Experiment No: 01 Understanding ARM Architecture

An Advanced RISC Machine (ARM) Processor is considered to be the family of Central Processing Units that are used in music players, smartphones, wearables, tablets and other consumer electronic devices. Advanced RISC Machines create an ARM processor architecture hence the name is ARM. This needs very few instructions sets and transistors. It is very small in size. This is the reason that it is a perfect fit for small-size devices.

It has less power consumption along with reduced complexity in its circuits. They can be applied to various designs such as 32-bit devices and embedded systems. They can even be upgraded according to user needs.

COMPONENTS OF ARM ARCHITECTURE:

CPU Core:

- Contains the Control Unit (CU) and Arithmetic Logic Unit (ALU), which are responsible for executing instructions and performing calculations.

Registers:

- Temporary storage for quick access to data and instructions.
- General Purpose Registers (R0-R15): Used for various data operations and holding intermediate results.
- Program Counter (PC): Holds the address of the next instruction to execute.
- Stack Pointer (SP): Points to the top of the stack in memory.
- Link Register (LR): Stores the return address for function calls.
- Status Registers (SR): Status registers hold information about the processor's current state, such as whether interrupts are enabled or disabled, and which mode the processor is in (e.g., user mode or supervisor mode).

Memory Management Unit (MMU):

- Manages memory access, translating virtual addresses to physical addresses.

Bus Interface:

- Connects the processor core to memory and peripherals.
- Uses the AMBA (Advanced Microcontroller Bus Architecture).

Pipeline:

- The pipeline allows the processor to work on multiple instructions at the same time by breaking them into stages like Fetch, Decode, and Execute.

Cache (L1, L2):

- Speeds up data retrieval by storing frequently accessed data closer to the processor.

Bus System:

- Handles data, address, and control signals between different components of the system.

Peripheral Interface:

- Connects the processor to external devices like input/output peripherals.

Representation of ARM Architecture:

```
+----------------------------------------------------+
|                    CPU Core                        |
|  +------------------+  +----------------------+     |
|  | Control Unit     |  |  Arithmetic Logic    |  |
|  |     (CU)         |  |    Unit (ALU)|       |  |
|  +------------------+  +----------------------+     |
|  +------------------------------------------------+  |
|  |                  Registers                     |  |
|  +------------------------------------------------+  |
+----------------------------------------------------+


+----------------------------+    +--------------------+
| Memory Management Unit (MMU) | <-> | Cache (L1, L2)  |
+----------------------------+    +--------------------+

              |                          |
    +-----------------+        +--------------------+
    |   Bus System    | <------>| Peripheral Interface|
    | (Data, Address, |        +--------------------+
    |   Control Bus)  |
    +-----------------+
```