



# arm Research Summit

Arm Education

# Addressing Global Challenges through Education

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# Arm Education: Vision and Mission

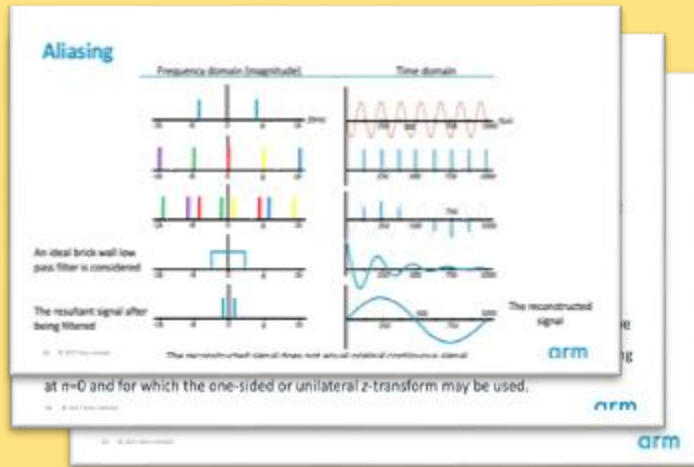
## Vision

To play a leading role in plugging the education and skills gap in computing for the benefit the scholarship and society

## Mission

To help academics and researchers access state-of-the-art technologies, tools and know-how from the Arm ecosystem so that they can educate, train and innovate effectively in the modern economy

# AUP Education Kit ( free via donation)



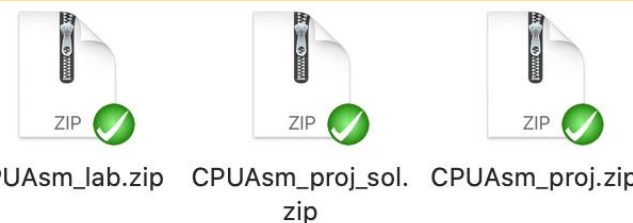
Slides, quizzes, exam questions



Lab manuals



Software tools (Arm Development Studio, Keil, etc.)

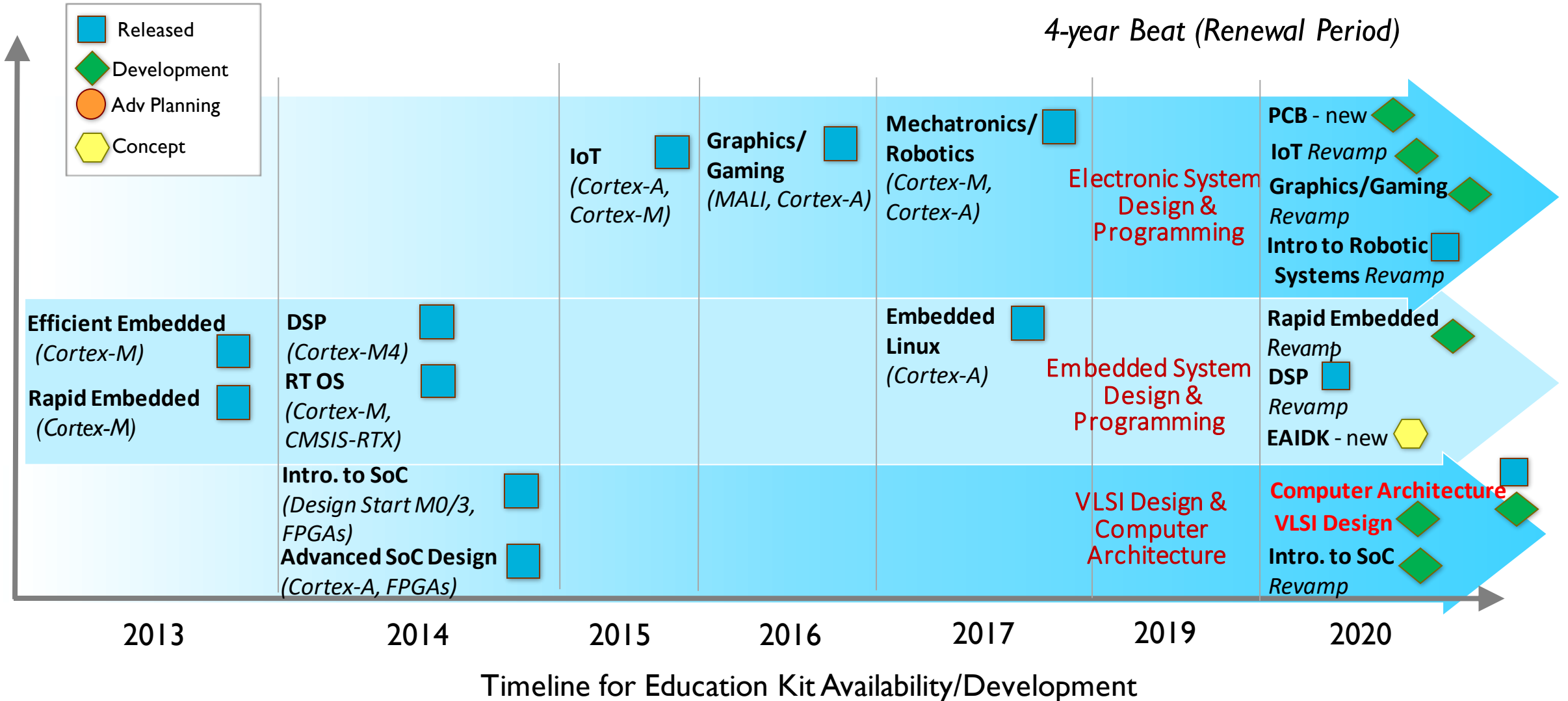


Code solutions



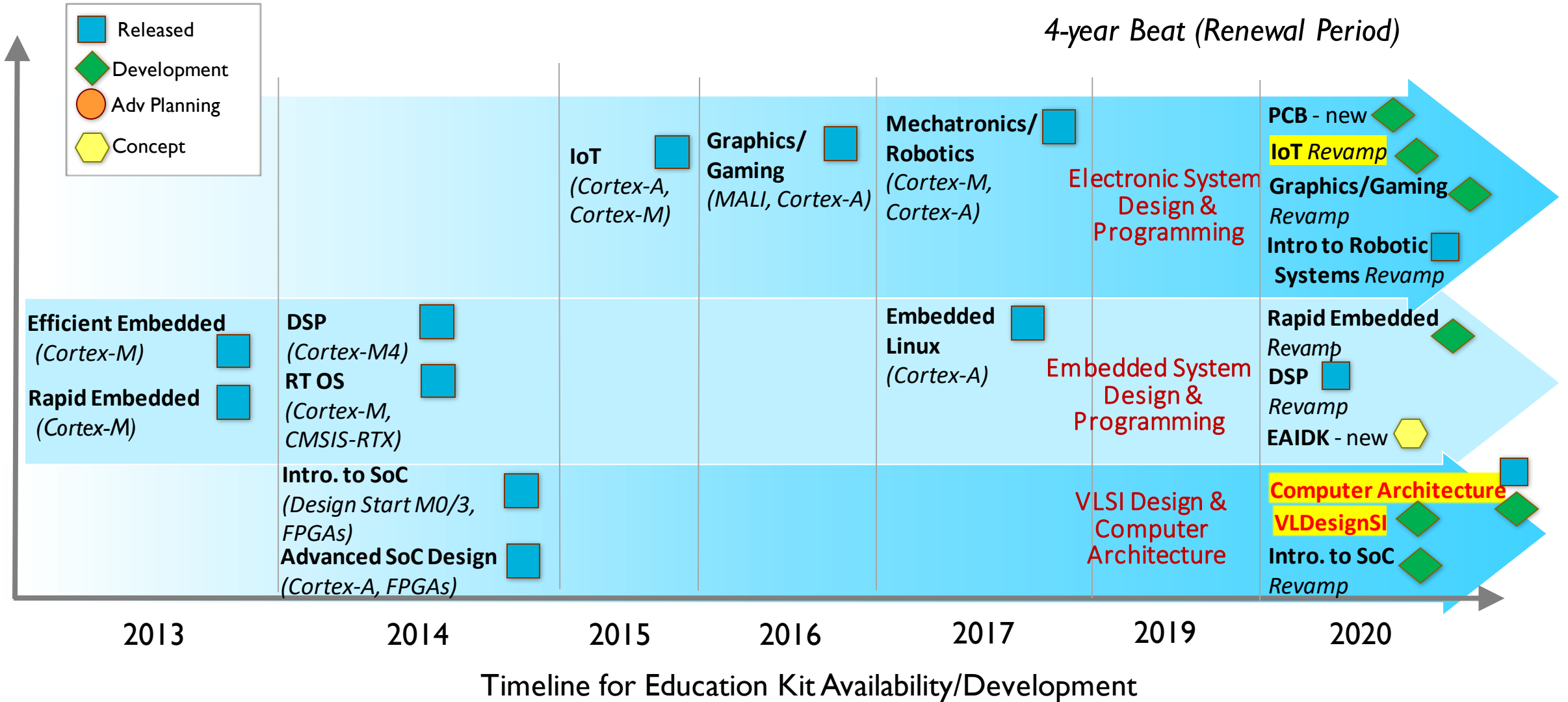
# Education Kits Roadmap

arm University Program



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arm University Program



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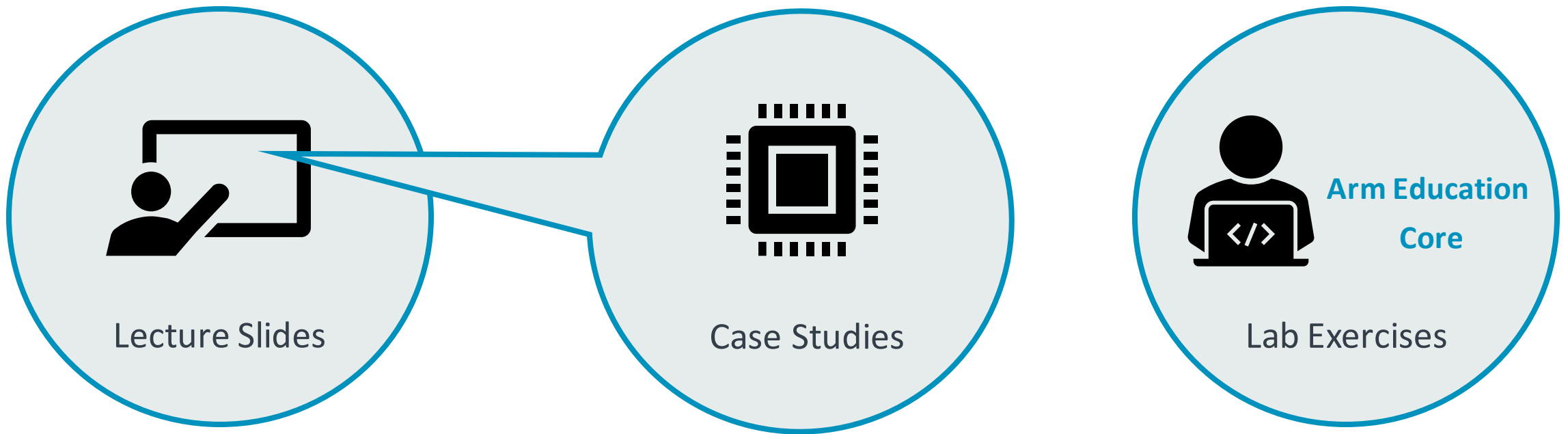
# Computer Architecture

Education Kit



# Computer Architecture Education Kit

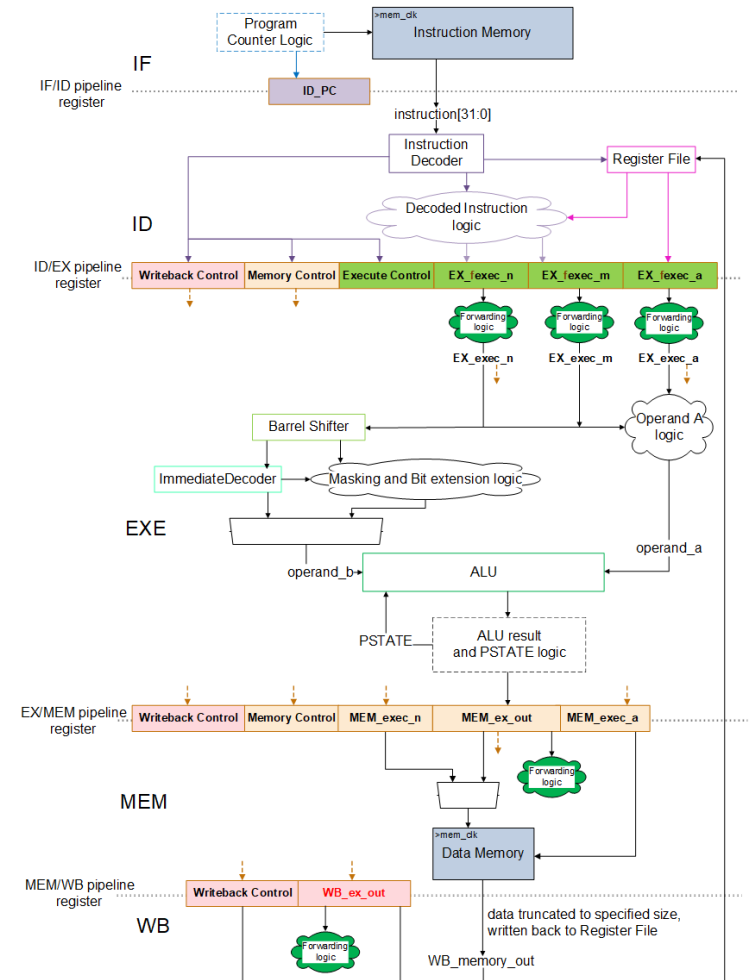
Teaching material for computer architecture fundamentals and explains how these concepts are applied and implemented in modern processors



# Computer Architecture Education Kit

## Arm Education Core

- 5-stage simple baseline education core
- **For educational purposes only**
  - Learners can modify core RTL
  - End User License Agreement (EULA)
- Supplied with Lab Exercises
  - Documentation, Assembly test files, testbench file & Makefiles
  - Tools: Icarus Verilog Simulator, GTKWave, and GCC Compiler
- Specification:
  - Verilog 2005
  - Supports a subset of Armv8-A Instruction Set Architecture
  - 32-bit instructions
  - 31 64-bit General Purpose Registers (GPRs)





# Computer Architecture Education Kit

## Syllabus

### Lectures

- Intro & Fundamentals of Computer Design
- Pipelining
- Branches and Limits to Pipelining
- Exploiting Instruction-Level Parallelism
- Memory
- Caches
- Multicore
- Multithreading
- Vector SIMD, GPU
- System on Chip (SoC) Case Study

### Labs

- Getting Started & Arm Education Core documentation
- Running Assembly on Arm Education Core
- Armv8-A Assembly encoding
- Instruction Fetch and Decode
- Execution, Memory Access, and WriteBack
- A Simple Pipeline
- Forwarding Paths
- Stalls, Control Hazards, and PPA Estimation

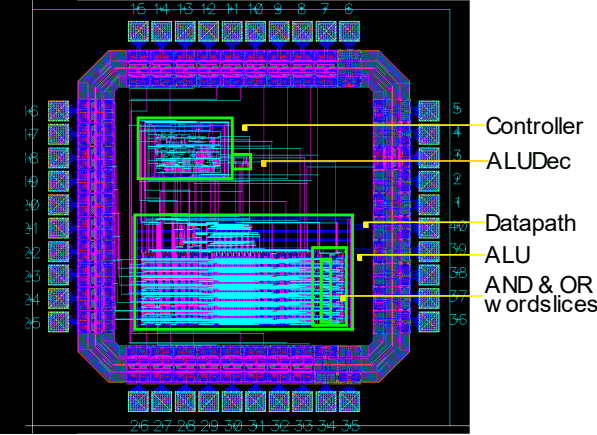
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Research Summit

# VLSI Fundamentals: A Practical Approach

Education Kit

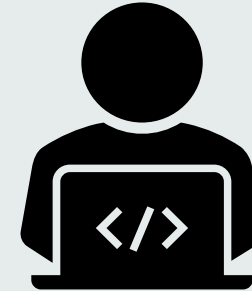
# VLSI Fundamentals: A Practical Approach Education Kit

Teach the fundamentals of VLSI design, including how the theories and concepts can be applied in the design of simple logic circuits and in the physical implementation of a simplified microprocessor



Lecture Slides

- Theory

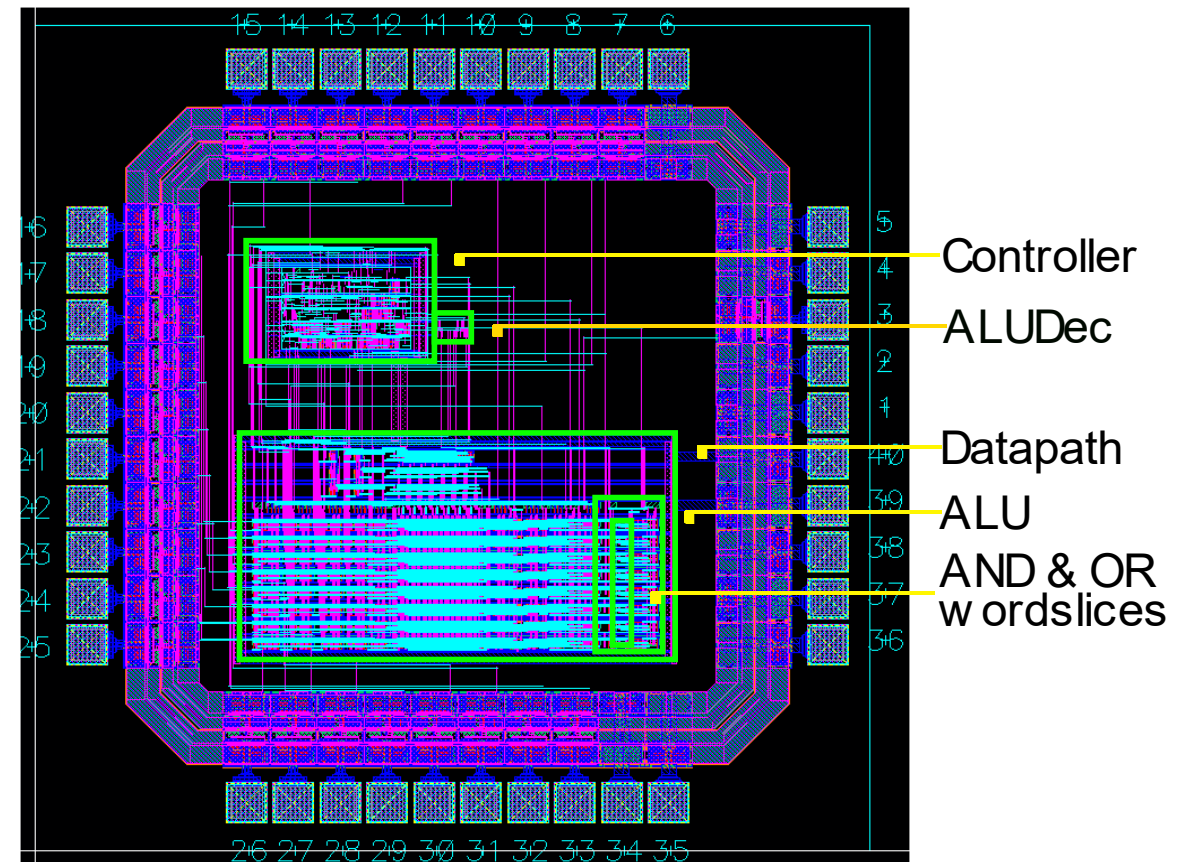


Lab Exercises

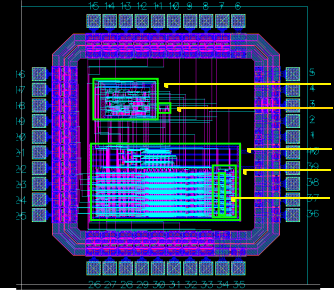
- Standard tools

# VLSI Fundamentals: A Practical Approach Education Kit

- Supplied with Lab Exercises
  - Lab guide
  - Libraries: Labs can be run using NCSU library which is free
  - Labs: Complete schematic, layout and simulate a simplified Processor based on a subset of Arm instruction set.
- Tools:
  - Cadence
    - Virtuoso: schematic capture, layout editing, DRC and LVS checks
    - Encounter SOC for PnR
    - NC-Verilog for HDL simulation
  - Synopsys
    - Design Compiler for RTL synthesis



# VLSI Fundamentals: A Practical Approach Education Kit



## Lectures

1. Introduction to VLSI	2. Circuits and Layout
3. Processor Example	4. CMOS Transistor Theory
5. Nonideal Transistor Theory	6. DC & Transient Response
7. Logical Effort	8. Power
9. Scaling	10. Simulation
11. Combinational Circuit Design	12. Sequential Circuit Design
13. Wires	14. Adders
15. Datapath Functional Units	16. SRAM
17. Clocking	18. Variation & Reliability
19. Test	20. Packaging, I/O & Power Distribution

## Labs

- Getting Started & brief description of simplified processor
- Draw transistor-level cell schematics, symbols and layout using Cadence Virtuoso
- Draw schematic and layout for a wordslice in Cadence Virtuoso
- Assemble a datapath including the wordslice
- Synthesize a logic block with Synopsys Design Compiler
- Use of SOC Encounter for P&R



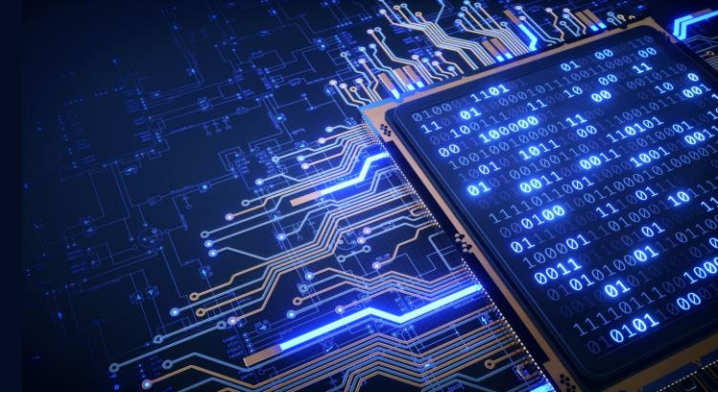
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# Internet of Things

Education Kit

# Internet of Things – Education Kit

An array of educational materials to cover vital topics involved in the development of end to end IoT systems



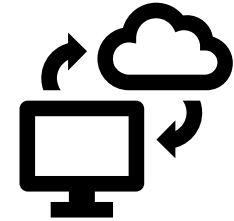
Topics covered:



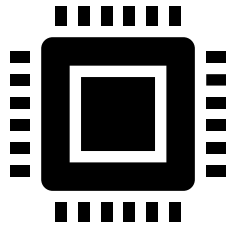
Internet of  
Things



Connectivity



Cloud  
Computing



Architectures  
and Platforms

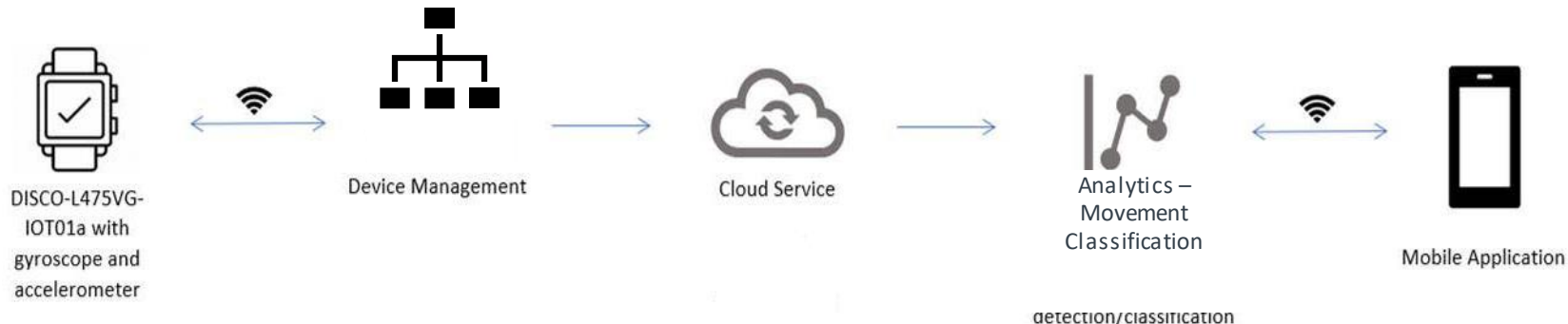


Security

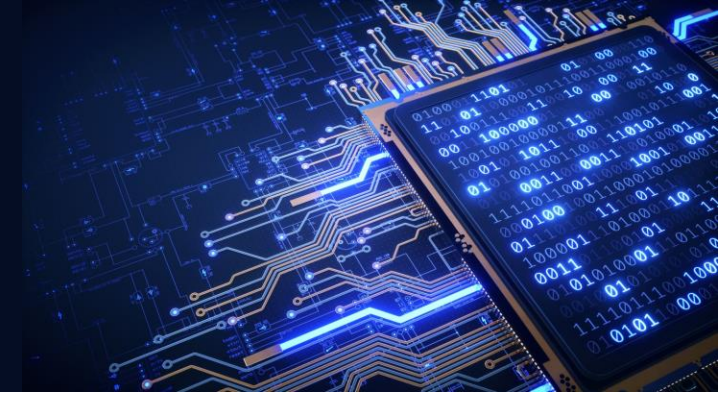
# Internet of Things – Activity Categorising App

A practical project that builds upon the knowledge gained from the lecture and lab material

- The education kit includes a project in which the goal is to develop an end to end IoT app which classifies a wearers movements into stationary, walking or running
- Microcontroller sends readings to a device management platform
- Platform passes data onto a cloud service where a simple classification model will analyse the data
- Information sent to mobile application for visualization



# Internet of Things – Syllabus



## Lectures

- Intro. to the Internet of Things
- IoT System Architecture and Standards
- Intro. to Embedded Systems
- Hardware Platforms for IoT
- The Arm Cortex-M4 Processor Architecture
- Interrupts and Low Power Features
- Intro. to the Mbed Platform
- IoT Connectivity, Pt1 and Pt2
- The Cloud
- IoT Security
- Current & Future IoT Trends

## Labs

- Getting Started with Mbed Tools
- IO and GPIO
- Basic Android App
- BLE Program
- Android App – Heart Rate Monitor
- IoT sensors
- Android App – Weather Station
- WiFi Lab
- Activity Classification App

# Thank you!

## Education

- Arm University Program Education Kits (request donation)
    - <https://www.arm.com/resources/education/education-kits>
  - Arm Education Media Online courses
    - <https://www.arm.com/resources/education/online-courses>
  - Books
    - <https://www.arm.com/resources/education/books>
  - Arm School Program
    - <https://www.arm.com/resources/education/schools>
- [university@arm.com](mailto:university@arm.com), [edumedia@arm.com](mailto:edumedia@arm.com),  
[school@arm.com](mailto:school@arm.com)

## Research

- Arm Flexible Access for Research (details coming soon...)
  - <https://www.arm.com/company/news/2019/09/arm-flexible-access-for-research-to-accelerate-innovation-for-academia-and-research>
- Research Enablement
  - <https://developer.arm.com/solutions/research/research-enablement>
- Research Collaboration
  - <https://www.arm.com/resources/research/rce>
- DesignStart Academic
  - <https://developer.arm.com/ip-products/designstart/university-and-research>



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Thank You

Danke

Merci

谢谢

ありがとう

Gracias

Kiitos

감사합니다

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