The Politics of Data Communication Networks

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INTRODUCTION

Many believe that the primary purpose of data communication networks is to facilitate the sharing of information. While this is certainly a function of networking, it is not the ultimate goal. The value of data communication networks is that they offer small groups, departments, and organizations a platform in which to share ideas and provide a building block for people to work as a team. By offering access to electronic mail facilities, to organizational computing facilities, and to other internal and external information resources, people can become more involved with the total organization and its' business purpose.

In any discussion on how to successfully implement a large multi-vendor data network, it is essential to remember that the goal is to integrate, not alienate, departments. By exploring technical and administrative issues as well as other relationships, we can begin to understand the political/social process that leads to successful implementation of an organizational network.

TECHNICAL ISSUES

A constant problem faced by many when attempting to establish a organizational-wide data network, is matching system design with user needs. If your company has a centralized purchasing policy that mandates what computer vendor departments must use (or in other words, dictating what equipment they perceive will meet a department's needs), then the answer is relatively obvious. You solicit the vendor for integration products that are compatible with their equipment. If on the other hand your organization subscribes to a decentralized philosophy, not unlike The Ohio State University's, in which each department has freedom to choose the computer system that best fits their needs, then the task may become considerably more difficult. This problem is compounded when your organization happens to be one of the largest universities in the country.

Consider for example that The Ohio State University's main campus, located in Columbus, Ohio, has 383 buildings

situated on 1,612 acres. Approximately 53,000 students are enrolled at this campus which is supported by over 20,000 full-time faculty and staff employed by 368 departments. As a major land grant university Ohio State is so large that if it were a city, it would be among the top 20 cities in the state of Ohio!

I am sure you can imagine that with each of these departments being responsible for choosing their own computer systems, a wide variety can be found. It would be safe to say that in general most universities give true meaning to the often used phrase "Multi-vendor environment." So how do you begin to integrate all of these diverse departmental networks, the three main computer centers (academic, administrative, and health care), and the several thousand standalone PCs located at various locations spanning several acres?

About two years ago, the academic computer center decided to take the lead in establishing a high-speed campus-wide computer network, SONNET (**S**ystem **O**f **N**eighboring **NET**works). There were several valid reasons for needing to construct such a beast. First, there was an expressed need for Ohio State to become a node connected to ARPANET (a large, packet-switched network intended for the conduct of, or in support of official U.S. government business), to enhance the University's ability to communicate with other institutions for research, mail transfer, grants, etc. Second, it was becoming apparent that the campus community was being forced to devise individual ways of accessing needed resources from one another and the computer centers. If some sort of direction wasn't provided for transferring messages and data, and a standard approach wasn't found that many different systems could use, then our ability to meet the goals of education and innovation could be directly impacted.

An open invitation was extended by the academic computer center to any department (not just faculty) interested in establishing an informal study group, headed by the center's deputy director, to examine the technical concerns. From the outset it was determined that if every courtesy was not made to include any department that was interested in forming a standard way to internetwork computers, the network would fail. People do not generally embrace ideas that they do not understand or are forced upon them. To be persuasive in implementing a organizational-wide network, everyone, who may be affected, should be included.

Once established, this networking group soon realized that they needed to find a standard networking solution that was

not vendor dependent. Rather than have Vendor A communicate directly with Vendor B or Vendor C, the goal would be to identify a standard medium that the majority of vendors could "talk" to. Every computer on the network could then have the same "look" as every other computer. This was important, not only from a technical point of view, but from a political perspective -- no one departmental computer would dominate and control the network. The group also believed that the criterion should provide three basic functions most important to end users: Integration of electronic mail systems; computer-to-computer file transfers; and virtual terminal capability.

Unfortunately for networking standards, they make great subjects for discussion, but if few vendors are providing workable off-the-shelf products, who wants to (or can) wait five years before they are developed? Fortunately, the standards commonly referred to as TCP/IP (Transmission Control Protocol/Internet Protocol) seemed to be the best currently available method to integrate diverse systems.

There were several valid reasons for adopting TCP/IP. First of all, it was a fairly well defined, reliable way to internetwork many heterogeneous systems. Second, it was generally associated with a larger grouping of protocols that offered the functions desired at the user level such as:

File Transfer Protocol (FTP)	Allowing a user on one host to interactively communicate with another host for the purpose of file transfer, directory listings, etc..
Simple Mail Transfer Protocol (SMTP)	The transmitting and relaying of mail, along with automatic return of undeliverable mail. The transfer of mail can be automatic or user specified.
Virtual Terminal Protocol (Telnet)	A local user on one host can become a remote user on another host by using normal log-on procedures.

Third, many of the departments' computer vendors offered software/hardware products supporting most, if not all, of the TCP/IP standards. Finally, many departments already felt comfortable with this popular group of standards. In fact, there already existed on campus an installed base of Ethernet Local Area Networks of which TCP/IP was or could be supported.

I believe it is important at this time to point out that TCP/IP was going to be the recommend networking standard. That is not to say that if departments wanted and could connect to SONNET with proprietary protocols they would not be allowed to do so. It was simply a matter that there was no other alternative but functional isolation from the rest of the organization if the majority of departments chose not to go with the recommendation. This provides quite an incentive.

Once the decision was made to go with TCP/IP, the next step was to decide on the physical configuration and interconnect methods (although it was presumed that the long-standing Ethernet specification would be the most popular way for departmental equipment to connect). Reliability and data traffic, including the amount and location, seemed to be the major concern driving the physical configuration. The general consensus was that the network needed to be based on a high-speed backbone, or data "highway", because of the enormous amount of interdepartmental information that was anticipated. To be reliable, this "highway" needed to be made of sections that could continue operating even if one section was unavailable.

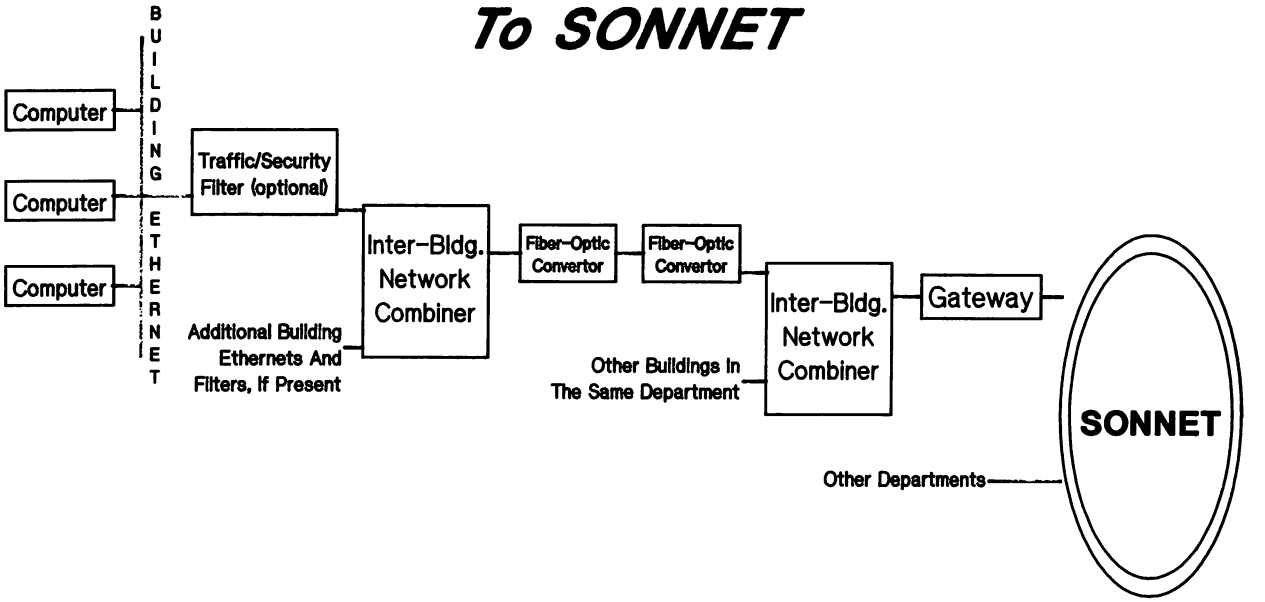
Another issue to be resolved was that traffic needed to be localized whenever possible. For instance, information sent from a local computer should not have to first be transmitted across the high-speed backbone to get to an adjacent receiving computer. Also, members were concerned that their already saturated local networks or computer systems might be used by others as a gateway to access the high-speed backbone.

The committee finally settled on a fiber-based 80 million bits per second star network (illustrated on the following page). Ethernet to high-speed token ring gateways are connected to primary and redundant fibers joining hub buildings. These help localize traffic along with other intelligent filters.

ADMINISTRATIVE POINTS

In addition to the technical issues, there are many other aspects involved in successfully implementing a organizational-wide network. The trap to avoid is to not get so wrapped up in the technical issues that behavioral concerns are overlooked. Many times the political or social process is just as important to the success of interdepartmental information resource connections as is the hardware and software that make it all work.

How Computers Typically Connect To SONNET



Adapted from a flowchart created by Instruction Research Computer Center.

* **Someone must act as the referee, coordinator, and liaison between the various groups.**

It is extremely important in the early stages of network development, when a balance is trying to be found between technical issues and political considerations, to appoint someone to act as the arbitrator. This person must be perceived as neutral and reasonably objective, and who the organization can entrust the difficult responsibility of meeting the needs of many, not just the needs of a few. We at The Ohio State University, were lucky enough to find such a person in the deputy director of the academic computer center (this opinion coming from a member of the administrative computer center).

* **Senior management must be aware and supportive of the project.**

People will be reluctant to participate if they feel that senior management is insensitive or even worse, opposed to the idea. Given the importance and high visibility of a project this size, it isn't hard to gain direct support or at least departmental participation. This is especially true in a decentralized hierarchy style of management where no one group wants to be perceived as "odd man out."

* **Develop a philosophy that will encourage the greatest number of participants to join.**

After all, the value of any corporate network, to its subscribers, increases as more members join. One obvious method to achieve participation is to mandate that all departments join which eliminates any alternatives. This usually requires stong-arm tactics -- forcing departments to abandon existing networks and join the one and true network defined as the one supported by the top political party. A more palatable approach is to gently encourage the use of the network without requiring everyone to join. By allowing the continued use of the already installed base of facilities, yet at the same time promoting the benefits of the new, user resistance is minimized. Recognize too that there will be some applications that just do not fit the "TCP/IP, etc.." mold or groups who initially do not directly benefit as members. For this reason it is very important to refer to a organizational-wide network -- not in the context of the "Fiber" or "TCP/IP" plan, but as the whole internetworked together -- because a network of data networks should serve as the balancing force in a multi-vendor environment.

* **Clarify responsibilities.**

Responsibilities need to be assigned and commitments made as to who is going to do what on a evenly distributed basis from the beginning. Unfortunately, the money is going to have to come from somewhere for installation and someone has to be responsible for maintenance: Equipment repair, assigning addresses, consulting, troubleshooting, etc. The organization needs to recognize that many of the conflicts and departmental concerns are going to be the outgrowth of how responsibilities are apportioned. If these issues are ignored in the beginning, they will later emerge to haunt the success of the project. The key ingredients rests on the willingness to have frank discussions and procedures in place to resolve conflicts that invariably surface.

* **Understand the end user.**

Users expect, and rightly so, certain levels of service. They require that the network be readily available and adaptable for use in their work environment. I have known people who use a system all day long, but when asked their opinion, they are very dejected and resentful. These problems are due, in part, to adversary relationships between end users and providers because large data concerns sometimes try to dictate what they think are the user needs. Ask questions and be prepared to respond to what the end user has to say about such issues as security, response time requirements, availability, etc.

CONCLUDING REMARKS

Technology is available today that addresses the problem of integrating yesterday's autonomous departments. By exercising care in choosing the appropriate strategy that deals with technical issues as well as social concerns, an organizational data network can provide the communication bond that is lacking in so many businesses. If a resource, such as a company-wide data network, can contribute in making each member feel that they are equal partners working towards shared goals, it has provided the essential element for any successful operation: Cooperation.