# Module 4

This Module will help you understand **how networks operate**. You will learn about **the hardware and software** needed to operate a network, the varying **types of networks** and **how information is sent** in a network. You will also explore **how to set-up a basic home network**.

# Module Sections

* 1. What is a Network?
	2. Network Operations
	3. Basic Home Networks

## 4.1 What is a network?

In a previous module, we discussed data communications. We learned that data communication is the electronic transmission of information and that the systems that carry the electronic transmission of information are called networks. Networks make our digital activities possible in current times. Especially the largest and most well-known network; the Internet.

Recall the video, *What is the Internet?* from Module 1. The Internet was described as a fully distributed system with no central control, consisting of many independently operated networks. So, let’s scale down the infrastructure of the Internet to get a solid view of what really is a network.

If we look up the definition of the word network, we get; “an arrangement of intersecting horizontal and vertical lines” or “a group or system of interconnected people or things.” When we factor in that electronic information is being transmitted, we have a computer network. A network can be as small as two devices communicating such as the small graphic below or as large as the Internet as we have already learned.



In the abstract sense, these two computers are connected.

## 4.2 Network Operations

One of the hardest things to grasp, however, is what the network would look like. Envisioning electronic data flow isn’t really a concrete thought. Let’s look at an analogy that is more grounded.

When you send a letter in the mail, you are sending it via a network, albeit a more physical version! Have you ever really thought about what path that letter travelled to get to its destination? The following scenario for a better idea of how this process works.

You write a letter to your friend in Central City, Ohio, put their physical address on the envelope, and place it in a United States Postal Service (USPS) drop box for routing and delivery. A mail carrier retrieves your letter and all the other mail from the drop box and takes it to a local location (post office) for sorting and routing. At the post office, your letter and other items are sorted according to the state listed on the envelope. All mail including your letter that is going to Ohio is loaded onto a truck or plane and transported to a new sorting location in Ohio. At that location, the mail is sorted by cities in Ohio, your letter gets put in the Central City pile and is again shipped off, most likely by truck to a location in Central City. At this location, the mail is all sorted according to the zip code first and then the actual street address, placed with a mail carrier and sent out for delivery. Your friend receives your letter and the process is complete. This is the basic idea of how a network transmits electronic information.

However, we know it isn’t always that simple. Mistakes are made and must be handled for each piece of mail.

This is where the computer network operates on checks and balances in the form of a layered protocol; just like the USPS! We call this layered protocol the TCP/IP Model. There are four layers to the TCP/IP Model; Application, Transport, Internet, and Network Access which is divided between Data Link and Physical layers.

| Layer 4 | Application |
| --- | --- |
| Layer 3 | Transport |
| Layer 2 | Internet |
| Layer 1 | Network Access |
| Data Link & Physical |

Figure 1 TCP/IP Model

TCP/IP is the set of protocols on which the Internet operates. It uses the protocols that allow different network elements communicate with each other. Data communication is not possible without TCP/IP model and therefore the Internet would not exist.

Let’s revisit the mail scenario to better understand these layers. The application layer covers the initial scenario from the point of placement in the drop box as described without errors. But what happens when you write the address wrong on the envelope? It gets stamped as undeliverable and returned to you for further action. This is the transport layer in a computer network doing its job. If you did write the address correctly, then the Internet layer takes over moving the letter between large regions or cities without prejudice or concern of what is being sent. Consider the airplane that your letter is on, the pilot does not care what is in the envelope, he only knows it must get to Ohio along with the other thousands of pieces he is transporting. At this point, the next stop is the first half of the fourth layer known as the Data Link layer. Those trucks in the sorting location in Ohio have now assumed responsibility of the mail in relation with their destinations based on city and zip code. The final stop is the physical layer. This is where your friend receives, opens and read your letter. Furthermore, if your friend writes a letter in reply, this too represents the physical layer. Once your friend drops your letter in the mail drop box, we go back to the beginning with the application layer and the process starts all over again.

Now that you have a concrete idea of network operations, we should now look at the scenario from a computer network perspective. In the simplest scenario, you open your web browser, type in a URL, and submit the request. A server somewhere receives the request, searches through its pages, finds the one you requested, and returns it back to you.

Now we expand on this scenario and address the TCP/IP layers. As before, the simple scenario is initiated at the application layer, then at the transport layer, the connection between your computer and the server is established and monitored for errors. If errors are found, you get a return message, most often is the famous 404 error we have all received. If there are no issues, the Internet layer helps move the data from one network to another (from your state to Ohio) where it is then handed off to the Data Link Layer which is typically the Ethernet protocol delivering the information to you (the trucks and the mail carrier transport the letter to your mailbox). Finally, the physical layer is where you receive the requested information on your computer.

Keep in mind that this is the most ideal process description and there are many other issues that can arise. However, for the purpose of this lesson, the scenarios are enough as is.

## 4.2 Basic Home Networks

Remember that a network can be as few as two devices? This sounds like we can set up a home network easily. While the process is fairly simple, it must be done precisely, or it won’t work. If you follow the basic steps below, you can be well on your way to your own home network. As with anything in the computing world, there are many other options besides these basic steps. For the purpose of this course, only the bare basics are covered.

## Getting Internet Access

It is wise to think about what you will be doing with your network devices and how many devices you will connect. The number of devices and your Internet activity will be a strong factor in the Internet transmission speeds you will need. You can call your local Internet Service Provider (ISP) and their techs can walk you through the best Internet package you should subscribe to, based on your answers to those questions. The ISP will set up an appointment to install your Internet access. Typically, most ISPs will provide the modem with wireless access for a monthly fee. If they only provide a modem, no worries, you can buy your own wireless router.

## Wired Setup

If you wish to have a computer directly connected to the Internet via a wire, you can do so with an ethernet cable. You will plug it directly into your modem or router and connect the other end to your computer. This will give you the most optimal speeds from your ISP.

## Wireless Setup

Once you have your Internet installed and you can set up your wireless by following either the instructions given by the ISP or the instructions provided with the wireless router. Be sure to secure your access point with an appropriate password. This will prevent anyone outside your home from accessing your Internet.

## Add Wireless Devices

Using the access password that you created, you can now go into the settings of your wireless capable devices and connect each to the wireless signal. You can typically connect laptops, tablets, mobile phones, printers, gaming consoles, smart TVs and much more. Keep in mind that the more devices you have actively accessing the wireless signal at the same time, the slower your speed will be.

And there you have it! The basics of a home network setup. You can view a diagram below to see what a basic home network looks like.

## Diagram of a basic home network set up

**Module 4 Project**

In this project you will write up your own network analogy. The analogy in the lesson used snail mail so you will make your own using some other concept. For example, you could go big as a country or go smaller and use a school, office, your home, or something else. The more creative the better but it must be clear that you understand the flow of information. Make sure to reference the TCP/IP model and use other terms that you learned in this module. Additional independent research is strongly encouraged for any terms or concepts that you are not completely clear on.

* 1. Review the module sections, do some research and then some brainstorming and develop a network analogy like the one in the module.
	2. You will need to demonstrate that you understand the terminology and the flow of the information and how each stage of information flow works. You must explain in some detail what is occurring at each ‘stop’, how, and why when possible.
	3. Post your analogy in well-formed sentences and paragraphs in the appropriate discussion forum.
	4. **You must also provide respectful feedback to at least two (2) other students’ posts. This includes identifying what you may see as errors or maybe a better way to write their analogy. Compliments are also always welcome however, all comments are to be at least two complete sentences and contain more than phrases such as “I agree.”**