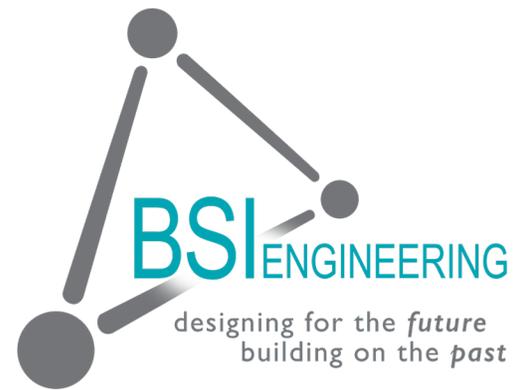


Communication via Ethernet



January 5, 2021

White Paper - Volume 13



Headquarters Address:

300 E-Business Way, Suite 300
Cincinnati OH 45241
Phone: 513-201-3100
Fax: 513-201-3190

E-mail:

info@bsiengr.com

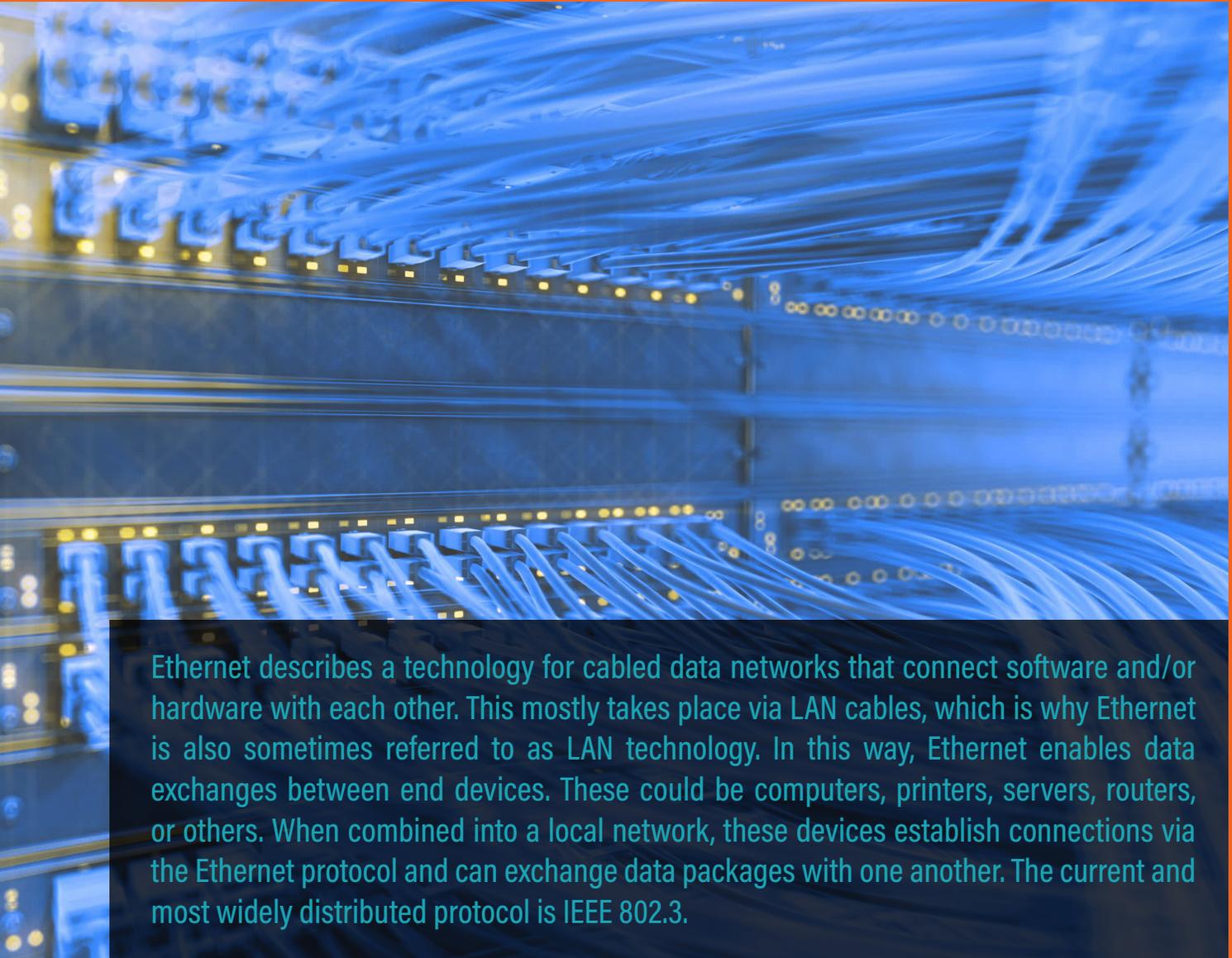
Website:

www.bsiengr.com

CONTENT

- 2 Abstract - What is Ethernet (IEEE 802.3)?
- 3 Hardware
- 4 Cables
- 5 Pros & Cons of the Hardware
- 6 The Standard
- 8 Summary

Abstract - What is Ethernet (IEEE 802.3)?



Ethernet describes a technology for cabled data networks that connect software and/or hardware with each other. This mostly takes place via LAN cables, which is why Ethernet is also sometimes referred to as LAN technology. In this way, Ethernet enables data exchanges between end devices. These could be computers, printers, servers, routers, or others. When combined into a local network, these devices establish connections via the Ethernet protocol and can exchange data packages with one another. The current and most widely distributed protocol is IEEE 802.3.

Ethernet was developed back in the early 1970s, but the network system was originally only used internally by the company Xerox. At the start of the 1980s, Ethernet was developed into a standardized product. However, Ethernet still wasn't widely used until the middle of the decade when several manufacturing companies started to work with Ethernet and related products. The technology made a significant contribution to the way that the personal computer revolutionized the working world. Today, the widely-distributed IEEE standard 802.3 is used in offices, private households, containers, and carriers.

While the first version of the technology only had a speed of 3 megabits per second, Ethernet protocol today enables speeds of up to 1.000 megabits per second. Earlier Ethernets were limited to a building, but today Ethernet can cover a range of just over 6 miles with the use of fiber optic cables. Over the course of its development, Ethernet has taken over a dominant role among LAN technology and outperformed various competitors. In addition, today real-time Ethernet is the industry standard for communication applications.

ETHERNET HARDWARE

As an important part of the whole data link, switch has been a hot spot. According to Ethernet standard, it can be divided into 1G switch, 10G switch, 40G switch and 100G switch; according to port configuration, it can be classified as 8 port switch, 16 port switch, 24 port switch and 48 port switch; according to PoE technology, there are PoE switch and non-PoE switch. But, do you know there are managed switch and unmanaged switch? This article will make a comparison between them.

Overview of Managed Switch And Unmanaged Switch

In a networking, a switch receives a message from any device connected to it and then transmits the message to the target device. Within a LAN, the switch can handle and transmit data among multiple devices via a intelligent and efficient way. As for managed switch and unmanaged switch, the key difference between them is that managed switch can be configured and it can prioritize LAN traffic to make the most important data get through; while unmanaged switch is a “plug and play” device. It can't be configured or analyze the data traffic.



ETHERNET CABLES

When shopping for cables, you may notice they're nearly always classified as "Cat-5," "Cat6e," or something similar. "Cat" simply stands for "Category." The number that follows indicates the specification version supported by the cable.

A general rule of thumb is that higher numbers represent faster speeds and higher frequencies, measured in megahertz (MHz). As is the case with most technologies, newer cables typically support higher bandwidths, and therefore increased download speeds and faster connections.

Keep in mind that longer Ethernet cables have slower transmission speeds. Cables bought for personal use rarely exceed 100 meters anyway and are unlikely to experience bottlenecked speeds. Below, you can see the capabilities of each cable type.

Ethernet	Media Type	Bandwidth Limit	Distance Limit
10BASE5	Coax (Thicknet)	10 Mbps	500 m
10BASE2	Coax (Thinnet)	10 Mbps	185 m
10BASE-T	Category 3 (or higher) UTP	10 Mbps	100 m
100BASE-TX	Category 5 (or higher) UTP	100 Mbps	100 m
100BASE-FX	MMF	100 Mbps	2 km
1000BASE-T	Category 5e (or higher) UTP	1 Gbps	100 m
1000BASE-TX	Category 6 (or higher) UTP	1 Gbps	100 m
1000BASE-LX	MMF/SMF	1 Gbps / 1 Gbps	550 m/S km
1000BASE-LH	SMF	1 Gbps	10 km
1000BASE-ZX	SMF	1 Gbps	70 km
10GBASE-SR	MMF	10 Gbps	20 - 300 m
10GBASE-LR	SMF	10 Gbps	10 - 25 km
10GBASE-ER	SMF	10 Gbps	40 km
10GBASE-SW	MMF	10 Gbps	300 m
10GBASE-T	Category 6a (or higher)	10 Gbps	100 m
100GBASE-SR10	MMF	100 Gbps	125 m
100GBASE-LR4	SMF	100 Gbps	10 km
100GBASE-ER4	SMF	100 Gbps	40 km

Considerations



MOBILITY: In terms of mobility, there are more physical limitations in ethernet. Unlike in a Wifi connection, you cannot roam freely when connected through ethernet. The device has to sit in one particular place. Therefore these types of connections can only be convenient to devices such as desktops. For those who have mobile devices, ethernet connections will not be ideal for them.



EXPANDABILITY: In case if you want to expand your network, then there will be additional expenses and it will be time consuming in ethernet. This is because you need more routers, switches and most importantly many meters of wires. Additionally all the devices need to be rewired.



INSTALLATION: Ethernet cabling, switches, and other associated hardware needs to be planned in detail. The topology both physical and logically should follow best practice using the OSI model to ensure high availability and security.



CONNECTIONS/CABLING: One of the biggest areas overlooked is the connections/cabling to final devices, switches, and patch downs. For example, standard office grade cabling may work, but it will give you the reliabilities or performance required when you need it the most. In addition, correct grounding of switches and shielded twisted pair can make or break your network. Final connections and cabling test must be at the top of any installation check list. The use of office grade RJ-45's and their installation can lead to communication problem during checkout or later, even months after everyone went home. Lastly proper testing and documentation of those tests will ensure that you have a quality installation.

Advantages



SECURITY: Unlike Wifi where it is prone to attacks, an ethernet connection has higher levels of security. With an ethernet connection, you always have the control over who is using the network. Hackers will not be able to get your information's easily when using an ethernet. Hence this can be used to prevent security breaches.



SPEED: Speed offered by an ethernet connection is much more greater compared to a wireless connection. Using ethernet you can easily achieve the speed of 10Gbps, especially with the latest twisted pairs. Some can go up to 100Gbps. The reason for this is the one to one connection present in them. For even more extended range there are fiber optic cables. These cables use light instead of standard way of passing information's.



RELIABILITY: Ethernet inherent reliability, performance, and interoperability possess supreme reliability. To meet the needs of the industrial environment, Industrial Ethernet essentially uses special industrial protocols encapsulated within the Ethernet protocol in a way that ensures the correct information is sent and received when and where it is needed to perform a specific operation.



EFFICIENCY: There are some ethernet cables such as Cat6 which consumes considerably lower amount of power. Even more lower than a Wifi connection. Therefore these kinds of cables are considered to be most power efficient.

ETHERNET

Ethernet is the most popular physical layer LAN technology in use today. It defines the number of conductors that are required for a connection, the performance thresholds that can be expected, and provides the framework for data transmission. A standard Ethernet network can transmit data at a rate up to 10 Megabits per second (10 Mbps). Other LAN types include Token Ring, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Fiber Distributed Data Interface (FDDI), Asynchronous Transfer Mode (ATM) and LocalTalk.

Ethernet is popular because it strikes a good balance between speed, cost and ease of installation. These benefits, combined with wide acceptance in the computer marketplace and the ability to support virtually all popular network protocols, make Ethernet an ideal networking technology for most computer users today.

The Institute for Electrical and Electronic Engineers developed an Ethernet standard known as IEEE Standard 802.3. This standard defines rules for configuring an Ethernet network and also specifies how the elements in an Ethernet network interact with one another. By adhering to the IEEE standard, network equipment and network protocols can communicate efficiently.

FAST ETHERNET

The Fast Ethernet standard (IEEE 802.3u) has been established for Ethernet networks that need higher transmission speeds. This standard raises the Ethernet speed limit from 10 Mbps to 100 Mbps with only minimal changes to the existing cable structure. Fast Ethernet provides faster throughput for video, multimedia, graphics, Internet surfing and stronger error detection and correction.

There are three types of Fast Ethernet: 100BASE-TX for use with level 5 UTP cable; 100BASE-FX for use with fiber-optic cable; and 100BASE-T4 which utilizes an extra two wires for use with level 3 UTP cable. The 100BASE-TX standard has become the most popular due to its close compatibility with the 10BASE-T Ethernet standard.

Network managers who want to incorporate Fast Ethernet into an existing configuration are required to make many decisions. The number of users in each site on the network that need the higher throughput must be determined; which segments of the backbone need to be reconfigured specifically for 100BASE-T; plus what hardware is necessary in order to connect the 100BASE-T segments with existing 10BASE-T segments. Gigabit Ethernet is a future technology that promises a migration path beyond Fast Ethernet so the next generation of networks will support even higher data transfer speeds.



GIGABIT Et

Gigabit Ethernet was developed to meet the need for faster communication networks with applications such as multimedia and Voice over IP (VoIP). Also known as “gigabit-Ethernet-over-copper” or 1000Base-T, GigE is a version of Ethernet that runs at speeds 10 times faster than 100Base-T. It is defined in the IEEE 802.3 standard and is currently used as an enterprise backbone. Existing Ethernet LANs with 10 and 100 Mbps cards can feed into a Gigabit Ethernet backbone to interconnect high performance switches, routers and servers.

From the data link layer of the OSI model upward, the look and implementation of Gigabit Ethernet is identical to that of Ethernet. The most important differences between Gigabit Ethernet and Fast Ethernet include the additional support of full duplex operation in the MAC layer and the data rates.

10 Gigabit Ethernet

10 Gigabit Ethernet is the fastest and most recent of the Ethernet standards. IEEE 802.3ae defines a version of Ethernet with a nominal rate of 10Gbits/s that makes it 10 times faster than Gigabit Ethernet.

Unlike other Ethernet systems, 10 Gigabit Ethernet is based entirely on the use of optical fiber connections. This developing standard is moving away from a LAN design that broadcasts to all nodes, toward a system which includes some elements of wide area routing. As it is still very new, which of the standards will gain commercial acceptance has yet to be determined.

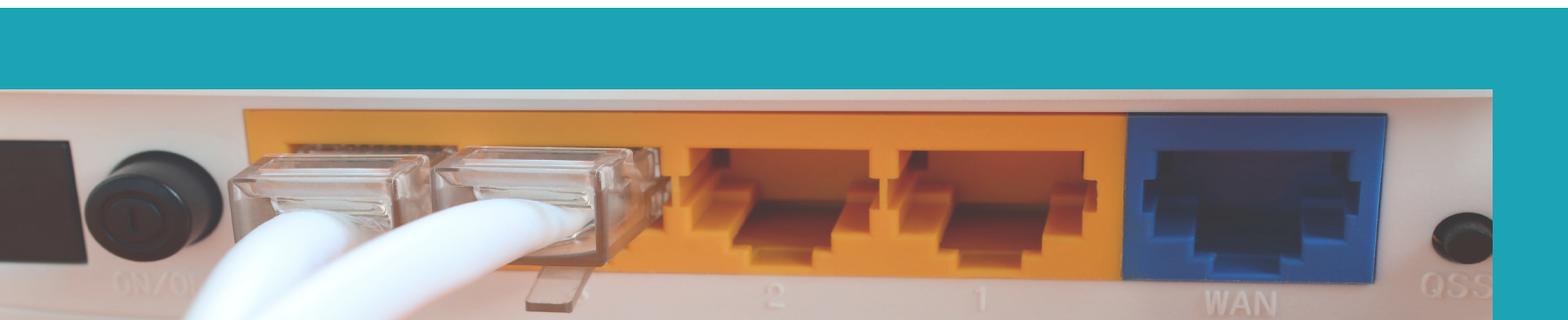
Asynchronous Transfer Mode (ATM)

ATM is a cell-based fast-packet communication technique that can support data-transfer rates from sub-T1 speeds to 10 Gbps. ATM achieves its high speeds in part by transmitting data in fixed-size cells and dispensing with error-correction protocols. It relies on the inherent integrity of digital lines to ensure data integrity.

ATM can be integrated into an existing network as needed without having to update the entire network. Its fixed-length cell-relay operation is the signaling technology of the future and offers more predictable performance than variable length frames. Networks are extremely versatile and an ATM network can connect points in a building, or across the country, and still be treated as a single network.

Power over Ethernet (PoE)

PoE is a solution in which an electrical current is run to networking hardware over the Ethernet Category 5 cable or higher. This solution does not require an extra AC power cord at the product location. This minimizes the amount of cable needed as well as eliminates the difficulties and cost of installing extra outlets.





SUMMARY

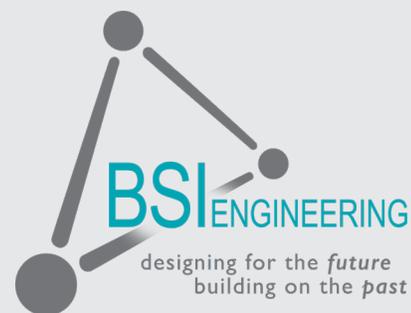
Ethernet is a way of connecting computers together in a local area network or LAN. It has been the most widely used method of linking computers together in LANs since the 1990s. The basic idea of its design is that multiple computers have access to it and can send data at any time. Per the cost to install and maintain, makes it a standard in the communication market.

THANK YOU

FOR CHOOSING US!

BSI Engineering is a full-service provider of engineering and design services for a very broad range of industry sectors.

The majority of our 200+ employees have over twenty years of technical experience and are ready to add their expertise to your project from any of our midwestern office locations. We deliver exceptional value for our clients wanting a fully integrated, engineering-led EPCM model.



300 E-Business Way, Suite 300
Cincinnati OH 45241

Phone: 513-201-3100
Fax: 513-201-3190

E-mail: info@bsiengr.com
Website: www.bsiengr.com