The Imagination University Programme (IUP)

Our mission is to enable you to use our technologies in your teaching and projects. We have more than 20 years' experience in this field.

There are four vital components in each package:

- Availability of low-cost hardware platforms. As an IP company, this requires Imagination to work closely with platform providers.

- Easy to use programming tools available free of charge to academia, with no limits. Our PowerVR SDK and Codescape MIPS Essentials meet this need.

- Effective support through forums, online and on-campus training

- Best-in-class teaching materials. Not commercial training materials, but genuine academic teaching materials written by expert academics, specifically for academic use.
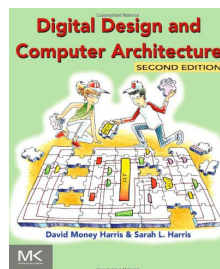
The course topics we focus on:

- Computer architecture

- System-on-chip

- Verification

- Embedded systems. Microcontrollers (MCUs) with internet connectivity for 'IoT' applications

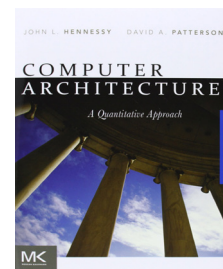- Mobile graphics and GPU compute

Popular Textbooks
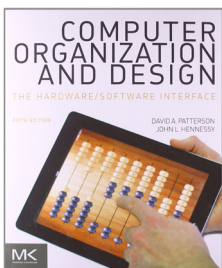
Computer Organization and Design

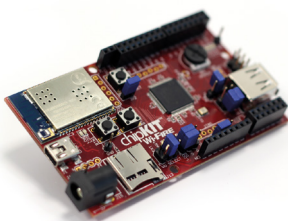David Patterson & John L. Hennessy

Digital Design and Computer Architecture, 2nd Edition
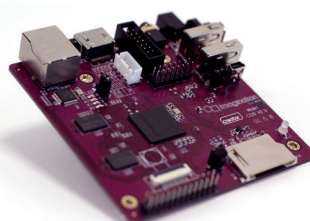
David Harris & Sarah Harris

Computer Architecture - A Quantitative Approach

David Patterson & John L. Hennessy
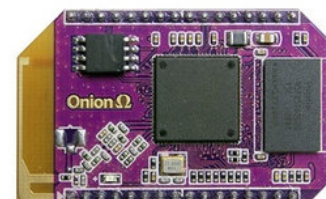
Popular Hardware Tools

Digilent chipKIT Wi-FIRE with FlowCloud

Based on the Microchip PIC32MZ MCU with microAptiv MIPS CPU 200 MHz, Wi-Fi, SD card and Arduino shield interface.

Imagination Ci20 Creator

A Debian, Linux and Android platform based on the Ingenic JZ4780 SoC with a 1.2GHz MIPS32 dual-core CPU, PowerVR SGX540 GPU. On-board Ethernet, Wi-Fi and Bluetooth 4.0.

Onion Omega

An extremely compact invention platform for the Internet of Things, Wi-Fi enabled and with support for Python and Node.JS.

Teaching Materials Packages

Our Teaching Materials consist of presentation slides, an instructor's guide, a student handbook, reference guides and lab exercises, supplied in both PDF and source PowerPoint formats.

There are three packages available now:

Introduction to Mobile Graphics

Scope	The first full semester course on Mobile Graphics, with Lectures and Labs
Audience	3rd year BSc/MSc Gaming and CS Students
Author	Darren McKie, Univ. of Hull, UK
Hardware	Ci20, Android devices, BeagleBoard/BeagleBone, CubieBoard4, OR: Software Emulator
Tool-Chain	PowerVR SDK
Support	PowerVR Insider forum
Status	English (now), Chinese (Simplified) Q1 2016
Partners	AllWinner, CubieTech
Next	Advanced Graphics, OpenCL, OpenGL ES 3.0, GPU Compute

| Lecture Topic	Week	Details
Introduction to mobile graphics technologies	1	Introduction to the different graphics technologies available and how we compare them.
Introduction to mobile graphics architectures	1-2	Comparison of mobile's dominant graphics hardware, and an introduction to the concerns relating to power consumption and performance. The PowerVR Graphics architecture case study will be outlined
Understanding the simple triangle code, and simple Object Orientated Design	2-3	How the simple triangle graphics program has been written using the PVRShell framework. How to separate the triangle code out of the main drawing function and into its own class.
Introduction to graphics SDKs and forums	4	How to use some of the PVRTools framework, including how to display text. The benefits and the importance of hardware IP forums to gain support and help.
Texturing	5	How texturing works, including the coordinate system and performance concerns.
Simple transformations and lighting	6	How transformations and lighting can be applied to vertices, including translations, rotations, and how to apply lighting.
3D graphics utilities	7	How to use some of the PowerVR utilities, including the texture compressor and shader profiler.
OpenGL ES 2.0 shader programming	8, 9, 10	How to program OpenGL ES 2.0 shaders, including more advanced lighting, reflection and refraction.

Complete 10 week lecture course

## The Connected MCU Lab

Teaching 32-bit Microcontrollers:

|	
Scope	A full semester MCU course with an IoT theme
Audience	The fisrt MCU course taken by undergrad: 2nd/3rd semester undergrads in EE, CE and Mechatronics and some CS undergrads taking an Embedded Systems option
Hardware	ChipKIT Wi-FIRE by Digilent. 200MHz Microchip PIC32MZ based on MIPS microAptiv core.
Tool-Chain	MPlab X, MPlab Harmony
Support	Forums – Microchip, Digilent and MIPS Insider
Partners	Microchip and Digilent
Author	Prof. Alex Dean, NC State, USA
Timing	Beta now, English Q1 2016, Chinese Q2 2016
Topics	Embedding a computer in a system MCUs versus computers. Connectivity. The tool chain. Software design concepts and tools. Debugging. Basic peripherals: Introduction and Digital I/O Basic concurrency. Threads, Interrupts, Debouncing. Peripherals: Analog interfacing, timing and counting, communications, interfacing with Arduino Shields Advanced concurrency: real-time kernel RTOS, multi-rate threads, adding interrupts Improving CPU throughput: software analysis and optimisation, architectures, what's 'under the hood?' IoT: overview, building a FlowCloud system and embedded web server
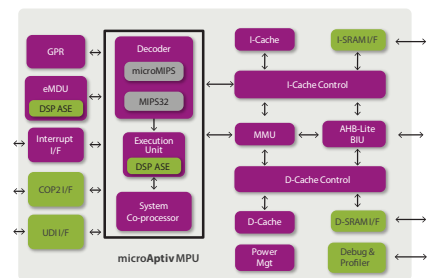
MIPS32 microAptiv processor runs the program's instructions
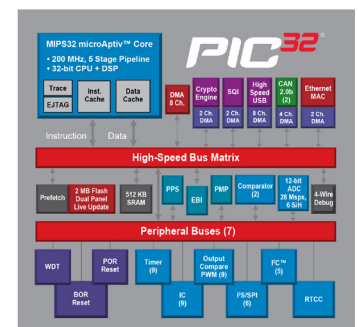
PIC32MZ microcontroller adds memory, control, interfacing and robustness circuits
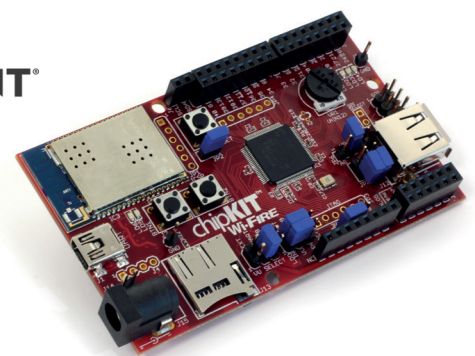

ChipKIT Wi-FIRE board adds inputs, outputs and power supply

MIPSfpga

A real verified un-obfuscated MIPS core for academic use

- Until now, none of the 'Big 3' architectures has been openly available to academia

- The core is a standard verified configuration of microAptiv

- It's in silicon and in academia already: Microchip's PIC32MZ and Samsung's Artik1 IoT solution

- This creates synergy with student projects and mass-production embedded systems

- 40K gates – small enough to fit in the most common FPGA platforms found in academia

- Tools: the programming and FPGA tools are all available free of charge

- Simple online license that allows use only on FPGA, not in silicon. Delivered via web download

- Active partnership with Xilinx for joint workshop programme and promotion
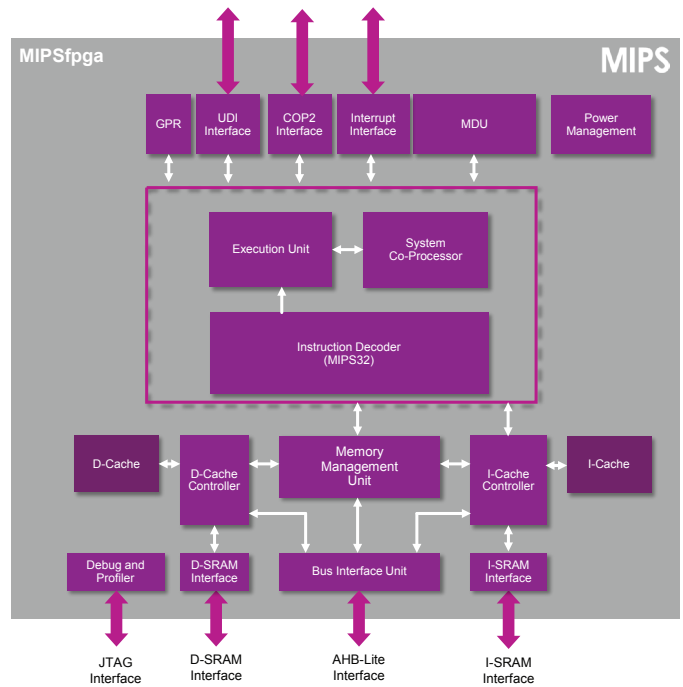
MIPSfpga block diagram

| Scope	The first course to give open access to a current real-world processor core.
Audience	Fundamentals: undergrad students CS and EE SoC Advanced: graduate and PhD students
Courses	Computer Architecture, Embedded Systems, SoC, Verification
Core	microAptiv ~40K gate UP configuration
Hardware	Digilent Nexys 4 DDR and Basys 3 (using Xilinx Artix 7), Terasic DE0-CV and DE2- 115 (Altera) + SEEED Studio MIPS Bus Blaster Probe
Tool-chain	FPGA: Vivado or Quartus MIPS programming: Codescape MIPS Essentials Debug: Open OCD
Support	MIPS Insider forum
Status	Getting Started Package – now MIPSfpga Fundamentals – now MIPSfpga SoC Advanced (runs BuildRoot Linux) – November 2015
Languages	English, Chinese, Japanese, Russian, Spanish (December 2015)
Authors	Sarah Harris and David Harris - writers of complementary textbook: Digital Design and Computer Architecture
Courses	Computer Architecture, Embedded Systems, SoC, Verification
Partners	Xilinx, Digilent and E-Elements
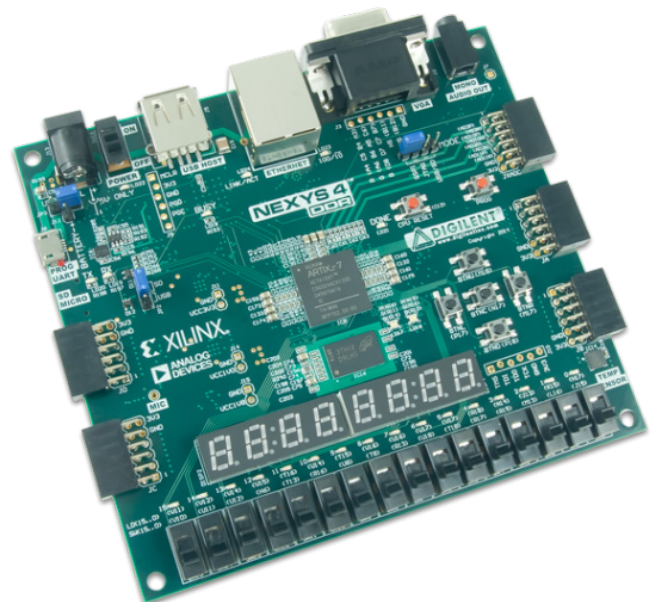
Xilinx Nexys 4 DDR
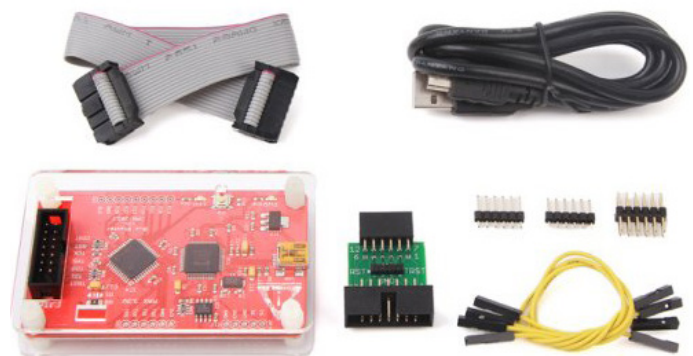
SEEED Studio MIPS Bus Blaster Probe Package

IUP online

The IUP is part of the Imagination Community website. Here you can find information about the IUP, our partners and upcoming events, view online tutorials, download teaching materials and more, and find forums and other resources.

www.imgtec.com/university

Joining the IUP

Join the IUP to access materials and be kept up to date with the latest news. To join:

1. Register online at **http://community.imgtec.com/ university/university-registration**.

2. After you receive the verification email and activate your account, return to the registration form above, click Log In, and complete the additional information for your University Programme profile.

3. Visit the IUP 'Resources' page: **http://community.imgtec.com/university/resources/** and request the package(s) you want.

The IUP homepage at www.imgtec.com/university

Talk to us! Get support!

The Imagination Forums are a great way to contact us and get support:

http://community.imgtec.com/forums/

The IUP has its own **University** forum, ideal for any questions about the IUP, curriculum, visits or training.

There are dedicated technology forums for all technical questions:

• **MIPS Insider** – includes specific MIPSfpga thread

• **PowerVR Insider**

• **FlowCloud Insider**

The University Forum at community.imgtec.com/forums/cat/university

Our Partners

The IUP is grateful to a select group of key partners who that ensure we provide the best possible hardware and software tools. Our key partners are:

Providers of PIC32 ChipKit and Xilinx FPGA platforms

Manufacturers of MIPS PIC32MX and PIC32MZ MCUs

Manufacturers and our Training Partners for MIPSfpga

Cubietech's CubieBoard4 platform incorporates Allwinner's A80 with leading-edge PowerVR Series6 GPUs
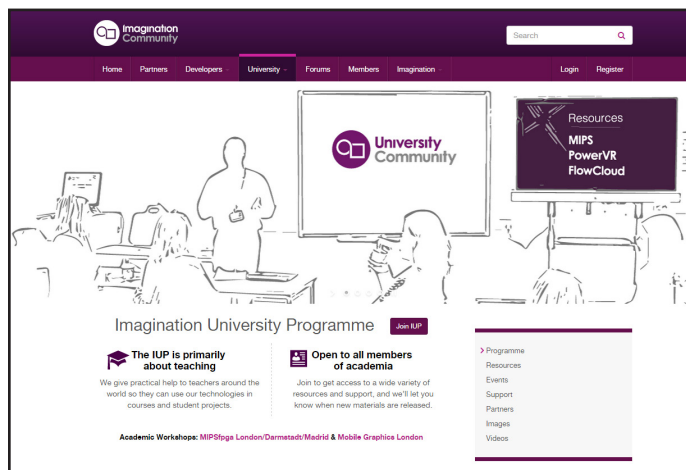

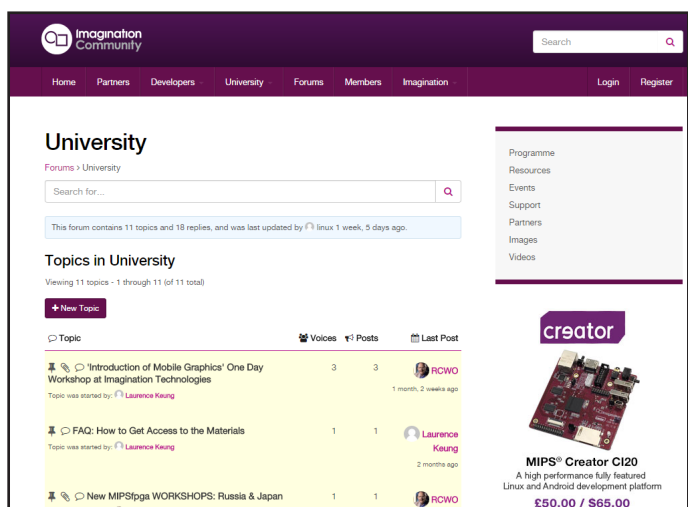TI's BeagleBoard and BeagleBone Black use PowerVR GPUs

Provide PIC32 Lab/Development Boards and Compilers

Partner and IUP representative in China and Taiwan