

5.3: Concepts - Networking and Communication

In order for communication to take place, networks rely on a combination of various standard rules and technologies that work together. To understanding of how networks operate, it is necessary to explore some essential concepts and terminology. By doing so, you will be able to identify the components that make up a network, how they are connected and interact, and the services networks provide. Gaining a thorough understanding of these fundamental components will lay a strong foundation for the world of networking.

This chapter contains many technical terms and acronyms due to the nature of the topic of Networking even though the author has kept out the technical details that are unsuitable for the general non-computer science audience.

Sidebar: An Internet Vocabulary Lesson

Understanding networking communication can be simple if you learn the key terms, which will enable you to converse about the Internet.

- **Packet:** The fundamental unit of data transmitted over the Internet. When a device intends to send a message to another device (for example, your PC sends a request to YouTube to open a video), it breaks the message down into smaller pieces, called packets. Each packet has the sender's address, the destination address, a sequence number, and a piece of the overall message to be sent.
- **Hub:** A simple network device connects other devices to the network and sends packets to all the devices connected to it.
- **Bridge:** A network device that connects two networks and only allows packets through that are needed.
- **Switch:** A network device that connects multiple devices and filters packets based on their destination within the connected devices.
- **Router:** A device that receives and analyzes packets and then routes them towards their destination. In some cases, a router will send a packet to another router; it will send it directly to its destination in other cases.
- **IP Address:** Every device that communicates on the Internet, whether it be a personal computer, a tablet, a smartphone, or anything else, is assigned a unique identifying number called an IP (Internet Protocol) address. Historically, the IP-address standard used has been IPv4 (version 4), which has the format of four numbers between 0 and 255 separated by a period. For example, the domain Saylor.org has an IP address of 107.23.196.166. The IPv4 standard has a limit of 4,294,967,296 possible addresses. As the use of the Internet has proliferated, the number of IP addresses needed has grown to the point where IPv4 addresses will be exhausted. This has led to the new IPv6 standard, which is currently being phased in. The IPv6 standard is formatted as eight groups of four hexadecimal digits, such as 2001:0db8:85a3:0042:1000:8a2e:0370:7334. The IPv6 standard has a limit of 3.4×10^{38} possible addresses. For more detail about the new IPv6 standard, see this [Wikipedia article](#).
- **Domain name:** If you had to try to remember the IP address of every web server you wanted to access, the Internet would not be nearly as easy to use. A domain name is a human-friendly name for a device on the Internet. These names generally consist of a descriptive text followed by the top-level domain (TLD). For example, Wikipedia's domain name is Wikipedia.org; Wikipedia describes the organization, and .org is the top-level domain. In this case, the .org TLD is designed for nonprofit organizations. Other well-known TLDs include .com , .net , and .gov . For a complete list and description of domain names, see this [Wikipedia article](#).
- **DNS:** DNS stands for "domain name system," which acts as the directory on the Internet. A DNS server is queried when a request to access a device with a domain name is given. It returns the IP address of the device requested, allowing for proper routing.
- **Packet-switching:** When a packet is sent from one device out over the Internet, it does not follow a straight path to its destination. Instead, it is passed from one router to another across the Internet until it reaches its destination. In fact, sometimes, two packets from the same message will take different routes! Sometimes, packets will arrive at their destination out of order. When this happens, the receiving device restores them to their proper order. For more details on packet switching, see this [interactive web page](#).
- **Protocol:** In computer networking, a protocol is the set of rules that allow two (or more) devices to exchange information back and forth across the network.

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