Abstract

In this paper, we discuss the details of a Code Division Multiple Access (CDMA)-based multicasting system in a wired Local Area Network (LAN). This technique enables multiple users to transmit and receive data simultaneously among themselves using a single serial wire link at any given time, hence, called multicasting. This is unlike the method followed with the Ethernet in a wired LAN. With security being the prime demand of today's world, allowing multiple users to access the channel simultaneously may be critical; but in this respect, the CDMA technology proposed by us, since it uses unique code for each user, also provides a solution to the problem. In this paper we aimed at simulating this technique. The simulation was done using Matlab. We studied the effectiveness of the scheme, and the results are discussed in this paper.

Keywords: CDMA; multicasting; PN sequences; wired LAN

Introduction

The present-day LAN mostly uses the popular Ethernet technology, which enables transmitting information between computers. A vast majority of computer vendors now provide equipment with Ethernet attachments, making it possible to link all types of computers with an Ethernet LAN. Because of this widespread use, there is a large market for Ethernet equipment, which helps keep the technology competitively priced. Each Ethernet-equipped computer, also known as a station, operates independently of all other stations on the network. All attached stations are connected to a shared media system. Signals are transmitted over the medium to every attached station using the Carrier Sense Multiple Access/Code Division (CSMA/CD) protocol. In this CSMA/CD protocol (Tobagi, 1990), a station first listens to the medium and when the medium is idle, the station transmits its data. If two stations happen to transmit at the same instant, a collision is
detected and the stations reschedule their transmission. To avoid another collision, those stations choose a random time interval to schedule the retransmission. This essentially means that transmission is sequential and, hence, simultaneous transmission of information is not possible. With this in view, in this paper we have proposed using CDMA technology to allow multiple users to transmit data sequences across the same channel simultaneously.

The paper has been organized as follows. Next, we explain in brief present-day technology. Then, we provide the details of the proposed scheme for simultaneous transmission of information in a wired LAN using the CDMA technique (multicast-ing). In this context, we emphasize the need to have several Pseudo-random Noise (PN) sequences of identical length. This section also provides techniques to generate different PN sequences having identical lengths as well as having good correlation properties. We provide the details of the simulation of the proposed multicast-ing system using Mat Lab and the results of the performance. Finally, we conclude the paper.

PRESENT-DAY TECHNOLOGY

In the LAN connection, the single broadcast channel is allocated among the users. The traditional way of allocating a single channel is Frequency Division Multiple Access (FDMA). In this method, if there is N users, then the bandwidth is divided into N equal-sized portions, each user being assigned one portion. When the number of users is more — that is, when it exceeds N — this cannot be used. The other method used in wired LAN is Time Division Multiple Access (TDMA), where each user is allocated a different time slot. Here, if a user does not have data in his or her time slot, it remains idle. Thus, in this method, the channel utility is not full. In 1970, Norman Abramson and colleagues devised a new method to solve the channel allocation problem (Abramson, 1985). They called it ALOHA. This system is simple, where everyone is free to transmit his or her data, and if more than one user happens to transmit at the same time, collision occurs. In 1972, Roberts published a method for doubling the capacity of an ALOHA system. In this method he divided the time to discrete intervals. This method is called the slotted ALOHA. Here a terminal is not permitted to send whenever it has data. Instead, it is required to wait for the beginning of the next slot. All these methods are non-carrier-sense protocols. Protocols in which stations listen for a transmission and act accordingly are called carrier-sense protocols. Tobagi (1975) has analyzed several such protocols. The first of this is one-persistent CSMA. In this method, if a station is busy the other waits until the channel becomes free. The shortfall of this method is that if two stations become ready in the middle of a third station’s transmission, both will wait politely until the transmission ends and then both will begin transmitting simultaneously, resulting in a collision. A second carrier-sense protocol is non-persistent CSMA. In this protocol, before sending, a station senses the channel, and if no one else is sending, the station begins doing so. However, if the channel is already in use, the station does not continually sense it for the purpose of seizing it immediately upon detecting the end of the previous transmission. Instead, it waits a random period of time and then repeats the algorithm. The last protocol is p-persistent CSMA. In this protocol, if a