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ARM vs x86 CPU Architecture

ARM and x86 are computer architectures, which is a level above the computer organization. Computer organization refers the hardware of the computer itself, and architecture is the level programmers interact with. CPUs with the same architecture can have widely different organizations. However, the design philosophy of an architecture has an impact on how the organization is designed. To understand the difference between the ARM and x86 architectures, and furthermore the processors that implement them, the difference of RISC and CISC architectures is key[[1]](#footnote-1).

ARM follows a RISC (Reduced Instruction Set Computer) architecture[[2]](#footnote-2). The basic idea of RISC is to reduce the complexity of each instruction in the instruction set. This allows each instruction to be executed in only one clock cycle. This is accomplished by only allowing ALU operations to be performed on registers. To perform operations on memory, the use of LOAD and STORE instructions is necessary. To add two numbers in memory addresses A and B, first LOAD must be used twice to load the two values into registers, then ADD can be used, and finally STORE is used on the result to wherever the value needs to be stored. Although each of the instructions took only one clock cycle, the overall operation took four instructions. The amount of instructions in a single program is increased, but the number of clock cycles per instruction is greatly reduced. It is up to the programmer to optimize the number of instructions used to decrease the execution time of the program. On top of less cycles per instruction, the organization can be made much simpler, which allows for a CPU that is more power efficient. The physical silicon area on the chip itself is smaller, which is why it is power efficient and produces less heat[[3]](#footnote-3).

The x86 architecture

1. <https://www.quora.com/Whats-the-difference-between-ARM-and-x86-processors> [↑](#footnote-ref-1)
2. <https://cs.stanford.edu/people/eroberts/courses/soco/projects/risc/risccisc/> [↑](#footnote-ref-2)
3. <https://stackoverflow.com/questions/14794460/how-does-the-arm-architecture-differ-from-x86> [↑](#footnote-ref-3)