**CRITICAL RESEARCH ON:**

**ARM ARCHITECTURE AS A PROCESSOR**

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**RISC**

**CISC**

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**ARM ARCHITECTUR**E

The ARM processor architecture is a family of RISC (Reduced Instruction Set Computing) processors developed by ARM Holdings. It is characterized by its energy efficiency, performance, and scalability, making it a popular choice in a wide range of devices and applications.

ARM, originally Acorn RISC Machine, later Advanced RISC Machine, is a family of Reduced Instruction Set Computing (RISC) architectures for computer processors, configured for various environments. British company ARM Holdings develops the architecture and licenses it to other companies, who design their own products that implement one of those architectures—including systems-on-chips (SoC) that incorporate memory, interfaces, radios, etc. It also designs cores that implement this instruction set and licenses these designs to a number of companies that incorporate those core designs into their own products. If you’ve paid any attention to smartphones and tablets you’ve likely heard of the term “ARM” used to refer to the hardware inside. It’s thrown around left and right, often as a point of differentiation from laptops and desktops, which use Intel x86. The Key To ARM Is RISC. RISC is, in its broadest form, a design philosophy for processors. It stems from a belief that a processor with a relatively simple instruction set will be more efficient than one which is more complex. The term originally came into use back in the 1980s with a research project called Berkeley RISC that investigated the possibilities of this approach to design and then created processors based on it. All ARM processors are considered RISC designs, but this doesn’t mean much because RISC itself is simply an approach to design rather than a technological standard or processor architecture. Still, a basic understanding of RISC properly frames ARM. Arm architecture specifies a set of rules that dictate how the hardware works when a particular instruction is executed. It is a contract between the hardware and the software, defining how they interact with one another

**AMD ARCHITECTURE**

Advanced Micro Devices (AMD) is a semiconductor company, known for designing and developing computer processors and graphics technologies. AMD primarily manufactures CPUs using the x86 instruction set. Note that the original 32-bit x86 was invented by Intel, but extended to 64-bit by AMD, that's why you see Intel x86\_64 being called "amd64" even if it's an Intel CPU and Intel architecture.

**RISC**

RISC, or Reduced Instruction Set Computer. is a type of microprocessor architecture that utilizes a small, highly-optimized set of instructions, rather than a more specialized set of instructions often found in other types of architectures.

• History

The first RISC projects came from IBM, Stanford, and UC-Berkeley in the late 70s and early 80s. The IBM 801, Stanford MIPS, and Berkeley RISC 1 and 2 were all designed with a similar philosophy which has become known as RISC. Certain design features have been characteristic of most RISC processors: – one cycle execution time: RISC processors have a CPI (clock per instruction) of one cycle. This is due to the optimization of each instruction on the CPU and a technique called PIPELINING – pipelining: a techique that allows for simultaneous execution of parts, or stages, of instructions to more efficiently process instructions; – large number of registers: the RISC design philosophy generally incorporates a larger number of registers to prevent in large amounts of interactions with memory.

**Major characteristics of a RISC architecture**

»1) Relatively few instructions

»2) Relatively few addressing modes

»3) Memory access limited to load and store instruction

»4) All operations done within the registers of the CPU

»5) Fixed-length, easily decoded instruction format

»6) Single-cycle instruction execution

»7) Hardwired rather than microprogrammed control

**Other characteristics of a RISC architecture**

– 1) A relatively large number of registers in the processor unit

– 2) Use of overlapped register windows to speed-up procedure call and return

– 3) Efficient instruction pipeline

– 4) Compiler support for efficient translation of high-level language programs into machine language programs

**CISC**

CISC means Complex Instruction Set Computer chips that are easy to program and which make efficient use of memory. Since the earliest machines were programmed in assembly language and memory was slow and expensive, the CISC philosophy was commonly implemented in large computers as the PDP-11 and the DECsystem 10 and 20 machines.

• Most common microprocessor designs such as the Intel 80x86 and Motorola 68K series followed the CISC philosophy.

• CISC was developed to make compiler development simpler. It shifts most of the burden of generating machine instructions to the processor. For example, instead of having to make a compiler write long machine instructions to calculate a square-root, a CISC processor would have a built-in ability to do this.

**CISC Attributes**

CISC instructions sets have some common characteristics:

• A 2-operand format, where instructions have a source and a destination. Register to register, register to memory, and memory to register commands.

• Variable length instructions where the length often varies according to the addressing mode

• Instructions which require multiple clock cycles to execute.

• Complex instruction-decoding logic, driven by the need for a single instruction to support multiple addressing modes.

• A small number of general purpose registers. This is the direct result of having instructions which can operate directly on memory and the limited amount of chip space not dedicated to instruction decoding, execution, and microcode storage.

• Several special purpose registers. Many CISC designs set special registers for the stack pointer, interrupt handling, and so on.

• A 'Condition code" register which is set as a side-effect of most instructions. This register reflects whether the result of the last operation is less than, equal to, or greater than zero and records if certain error conditions occur

**Major characteristics of a CISC architecture**

»1) A large number of instructions - typically from 100 to 250 instruction

»2) Some instructions that perform specialized tasks and are used infrequently

»3) A large variety of addressing modes - typically from 5 to 20 different modes

»4) Variable-length instruction formats

»5) Instructions that manipulate operands in memory (RISC in register)

**DIFFERENCE BETWEEN RISC AND CISC**

**CISC RISC**

1. Emphasis on hardware Emphasis on software
2. Small code size large code size
3. High cycle per second low cycle per second
4. Transistor used for storing spends more transistor

Complex instructions on memory register