Computer Networking Essay, Research Paper

in network is a group of two or more computer systems sharing services and interacting in some manner. In most cases, this interaction is accomplished through a shared communication link, with the shared components being data. Put simply, a network is a collection of machines that have been linked both physically and through software components to soothe communication and the sharing of information. To make the communications between two or more computers work, several things need to be in place. First, some type of physical connection mechanism has to exist between the computers involved. Normally, this mechanism is a wire or cable of some kind or a transceiver that can both transmit and receive information attached to or built into your computer. The idea of computer networking is new to some people and almost always seen as a highly technical and rapidly evolving process. Every day, computer professionals are called upon by their employers to evaluate, judge, and implement the technologies necessary for the rapid communication of dissimilar groups in order to enhance productivity or lessen complexity within the organization’s processes. Most see the task as a formidable one, and many feel they are not qualified or fully prepared to drive the creation of a Local Area Network (LAN) or Wide Area Network (WAN). James 2 The type of network you can create is often determined by the network operating system you use. Like a regular operating system for your PC, a network operating system coordinates how all the individual software application on a network work and how the network interacts with the hardware attached to it. Sharing data is made much easier when a network is involved. People are more productive because several people enter data at the same time and can also evaluate and process the shared data. The effective use of networks can turn a company into an agile, powerful, and creative organization, giving it a long-term competitive advantage. Networks can be used to share hardware, programs, and databases across the organization. They can transmit and receive information to improve organizational effectiveness and efficiency. They enable geographically separated workgroups to share documents and opinions, which fosters teamwork, innovative ideas, and new business strategies (Stair, Reynolds 269). Getting computers connected and speaking the same language may be somewhat interesting for some people, but it’s really just a necessary evil to get to the good stuff. In order to take advantage of your network, you need to configure network services, such as file, print, and application services. A server in a network is dedicated to performing specific task in support of other computers on the network. In a server-based network, not all servers are alike. Networks are about sharing three things: files, resources, and programs. File servers offer services that allow network users to share files. File services include storing, retrieving, and moving data. File and print servers do not do processing for client computers (Lammle 7). Print servers manage and control a single printer or a group of printers on a network. The print server controls the queue or spooler. Clients send print jobs James 3 to the print server, and the print server uses the spooler to hold the job until the printer is ready (7). Application servers allow client PCs to access and use extra computing power and expensive software applications that reside on a shared computer. Application servers offload work from the client by running programs for the client and sending the results back to the client. For example, when a client asks a Microsoft SQL Server server to find a record, SQL Server does all the processing to find the answer, and then sends the results back to the client (7). File, print, and application services are the main services that servers provide. Although you can dedicate a server to a particular service, such as having a computer that serves only as a print server, you do not need a different server for each type of service. One server can function as a file, print, and application server (8). To compare the three, the file and print servers offer a storage location for clients. They benefit greatly from large hard drives. Although Random Access Memory (RAM) is important, the processor is not so important. An application server, on the other hand, requires a fast processor to run the application and get the results to the client. When to network or not to network is the question? The rapid growth in the number of networked computers over the last decade or so has been dramatic. One factor of this growth is the number of Internet host computers, which is now in excess of six million. This acceleration in growth rate is because when two networks are connected, both are expanded and enhanced. Connecting thousands of LANs made the combined resources of the Internet so vast that it eventually became unrealistic for network planners to attempt to rival it; better to connect to it, take advantage of it, and at the same time, contribute to it. The only time you would not use a James 4 network is when you are not required to use any type of shared resources that requires a connection either through a LAN, modem or some other type of connection that would connect your computer to a shared resource. The growth of networking may not continue indefinitely but by the time it begins to slow, it is likely that networking involving Internet access will be as commonplace as cable television. When deciding which type of network to implement, several factors must be considered: number of computers, cost, security requirement, and administrative requirements. PC networks generally fall into two categories peer-to-peer networks, also called workgroups and server-based networks, also called domains: 1. Peer-to-Peer Networking is the simplest form. In a peer-to-peer network, each workstation acts as both a client and a server. There is no central repository for information and no central server to maintain. Data and resources are distributed throughout the network, and each user is responsible for sharing data and resources connected to their system (Nash 13). Advantages of peer-to-peer networking: While peer-to-peer networks may not always be the best choice, they do have their place and advantages. Small, inexpensive networks can easily be set up using peer-to-peer systems. The peer-to-peer network model works well for small office networks. Once your network has reached about ten clients, it can become too hard to maintain. All that is need to connect several individual systems and create a peer-to-peer network are network adapters, cable or other transmission media, and the operating system (14). Disadvantages of peer-to-peer networking: The general rule is to stop using peer-to-peer networking once your total number of clients reaches about ten. If you start having more than ten clients before long, you would have people with different revisions of the documents on different client computers and setting up the network would become a problem. If the James 5 network had a central server, you would only need to get information from one source (14). Training is also difficult when you have a large number of clients. If you use peer-to-peer networking, your users need to be trained on how to share resources (14). Security in a peer-to-peer networking becomes difficult to maintain. Users need to know how to secure their own resources. Because there is no central administration, it is the users’ responsibility to ensure that only authorized users can access their data. Most peer-to-peer security consists of a single password for each resource; this is known as share-level security (14-15). Peer-to-peer networking works in small environments. If you grow beyond approximately 10 machine, the administrative overhead of establishing the shares, coupled with the lack of tight security, creates a nightmare. 2. Server-Based Networks – In a server-based network, you have one computer – usually larger than the clients, which is dedicated to handing out files and or/information to clients. The server controls the data, as well as printers and other resources the clients need to access. The server is not only a faster computer with a better processor, but it also requires much more storage space to contain all the data that needs to be shared to the clients. Having the tasks handled by the server allows the clients to be less powerful because they only request resources (16) Since the server is dedicated to handing out files and/or information, it cannot be used as a workstation. Its purpose is strictly to provide services to other computers, not to request services (17). Advantages of server-based networks: If your network has more than ten to fifteen clients, you should really consider a server-based network. With James 6 a server-based network, you only need to have your clients connect to one or a few servers to get the resources they need (18). Security is also much easier to manage in a server-based network. Since you only need to create and maintain accounts on the server instead of every workstation, you can assign rights to resources easily. Access to resources can be granted to user accounts. Since the server on the network acts as the central repository for almost all your information, you only need to perform backups to the server (19). This type of network can also be quite cost efficient. With the server storing almost all of the information on your network, you do not need large hard drives on the client computer (19). Disadvantages of server-based network: The two main disadvantages are the requirement of a server and a dedicated administrator. Servers can be expensive when compared to a normal workstation, but they also usually have features to help it handle client requests better (20). With a server-based network centralized administration, you can add all users at one location, control logon scripts and backups, and so on. With centralized authentication, you can identify a user to your entire network based on his logon name and password, not based on each share he attempts to access. Each type of network has a physical topology, which is the wiring, and a logical topology, which is the path data, follows. A network’s topology is the physical layout of computers, cables, printers, and other network related equipment. The topology is not a map of the network. It is a theoretical construct that graphically conveys the shape and structure of the James 7 Local Area Network (LAN). A logical topology describes the possible connections between pairs of networked endpoints that can communicate. This is useful in describing which endpoints can communicate with which other endpoints, and whether those pairs capable of communicating have a direct physical connection to each other. Topological variation can be an important way to optimize network performance for each of the various functional areas of a LAN. There are four types of topologies: 1. Star topology requires a hub, which is a central piece of equipment that connects separate computers or network segments together. In a basic Star topology, each computer has its own cable length that connects to the central hub. The benefits of a star topology include the following: A. A star topology is more fault tolerant than other topologies, because a cable break does not bring down the entire segment (Donald 201). B. It is easy to reconfigure the network, or add nodes, because each node connects to the central hub independent of other nodes (201). C. It is easy to isolate cable failures, because each node connects independently to the central hub (201). The drawbacks of a star topology include the following: A. If the central hub fails, the network becomes unavailable (201). B. This topology uses more network cable than other network models (201). James 8 2. Ring topologies allow network cable to run from one network interface card to the other with no free ends which means the network cable makes a complete, closed circle. Ring topologies offer the advantage of equal access to the network media through token passing. The main disadvantage of a ring topology is the same as a bus: a single node’s failure can disrupt the entire network (Moncur 36). 3. Bus topology is the simplest topology and requires the least amount of cable to implement. Bus topologies are created by simply running a single cable length and connect computers to it with T-shaped connectors that have three ends. The chief disadvantage of a bus topology is that a break at any point in the bus will bring the network down (36). 4. Mesh topology provides fault tolerance through redundant links. In this system, each node is connected to every other node with separate cables. The main advantage of this system is a high degree of reliability. The disadvantage is that mesh topologies require large amount of cable, making them very expensive to install and expand (36). Depending on the physical distance between nodes on a network and the communication and services provided by the network, networks can be classified as local area networks (LANs), metropolitan are networks (MANs), and wide area networks (WANs). A network that connects computer systems and devices within the same geographic area is a local area network (LAN). A local area network can be a ring, star, hierarchical, or hybrid network. Typically, local area networks are wired into office buildings James 9 and factories. They can be built around powerful personal computers, minicomputers, or mainframe computers (Stair, Reynolds 272). Another basic LAN is a simple peer-to-peer network that might be used for a very small business to allow the sharing of files and hardware devices such as printers. These types of networks have no server. Instead, each computer uses special network operating systems, a network interface card, and cabling to connect it to the next machine. The performance is usually slower because one computer is actually sharing the resources of another computer (273). It has been estimated that over 70 percent of business PCs in the United States are connected to one or more local area networks. As the capabilities and power of LANs increase, the demand for local networks is expected to soar doubling in just the next three to four years. LANs provide excellent support for businesses whose main communications are internal or encompass only a small region (273). A metropolitan area network, or MAN, is a group of LANs located in a city. For example, if a college has campuses with networks at each spread over the majority of a city, they could be connected to create a MAN. MANs are slower than LANs but usually have few errors on the network. Since special equipment is needed to connect the different LANs together, they have a high price (Nash 26). The largest network size is a wide area network, or WAN. WANs can interconnect any number of LANs and WANs. They connect networks across cities, states, countries, or even the world. WANs normally use connections that travel all over the country or world. For this reason they are usually slower than MANs and LANs, and more prone to errors. They also require a lot of specialized equipment, so their price is high (26). James 10 There are many reasons that WAN technology is used: 1. PSTN (Public Service Telephone Network) is the telephone system used throughout the U.S. and many other countries. A modem is used to interface between a computer and the telephone system. 2. RAS (Remote Access Service) used under Windows NT and dial-up networking under Windows 95. 3. DDS (Digital Data Service) is a type of dedicated digital line provided by phone carriers. 4. ISDN (Integrated Digital Network) was developed as an alternative to the standard PSTN telephone system for voice communications. 5. ATM (Asynchronous Transfer Mode) is a high-speed packet switching format that supports speeds up to 622 Mbps. ATM uses a virtual circuit between connection points for high reliability over high-speed links. Technological advances in networking hardware and software have led to greater throughput on all scales and to increasingly tighter integration of networking with all aspects of computing. In keeping with these advances, the idea of networking has entered the common consciousness to an extent that would have been unimaginable a few short years ago. This shift in perception has led to an expansion of networking beyond the workplace, which is already beginning to shape developments in networking technology.

32d