Introduction to Computer Networking

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MODULE 1: Computer Networking and Telecommunications

1.1 Introduction

This module addresses (1) the forces driving the computer networking explosion, (2) the comparison between the telephone network and computer networks, (3) the concept of data convergence, and (4) some questions related to this module.

1.2 Background

We are all familiar with networks because the telecommunications industry has given us high quality telephone networks for years. Today computer networks, especially the Internet, have caused almost everyone to demand not only high quality telephone networks, but also high quality data networks.

In this module, we will cover the things that have driven networks to their tremendous popularity, followed by the model developed by the telephone industry. We will follow up with a look at how the old telephone and new data networks are converging.

1.3 Forces Driving the World of Computer Networking

While there may be many theories of what has caused the explosion of the Internet and computer industry, the simple fact is people want to share information. We moved many years ago from a totally industrial society to an information society. As the telephone was enhanced by fax as a means to communicate, people needed more. With the explosion of computers, data files came to be more important than the voice call or fax, but sending a disk with data is just not practical. Hence, computer networks were built that allowed multiple computers to communicate. For the most part networks started because people wanted to share computer data files.

However, we also needed to share devices such as printers. A printer dedicated to each Personal Computer (PC) is just not practical. The mainframe world used networking solutions that worked well, since there was not really a network at all, everything came back to the mainframe. In the world of PCs, each device is an intelligent system, which can share files, printers, and other resources. Networks allow us to share these resources across offices, cities, countries, and the world.

1.4 The Telephone was (is) the Model

The telephone system has developed a truly interconnected, highly reliable system that allows anyone to connect to another telephone anywhere in the world. The telephone network is

designed to make the connection from the dialing party to the party or person being called. This connecting two remote devices using a numbering scheme is called routing – getting the call from the source to the proper destination. Routing is a major issue, and market, for computer networks, and is facilitated by what we call Internet Protocol addresses – or simply IP addresses. IP addresses are to a computer network what a telephone number is to the telephone network. While there are other numbering schemes and network types, most computer networks – including the Internet - are based on this IP numbering scheme. Therefore, we will only address the IP scheme in this course. We will discuss some details of the IP address later.

1.5 Everything Converging

The engineer involved with computer networks today is often concerned with more than just sending and receiving data. We are seeing what is called convergence – the melding of voice, video, audio, and traditional data into a new form that we can call multimedia data. Let us take a minute to look at a few of these.

1.5.1 Data Networks for Voice

Actually making voice into data is not new at all – the telephone industry has been doing it for years. To accomplish this task, the analog voice is digitized into a digital signal. In terms of modems and data transmission, the voice signal sent over the telephone line today is a 64 kbps (or 64,000 bits per second) data stream. If you use a 33.3 kbps modem to access the Internet, you can appreciate the fact that your voice is moved at a rate twice as fast as your Internet connection.

Now with the advent of the Internet, creative minds realized that a telephone conversation could be established long distance over the Internet - free of charge. Using inexpensive hardware and software, a student attending school in the United States from India can call home using the school Internet connections, and not have to pay a dime of long distance charges. Businesses also realize great possibilities here, and many have converted their entire telephone system to be an IP, or Internet based telephone. The term Voice over IP (VoIP) is being used to describe this general technique. Variations of this are offered, but basically they are all using the same concepts – using the personal computer (PC) to digitize the voice and send it over what was once a computer only network.

1.5.2 Voice Networks for Data

The usage of voice networks for data transmissions is not new either. After all, if you use a telephone line modem at home or the office, you have been using what was once an all-voice network for data transmission. However, we are seeing this extended even further with the advent of the Internet mobile phone, or what is often called the wireless Internet.

1.5.3 Overall Convergence

The big picture is that the data and voice networks are coming together. What this really means is that all things are going to be treated as data, whether it is audio in the form of voice, music, or

other sounds, video images, or pure old-fashioned data. We are also seeing some uses of networking to provide virtual reality environments by using network data and special devices to deliver smell, touch and feel, as well as audio and video.

At issue here is that many new ways to use computer networks are being found everyday. People and companies are finding that they can make use of the Internet to transmit all types of data – and do it cheaply. Some might be monitoring temperatures at a remote location, while others are watching live security video, and doctors will (and do) use Internet video and audio to discuss medical cases remotely while looking at the medical images.