

Document: Arithmetic Logic Unit

We have enough of a basic understanding of logic gates, flip flops, and components that we can start to discuss the architecture of microprocessors.

The core of basic computation in a processor is called the **arithmetic logic unit (ALU)**. Study the diagram to the right that represents a simple arithmetic logic unit.

The data bus width depends on the processor. Early processors commonly performed operations on 8-bit or 16-bit wide data. Modern processors are commonly operate on 64-bit data.

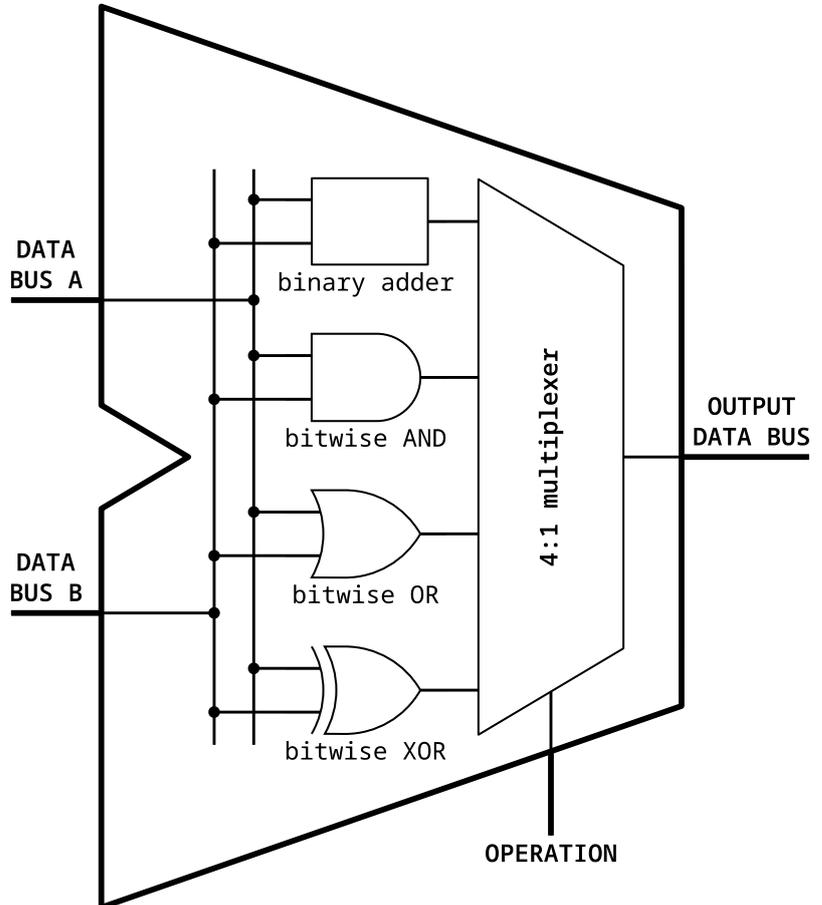
On the left hand side of the ALU the two numbers are input.

In the middle of the ALU various operations are computed in parallel (at the same time).

The desired operation is selected for output by the multiplexer.

The right hand side of the ALU shows the data bus where the result of the desired computation is output.

Although the four operation shown are common, on an actual ALU, there will usually be more than those shown. However, for **reduced instruction set computing (RISC)** processors, the number of operations is intentionally kept low.



A Simple Arithmetic Logic Unit (ALU)

This next figure, to the right, is a circuit diagram showing how storage registers within a processor can be connected to an ALU.

In the example, there are four data registers that can store four different numbers. The letter n in the diagram represents one less than the number of bits of each number. These data registers will be implemented using flip flops.

The control lines are not shown, but would be connected to a control unit.

To perform a computation:

- **selA** selects which register is to be driven on data bus A
- **selB** selects which register is to be driven on data bus B
- **op** selects the desired ALU operation
- one of the register **EN** signals is active to save the computation result to the desired register.

