Ethernet Network

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Abstract: - This paper describes about local-area network (LAN) architecture. Ethernet uses a bus or star topology and supports data transfer rates of 10 Mbps. The Ethernet specification served as the basis for the IEEE 802.3 standard, which specifies the physical and lower software layers. Ethernet uses the CSMA/CD access method to handle simultaneous demands. It is one of the most widely implemented LAN standards.
A newer version of Ethernet, called 100Base-T (or Fast Ethernet), supports data transfer rates of 100 Mbps. And the newest version, Gigabit Ethernet supports data rates of 1 gigabit (1,000 megabits) per second).
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Keywords: - CSMA/CD, 100Base-T.

1. INTRODUCTION

Carrier Sense Multiple Access / Collision Detection, a set of rules determining how network devices respond when two devices attempt to use a data channel simultaneously (called a collision). Standard Ethernet networks use CSMA/CD to physically monitor the traffic on the line at participating stations. If no transmission is taking place at the time, the particular station can transmit. If two stations attempt to transmit simultaneously, this causes a collision, which is detected by all participating stations. After a random time interval, the stations that collided attempt to transmit again. If another collision occurs, the time intervals from which the random waiting time is selected are increased step by step. This is known as exponential back off.
CSMA/CD is a type of contention protocol. Networks using the CSMA/CD procedure are simple to implement but do not have deterministic transmission characteristics. The CSMA/CD method is internationally standardized in IEEE 802.3 and ISO 8802.3
There are several CSMA access modes: 1-persistent, P-persistent and O-persistent. 1-persistent is used in CSMA/CD systems, like Ethernet. This mode waits for the medium to be idle, then transmits data. P-persistent is used in CSMA/CA systems, like Wi-Fi. This mode waits for the medium to be idle, then transmits data with a probability p. If the data node does not transmit the data (a probability of 1 - p), the sender waits for the medium to be idle again and transmit the data with the same probability p. O-persistent is used by CobraNet, LonWorks, and the controller area network. This mode assigns a transmission order to each data node. When the medium becomes idle, the data node next in line is able to transmit data. The data node next in line waits for the medium to be idle again and then transmits its data. After each data node transmits data, the transmission order is updated to reflect what data nodes have already transmitted, moving each data node through the queue.

2. EVOLUTION

Ethernet stations communicate by sending each other data packets: blocks of data individually sent and delivered. As with other IEEE 802 LANs, each Ethernet station is given a 48-bit MAC address. The MAC addresses are used to specify both the destination and the source of each data packet. Ethernet establishes link level connections, which can be defined using both the destination and source addresses. On reception of a transmission, the receiver uses the destination address to determine whether the transmission is relevant to the station or should be ignored. Network interfaces normally do not accept packets addressed to other Ethernet stations. Adapters come programmed with a globally unique address.An Ether Type field in each frame is used by the operating system on the receiving station to select the appropriate protocol module (i.e. the Internet protocol module). Ethernet frames are said to be self-identifying, because of the frame type. Self-identifying frames make it possible to intermix multiple protocols on the same physical network and allow a single computer to use multiple protocols together. Despite the evolution of Ethernet technology, all generations of Ethernet (excluding early experimental versions) use the same frame formats (and hence the same interface for higher layers), and can be readily interconnected through bridging.

3.VARIETIES OF ETHERNET

Ethernet physical layer

The Ethernet physical layer evolved over a considerable time span and encompasses coaxial, twisted pair and fiber optic physical media interfaces and speeds from 10 Mbit to 100 Gbit. The most common forms used are 10BASE-T, 100BASE-TX, and 1000BASE-T. All three utilize twisted pair cables and 8P8C modular connectors. They run at 10 Mbit/s, 100 Mbit/s, and 1 Gbit/s, respectively. Fiber optic variants of Ethernet offer high performance, electrical isolation and distance (tens of kilometers with some versions). In general, network protocol stack software will work similarly on all varieties.

Datagrams

In IEEE 802.3 datagrams are called "frames". A frame begins with preamble and start frame delimiter, followed by an Ethernet header featuring source and destination MAC addresses. The middle section of the frame consists of payload data including any headers for other protocols (e.g., Internet Protocol) carried in the frame. The frame ends with a 32-bit cyclic redundancy check, which is used to detect corruption of data in transit.

FPGA in Data Acquisition

FPGA devices have become common in data acquisition (DAQ) systems for high energy particle physics experiments. The next generation of DAQ systems will use FPGAs with commercial networking components. The use of FPGAs to generate gigabit-Ethernet data streams has been investigated using a Virtex 4 development system to generate raw Ethernet packets over both fibre and copper links. Details of the firmware developed to drive the links are presented.

Technical Highlights

- Low power data loggers, data acquisition systems and data acquisition boards
- Seismic monitoring and warning systems
- Accelerometer data loggers
- High resolution (24-bit) USB data
- Microsoft Windows and Linux systems
- GPS time-stamped data
- Real-time Internet data transfer

4. Modern Ethernet Network

Modern Ethernet implementations often look nothing like their historical counterparts. Where long runs of coaxial cable provided attachments for multiple stations in legacy Ethernet, modern Ethernet networks use twisted pair wiring or fiber optics to connect stations in a radial pattern. Where legacy Ethernet networks transmitted data at 10 megabits per second (Mbps), modern networks can operate at 100 or even 1,000 Mbps!

Perhaps the most striking advancement in contemporary Ethernet networks is the use of switched Ethernet. Switched networks replace the shared medium of legacy Ethernet with a dedicated segment for each station. These segments connect to a switch, which acts much like an Ethernet bridge, but can connect many of these single station segments. Some switches today can support hundreds of dedicated segments. Since the only devices on the segments are the switch and the end station, the switch picks up every transmission before it reaches another node. The switch then forwards the frame over the appropriate segment, just like a bridge, but since any segment contains only a single node, the frame only reaches the intended recipient.

This allows many conversations to occur simultaneously on a switched network.

Figure 1.1 will describe about modern Ethernet networks.

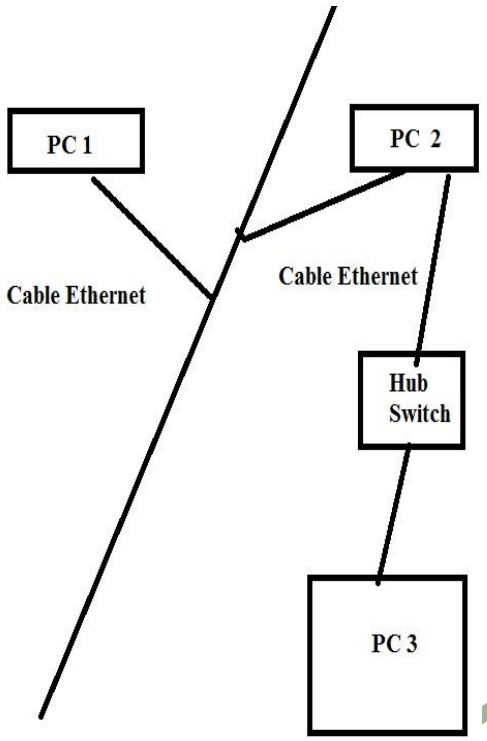

Figure 1.1 Showing Modern Ethernet Network

REFERENCES

1.Gerald W. Brock (September 25, 2003). The Second Information Revolution. Harvard University Press. p. 151. ISBN 0-674-01178-3.

2. Cade Metz (March 13, 2009). Ethernet — a networking protocol name for the ages: Michelson, Morley, and Metcalfe. The Register. p. 2. Retrieved March 4, 2013.

3.Mary Bellis. "Inventors of the Modern Computer". About.com. Retrieved September 10, 2011

4. Computer.howstuffworks.com/ethernet14.htm

5ieeexplore.ieee.org/xpl/articleDetails.jsp?tp=&arnumber=4382745.

6. Daqsystems.com

7. Douglas E. Comer (2000). Internetworking with TCP/IP – Principles, Protocols and Architecture (4th ed.). Prentice Hall. ISBN 0-13-018380-6. 2.4.9 – Ethernet Hardware Addresses, p. 29, explains the filtering.

8 Iljitsch van Beijnum. "Speed matters: how Ethernet went from 3Mbps to 100Gbps... and beyond". Ars Technica. Retrieved July 15, 2011. "All aspects of Ethernet were changed: its MAC procedure, the bit encoding, the wiring... only the packet format has remained the same.

9.Computerhope.com/jargon/c/csmacd.html.

10. webopedia.com/TERM/E/Ethernet.html.