ARM ARCHITECTURE

Introduction

- An Arm processor is one of a family of central processing units (CPUs) based on the reduced instruction set computer (RISC) architecture for computer processors.

- Arm Limited, the company behind the Arm processor, designs the core CPU components and licenses the intellectual property to partner organizations, which then build Arm-based chips according to their own requirements.

- Arm Limited does not manufacture or sell any chips directly.

- Its counterpart Intel is based on the complex instruction set computing (CISC) architecture.

- Arm processors are used extensively in consumer electronic devices such as smartphones, tablets, wearables and other mobile devices. They're also used in a wide range of sensors and IoT devices.

ARM Evolution

- ARM is a family of RISC-based microprocessors and microcontrollers designed by ARM Holdings, Cambridge, England.
- The company doesn't make processors but instead designs microprocessor and multicore architectures and licenses them to manufacturers.
- ARM chips are high-speed processors that are known for their small die size and low power requirements.
- They are widely used in smartphones and other handheld devices, including game systems, as well as a large variety of consumer products.
- ARM chips are the processors in Apple's popular iPod and iPhone devices, and are used in virtually all Android smartphones as well.

Instruction Set Architecture

- All instructions are 32 bits long and follow a regular format.

- Augmenting the basic ARM ISA is the Thumb instruction set, which is a re-encoded subset of the ARM instruction set. Thumb is designed to increase the performance of ARM implementations that use a 16-bit or narrower memory data bus, and to allow better code density than provided by the ARM instruction set.

ARM Products…

- ARM Holdings licenses a number of specialized microprocessors and related technologies, but the bulk of their product line is the Cortex family of microprocessor architectures.

- There are three Cortex architectures, conveniently labeled with the initials A, R, and M.

- **Cortex-A/Cortex-A50:** The Cortex-A and Cortex-A50 are application processors, intended for mobile devices such as smartphones and eBook readers, as well as consumer devices such as digital TV and home gateways (e.g., DSL and cable Internet modems).

- These processors run at higher clock frequency (over 1 GHz), and support a memory management unit (MMU), which is required for full feature OSs such as Linux, Android, MS Windows, and mobile OSs. An MMU is a hardware module that supports virtual memory and paging by translating virtual addresses into physical addresses;

ARM Products

- *Cortex-R:* The Cortex-R is designed to support real-time applications, in which the timing of events needs to be controlled with rapid response to events. They can run at a fairly high clock frequency and have very low response latency. The Cortex-R includes enhancements both to the instruction set and to the processor organization to support deeply embedded real-time devices.

- *Cortex-M:* Cortex-M series processors have been developed primarily for the microcontroller domain where the need for fast, highly deterministic interrupt management is coupled with the desire for extremely low gate count and lowest possible power consumption. There are currently four versions of the Cortex-M series: **M0, M0+, M3, M4.**