

REAL WORLD CONNECTIONS

MASKING BITS:

In control systems, the state of processes can be expressed by a 1 or 0, the process is happening or not. Multiple states can be sent in a single byte to be interpreted by a control processor. Say you code sensor input as good (1) or bad (0), then you can send the status of 8 sensors in one byte. To check each sensor you can AND the value with a mask value. When the mask bit is a 1 the sensor value for that bit position will be the result.

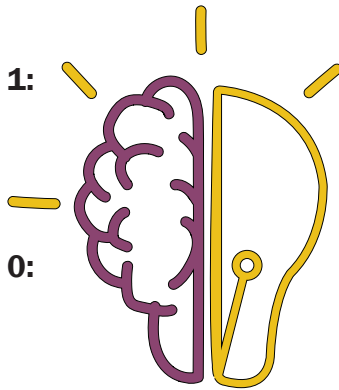
Here we check to see if the bit in the 16's place is a 1. We AND the input with a mask that has a 1 in the 16's place. The result will be 16 or 0 depending on the value of the 16's bit.

Bit in the 16's place is a 1:

Input 0010110 = 22
Mask 0010000 = 16
AND 0010000 = 16

Bit in the 16's place is a 0:

Input 0000110 = 6
Mask 0010000 = 16
AND 0000000 = 0



- Notice that only the bit selected by the mask appears in the output
- In decimal you might see it this way:
 $22 \& 16 > 0$
- When the value is greater than zero, that bit was a 1 in the input

BACKGROUND

BINARY OPERATOR: Has two inputs and one output, like addition $4 + 2 = 6$, the inputs are 4 and 2 and the output is 6

BITWISE OPERATOR: Input is a single bit or a group of bits, the output is a single bit or a group of bits, generally the output is the same number of bits as the input

EXCLUSIVE OR (XOR): Outputs a 1 when exactly one of the input values is a 1

TRUTH TABLE: Lists all possible inputs and the resulting outputs

BIT SHIFT: Move the bits over one binary position which is the same as multiplying or dividing the number by 2

CONCEPT Bitwise operators act on single bits within a group of bits like a byte, an integer, or memory locations.

SUBNET MASK:

A common mask that you might see on a computer is called the Subnet Mask. The computer will AND together the IP address and the Subnet Mask to get the network address associated with that IP address. This type of masking is used to decide how to get data packets from one network to another or from your computer to a server.