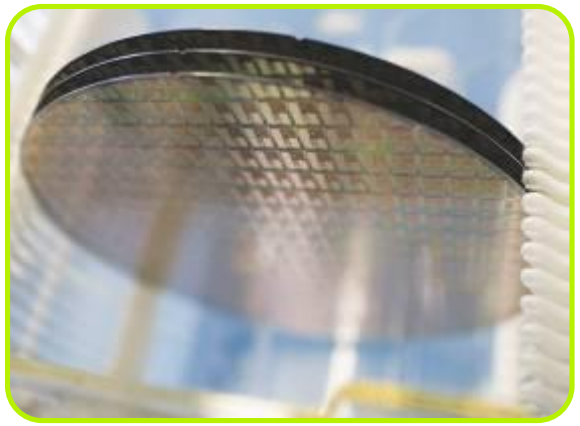
突破8-/16-/32-位和DSP界限的ARM MCU解决方案

BL Microcontrollers
BU HPMS
Jul 28th, 2010

NXP Semiconductors

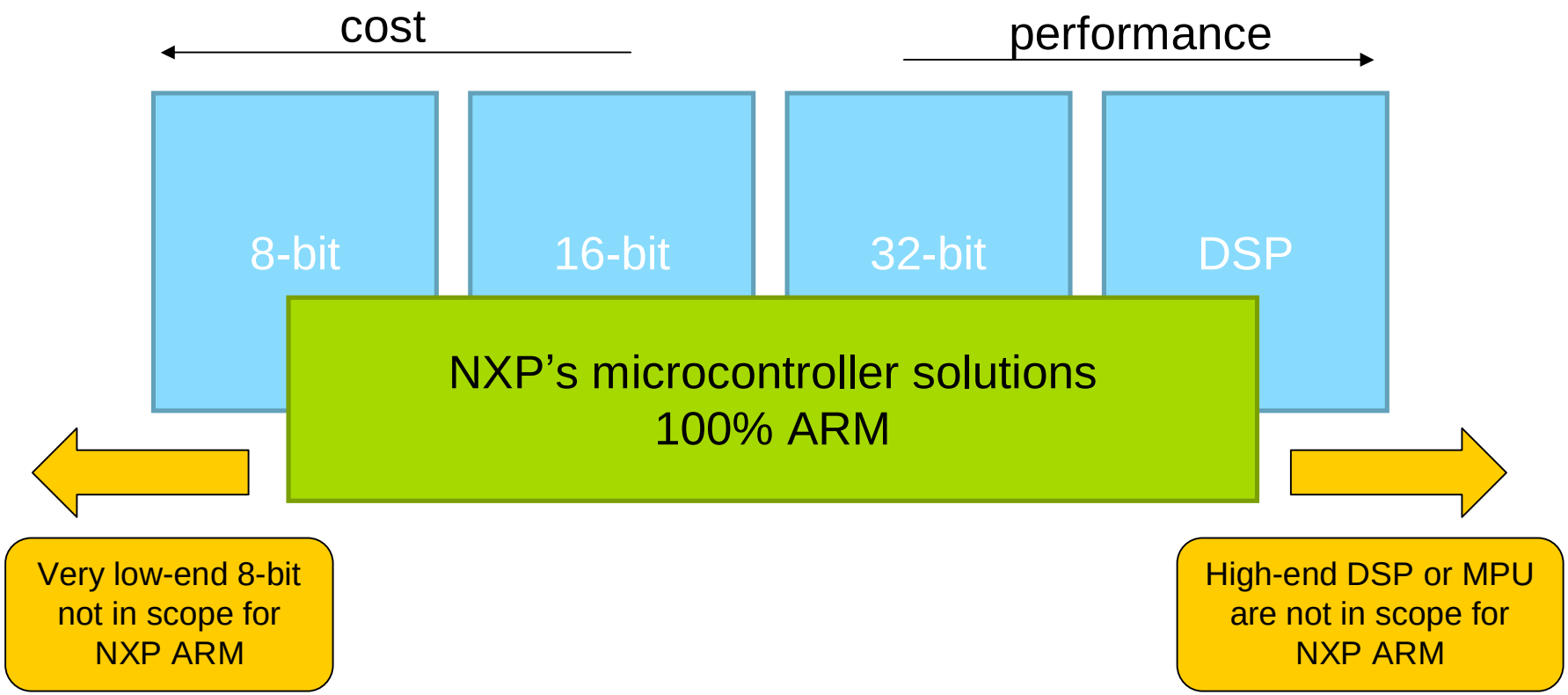
NXP Semiconductors provides High Performance Mixed Signal and Standard Product solutions that leverage its leading RF, Analog, Power Management, Interface, Security and Digital Processing expertise



- **Headquarters**: Eindhoven, The Netherlands
- **Employee base:** 27,000 employees working in more than 25 countries with research and development activities in Asia, Europe and the United States, and manufacturing facilities in Asia and Europe
- **Net sales**: $3.8 billion in 2009, over 60% of our sales are derived from the Asia Pacific region
- **Customers**: Leading OEMs worldwide

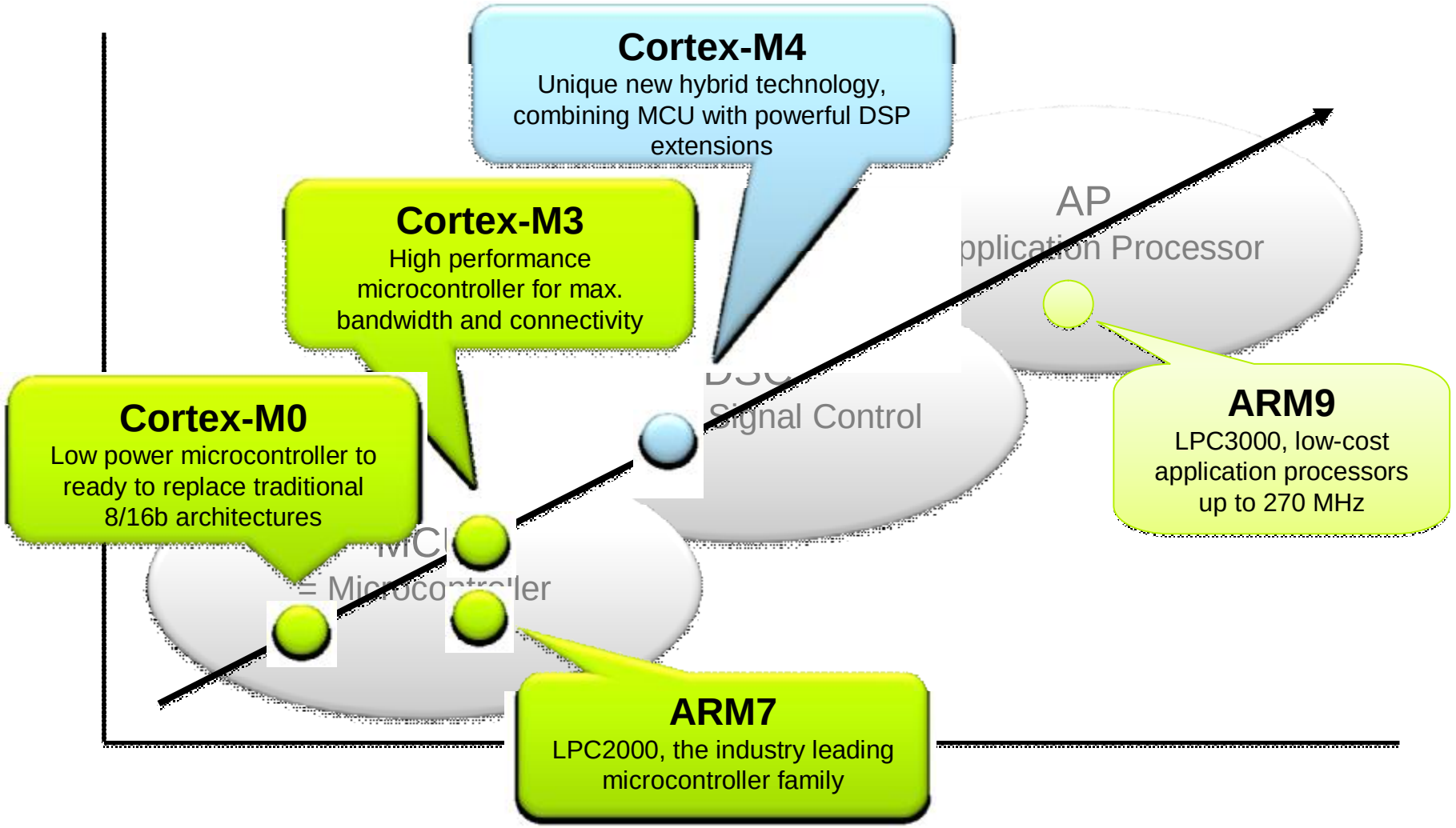
NXP changing the industry MCU landscape

è Breaking through traditional boundaries of 8b, 16b, 32b and DSP



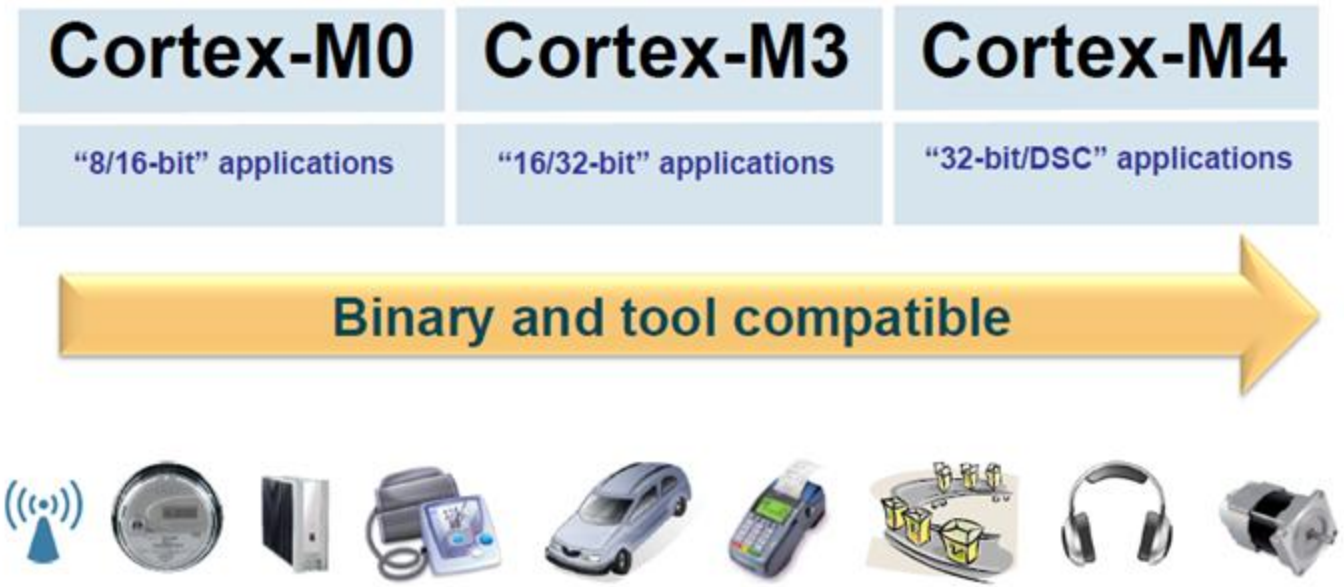
NXP microcontrollers = One continuum

è Five MCU cores lined up to serve a full range of application requirements

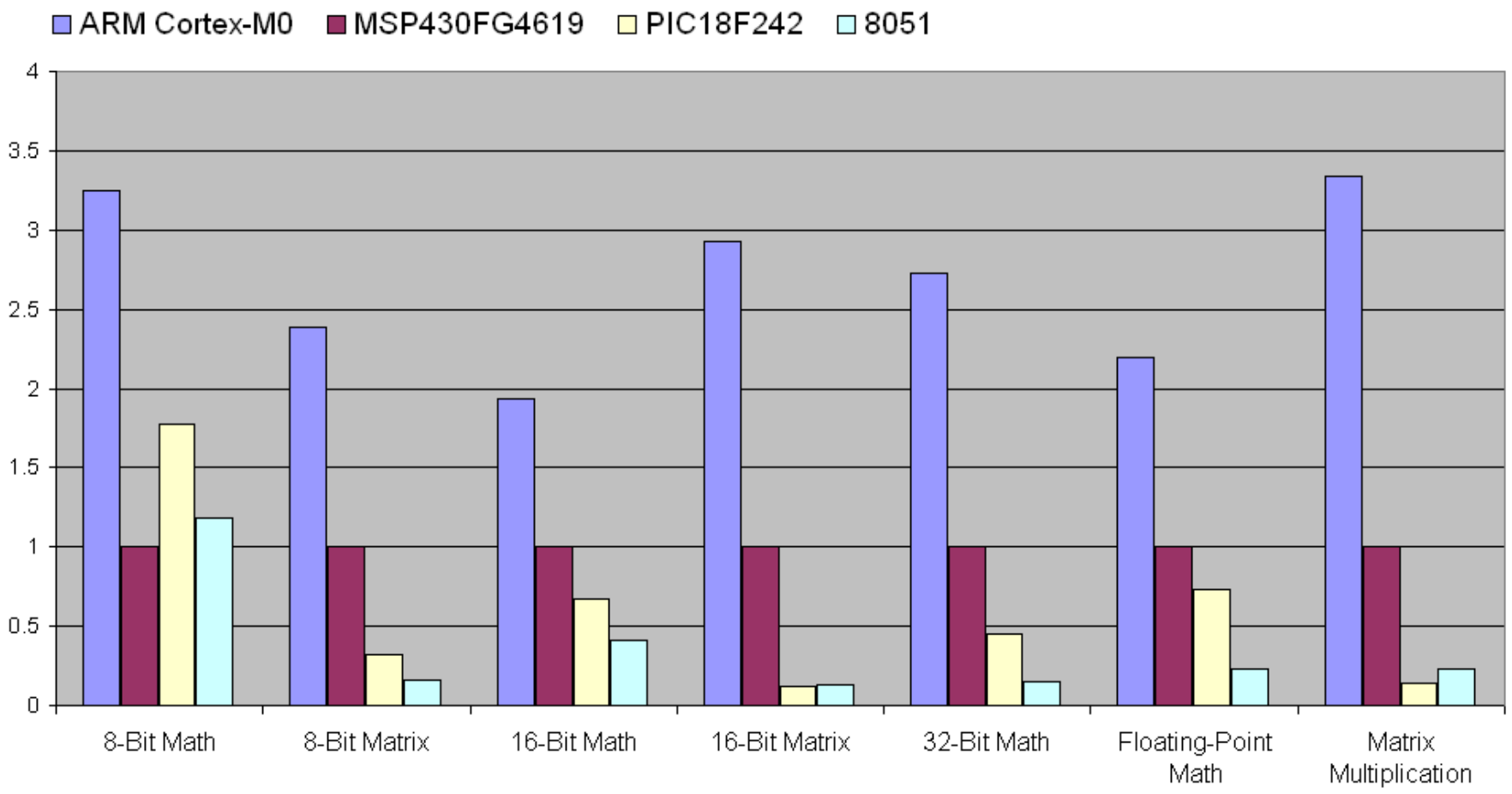


Driving innovation with the latest Cortex-M Processors

- Traditional 8-/16-/32- bit classifications will become redundant
- Seamless single architecture across all applications
- Every product optimized for ease of use, performance and power
- Now extended to Digital Signal Control applications

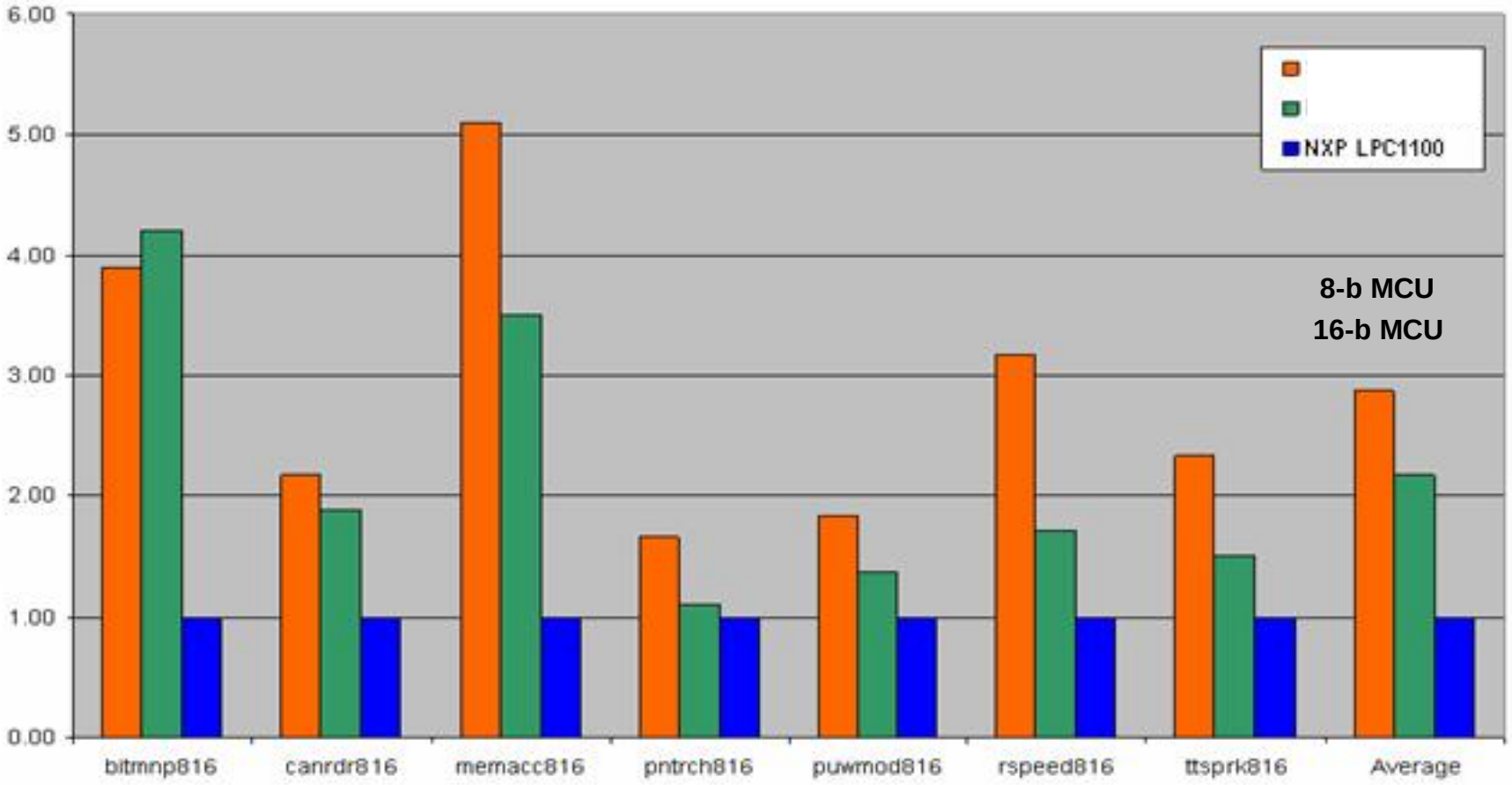


Performance Comparison – *LPC1100 Cortex-M0*



2-10x higher performance than 8/16-bit MCUs

Code Size Comparison – *LPC1100 Cortex-M0*



40-50% smaller code size than 8/16-bit MCUs

Code Size & Performance Efficiency

-- 16-bit multiply example

- **Consider an device with a 10-bit ADC**
  - Basic filtering of data requires a 16-bit multiply operation
  - 16-bit multiply operation is compared below

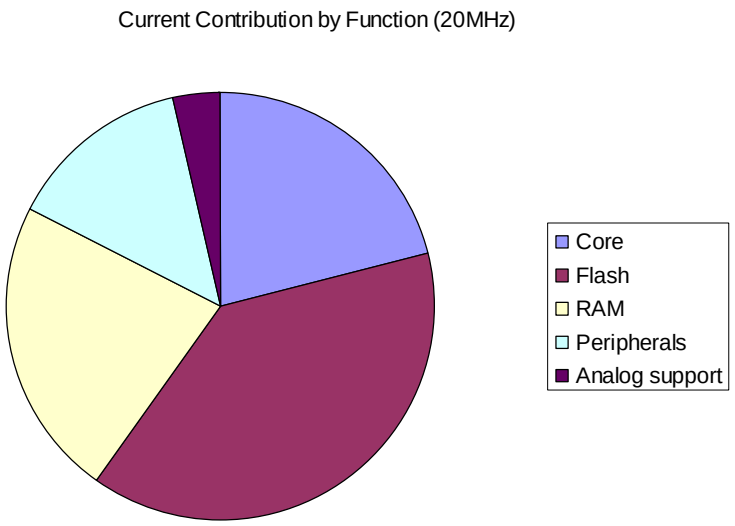
8-bit example	16-bit example	ARM Cortex-M0

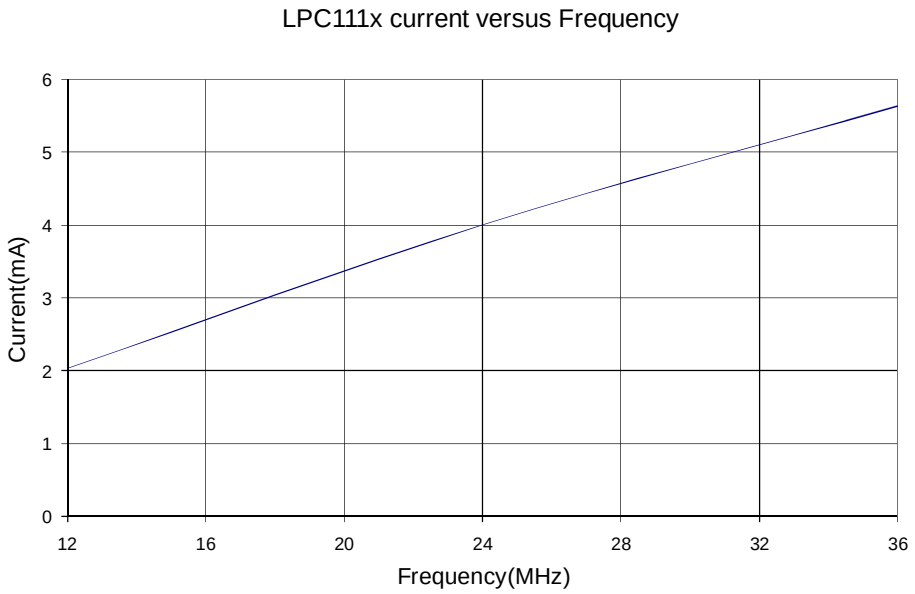
`MOV A, XL ; 2 bytes`
`MOV B, YL ; 3 bytes`
`MUL AB; 1 byte`
`MOV R0, A; 1 byte`
`MOV R1, B; 3 bytes`
`MOV A, XL ; 2 bytes`
`MOV B, YH ; 3 bytes`
`MUL AB; 1 byte`
`ADD A, R1; 1 byte`
`MOV R1, A; 1 byte`
`MOV A, B ; 2 bytes`
`ADDC A, #0 ; 2 bytes`
`MOV R2, A; 1 byte`
`MOV A, XH ; 2 bytes`
`MOV B, YL ; 3 bytes`
`MUL AB; 1 byte`
`ADD A, R1; 1 byte`
`MOV R1, A; 1 byte`
`MOV A, B ; 2 bytes`
`ADDC A, R2 ; 1 bytes`
`MOV R2, A; 1 byte`
`MOV A, XH ; 2 bytes`
`MOV B, YH ; 3 bytes`
`MUL AB; 1 byte`
`ADD A, R2; 1 byte`
`MOV R2, A; 1 byte`
`MOV A, B ; 2 bytes`
`ADDC A, #0 ; 2 bytes`
`MOV R3, A; 1 byte`
	`MOV R1,&MulOp1`
	`MOV R2,&MulOp2`
	`MOV SumLo,R3`
	`MOV SumHi,R4`
		`MULS r0,r1,r0`

Time: 48 clock cycles* **Code size:** 48 bytes	**Time:** 8 clock cycles **Code size:** 8 bytes	**Time:** 1 clock cycle **Code size:** 2 bytes

* 8051 need at least one cycle per instruction byte fetch as they only have an 8-bit interface

Power performance – *LPC1100 Cortex-M0*



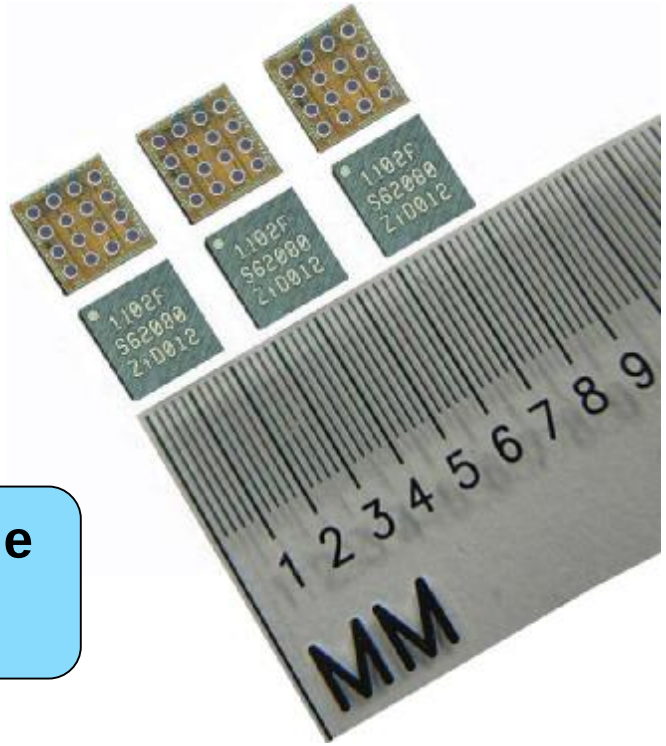


Very low active power 150uA/MHz

World's Smallest ARM Microcontroller

- The LPC1102 is available in Wafer Level Chip Scale Packaging
  - 2.17mm² x 2.32mm² WL-CSP
  - Thickness of 0.6mm
  - Pitch of 0.5mm

- High performance 32-bit Cortex M0 core based
  - 32KB flash
  - 8KB RAM
  - 1 SPI, 1 UART, 4-Channels 10-bit ADC
  - 11 I/O, IRC, 2 GP timers, 1 syst. Timer



Available for all customers with **high-volume** demands or **space saving** needs!

See also: http://www.nxp.com/news/content/file_1701.html

Why choose a DSC? – *NXP's Cortex-M4*

MCU
= Microcontroller

DSC
= Digital Signal Control

DSP
= Digital Signal Processor

- Easy to use
- Peripheral mix
  - Memory integration
  - USB, Ethernet, etc.
- Ultra low power– sleep modes etc
- Excellent software ecosystem (write in C)
- Low Cost
- Excellent interrupt control and latency
- Low cost debug and trace

Best of both worlds

- Good DSP benchmarks
  - Core efficiency
  - Memory access speed
  - Processor speed
- All the benefits of an MCU
  - Peripheral mix
  - Low power consumption
  - Software ecosystem
  - Cost
- Can win on low power and peripheral mix versus DSPs

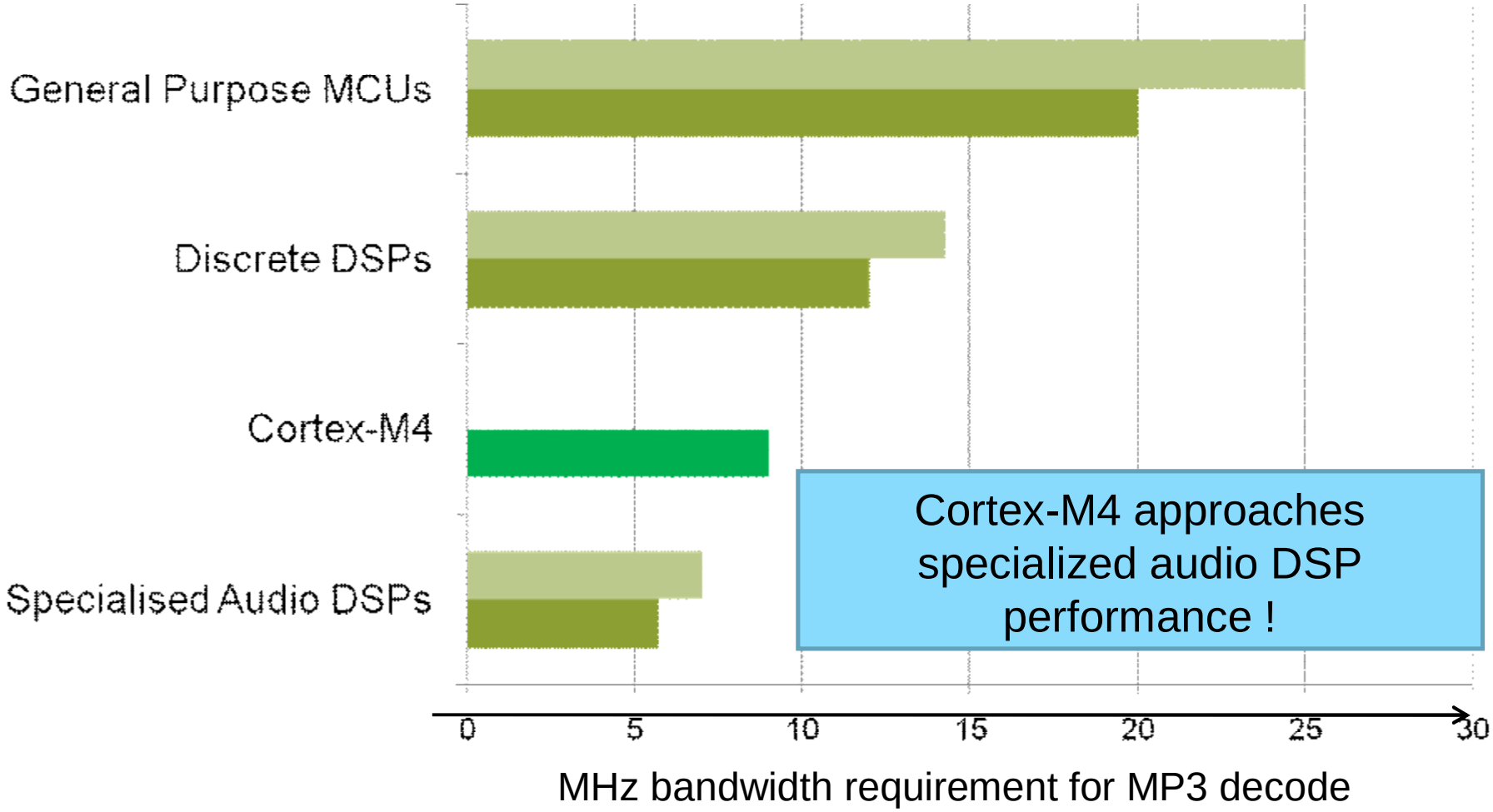
- Harvard architecture
- High performance MAC
- Saturating math
- SIMD instructions
- Barrel shifters
- Circular addressing
- Zero overhead loops
- Load/store in parallel with math
- Software libraries



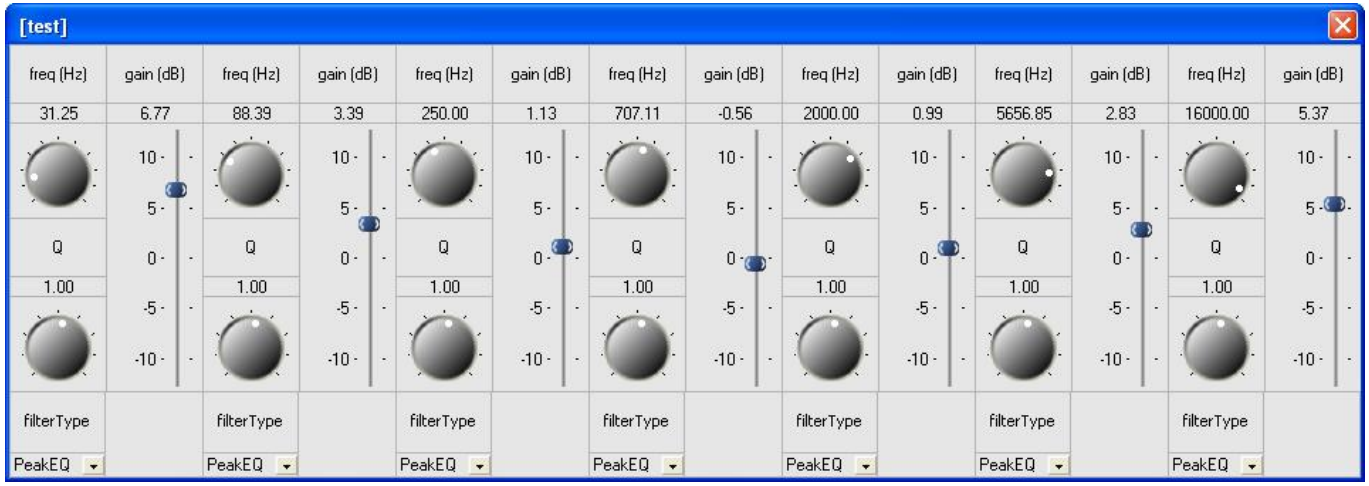





DSP example – MP3 audio playback



DSP example – graphic equalizer



DSP CONCEPTS

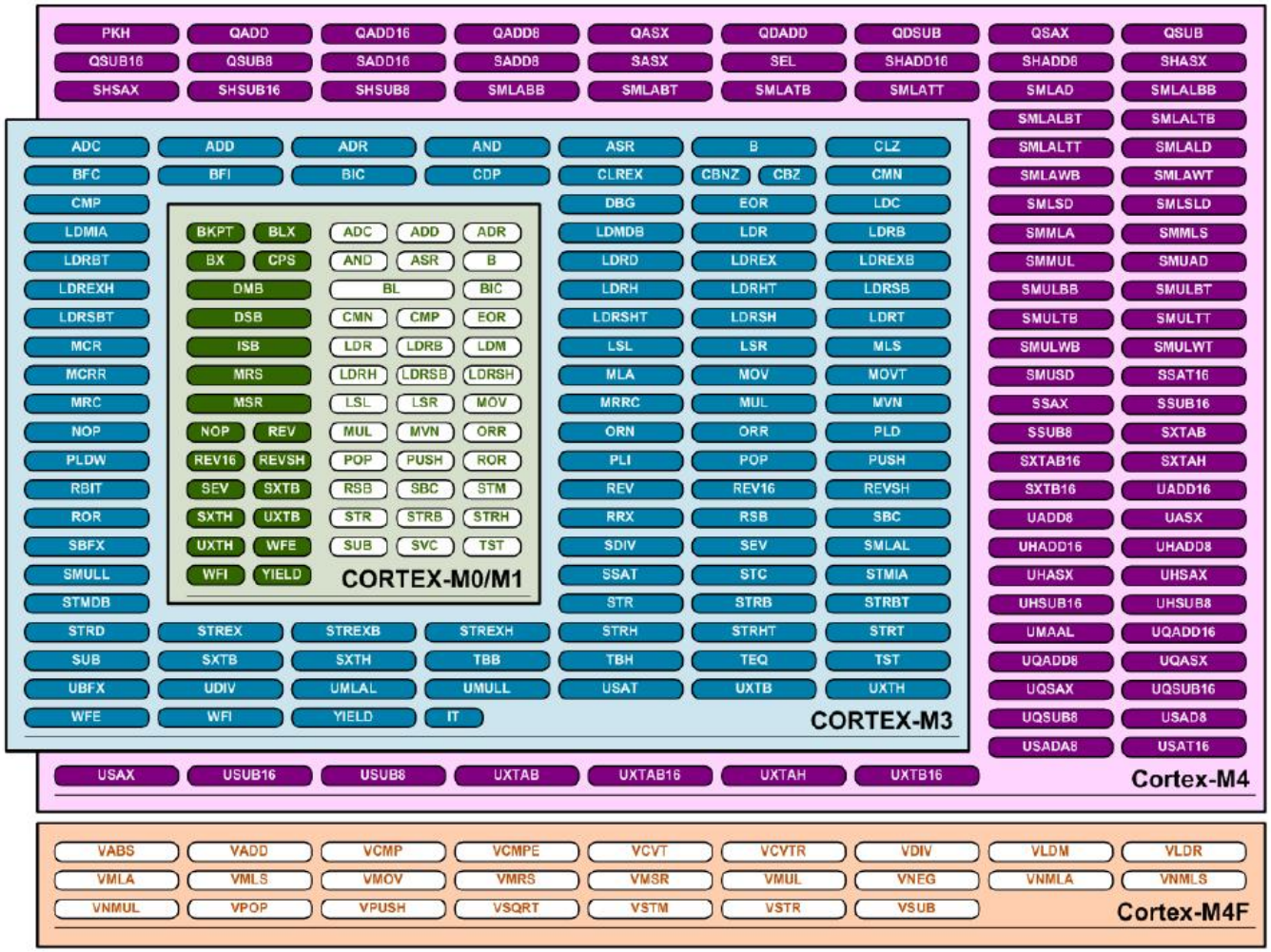
Real-time Demo

- 7 band parametric EQ
- 32-bit precision
- Stereo processing
- 48 kHz sample rate

Performance

- Cortex-M3 57 MHz
- Cortex-M4 13.2 MHz

Cortex-M Processors: Binary Compatible



All supported with the same MCU Tool Chain

code_red

IAR SYSTEMS

KEIL An ARM® Company

Embedded Artists

hitex and others

Fully Featured Development Tools

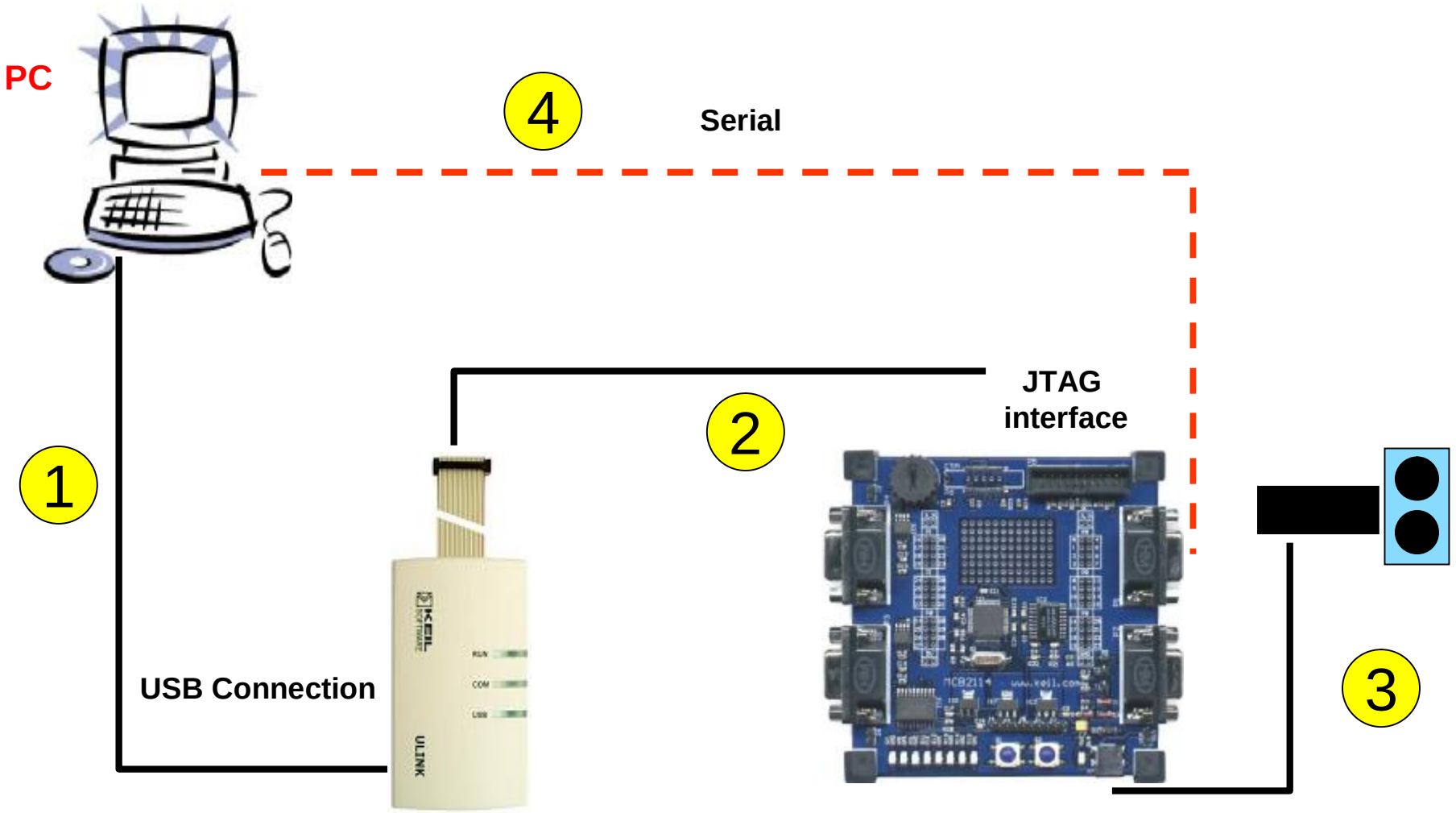
mbed

Online Rapid Prototyping Tool

LPC X PRESSO

NXP's Low cost Development Tool Platform (under $30)

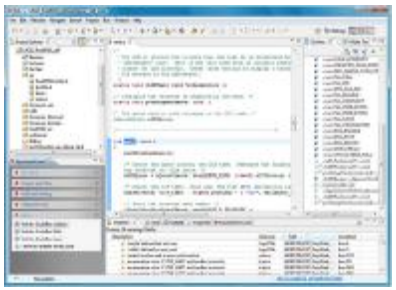
Traditional Development Environment



NXP's Low Cost Development Tool Platform

LPC X PRESSO

Eclipse-based IDE

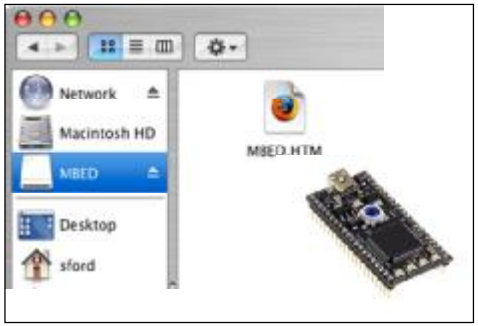


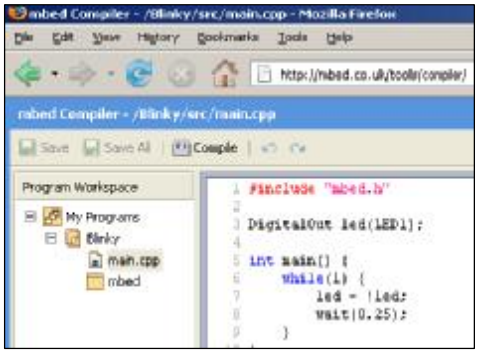
Development Board

Evaluation → *Product Development*

- Provide end-to-end solution from evaluation all the way to product development
- Attractive upgrade options to full blown suites and development boards

Rapid Prototyping Tool- “mbed”






```
#include “mbed.h”
Serial terminal(9,10);
AnalogIn temp(19);
int main() {
 if(temp > 0.8)
   terminal.printf(“Hot!”);
}
```

USB Drag ‘n’ Drop Programming Interface

- Nothing to Install: Program by saving binaries
- Works on Windows, Linux, Mac, without drivers
- Links through to mbed.org website

Online Compiler

- Nothing to Install: Browser-based IDE
- Best in class RealView Compiler in the back end
- No code size or production limitations

High-level Peripheral Abstraction Libraries

- Instantly understandable APIs
- Object-oriented hardware/software abstraction
- Enables experimentation without knowing MCU details

NXP is the First ARM Partner for the Online Tool Program

Where to get started?

- www.nxp.com/microcontrollers
  - MCU homepage

- www.nxp.com/lpczone
  - Product updates and training

- www.nxp.com/lpcxpresso

- www.mbed.org