LAN AND WAN

1. Local Area Network

A computer network that spans a relatively small area. Most LANs are confined to a single building or group of buildings. However, one LAN can be connected to other LANs over any distance via telephone lines and radio waves. A system of LANs connected in this way is called a wide-area network (WAN). Most LANs connect workstations and personal computers. Each node (individual computer) in a LAN has its own CPU with which it executes programs, but it also is able to access data and devices anywhere on the LAN. This means that many users can share expensive devices, such as laser printers, as well as data. Users can also use the LAN to communicate with each other, by sending e-mail or engaging in chat sessions. ARCNET, Token Ring and other technology standards have been used in the past, but Ethernet over twisted pair cabling, and Wi-Fi are the two most common technologies currently used to build LANs.

There are many different types of LANs Ethernets being the most common for PCs. Most Apple Macintosh networks are based on Apple's AppleTalk network system, which is built into Macintosh computers.

The following characteristics differentiate one LAN from another:

- **Topology :** The geometric arrangement of devices on the network. For example, devices can be arranged in a ring or in a straight line.
- **Protocols :** The rules and encoding specifications for sending data. The protocols also determine whether the network uses a peer-to-peer or client/server architecture.
- **Media :** Devices can be connected by twisted-pair wire, coaxial cables, or fiber optic cables. Some networks do without connecting media altogether, communicating instead via radio waves.

LANs are capable of transmitting data at very fast rates, much faster than data can be transmitted over a telephone line; but the distances are limited, and there is also a limit on the number of computers that can be attached to a single LAN. Network topology describes the layout pattern of interconnections between devices and network segments. Switched Ethernet has been for some time the most common Data Link Layer and Physical Layer implementation for local area networks. At the higher layers, the Internet Protocol (TCP/IP) has become the standard. Smaller LANs generally consist of one or more switches linked to each other, often at least one is connected to a router, cable modem, or ADSL modem for Internet access.

Larger LANs are characterized by their use of redundant links with switches using the spanning tree protocol to prevent loops, their ability to manage differing traffic types via quality of service (QoS), and to segregate traffic with VLANs. Larger LANs also contain a wide variety of network devices such as switches, firewalls, routers, load balancers, and sensors. LANs may have connections with other LANs via leased lines, leased services, or by tunneling across the Internet using virtual private network technologies. Depending on how the connections are established and secured in a LAN, and the distance involved, a LAN may also be classified as a metropolitan area network (MAN) or a wide area network (WAN).

Cabling

Early LAN cabling had always been based on various grades of coaxial cable. However shielded twisted pair was used in IBM's Token Ring implementation, and in 1984 StarLAN showed the potential of simple unshielded twisted pair by using Cat3-the same simple cable used for telephone systems. This led to the development of 10Base-T (and its successors) and structured

cabling which is still the basis of most commercial LANs today. In addition, fiber-optic cabling is increasingly used in commercial applications. As cabling is not always possible, wireless Wi-Fi is now the most common technology in residential premises, as the cabling required is minimal and it is well suited to mobile laptops and smart phones.

Ethernet

Ethernet is the most widely-installed local area network (LAN) technology. Specified in a standard, IEEE 802.3, Ethernet was originally developed by Xerox from an earlier specification called Alohanet (for the Palo Alto Research Center Aloha network) and then developed further by Xerox, DEC, and Intel. An Ethernet LAN typically uses coaxial cable or special grades of twisted pair wires. Ethernet is also used in wireless LANs. The most commonly installed Ethernet systems are called 10BASE-T and provide transmission speeds up to 10 Mbps. Devices are connected to the cable and compete for access using a Carrier Sense Multiple Access with Collision Detection (CSMA/CD) protocol.

Fast Ethernet or 100BASE-T provides transmission speeds up to 100 megabits per second and is typically used for LAN backbone systems, supporting workstations with 10BASE-T cards. Gigabit Ethernet provides an even higher level of backbone support at 1000 megabits per second (1 gigabit or 1 billion bits per second). 10-Gigabit Ethernet provides up to 10 billion bits per second.

Ethernet was named by Robert Metcalfe, one of its developers, for the passive substance called "luminiferous (light-transmitting) ether" that was once thought to pervade the universe, carrying light throughout. Ethernet was so-named to describe the way that cabling, also a passive medium could similarly carry data everywhere throughout the network. When first widely deployed in the 1980s, Ethernet supported a maximum theoretical data rate of 10 megabits per second (Mbps). Later, so-called "Fast Ethernet" standards increased this maximum data rate to 100 Mbps. Today, Gigabit Ethernet technology further extends peak performance up to 1000 Mbps.

Higher level network protocols like Internet Protocol (IP) use Ethernet as their transmission medium. Data travels over Ethernet inside protocol units called frames. The run length of individual Ethernet cables is limited to roughly 100 meters, but Ethernet networks can be easily extended to link entire schools or office buildings using network bridge devices.

2. wireless local area network (WLAN)

A wireless local area network (WLAN) links two or more devices using some wireless distribution method (typically spread-spectrum or OFDM radio), and usually providing a connection through an access point to the wider internet. This gives users the mobility to move around within a local coverage area and still be connected to the network. Most modern WLANs are based on IEEE 802.11 standards, marketed under the Wi-Fi brand name.

Wireless LANs have become popular in the home due to ease of installation, and in commercial complexes offering wireless access to their customers; often for free. Large wireless network projects are being put up in many major cities: New York City, for instance, has begun a pilot program to provide city workers in all five boroughs of the city with wireless Internet access.

WLANs provide wireless network communication over short distances using radio or infrared signals instead of traditional network cabling. A WLAN typically extends an existing wired local area network. WLANs are built by attaching a device called the access point (AP) to the edge of the wired network. Clients communicate with the AP using a wireless network adapter similar in function to a traditional Ethernet adapter. Network security remains an important issue for

WLANs. Random wireless clients must usually be prohibited from joining the WLAN. Technologies like WEP raise the level of security on wireless networks to rival that of traditional wired networks.

Stations

All components that can connect into a wireless medium in a network are referred to as stations. All stations are equipped with wireless network interface controllers (WNICs). Wireless stations fall into one of two categories: access points, and clients. Access points (APs), normally routers, are base stations for the wireless network. They transmit and receive radio frequencies for wireless enabled devices to communicate with. Wireless clients can be mobile devices such as laptops, personal digital assistants, IP phones and other smart phones, or fixed devices such as desktops and workstations that are equipped with a wireless network interface.

Basic service set

The basic service set (BSS) is a set of all stations that can communicate with each other. Every BSS has an identification (ID) called the BSSID, which is the MAC address of the access point servicing the BSS. There are two types of BSS: Independent BSS (also referred to as IBSS), and infrastructure BSS. An independent BSS (IBSS) is an ad-hoc network that contains no access points, which means they cannot connect to any other basic service set. An infrastructure BSS can communicate with other stations not in the same BSS by communicating through access points.

Extended service set

An extended service set (ESS) is a set of connected BSSs. Access points in an ESS are connected by a distribution system. Each ESS has an ID called the SSID which is a 32-byte (maximum) character string.

Distribution system

A distribution system (DS) connects access points in an extended service set. The concept of a DS can be used to increase network coverage through roaming between cells. DS can be wired or wireless. Current wireless distribution systems are mostly based on WDS or MESH protocols, though other systems are in use.

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