Bus

- Collection of parallel wires for transmitting address, data, and control values
- Multiple wires allow multiple bits to be transmitted at once in parallel

Central Processing Unit (CPU)

- Executes program instructions
- Control unit
    - Fetches instructions from main memory (RAM) and determines their types
- Registers
    - Special high-speed memory located on the CPU
    - General purpose registers
        - Generally 64 bits on a 64-bit machine
        - They can store
            - Variables that can be used in arithmetic
            - Results of computations (could be temporary)

- Special purpose registers

    - Program counter (PC) - points to the next instruction to be fetched for execution

    - Instruction register (IR) - holds the instruction currently being executed

    - And more!

  - Word
    - Unit of data moved between memory and registers
    - Typically 64 bits on a 64-bit machine

- Arithmetic Logic Unit (ALU)
    - Performs operations (addition, logical operations, etc) needed to carry out instructions
    - Result is stored in a register
    - A CPU typically has multiple ALUs for different functions

- Data path
    - Path along which data flows from the registers to the ALU and back

- Fetch - decode - execute cycle
    1. Fetch the next instruction from main memory into the instruction register
    2. Change the program counter to point to the next instruction
    3. Determine the type of instruction fetched
    4. If the instruction uses a word in memory, determine where it is
    5. Fetch the word, if necessary, from memory
    6. Execute the instruction
    7. Go back to the fetch step

CPU architecture

- Different CPUs can support the same instructions
- x86-64 is currently the most popular desktop and laptop architecture
- Programs are compiled for a specific architecture, which could be supported by many CPUs
- Provides a layer of abstraction so we don't have to compile programs for specific CPUs, just specific architectures

RISC vs CISC (reduced vs complex instruction set computers)