Fundamentals

Section One

“The People Factor”

Introduction

GENERAL

This book is all about computer networks; LANs[3], WANs[4], MANs[5] and the Internet[6]. The goal is to offer a balanced presentation of how things work and where you stand either supporting or using them. What I’ve learned most over the years is that computer books have been generally written for computer geeks -- not the common person. The end goal is to make you (the reader) more familiar with technology and verbiage commonly associated with the networking world -- thus making you more knowledgeable and resourceful.

BRIEF HISTORY

Many people tend to look at the IBM PC as the beginning of personal computers and networking, but in 1973 Xerox introduced not only the concept of personal computers but also networking. Xerox created a computer that introduced ethernet, mice and an icon based graphic user interface. While their concept was expensive and power hungry,

3. LAN is a group of computers and associated devices that share a common communications line and typically share the resources of a single processor or server within a small geographic area (for example, within an office building).
4. WAN is a geographically dispersed telecommunications network.
5. MAN or metropolitan area network is a network that interconnects users with computer resources in a geographic area or region larger than that covered by even a large local area network (LAN) but smaller than the area covered by a wide area network (WAN).
6. Internet, sometimes called simply “the Net,” is a worldwide system of computer networks - a network of networks in which users at any one computer can, if they have permission, get information from any other computer (and sometimes talk directly to users at other computers). It was conceived by the Advanced Research Projects Agency (ARPA) of the U.S. government in 1969 and was first known as the ARPANET.

it was to be the base for all modern business computers. But not until the Apple Lisa did this concept really take off.

IBM looked at the personal computer in a very different way -- text based and individual (not networked). They also put a heavy price on their interpretation of what business needed. They did not take the concept of home computers into account until IBM clones overtook the market. IBM used public technology to engineer most of their product (a mistake that would cost them dearly). Further they contracted with a little known company (Microsoft) to manufacture their operating system. Both of these choices are now realized to be dramatic failures in forecasting the market.

With the birth of the IBM clones came the personal computer boom and most importantly public interest. This interest grew exponentially. For a while there was the family computer store that made cheap IBM clones and flooded the market. From these came more elaborate “national” brands (such as Compaq) with newer technologies that included portable computers. Companies like the Sinclare and Heathkit promoted cheaper reliable systems that introduced the concept of non-technical people building their own systems from scratch.

Apple, with founders Steve Jobs created educational systems such as the Apple II series which led to the Macintosh. Apple tried to corner the market on graphic based operating systems (GUI[7]) suing Microsoft when they manufactured the first versions of Windows. Apple lost the suite given that they themselves had copied Xerox in order to create their popular GUI. The failed suit opened the door for Microsoft to battle head on with Apple for that market share.

Novell and Sun built a strong market for network operating systems (a.k.a. NOS[8]). For many years it seamed that no one could compete with Novell for networking systems. There were specialized networking systems such as PICK and LANTastic, but these did not compete of the same level as Novell. UNIX, ULTRIX and VMS were expensive to own and manage -- requiring specialized knowledge that was not common to the lay person. Microsoft challenged all of these with their release of Windows for Workgroups which made peer to peer[9]networking possible at a fraction of the cost

7. GUI - Graphic User Interface.
8. NOS is a computer operating system that is designed primarily to support workstation, personal computer, and, in some instances, older terminal that are connected on a local area network (LAN). Artisoft's LANtastic, Banyan VINES, Novell's NetWare, and Microsoft's LAN Manager are examples of network operating systems. In addition, some multi-purpose operating systems, such as Windows NT and Digital's OpenVMS come with capabilities that enable them to be described as a network operating system.
9. Peer-to-peer is a communications model in which each party has the same capabilities and either party can initiate a communication session. Other models with which it might be contrasted include the client/server model and the *master/slave* model. In some cases, peer-to-peer communications is implemented by giving each communication node both server and client capabilities. In recent usage, peer-to-peer has come to describe applications in which users can use the Internet to exchange files with each other directly or through a mediating server.

Novell, in an attempt to corner the market on personal computer software (to accent their networking strategy) started buying up companies such as Word Perfect to build an office suite. This strategy over-tasked Novell and took their eye away from their core business (networking). At the same time Microsoft had enlisted the aid of a software engineer from the company that made VMS[10] and incorporated its technology into their Windows GUI creating what is now know as NT technology. Since VMS was a mature operating system used for large scale networking operations, the marriage of technologies became the downfall of Novell as the leader in the networking marketplace.

Novell tried to regain ownership of the networking marketplace by creating an innovative directory concept NDS[11]. Novell had touched on an area of networking management that would help to change computer management up to the present. Unfortunately for Novell, Microsoft quickly engineered their own version of Directory services (Active Directory) and promoted it with their common server package Windows 2000. While Active Directory was a less mature technology then NDS, it was cheaper and backed by a company on the rise in the market place. It can be said that NDS is a better Directory service but Microsoft is a more viable company. Today Microsoft commands a forty six percent market share on all software sold throughout the world. If you were to bet your companies IT budget on any one company it would be very difficult to choose someone other then Microsoft at this point.

By the way, Apple is still fighting to maintain a significant place in the market. Apple has a strong user base that will not give up on the company. They have re-tooled their operating system to incorporate UNIX and have made a strong showing by doing so. It would be foolish to not keep an eye on the Macintosh.

UNDERSTANDING NETWORKS

People tend to look at complex things in a macro perspective -- encompassing the big picture. When troubleshooting or understanding networks it is necessary to start from the most basic concepts and work up. As an old technician’s troubleshooting technique states:

> “Check to see if all the cables are plugged in first before looking elsewhere.”

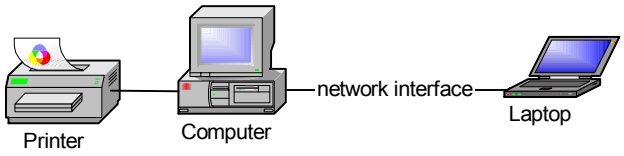
Many times the problem is a simple one but our lack of understanding prevents us from seeing it.

10. VMS (Virtual Memory System) is an operating system from the Digital Equipment Corporation (DEC) that runs in its older mid-range computers. VMS originated in 1979 as a new operating system for DEC's new VAX computer, the successor to DEC's PDP-11. VMS is a 32-bit system that exploits the concept of virtual memory.

11. (Novell Directory Services) is a popular software product for managing access to computer resources and keeping track of the users of a network, such as a company's intranet, from a single point of administration. Using NDS, a network administrator can set up and control a database of users and manage them using a directory with an easy-to-use graphical user interface (GUI).

BASIC NETWORK

FIGURE 1 - 1. Basic two computer network



A network is *two or more* computers connected together by a communication device in order to share information and peripherals (printers, modems, etc.) -- as they say it takes two to tango. Even in the most basic network we can see the foundation for larger networks:

- network interface (the technology that connects computers together).
- protocols (the way in which both computers understand each other).
- shared devices (printers, modems, hard drives, etc.)

These three things (network interface, protocols and shared devices) work together to form an alliance of resources that combine their software and hardware so that more can get accomplished then with one computer. You could think of it in terms of people. One person can get so much done while two or more people can get even more done. Ultimately the goal is to get as much done with whatever resources you can pool together, and save money along the way (also know as getting your "return on investment" or ROI). Just as with groups of people, the more you put together the more complicated it gets.

STABILITY

By applying "standards"[12] we can limit the overall complication and remove much of the problems that would result from something being complex. The drawback to using standards is that you are intentionally limiting the *variety* of resources in order to have less problems. This (in itself), becomes a problem in that people enjoy variety and don't like standards being applied on anything they do. It is a fine line between offering the right amount of options for people to have available on a network and offering too much. It is usually the lack of standards that causes networks to fail or become unstable.

A stable network, much like a stable relationship between two or more people, requires compromise and leadership. People on the network must trust and allow for leaders of the network to define limitations that will benefit everyone across the board. Leaders (better known as *system administrators*) must take into consideration all of the needs of the people who use the network and accommodate as much as they can while insuring that the network remains stable.

12. Standards - Serving as or conforming to a standard of measurement or value. Widely recognized or employed as a model of authority or excellence: *a standard reference work.* Acceptable but of less than top quality: *a standard grade of beef.* Normal, familiar, or usual: *the standard excuse.* Commonly used or supplied: *standard car equipment. Linguistics.* Conforming to established educated usage in speech or writing.

In large environments complexity arises from the value placed on unique individuals using the network who have political pull and can override the authority of system administrators (trying to maintain stability). There is usually some position of authority (also known as the Chief Information Officer or CIO) who takes responsibility for ensuring that standards are followed by everyone. This CIO usually reports directly to the Chief Executive Officer (CEO) and maintains a high level of authority.

The bottom line is that a network is only as stable as the standards and organizational structure (authority) granted it by the company or institution. If authority fails to keep those standards for everyone, the level of network stability is weakened and compromised.

DIFFICULTIES

Technically a network is a simple thing that is best maintained with standards and organization. In reality, a network becomes complex because people use it. People demand that the network conforms to their needs providing the tools they choose to do their daily work. People bring with them politics, personalities and differences of opinion. Powered by their position in an organization, people influence how and why things are done. It is people that make networking difficult.

The needs of groups of people drive technology to supply answers (also know as solutions). While these answers complicate networking, they also push technology to provide new ideas that, like pendulum, push back and forth to make networking simple again. This tug of war between people and network technology helps to advance the science of information management. While there is an obvious movement back and forth between stability and compromise the end result can be a work or art -- a solution of beauty.

CREATING

Taking in all of what I've said so far, it would be reasonable to assume that creating a network (at least for an organization), begins with an agreed hypothetical environment that everyone can work in -- a sand box were everyone can play and get along. It should have as many resources as are needed for everyone to get the job done while keeping the overall costs down. It should have software and hardware that work well together.

There needs to be consensus between system administrator and user. There needs to be an authority to enforce standards that everyone will live with. There also needs to be communication between people using network resources and the ones managing it. Well defined policies and procedures need to be published for all to see, read and understand. A dialog must be present for everyone to have a say it what goes on and definition for why things are as they are.

For a successful computer network to be built there must be a successful human network in existence. A network begins with consensus between user and administrator so that basic goals and needs are defined and agreed too. The computer network must reflect the human network it supports. Finally, conflict does not always lead to chaos, it can lead to innovation.

VENDORS

Contrary to popular belief, it really does not matter which company you choose as your network operating system vendor -- they all work well when you use applications and

hardware that they support. What dose matter is how well the vendor performs for the customer and if they have a future in the market. Sun, Apple, and Microsoft produce a stable, manageable and well balanced networking environment that can accomplish anything a company wishes, and conforms to future expectations in technology. The bottom line -- “what is your company culture”?

Too often network technology is driven by people with blinders. A few key personnel decide what will happen and force others to conform. Some are Sun bigots, other are Apple or Microsoft bigots. In the end they all are equally wrong. What makes the right choice in networking software is solely based on the technical resources and funding available. If you live in an area that has primarily Apple based training, you’ll find “Apple ready” personnel. If your area has a glut of Microsoft training there will be plenty of people to fill your network resources.

There are special considerations to take into account; such as scientific applications that can only be conducted using UNIX[13] based solutions, but these are fairly unique and almost always never apply to office applications. Such considerations are usually defined in business models that embrace cutting edge technologies and have extensive resources to support them.

All in all, the vendor you choose must have strong market share, solid products, and ample hardware/application partnerships showing continued commitment for the evolution of the platform. In other words there must be others out there (not only customers) wishing to support the network system vendor you choose in order for that to be the right choice.

LEGACY[14] TRANSITIONS

Well established institutions and companies face the pain of transitioning from legacy information systems to modern network infrastructures. This pain stems more from re-training and re-thinking then from migrating data and replacing hardware. Mainframe personnel (I like to call digital paleontologists), are nearing retirement and generally reluctant to re-train for their positions. Further, the overall structure of the MIS[15] (or ITS[16] or IS[17]) department is based on the mainframe mentality. These conditions promote the status quo and make it very difficult to re-think or re-train whole organizations. The process is further hindered by upper management being entrenched in the mainframe vendor ideology. The common perception is “big boxes equal business critical”

13. UNIX (often spelled "Unix" in news media) is an operating system that originated at Bell Labs in 1969 as an interactive time-sharing system. Ken Thompson and Dennis Ritchie are considered the inventors of UNIX. The name (pronounced YEW-nihks) was a pun based on an earlier system, Multics. In 1974, UNIX became the first operating system written in the C language. UNIX has evolved as a kind of large freeware product, with many extensions and new ideas provided in a variety of versions of UNIX by different companies, universities, and individuals
14. Legacy - In information technology, legacy applications and data are those that have been inherited from languages, platforms, and techniques earlier than current technology.
15. MIS - Management Information Services. (a.k.a. Management Information Systems)
16. ITS - Information Technology Services
17. IS - Information Services (a.k.a. Information Systems)

while “small boxes are unreliable”. While this could not be further from the truth, it is the perception of legacy systems that is manifested by legacy culture.

While legacy systems will fade away, their imprint on the information technology world will live on for some time to come. Even now we see the concept of a centralized information server base replacing disbursed storage. Many of the most fundamental concepts being applied to newer networking technologies are founded in the principles that made legacy systems so popular. It is fair to say that legacy transitions will cycle again and again as information technology evolves. The need to make the transition process a less painless one should be the primary goal for technology managers now and into the future.

HARDWARE LIFE CYCLES

It is a fairly common practice for businesses to bind the life of computer technology with that of its’ depreciation[18] value stated on the balance sheet. While most businesses can not replace all of the computers at the same time (nor should they), groups of computers are usually replaced as their value nears zero.

A migration of older technology takes place so that the newest technology is concentrated with those employees that can produce the most from it’s benefits. Usually less trained personnel get the older machines. This process is referred to as “trickle down technology”.

As hardware looses all accountable value, it is either given to employees to take home or disposed of in public auctions and/or scrapped. If the cost of maintenance for an asset exceeds the value of that asset it is written off much the same as an asset with no accountable value.

SUMMARY

The bottom line is that people are the variable in the equation called “networking”. People add the complication, decision making and design. If ever there was a fundamental to take into consideration when creating a network it would be how people react, use and view their network resources. I was once told by a smart system manager that the goal of the network administrator was to *make the network invisible*. One should be able to use network resources without feeling that they are on a network.

In order to gain the fullest benefit of combining resources we must make each workstation as individual as the person using it. But we must also make the network stable, reliable and fully functional. Given the dilemma of individuality vs. standardization, it is the blend of the two that marks a great network administrator. It is the ability to combine resources with talent to achieve a complete compatibility that is the end goal.

18. A decrease or loss in value, as because of age, wear, or market conditions. *Accounting*. An allowance made for a loss in value of property. Reduction in the purchasing value of money.