
TIP

- NOT: The NOT operation doesn't compare two values. Instead, it simply changes the value of a single binary value. If the original value is 1, NOT returns 0. If the original value is 0, NOT returns 1.

  Logical operations are applied to binary numbers that have more than one binary digit by applying the operation one bit at a time. The easiest way to do this manually is to

  1. *Line one of the two binary numbers on top of the other.*
  2. *Write the result of the operation beneath each binary digit.*

  The following example shows how you calculate `10010100 AND 11001101`:

  ```
  10010100
  AND 11001101
  10000100
  ```

  As you can see, the result is `10000100`.

Introducing IP Addresses

An *IP address* is a number that uniquely identifies every host on an IP network. IP addresses operate at the Network layer of the TCP/IP protocol stack, so they're independent of lower-level addresses, such as MAC addresses. (MAC stands for *Media Access Control.*)

IP addresses are 32-bit binary numbers, which means that theoretically, a maximum of something in the neighborhood of 4 billion unique host addresses can exist throughout the Internet. You'd think that'd be enough, but TCP/IP places certain restrictions on how IP addresses are allocated. These restrictions severely limit the total number of usable IP addresses, and about half of the total available IP addresses have already been assigned. However, new techniques for working with IP addresses have helped to alleviate this problem, and a new standard for 128-bit IP addresses (known as *IPv6*) is on the verge of winning acceptance.

Networks and hosts

The primary purpose of Internet Protocol (IP) is to enable communications between networks. As a result, a 32-bit IP address consists of two parts:

- **The network ID (or network address):** Identifies the network on which a host computer can be found