Chapter XVII

A Practical Introduction to Serial Protocols

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Abstract

This chapter discusses how addressing information, control information, and data are encapsulated in a serial packet or frame. It shows the bit-level detail of an IEEE 802.3 Ethernet frame, an IP packet, and a TCP packet and shows how these protocols are used to create a sample protocol stack. The GNU-licensed and Windows-based application Packetyzer is used to explore a sample TCP/IP packet contained in an Ethernet frame. Once the student has studied the material of this chapter and has completed the hands-on experiment, he or she will have the skills to examine any packet or frame and, using the description of its protocol, extract the details of the message.
Learning Objectives

After completing this chapter, you will be able to:

• Describe the Ethernet, TCP and IP packet structures.
• Describe using general terms what a protocol stack is and how it is important.
• Explain how a frame can be transmitted from one device to another across a serial link.
• Define the following key terms: CRC, datagram, data link layer, MAC address, and protocol.
• Suggest further enhancements to the practical activities presented in the chapter.

Introduction

Since the early days of computer system design, it has been necessary to develop communication schemes to allow the components of a digital system to exchange data. For example, the earliest mainframe computers used terminals as the standard method for user input and output. These terminals, connected either by direct connection or through a modem, used a single wire to transmit characters typed on the keyboard to the mainframe and a second wire to receive characters from the mainframe to be displayed on the user’s screen. Any communication method where data is transmitted over a single wire is referred to as serial communications.

A number of different schemes have been developed for serial communications. These schemes are defined by a set of rules that must be followed by both the transmitting device and the receiving device in order to successfully transfer data. The set of rules defining a specific serial communication scheme is referred to as a protocol.

This chapter presents a general description of the components of a serial protocol. This is followed by an overview of three serial protocols: Ethernet, TCP, and IP. Finally, the Windows-based application Packetyzer is used to examine an Ethernet packet containing a simple TCP acknowledgment message. The methods presented here should allow for a basic understanding of some standard protocols and how they might be embedded within each other.