CMP Conference
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ARM Cortex Advanced Processors

Architectural innovation, compatibility across diverse application spectrum

- **ARM Cortex-A family:**
  - Applications processors for feature-rich OS and 3rd party applications

- **ARM Cortex-R family:**
  - Embedded processors for real-time signal processing, control applications

- **ARM Cortex-M family:**
  - Microcontroller-oriented processors for MCU, ASSP, and SoC applications
The Perpetual Demand for Performance

- Increasing screen resolution >5x
- Increasing content complexity >10x
- Graphics processing increase of >50x
- Within a device power budget average of 850mW for handheld

Desktop:
- TrueForce (complexity=10)
- OpenGL ES 2.0
- Taiji (complexity=5)

- 1080p
- WXGA
- WVGA

Image credit: Rightware

OpenGl ES 1.1
- Samurai (complexity=1)
Addressing the New World of Graphics

Performance

5X

Mali-T604

Mali-400 MP

Open GL ES 1.1 & 2.0 Direct3D Open CL 1.1 API Support
AMBA 4

- AXI4 is deliberately a small change to AXI3.
  - Gives maximum compatibility of legacy IP.
  - The right solution for anything from FPGA to A15 class systems.
- ACE4 is for Multi-Processing
  - Covering coherency, barriers (ordering), virtualisation

- Quality of Service
  - Why need it – intelligent management of traffic in a multi-master SoC design, guarantee latency and bandwidth

- Longer burst support
  - Why need it – helps with efficient memory management and integration of devices with large block transfers

- Barriers
  - Why need it – ensure correct ordering of messages between communicating devices, increasing on SoC performance

- Hardware coherency
  - Why need it – multiple coherent cached copies of same data, increasing on SoC performance and off SoC efficiency by reducing dataflow to external memory.
ARM - Linux and Communities

- Linux kernel
- GNU Tools

- Ubuntu
- Debian
- MeeGo
- beagleboard.org
- Linaro
- plugcomputer.org
- montavista
- fedora
- openmoko projects
- ARM

The Architecture for the Digital World®
Linaro Partner Initiative

- Recognizing new base level of connected functionality
- Accelerating path to differentiation
- Enabling partners to differentiate and accelerate TTM

Accelerating Open Source Investment

- Industry leaders creating the future
  - Most pervasive SoC processor architecture
  - Largest contributor to Linux and Open Source
  - Market leading SoC companies

- ARM
- freescale
- IBM
- SAMSUNG
- ST ERICSSON
- Texas Instruments
Linaro Partner Initiative

- Recognizing new base level of connected functionality
- Accelerating path to differentiation
- Enabling partners to differentiate and accelerate TTM

**Linaro focus: tools, kernel, middleware**

- Invests in open source projects
- Linaro does essential engineering
- Relevant to multiple verticals markets
- Relevant to multiple distributions
ARM University Program

Benefit from using ARM in your next engineering or computer science course

- SoC Design
- Systems Development
- Assembly Programming
- Computer Architecture
- Research and Student Projects
- Embedded Applications Programming

www.arm.com/support/university/
Development platforms

Academic pricing on:
Baseboards
Core Tiles
Multi-ICE/RealView ICE
Keil evaluation boards

Hundreds of 3rd-party boards
for students and courses
Free Development Tools

```c
#include <stdio.h>     /* prototype declarations for I/O Functions */
#include <LPC21xx.h>   /* LPC21xx definitions */

int main (void) {    /* execution starts here */
    /* initialize the serial interface */
    PINSEL = 0x00000000;  /* Enable RXD1 and TXD1 */
    U1CR = 0x83;          /* 8 bits, no Parity, 1 Stop bit */
    U1DL = 97;            /* 9600 baud rate @ 16MHz VME Clock */
    U1CR = 0x03;          /* DBLE = 0 */

    printf ("Hello World\n");      /* the 'printf' function call */

    while (1) {          /* an embedded program does not stop and */

    }

    return 0;            /* return value */
}
```

The Architecture for the Digital World®

ARM®
Textbooks

ARM Assembly Language Fundamentals and Techniques

Embedded Linux Primer

The Definitive Guide to the ARM CORTEX-M3 Second Edition

Programming and Customizing the ARM7 Microcontroller
Guest Lectures, Seminars, and Training
Fast ARM CPU and fabric models

- The ARM Fast Model Library includes CPU models of:
  - ARM968E-S
  - ARM926EJ-S
  - ARM1136J(F)-S
  - ARM1176JZ(F)-S
  - Cortex-R4(F)
  - Cortex-A8
  - Cortex-A9 UP
  - Cortex-A9 MPCore
  - Cache support

- In addition there are models of key fabric components, including:
  - ARM L2 Cache Controller (PL310)
  - ARM Memory Controllers (PL080, PL340, PL350)
  - ARM Interrupt Controllers (PL390, PL192, PL890)
  - ARM Multimedia Card Interface (PL180)
Cortex-M0 netlist available

Forget traditional 8/16/32-bit classifications!

ARM Cortex-M4
“32-bit/DSC” applications
Efficient digital signal control

ARM Cortex-M3
“16/32-bit” applications
Performance efficiency

ARM Cortex-M0
“8/16-bit” applications
Low-cost & simplicity
Cortex-M0 netlist available

Forget traditional 8/16/32-bit classifications!

<table>
<thead>
<tr>
<th>ARM Cortex-M4</th>
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The M0 Netlist is a retargetable netlist of one implementation of Cortex-M0

<table>
<thead>
<tr>
<th>ARM Cortex-M0 processor features</th>
<th>Full product options</th>
<th>Netlist implementation</th>
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</thead>
<tbody>
<tr>
<td>Zero jitter 32-bit RISC core</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>AMBA AHB-lite interface</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>ARMv6-M instruction set architecture</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>NVIC Interrupt controller</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Interrupt line configurations</td>
<td>1 to 32</td>
<td>16 only</td>
</tr>
<tr>
<td>Debug (SWD, JTAG) option</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Up to 4 breakpoints, 2 watchpoints</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Low power optimisations (ACG)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Multiple power domain support with WIC</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Fast multiplier (1 cycle) option</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>System timer</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Area (gates)</strong></td>
<td>12k – 25k</td>
<td>16K</td>
</tr>
</tbody>
</table>

Available as a verilog netlist targeting FPGAs / ASIC

Faculty to ask for deliverables

Physical IP*

- **Classic (180nm to 90nm):**
  - Access to ARM Physical IP
    - Everything needed to implement a chip
    - High-quality libraries and memories

- **DesignStart:**
  - Free access to ARM processor IP
    - ARM7TDMI® and ARM926EJ™ hardened from 180nm to 90nm for major foundry processes
    - More than 275 downloads to date
    - Separate license needed to produce silicon
    - SoC designs can be done with these models

- Material is limited to research programs

- Latest breaking new:
  - IBM-ARM to collaborate on 20 & 14 nm
Student/Faculty Support

www.arm.com/support/university
Questions?