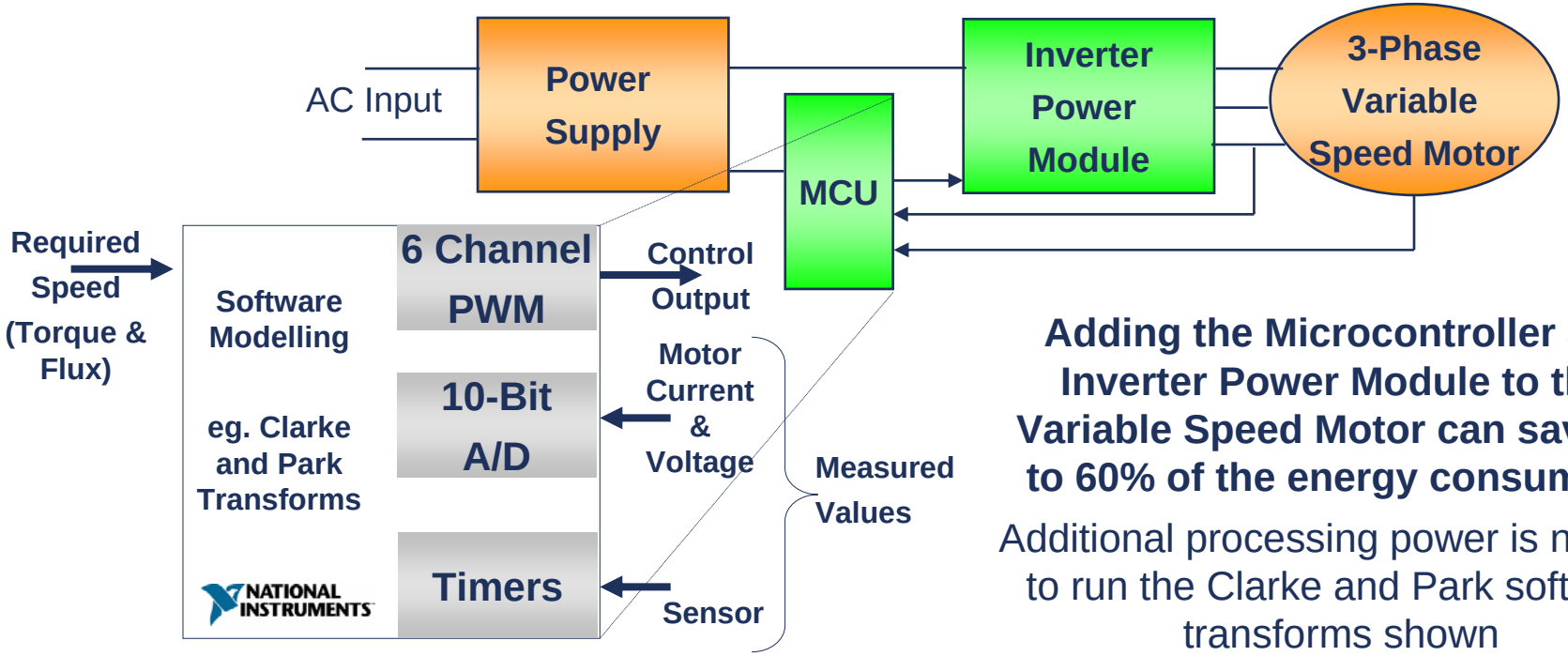
* United States Department of Energy: Energy consumption by application in commercial buildings

** The ampere strikes back - Energy Saving Trust June 2007

*** Energy Use in North America - US Department of Energy

Enabling Innovation in Motor Control

- Motor Control similar to other fields, estimating values is OK and can get the job done but will lead to wasted materials.
- Measuring values more accurately and more often, as motor spins, leads to improved control and less wasted energy
  - One example is use of 'Field Oriented' or 'Vector' control which takes account of magnetic coupling effects within the Motor



Adding the Microcontroller and Inverter Power Module to this Variable Speed Motor can save up to 60% of the energy consumed.*

Additional processing power is needed to run the Clarke and Park software transforms shown

* Sanken – Sept 2007, Energy Use in North America (US Department of Energy)

促进微控制器市场的竞争优势

嵌入式的市场发展趋势： 低费用的32位MCU

- Tremendous market opportunity in Automotive, Industrial and Consumer


Energy Efficient Appliances

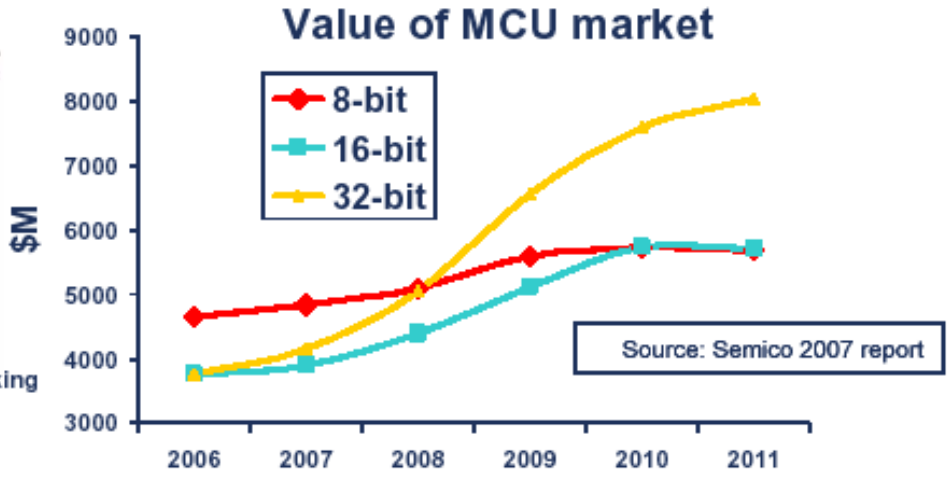

Intelligent Toys


Exercise Machines


Utility Meters


IR Fire Detector

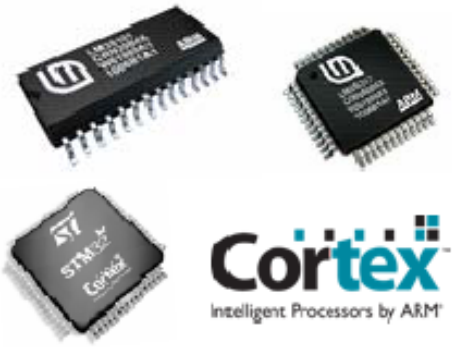

Tele-parking



Market Demands	Migration to 32-bit trends
Cost	ARM devices available at less than $1, multiple 8/16-bit devices move to single 32-bit device
Efficiency	Complex algorithms save power and costs, increase performance and reduce size
Availability	Multiple partners shipping ARM MCUs, tools and software
Software development support	Multiple tool chain partners and RTOS partners
Performance	Increasingly connected devices require higher performance for complex software

Cortex-M3

- Smallest ARM processor; for cost-sensitive, ultra-low-power applications
- Advanced features compel upgrades and attract new licensees
- Cortex-M3 delivers:
  - High performance
  - Lower cost 32-bit devices
  - Low power and integrated sleep modes
  - Simplified development



Market Demands	Cortex-M3 delivers
Cost	**Package costs reduced**: smallest ARM core and debug technology **System costs reduced**: Thumb2 technology optimises code size and memory needs
Efficiency	**Lowest power** ARM core - ~1/3 less power than ARM7
Availability	**18 licensees** BROADCOM NXP ST LUMINARY MICRO TEXAS INSTRUMENTS TOSHIBA zilog
Software development support	RealView ARM Tools by ARM KEIL An ARM Company IAR SYSTEMS LAUTERBACH Green Hills CODESOURCERY
Performance	**Over 2x performance** of ARM7 on same process

RealView MDK （中国版）

Complete software development environment for ARM processor-based microcontrollers. Easy to learn and easy to use!

- Industry leading technology
  - ARM RealView Compilation Tools
  - Keil µVision Integrated Development Environment
- Complete device support
  - ARM7/9 and Cortex-M3 processor-based MCU’s
  - Start-up code, Flash algorithm, etc
  - Extensive example code library
  - Complete device simulation
- RTX Real Time Kernel
  - Efficient RTOS Kernel for small systems
- ULINK2 JTAG-to-USB interface
- 强大的本土化的支持 **www.realview.com.cn**

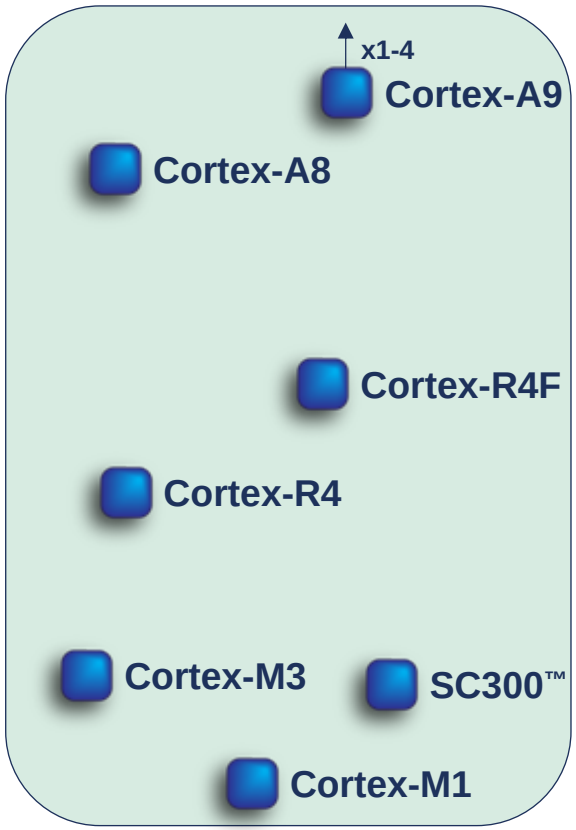
ARM 开发从未如此简单！

ARM Cortex Family of Processors

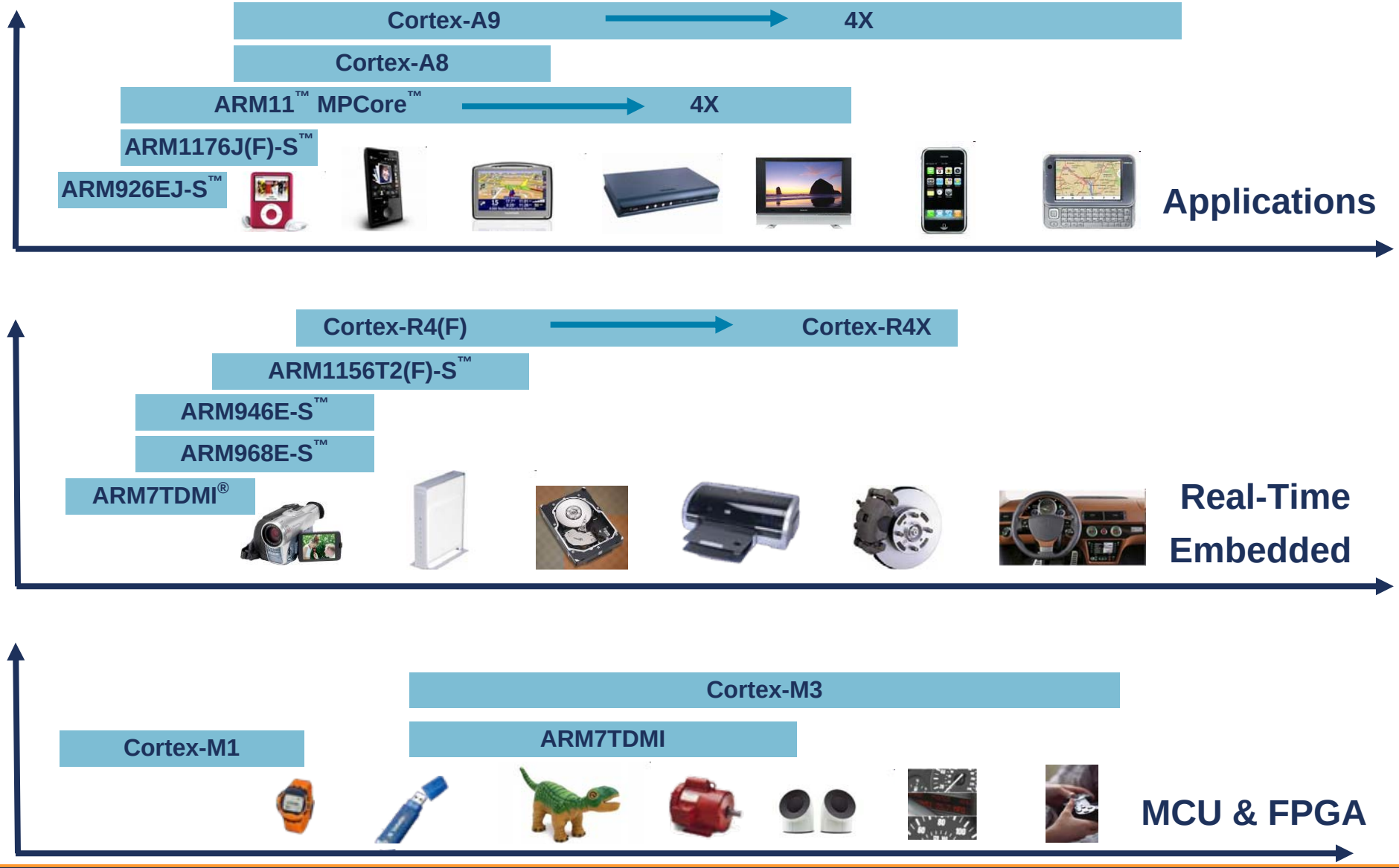
Bringing the benefits of architectural innovation across the computing spectrum

- ARM Cortex™-**A** Series:
  - Applications processors for complex OS and user applications
- ARM Cortex-**R** Series:
  - Embedded processors for real-time signal processing and control applications
- ARM Cortex-**M** Series:
  - Deeply embedded processors optimized for microcontroller and low-power applications

Cortex™
Intelligent Processors by ARM®

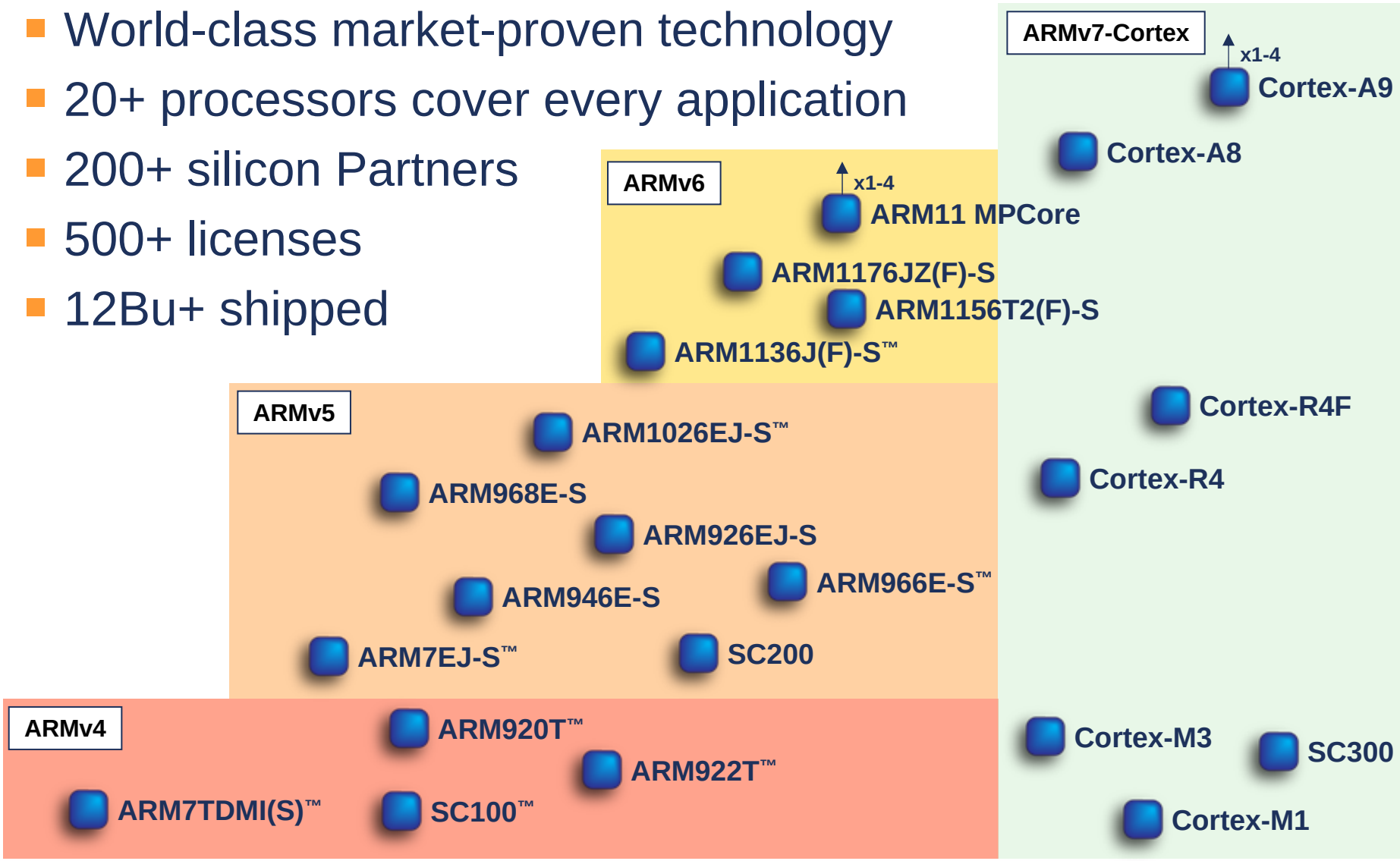


Processors Across Applications

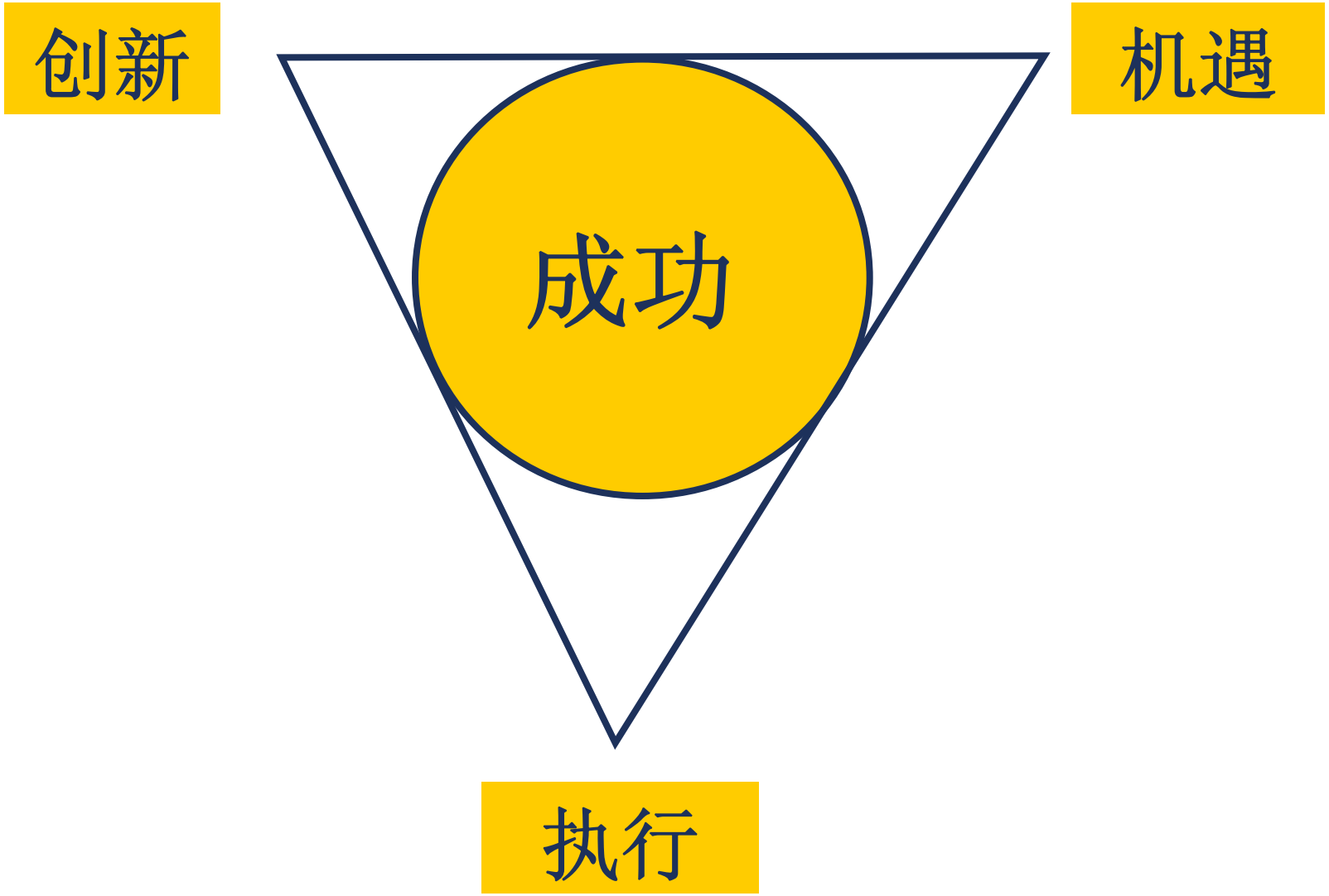


Announced Processor Portfolio

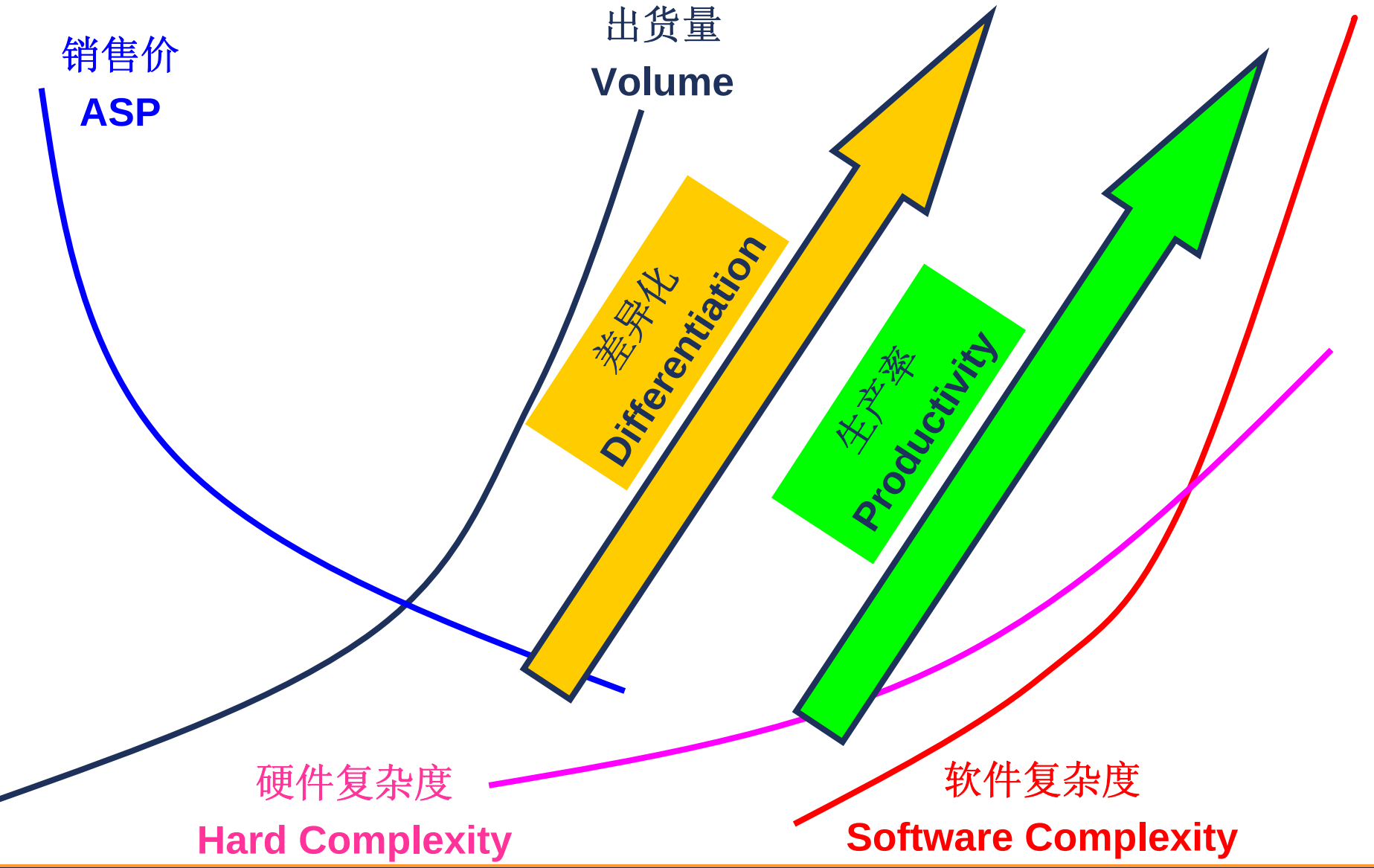
- World-class market-proven technology
- 20+ processors cover every application
- 200+ silicon Partners
- 500+ licenses
- 12Bu+ shipped



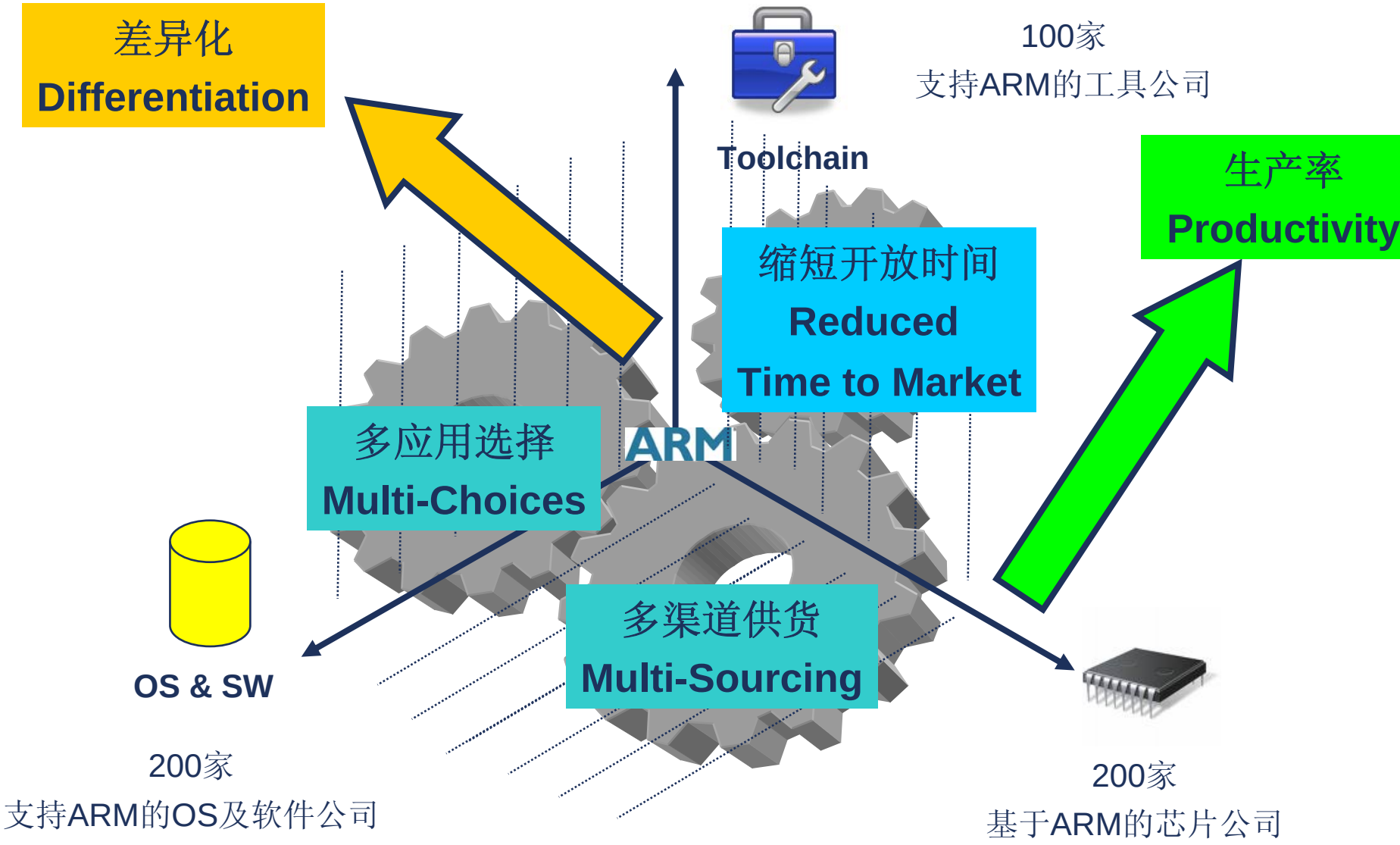
今天：一个充满机遇及竞争的时代



执行: 如何在未来的嵌入式产品取得成功



执行: ARM促进微控制器市场的竞争优势



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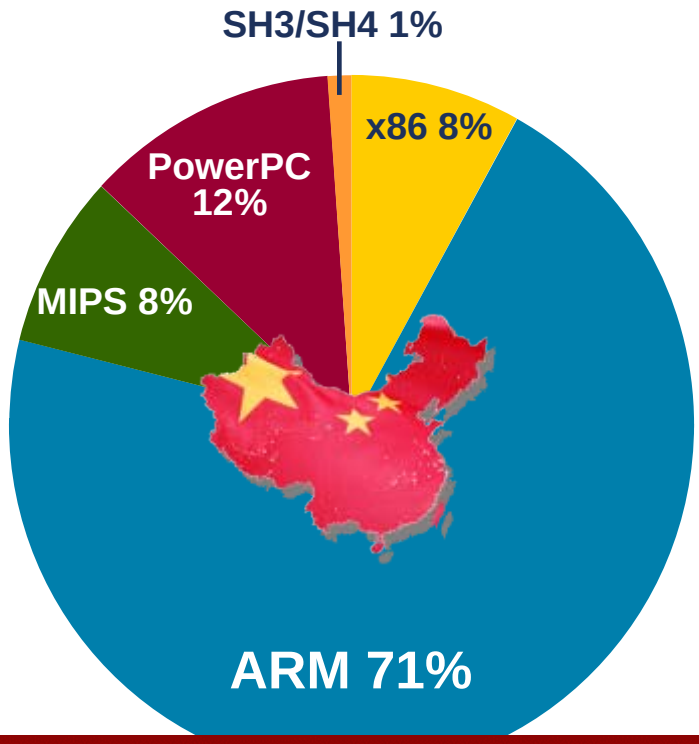
Which microprocessor architecture would you prefer to use for your embedded system development in the next two years?



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