

## Overview

Programming isn't just limited to writing programs that run on the command line. Code can also be written that runs on the Internet. Many different systems and protocols are in place so that the internet can work, and all of the Internet's components need to work together in order to allow people to use the Internet effectively. Understanding what the systems of the Internet are and how they work can enhance your understanding of the Internet overall.

### Key Terms

- IP address
- access point
- DHCP
- DNS
- URL

## IP Addresses

Devices on the Internet are assigned an **IP address** (which stands for Internet Protocol), which helps to identify them, and allows them to be found by other devices on the Internet. IP addresses take the form **#. #. #. #**, where each **#** is a number in the range of 0 to 255. This allows for about 4 billion possible IP addresses. However, this number is over time becoming inadequate for the total number of internet-connected devices that exist. Some workarounds, such as assigning some devices private IP addresses that together share a single public IP address, do exist.

In the long term, however, this 32-bit IP address scheme, called IPv4, is being replaced by a 128-bit address scheme, called IPv6. While IPv4 addresses take the form of 4 numbers, each representing an 8-bit value, IPv6 addresses have 8 numbers, each representing a 16-bit value, in the form **#: #: #: #: #: #: #: #**.

When information is being sent across the Internet, IP addresses are used so that the Internet knows where the information is being sent from, and where information is being sent to. In this sense, it's very much like sending physical mail: information has a return address, and a destination.

## Connecting to the Internet

Several steps are involved for a device to connect to the Internet. For a wireless device (like a laptop or cell phone) to connect to the internet, it must first connect wirelessly to an **access point** (or AP). For many consumers, this access point takes the form of a home router. The access point is connected to a switch, which is connected to a router, which can then connect to the rest of the internet.

Two other servers are particularly important for connecting to the internet: **DHCP** and **DNS**. DHCP, which stands for Dynamic Host Configuration Protocol, is responsible for assigning computers IP addresses. At one point in time in the Internet's history, a network administrator was responsible for manually assigning each computer an IP address; but now, DHCP automates this process.

It would be difficult if everyone using the Internet had to remember every IP address for every website they wanted to visit. Instead, most people type a text based address (e.g. google.com) into their web browsers to access a page. This is called a **URL**, or Uniform Resource Locator.

DNS, which stands for the Domain Name System, refers to servers that take URLs and converts them to and from IP addresses. When a user types in a URL into their web browser, DNS servers must first look up the URL, and determine which IP address that name refers to.

## Other Protocols

Several other protocols are involved in ensuring that communication on the Internet works effectively. TCP, the Transmission Control Protocol, is responsible for guaranteeing the delivery of all data packets that are submitted via the Internet, and also ensures that packets of information sent via the internet know what service they are meant for (web browsing, email, etc.)

HTTP, the Hypertext Transfer Protocol, is another protocol which helps web browsers communicate with servers.