

Overview

Programming isn't just limited to writing programs that run on the command line. Code can also be written for web browsers and shared on the Internet. To be able to share information anywhere, a standard set of rules for sending, receiving, and interpreting the information must be set. Because the Internet connects people and computers from all over the world, there are many different systems and protocols in place that work together in order to allow people to use the Internet effectively. Understanding what these are and how they work will enhance your understanding of the Internet and computer science overall.

Key Terms

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

IP Addresses

Devices on the Internet are assigned an **IP address** (which stands for Internet Protocol) to help identify them and allow them to be found by other devices also on the Internet. IP addresses take the form of **#. #. #. #**, where each **#** is a number in the range of 0 to 255. This allows for about 4 billion possible IP addresses. Although this may sound like a lot, there are far more devices on the Internet than that. This has led to some workarounds, including assigning some devices private IP addresses that together share a single public IP address.

In the long term, however, the 32-bit IP address scheme (IPv4) we mostly use today will be 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 to and from. In this sense, it's very much like sending physical mail: information has a both a mailing (to) and a return (from) address.

Connecting to the Internet

Several steps are involved in connecting a device to the Internet. For a wireless device (like a laptop or cell phone), it must first connect wirelessly to an **access point** (known as an AP). For many consumers, this access point takes the form of a home router. This access point is connected to a switch, which is connected to another 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. Early in the Internet Age, network administrators had to manually assign IP addresses to all computers, but thankfully, DHCP now automates this process.

It would be very difficult if everyone using the Internet had to remember each IP address for every website they wanted to visit. Instead, most people type a text-based address (such as “google.com”) into their web browsers to access a page. This text-based address is called a **URL**, or Uniform Resource Locator. But how do our computers know what IP addresses to take us to based on our text input?

This is where **DNS**, which stands for Domain Name System, comes in. The term DNS refers to servers that take URLs and converts them to and from IP addresses. When a user types a URL into their web browser, DNS servers look up the URL and then determine which IP address that name refers to, relating this important information back to the computer.

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. It also makes sure that these 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 server.