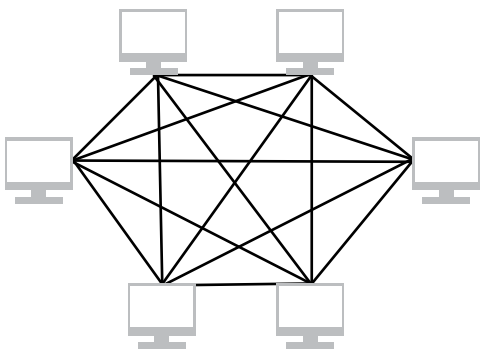# CS50

Routers

Overview

The Internet allows information to be sent from one device to another. To facilitate this process of passing data between computers, the Internet makes use of **routers**, which direct packages of data across various networks. Routers follow a very specific set of instructions in order to ensure that the data they are routing across the Internet ends up at the correct location.
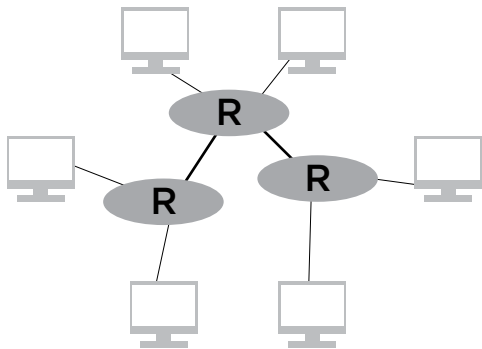
The Routing Model

Network Without Routers

Devices on the Internet need to be able to communicate with other Internet-connected devices. One way to organize such a network is as per the diagram on the left, where every computer on the network is physically connected to every other computer on the Internet.

Such a model would certainly be fast, since to get information from one computer to another, it could be sent directly to its destination. However, such a model would require an infeasible number of physical connections. Note how complicated this connection web is, even with just six computers connected to the Internet. Imagine what it would look like with millions, or even billions, of Internet-connected devices! Clearly, having every computer physically connected to every other computer is not at all reasonable.

Network With Routers

Instead, the Internet makes use of routers. Routers act as intermediaries between devices on the Internet. Every computer is connected to a router, and each router is connected to other routers. You can think of router as a post office. A package gets sent from post office to post office until it reaches the post office closest to its destination. Just as anyone can send anyone else a package, every computer on the Internet can communicate with every other computer through these routers – just not directly.

Computers can send information to one other on the Internet by passing data through one or more routers. This data is sent in packets, which travel through the Internet via routers, getting passed along from router to router until reaching their final destination: the router which is connected to the destination computer.

Routing Tables

Routers are programmed with instructions on how to figure out where to send each packet of data based on the destination's IP address. These instructions are often stored in what's known as a **routing table**. Routers can discern, based on the initial digits of an IP address, the direction in which packets need to be sent.

But routers don't need to have information about the exact overall path the data packet needs to take in order to get to its destination: the router just sends the packet one step closer to the destination and then lets the next router take care of the rest. Furthermore, there often won't be just one route that data must take in order to get from one location on the Internet to another. Routers will frequently move different packets of data across different routes, even if they are intended for the same location.