CS50

DNS and DHCP

Overview

Two important systems are in place for making sure that devices on the Internet can use IP addresses effectively. The Domain Name System, or **DNS**, is responsible for converting the words that are typed into an address bar in a web browser like Google Chrome or Safari into the corresponding IP address. The Dynamic Host Configuration Protocol, or **DHCP**, helps to assign each device an IP address.

Key Terms

- DNS
- DHCP
- URL
- domain

DNS

Most people browsing the web don't type in an IP address when they want to access a web page. Instead, they type a **URL**— a Uniform Resource Locator which acts as a more human-readable and memorable web address than an IP address.

However, IP still requires the computer to know which IP address it is trying to access. This is where DNS comes in. DNS is responsible for taking the **domain**, which is just an identifier like "google.com" or "facebook.com", and translating it into its respective IP address(es).

When a user types a URL into a web browser, the computer contacts a DNS server, which stores information about which domain names map to which IP addresses. There are many DNS servers, and not all of them will always be updated at the same time when there are new changes to which domain names map to which IP addresses. As a result, DNS servers must be in communication with one another about changes, although it takes time for the changes in the DNS system to propogate throughout all of the DNS servers on the internet.

DNS Hierarchy

```
                    Root
                   /    \
                com       net
               / | \
         google facebook cs50
          /  \              \
     images  maps          cdn
```

Domains in the DNS are organized in a tree-like hierarchy. There are a set of basic "top-level domains" (TLDs) which you may recognize from the ends of many websites you're familiar with (com, net, org, edu, among others). Website URLs must branch off from one of these top-level domains.

For instance, "google.com" branches off of the "com" top-level domain. Some websites branch even further— these branches are known as subdomains. "images.google.com" and "maps.google.com" are examples of subdomains.

DHCP

Computers need a mechanism of being assigned IP addresses. At one point in the Internet's history, a human network administrator was responsible for assigning IP addresses to computers. Now, the Dynamic Host Configuration Protocol, or DHCP, is able to take care of this automatically.

When computers connect to a network, they will connect to a DHCP server. The DHCP server is able to access a pool of available IP addresses, and the server is responsible for assigning each computer on the network a unique IP address.

Using DNS and DHCP, devices on the Internet are able to receive their own IP, and determine which IP address corresponds to the website that a user is trying to visit. These are crucial steps to allowing the Internet Protocol to effectively facilitate communication across the Internet.