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TCP/IP NETWORK PROTOCOL

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INTRODUCTION

The purpose of this paper is to discuss the TCP/IP network protocol and justify why the company Microwave InfoTech Ltd has selected to use the TCP/IP protocol when setting up their LAN with a gateway to a WAN and the Internet. By exploring a range of published books, internet sites and Ebooks on the topic TCP/IP, this report describes the structure, components of the TCP/IP suite, how LAN connects to WAN and the Internet through a gateway, and its benefits

A BRIEF HISTORY ABOUT TCP/IP

A few years ago, TCP/IP was known as the protocol of the internet, and the biggest challenge of getting a Local Area Network to the Internet was figuring out how to mesh TCP/IP with the propriety protocols such as IPX/SPX and NETBEUI. A few years ago, network administrators realized that they could save the trouble of combining TCP/IP with IPX/SPX and NETBEUI by eliminating IPX/SPX and NETBEUI altogether. Therefore making TCP/IP the protocol not just for the internet but making it the protocol which almost all local area networks are based.

3.0 TRANSMISSION CONTROL PROTOCOL/ INTERNET PROTOCOL

3.1 THE STRUCTURE OF TCP/IP

TCP/IP protocols are based on a layered framework like the seven-layer OSI Reference model. TCP/IP has four layers. These layers are the Application layer, Transport layer, Network layer and the Network Interface layer, each having different protocols

3.1.1 THE TCP/IP PROTOCOL FRAMEWORK

3.1.1a THE NETWORK INTERFACE LAYER

It is the lowest level in the TCP/IP architecture. It corresponds to the OSI's Physical and Data Link layers. Different TCP/IP protocols at the Network Interface layer can be used, including Ethernet and Token Ring for Local area networks and protocols such as Frame Relay and ATM for Wide area networks

3.1.1b THE NETWORK LAYER

This is where data is addressed, packaged and routed among networks. There are several important Internet protocols that operate at the Network layer, which are:-Internet Protocol (IP); which is a routable protocol that uses IP addresses to deliver packets to network devices: Address Resolution Protocol (APR); which resolves IP addresses to hardware MAC addresses: Internet Control Message Protocol (ICMP); which sends and receives diagnostic messages, and finally the Internet Group Management Protocol (IGMP); which is used to multicast messages to multiple IP addresses at once

3.1.1c THE TRANSPORT LAYER

This is where sessions are established and data packets are exchanged between hosts. There are two core protocols found at this layer which are the Transmission Control Protocol and the User Datagram Protocol. The Transmission Control Protocol (TCP) provides reliable connection oriented transmissions between two hosts. TCP establishes a session between two hosts and then ensures delivery of packets between the hosts. The User Datagram Protocol (UDP) provides connectionless, unreliable and one-to-one or one-to-many deliveries.

3.1.1d THE APPLICATION LAYER

This layer corresponds to the Session, Presentation and Application Layers of the OSI Reference Model. A few protocols found in this layer are: Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP), Telnet, Simple Mail Transfer Protocol (SMTP) and Domain Name System (DNS).

3.2 COMPONENTS OF THE TCP/IP SUITE

3.2.1 IP ADDRESSING

One of the most basic components of TCP/IP is IP addressing. Every device on a TCP/IP network must have a unique IP address

3.2.1.1 IP ADDRESSES EXPLAINED

An IP address is a 32 bit number which is usually represented as a four part number, with each of the four parts separated by a period or decimal point but usually referred to as the dotted decimal notation. In the IP address, each individual byte or octet can have a usable value in the range 1 through 254. IP addresses which are used vary according to the class of the network, that is, the 32 bit IP address is divided in a way to create an address for the network and an address for each host, and in addition, the host part of the address can be further divided to allow a subnetwork address

3.2.1.2 IP ADDRESS CLASSIFICATION

There are three classes of standard IP addresses which support LANs. These classes are: Class A, Class B, Class C

3.2.1.2a CLASS A

Class A is used for very large networks only. The high-order bit in a Class A network is always zero, which leaves 7 bits available to define 127 networks yet the value of 127 is reserved as a loopback test address leaving only 126

available networks. The remaining 24 bits of the address allow each Class A network to hold as many as 16,777,216 hosts

3.2.1.2b CLASS B

Class B is used for medium sized networks. The 2 high-order bits are always or are required to be 10, and the remaining bits are used to define 16,384 networks, each with as many as 65,535 hosts attached. All Class B addresses fall within the range 128.x.x.x to 191.x.x.x.

3.2.1.2c CLASS C

Class C is for smaller networks. The 3 high-order bits are always 110 and remaining bits are used to define 2,097,152 networks but each network can only have a maximum of 254 hosts. The problem with Class C networks is that they are too small. Although few organizations need tens of thousands of host addresses provided by Class B address, many organizations need more than a few hundred host addresses thus the large discrepancy between Class B and Class C networks is what led to the development of Subnetting.

3.2.1.3 SUBNETTING

Subnetting is a way or technique that lets network administrators use the 32 bits available in an IP address more efficiently by creating networks that aren't limited to the scales provided by Class A, B and C IP addresses

Subnets are created by masking off or hiding the network portion of the IP address on the units within the subnet, doing this limits the mobility of the data to those nodes within the subnet because they can reconcile addresses only from within their masked range

3.2.2 DOMAIN NAME SYSTEM (DNS)

The IP addresses of all computers attached to the internet are tracked using a listing system called the Domain name System. On the Internet, domains are arranged in a hierarchical tree structure. The seven top level domains in use are: .com which are Commercial Businesses .edu which are educational Institutions .gov which are Government Agencies .int which are International Organizations .mil which are Military Establishments .net which are Networking Organizations .org which are Non-profit Organizations

The DNS system resolves individual domain names of computers to their current IP address listings whereas some IP addresses are permanently assigned to a particular domain name so that whenever the domain name is issued on the internet it always accesses the same IP address. This is called or is referred to as static IP addressing, but most Internet services providers use a dynamic IP addressing scheme for allocating IP addresses.

3.2.3 DYNAMIC HOST CONFIGURATION PROTOCOL (DHCP)

This allows individual computers on a TCP/IP network to obtain their configuration information such as obtaining their IP address from a server. The DHCP server keeps track of which IP address have already been assigned so that when a computer requests an IP address, the DHCP server will give it an IP address that is not already in use

3.2.4 WINDOWS INTERNET NAMING SERVICE (WINS)

Windows Internet Naming Service (WINS) is an essential part of the Microsoft networking topology. WINS is used in conjunction with TCP/IP and maps NETBIOS (Network Basic Input/output System) names to IP addresses. TCP/IP does not understand NETBIOS names; therefore WINS are used as a way of knowing the location of the servers and their addresses. WINS is similar to DNS in that it cross references host names to addresses; however, WINS references NETBIOS names to IP addresses ,and DNS references TCP/IP host names to IP addresses

Another difference between WINS and DNS is that WINS builds its own reference tables dynamically, and DNS has to be configured manually. When a workstation running TCP/IP is booted and attached to the network, it uses the WINS address settings in the TCP/IP configuration to communicate with the WINS server thus the workstation gives the WINS server various pieces of information about itself, such as the NETBIOS host name, the actual user name logged on to the workstation and the workstations' IP address. WINS store this information for use on the network and periodically updates or refreshes it to maintain accuracy.

3.3 HOW LAN COMMUNICATES TO WAN/INTERNET THROUGH A GATEWAY

A LAN is able to facilitate sharing of files and resources by linking computers together through a central device known as a router. The router acts as a go-between, directing data traffic on the LAN. Computers can be connected to a router using an Ethernet cable, or a router can communicate wirelessly using radio waves. Internet access is an option that can be incorporated into a LAN. A central modem is either connected or integrated into the router, providing a gateway between the LAN and the internet. A firewall is typically present in the gateway to act as a one-way valve, keeping unwanted public traffic from accessing the LAN. (R. Kanye. 2009)

3.4 THE BENEFITS OF USING TCP/IP

TCP/IP enables cross-platform, or heterogeneous, networking. For example, a Windows NT/2000 network could contain Unix and Macintosh workstations or even networks mixed in it. TCP/IP also has the following characteristics: Good failure recovery, the ability to add networks without interrupting existing services, high error-rate handling, platform independence, and low data overhead. Because TCP/IP was originally designed for Department of Defense-related purposes, what we now call features or characteristics were actually design requirements. The idea behind "Good Failure Recovery" was that if a portion of the network were disabled during an incursion or attack, its remaining pieces would still be able to function fully. Likewise is the capability of adding entire networks without any disruption to the services already in place. The ability to handle high error rates was built in so that if a packet of information got lost using one route, there would be a mechanism in place to ensure that it would reach its destination using another route. Platform independence means that the networks and clients can be Windows, Unix, Macintosh, or any other platform or combination thereof. The reason TCP/IP is so efficient lies in its low overhead. Performance is key for any network. TCP/IP is unmatched in its speed and simplicity. (Parker T, Siyan S. K, 2002)

CONCLUSION

TCP/IP protocols are based on four layered framework like the seven-layer OSI reference model. These layers are the Application layer, Transport layer, Network layer and Network interface layer. There are three classes of standard IP addresses which are class A, class B and class C. subnetting is a way or technique that lets network

administrators use the 32 bits available in an IP address for efficiently. The main components of the TCP/IP suite are the Domain Name system (DNS), the Dynamic Host Configuration Protocol (DHCP) and the Windows Internet Naming Service (WINS). The benefits of using TCP/IP are good failure recovery, the ability to add networks without interrupting existing services, high error-rate handling, platform independence, and low data overhead.

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