Use of Ethernet Technology in Computer Network

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Abstract

This paper explains the basic functionality of Ethernet and how it can be utilized at home and business networks. This paper includes types of Ethernet, how Ethernet works with OSI modal and cable? , specifications of Ethernet with respect to different types of cables and distance between two points, networking devices supported by it and the topology used by it.

Index terms— Ethernet, History of Ethernet, Ethernet devices, OSI modal used, working of Ethernet, Ethernet topology and protocols and types of Ethernet.

Introduction n this paper, Ethernet is introduced as one of the oldest but still the largest form of technology being used for networking. For many years, Ethernet has proven itself as a very popular, fast and relatively inexpensive LAN technology.

Actually, it would be difficult to think of the presence of computer network without Ethernet. So keeping the immense relevance of Ethernet in mind, Ethernet is defined as under.

1 II.

2 Definition

Ethernet is a protocol that controls the way data is transmitted over a local area network (LAN). The name Ethernet came from the combination of words "Ether" and "Net". Ether, meaning "light bearing", stands for the use of light as a means of data carrying medium whereas Net is a short form of network that means the community or a group of linked computers. It is not a wireless technology because it uses physical media generally called wires. Predominantly, Ethernet specifications define low level data transmission protocols.

3 III.

4 Brief History of Ethernet

The concept of Ethernet was formulated and introduced by XEROX PARC, now simply known as PARC (Palo Alto Research Centre).This agency proposed to develop a form of system that would permit/allow computers and devices to be connected with one and other using coaxial cables. Engineers Bob Metcalfe and D.R Boggs developed Ethernet beginning in 1972. In 1976, a connection two computers were made and data transfer fruitfully took place with the speed of 3MB/second. In 1980, industry standards To install or connect Ethernet cables to a computer, a person generally uses a network adapter, also known as a network interface card (NIC) or Ethernet network adapters. Ethernet adapter interfaces directly with a computer's system bus. The cables in turn utilize RJ-45 connector used with modern telephones. Ethernet network adapters exist in multiple forms: a) PCI cards: most popular for desktop computers b) PCMCIA ("credit cards"): most popular for notebooks or laptops c) USB Ethernet adapters exist for both desktops and laptops d) Wireless Ethernet adapters b) Repeaters A Repeater in Ethernet networking is a device that allows multiple cables to be joined and greater distances to be spanned.

5 c) Bridge

A Bridge device can join an Ethernet to another network of a different type, such as a wireless network.

6 V. How Ethernet works?

Ethernet works by linking computers and other devices using cables. One end of the Ethernet cable is connected to the computer whereas the other is connected to a connector such as repeater, hub and switch. As far as sending signal is concerned, Ethernet basically works by chain reactions. One computer generates and sends a signal of its desired action. The signal passes through the cables, and then through the connector, then to cables again and finally to their designated receiving computer. Also, Ethernet uses an algorithm based on random delay times to determine the proper waiting period between retransmission. In traditional Ethernet, the protocol for broadcasting,

7 Relation of Ethernet with OSI modal

In the OSI model, Ethernet technology operates at the physical and data link layers-layers one and two respectively. The physical layer of the network focuses on hardware elements, such as cables, repeaters and network interface cards. As far as data link layer is concerned, here the data packets are sent from one node to another. Ethernet uses an access method called CSMA/CD (carrier sense multiple Access/collision detection). This is a system where each computer listens to the cable before sending anything through the network. If the network is clear the computer will transmit. If some other node is already transmitting on the cable, the computer will wait and try again when the line is clear. The CSMA/CD access rules are summarised by the protocol's acronym:

Carrier sense: Each station continuously listens for traffic on the medium to determine when gaps between frame transmissions occur.

Multiple access: Stations may begin transmitting any time they detect that the network is quiet (there is no traffic).

Collision detection: If two or more stations in the same CSMA/CD network (collision domain) begin transmitting at approximately the same time, the bit streams from the transmitting stations will interfere(collide) with each other, and both transmission will be unreadable. If that happens, each transmitting station must be capable of detecting that a collision has occurred before it has finished sending its frame. Each must stop transmitting as soon as it has detected the collision and then must wait quasirandom length of time (determined by a back-off algorithm before attempting to retransmit the frame).

8 a) Indication of worst situation

The worst case situation occurs when the two most distant stations on the network, both need to send a frame and when the second station does not begin transmitting until just before the frame from the first station arrives. The collision will be detected almost immediately by the second station, but it will not be detected by the first station until the corrupted signal has propagated all the way back to the station. b) Methods to detect worst case collision a) A maximum network diameter is chosen (about 2500 meters). b) The minimum frame length is set to ensure detection of all worst case collision. c) Slot time method is used to detect time spent during collision. It is the maximum time required to detect collision. It is roughly found to be equal to twice the signal propagation time between the two most distant stations on the network.

Ethernet supports all popular network and higher level protocols, principally IP.

9 VII.

10 Ethernet topology and protocols

Ethernet supports a bus, star and tree topologies. Traditionally Ethernet employs a bus topology, meaning that all devices or hosts on the network use the same shared communication line. Each device possesses an Ethernet address, also known as MAC address. Sending devices use Ethernet addresses to specify the intended recipient of messages. Data sent over the Ethernet exists in the forms of frames. An Ethernet frames contains a header, a data section and a footer having a combined length of no more than 1518 bytes. Data sent over the Ethernet is automatically broadcast to all devices on the network. Common twisted pair standards are 10Base-T, 100Base-T and 1000Base-T. The number (10/100/1000) stands for the speed of transmission (10/100/1000 megabits/second). The "Base" stands for "baseband" meaning it has full control of the wire on a single frequency, and the 'T' stands for "twisted pair cable".

11 VIII.

12 Types of Ethernet

13 e) Ethernet cable in current use

The most popular Ethernet cable in current use is category 5 or CAT 5, supports both traditional (supports data transfers at the rate of 10Megabits/second) and fast Ethernet (category 5e or CAT 5e supports data transfers at the rate of 10Gigabits/second or 10000Mbps). Gigabit Ethernet still remains an active area of research.

14 IX.

15 Conclusion

This paper describes basics of Ethernet technology, how Ethernet can be utilised in industries and businesses. Efforts have been made to lucidly discuss the use of Ethernet and its relationship with OSI modal and the future use of Ethernet.

X.

Figure 1:

The most common form of traditional Ethernet is 10-BaseT. 10Base T offers better electrical properties than thicknet or thinnet because it utilizes UTP wiring rather than coaxial. Also it is more cost effective than fiber optic cable.

c) Fast Ethernet

Fast Ethernet standards include:

? 100Base T-(100 Mbps over 2-pair category 5 or better UTP cable). It is a standard that includes 100Base-TX(category 5 UTP),100Base-T2(category 3 or better UTP) and 100Base-T4(100Base-T2 cabling modified to include two additional wire pairs)

? 100base FX-100 Mbps over fiber cable

? 100Base SX-100 Mbps over multimode fiber cable

? 100Base BX–100 Mbps over single mode fiber cable

? 1000Base-LX–100Mbps,baseband,long wavelength over optical fiber cable

d) Cable standards/Terms/Symbols used

a) Thicknet (10Base 5)

It was the first incarnation of Ethernet technology. The industry used thicknet in the 1980's.

b) Thinnet

It was thinner as compared to thicknet (5 millimeters vs 10 millimeters), more flexible cabling, and easy to install office buildings for Ethernet.

As   per   the   Ethernet   speci
manufacturers of Ethernet equipment must meet the below minimum specifications/standards for short distance segment length. Here segment means a network connection made by a single unbroken network cable.

Name	Max.segment length	Types of cab
10 Base 5	500m/1640ft	RG-8 or RG
10 Base 2	185m/606ft	RG-58A/U coaxial
10 Base T	100m/328ft	Category 3

Figure 2:

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