Design and Implementation of a Wide Area Network: Technological and Managerial Issues

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EXECUTIVE SUMMARY

This case deals with the experience of a school district in the design and implementation of a wide area network. The problems faced by the school district that made the WAN a necessity are enumerated. The choice of hardware and the software is explained within the context of the needs of the school district. Finally the benefits accruing to the school district are identified, and the cost of the overall system is determined.

BACKGROUND

The organization is a reasonably small school district with about 2,700 students, in a town named X that is comprised of four villages (A, B, C and D). There are five schools in the district, the Board of Education that oversees those schools, and the Bus Garage. The buildings that house these seven entities are spread over the four villages, and the distance between locations is more than ten miles in some cases. While the school district is not exceedingly wealthy, it does have access to state and federal grants for bringing schools online. What isn't covered by the grants has been funded out of the municipal budget, with virtually no opposition from the Board of Finance, setting a stage whereby the town maintains an aggressive approach to deploying technology in its schools.

SETTING THE STAGE

The Town of X needed to connect the computers and systems at the seven locations in order to share information and resources. The district is spread out over the four villages that make up the town (A. B, C and D) and its seven locations within that area are separated by as much as ten miles. The faculty, staff and students within the school district needed the ability to communicate with each other and with the rest of the world via electronic mail. Accessing information via the World Wide Web was needed to keep up with the changing world, both for the faculty and the students. They needed to share files without printing and distributing hard copies. There was a distinct need for getting access to the Internet into the classroom. The schools in the school district had computer labs,

and computer-based education was a priority, but the computers could not connect to the Internet. The students, teachers and administrators in the school district needed to run collaboration applications like groupware and various administrative applications that required connectivity to a central database. Given the geographical distances involved, a wide area network seemed to be a good solution, that would take care of most of the needs of the school district.

An example of this need for connectivity and bandwidth is the Phoenix database, a school administration package used in the school district for town X and many other districts. Phoenix is a large and complex database written for Microsoft Access 2.0. It is clunky and painful to deploy in many respects, and it does not run on the newer versions of Access. So Access 2.0 must be installed for the database to run, but package serves its purpose and is popular. Phoenix has modules for maintaining student records (attendance, grades, discipline, etc.), class and bus schedules, payroll for faculty and staff, cost accounting and a number of other functions needed to run a school district. The ability to run this software product across a network is indispensable in this environment, as it allows each school to handle its own administrative tasks independently. In order to enable the proper running of the Phoenix software over the network, a good bandwidth is a requirement.

When the project was envisioned, direct fiber over the distances involved was not a viable option (the distances between two consecutive schools could run to more than ten miles). A wide area network, using some form of leased transmission lines was considered the most efficient way to connect the school district and create a cohesive enterprise. Such an enterprise could communicate efficiently and act in concert, providing connectivity and services to the faculty, staff, students and even the citizens of the Town X school district.

CASE DESCRIPTION

A Look at the Network

The Town X wide area network is described from two perspectives. The first perspective gives an overview of the network and the services that it delivers. This view primarily describes the software. The second perspective explains how these services are delivered. This perspective provides a discussion of the hardware and the network protocols used in the wide area network deployed.

Network Services

Just as a desktop computer requires an operating system (OS) to run, a network needs a network operating system (NOS). For the town X school district, the NOS chosen was Microsoft's Windows NT Server 4.0. There were a number of reasons for choosing Windows NT 4.0, but the overriding reason was the fact that the network administrator was familiar with the software. The NOS resides on a single computer known as a Primary Domain Controller (PDC). The school district network is configured as a single NT domain network–that is, a user needs to log on only once to the network in order to reach all resources he/she is allowed access to. The NT Server OS can also be configured to run as a stand-alone server to host other services on the network. There may be a number of such servers in a domain. In the case of the Town X school district WAS, there are two other NT servers that serve as hosts for additional services.

The Role of Domain Controller(s)

While the PDC, of which there can be only one, hosts the Security Accounts Management (SAM) Database, it is the Backup Domain Controllers (BDC) who maintain a copy of this SAM Database and actually perform the authentication of logins to the Domain. So when a user turns on a client machine and enters a user name and password, the "request" is directed not to the PDC but to a BDC, provided there is BDC present. For the Town X school district, each location has a BDC. At login the user name is compared against the SAM Database, and those privileges and accesses