How to Evaluate and Select Local Area Networks/Cabling Systems

(Based on the project that resulted in the selection of the IBM Cabling System for the new American Express world headquarters.)

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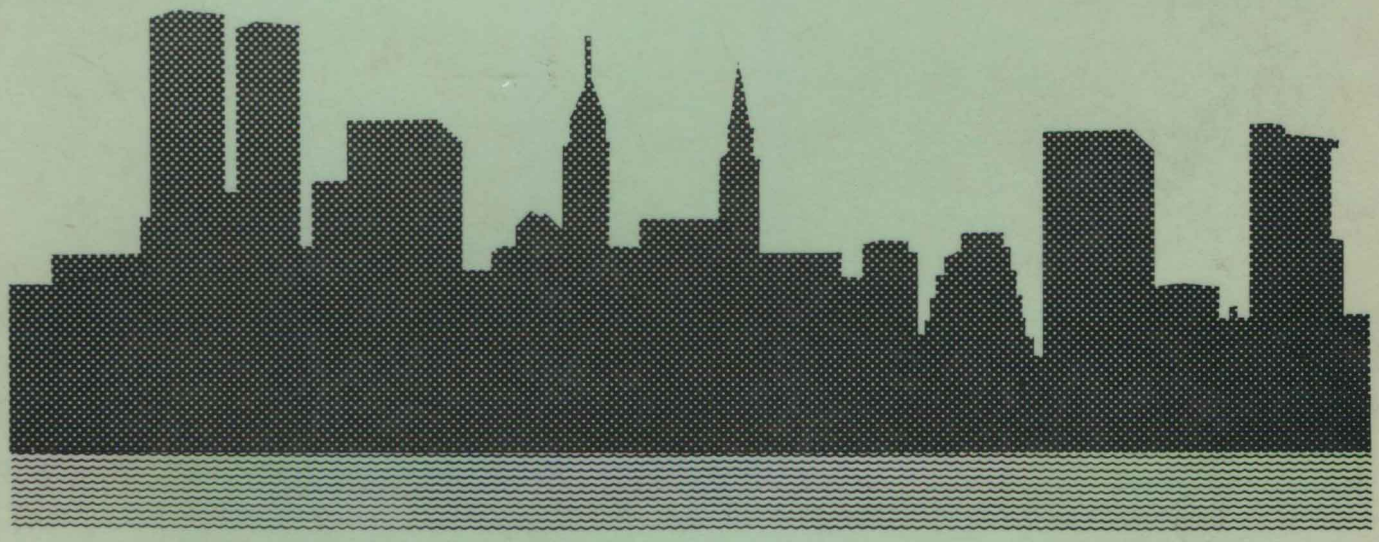

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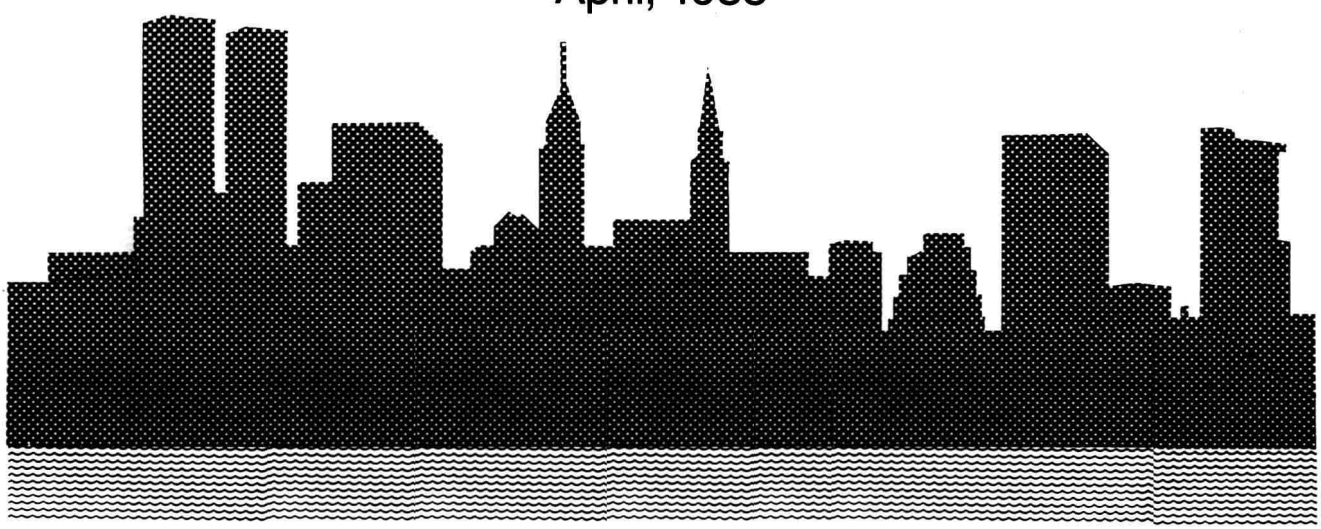

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Foreword

The purpose of this report is to give readers insight into the decision-making process and methodology used to evaluate a local area network and/or cabling system solution for a new corporate headquarters. The information contained in the report is drawn from the authors' firsthand experiences at the American Express Company's world headquarters in New York.

Mark Lieberman and Mino Akhtar were instrumental in the planning, evaluation, and selection procedure that resulted in the decision to install the IBM Cabling System in the new Amex Tower in Lower Manhattan. Before settling on the IBM Cabling System, they had to consider the range of available technology in light of the company's present and future requirements, and throughout the process, they had to work closely with end users and managment alike to ensure that the proposals under consideration would be practical and financially sound. Their experiences are recorded here in the hope that people facing similar decisions for their companies will gain a better understanding of:

1) the issues that must be dealt with in evaluating LANs and cabling solutions; and

2) a methodology that can be used to analyze the issues and evaluate alternatives.

As stated above, the report is based on the actual decision-making process that took place at American Express, and the conditions described within it mirror those of the Amex Tower. In order to make the report broadly applicable, however, the authors have taken the American Express experience and generalized it as a case study which illustrates certain issues and decisions likely to be faced by companies considering local networks or cabling solutions. The case study is ultimately used to demonstrate the benefits of the IBM Cabling System within certain environments. These benefits are discussed at the end of the related sections within each chapter.

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1. Introduction

1.1. Issues

The process that an organization must go through to select, cost justify, and implement a local area network (LAN) and/or cabling system is much more involved than deciding between broadband or baseband technology. It's much more involved than deciding between fiber or coaxial cable. And, it's much more involved than selecting a bus, ring, or tree architecture. The issues that must be dealt with, in addition to the ones noted above, include:

- selecting a vendor with a long-term, strategic product
- determining current and long-term terminal and systems requirements
- determining current and long-term connectivity and communications requirements
- planning for the physical implementation, including cable runs, furniture cabling, distances between key network points, locating processors and controllers, etc.
- planning for communications from/to the facility being cabled
- writing a Request for Proposal (RFP) and evaluating vendor responses
- identifying major alternatives
- evaluating the costs and savings associated with each major alternative
- calculating the net present value (NPV) of various alternatives and presenting the results to senior management
- staffing or contracting for the skills necessary to design, install, and maintain a local area network
- managing the final bidding process with contractors
- scheduling the actual installation, cutover, and initiation of the system

With all these subjects in mind, it becomes obvious that the literature has been primarily focusing on technology; not on applying technology, planning, evaluating costs and proposals, nor on implementing. This point is stressed to alert the reader and those individuals with responsibility for evaluating and

selecting local area networks and/or cable solutions, that considerable more time will be spent in this report on the requirements, decision process and the implementation issues noted above than on the technological issues.

By entitling this report How to Evaluate and Select Local Area Networks/Cabling Systems, it is the authors' intention to present a "start" to "finish" project plan that can be used as the basis for other LAN/cabling system selection and evaluation efforts. There is only one section of this report (Chapter 5) dedicated to the technology issues. That chapter is presented more as an overview of alternatives than as a technical review.

The remainder of the report is organized in a logical sequence to aid the evaluation team in its effort. It begins by stating the problem to be addressed and asking "Why evaluate local networks or building cabling solutions, and how do we decide which one is really needed?" This section is followed by a procedure for taking an inventory of current and future equipment, as well as connectivity and communications requirements. Then the possible system and architectural constraints are presented, followed by the current technology alternatives. The reader is then provided with an approach for issuing and evaluating an RFP and for identifying major selection alternatives. Lastly, the report focuses on preparing a detailed cost-benefit analysis.

Throughout the report, the reader is presented with a case study based on the American Express Company's new world headquarters, and shown the rationale for their ultimate selection of the IBM Cabling System. The report is not intended to be an unequivocal endorsement of the IBM Cabling System, but rather a discussion of the process by which organizations should evaluate and select the local networks/cabling systems most appropriate for their needs.

1.2. Evaluation Methodology

Every situation requires careful analysis; therefore this, or any methodology should be adapted to accommodate the specific situation. The authors present this methodology as only one possible approach. They do not guarantee its results, but they believe it is the best approach to follow. The reader must decide, and then take full responsibility for following any evaluation approach. To a great extent, any approach followed will be confined to the time and other resources/constraints applicable to the evaluation process. This material, therefore, should be used as a guide.

As a guide, this report describes a methodology that begins by stating the objective of the evaluation. This is necessary to maintain a focus and to delineate to others the exact purpose of the effort. Given that this objective is accepted, the next step

of the methodology calls for the establishment of an inventory system to help determine the equipment and services currently in use. It is not unusual to find, even in the largest of organizations, the lack of an inventory system. Many organizations, especially decentralized ones, have no detailed information pertaining to the systems products in use throughout the organization.

The inventory system described later is a very basic one. It provides the ability to determine which manufacturer's equipment and models exist within the facility to be cabled. This approach is also used to determine how these products are wired today. This inventory will be necessary to determine which local area network vendor's products can meet current needs (if it is the intention of the organization to install the current systems on the LAN/Cable System [hereafter referred to often as a LAN] selected).

The inventory system described will also provide valuable implementation information. It encompasses the current connectivity and communications patterns of the enterprise. Here too, a LAN solution may be developed or designed according to these patterns (unless the intention is to replace all current systems with new and different systems).

The inventory system will also include an approach for obtaining estimates for future equipment and communications needs. These future plans are vital to have from the many departments and divisions involved if the LAN is to fully support all of the systems being planned for the facility. Since a LAN is a long term investment, it must serve current as well as future requirements.

Knowing these requirements, however, is not sufficient information to select a LAN. It will also be necessary to know what constraints exist. These may include systems constraints (mainframe, minicomputer, communications front ends, etc.). The potential constraints also include physical attributes of the facility such as layout, space availability, etc.

The architecture of the facility may present the evaluator with obstacles that will have bearing on the final solution. It will be necessary, therefore, to evaluate the horizontal floor plan with the architect as well as the vertical plan, building access and the furniture to be used. Many LAN components are incompatible or at least difficult to implement within certain physical environments.

Once all the current and future requirements are known along with the constraints of the environment, the organization can then develop an RFP to present to vendors. This is not a trivial process. It will take months to prepare and evaluate an RFP. In addition, since the potential expenditure may be in the multi-millions of dollars, it will be necessary to put a very

practical and fair RFP evaluation process in place.

Another aspect of the RFP process is to decide which companies should be sent the RFP. These may include companies that only manufacture local area network products, terminal and systems manufacturers that also offer LANs, PBX manufacturers or special consultant/designer organizations that provide "turnkey" solutions.

All of the information gathered during this process will be used to determine the possible solutions to meet the overall purpose of the project. This information will also be used to determine costs and savings, requiring a full financial evaluation. Using net present value algorithms and cash flow models the financial aspects of each alternative solution can be developed and included in a complete presentation to management, along with the pros and cons of each alternative.

Once an alternative is selected and approved by management, it will be necessary to get final bids from all contractors including electricians and any other groups involved in the implementation phase. The implementation will then be fully detailed to include specific cabling plans, schedules and cutover from the current wiring approach.

Each of these steps is explained in detail to provide the reader with as much assistance as possible. In addition, forms, tables and illustrations are used throughout this report to support and augment the descriptions. A bibliography and glossary of terms is also included to provide the reader with additional sources of information and quick definitions. The glossary was provided by the IEEE 802 Committee on local area networks.

1.3. Sample Project Plan

I. Define Project Objective
II. Determine Requirements
III. Develop and Issue a Request for Proposal
IV. Establish Criteria for RFP Evaluation
V. Develop a Cost-Benefit Model
VI. Evaluate RFP Responses and Analyze Costs
VII. Select a Vendor and Alternates and Present Findings to Management
VIII. Plan Implementation
IX. Put Out Installation Plan for Final Bids
X. Manage Implementation

2. Problem Statement

The purpose of the problem statement, for any project, is to state the objectives of the project and describe the problem that must be solved. Often a project must begin with a very general goal or objective. However, as the project progresses and the requirements are investigated, the issues confronting the project team become clearer and can be stated in a more precise manner. Therefore, the problem statement may evolve and be refined during the project.

The problem statement must be stated in business terminology since it will ultimately be presented to senior management for approval. For technical people, it is often difficult to keep the business perspective, since they are so involved in the technical details. Therefore, the problem statement also serves to keep the project team focused on the issues that must be solved rather than straying off on technically exciting, but sometimes irrelevant, solutions. This can be a problem with new technologies such as local area networks or personal computers, which may be called "technology-push" markets. In other words, the technology is currently far ahead of the ability of many users to use the technology. Moreover, the technology is undergoing rapid change, and users are bombarded with new choices every day. This makes it difficult to commit to any technology since the risk of obsolescence is so high.

2.1. LAN Definition

To understand why an organization may want to evaluate a local area network, the definition of a local area network must be stated. One way to define a LAN is a data communications network that connects multiple computer systems and terminals within a local area or facility, such as a building or campus (collection of nearby buildings). It has different requirements and properties than wide area networks, which are long-distance data communications networks, or metropolitan networks, which are medium-distance data communications networks. An example of the latter is the Manhattan Cable TV data network installed on the island of Manhattan in New York City. Figure 2-1 illustrates these three types of networks. Figure 2-2 lists some of the differentiating factors between these three categories. It must be noted, however, that these are broad generalizations and that several intermediary networks may exist.

LANs and cable systems face present issues and cost considerations, such as facility issues, number and types of terminals supported, etc., than metropolitan or wide area networks. Also, LANs are almost always private networks. Three distinct characteristics of LANs are the high number of terminal connections, the short distances and the high bandwidth requirements.

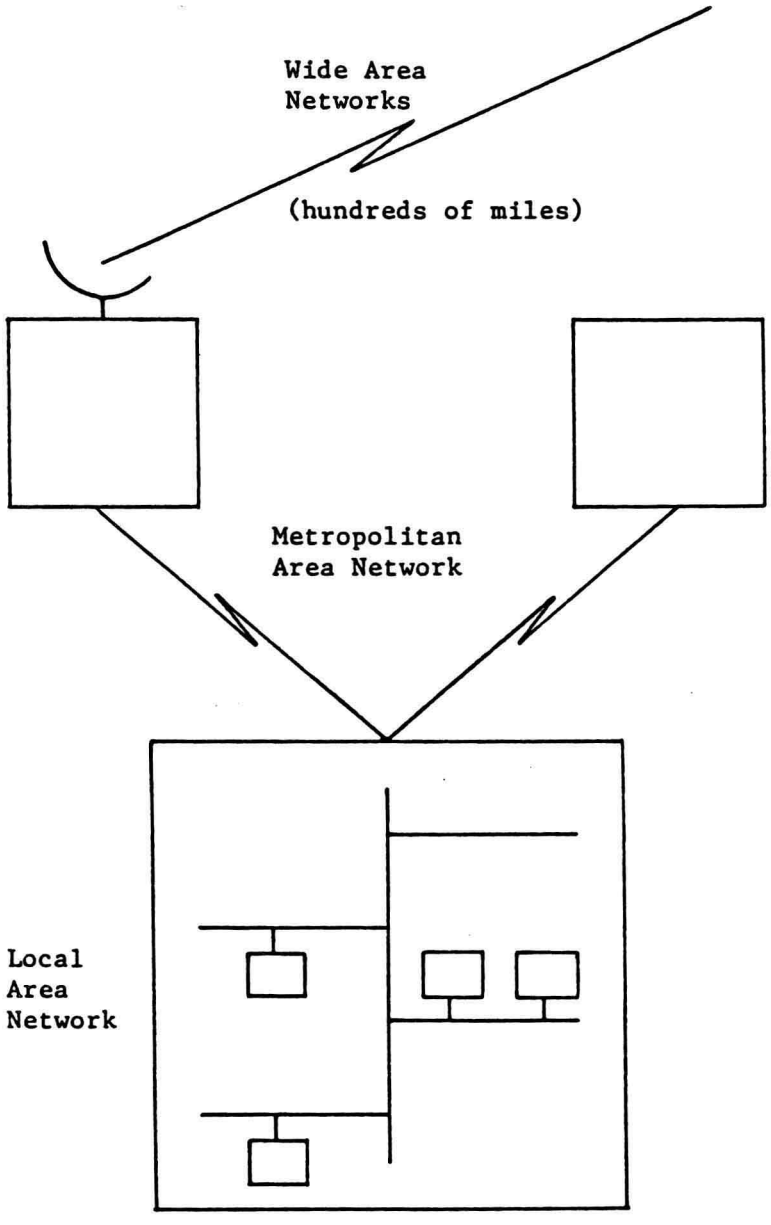

Figure 2-1: Types of Networks

LOCAL AREA VERSUS OTHER NETWORKS

	LOCAL AREA	METROPOLITAN	WIDE AREA
MEDIA	Coaxial Cable	Coaxial Cable	Fiber
	Twisted Pair	Fiber	Satellite
	Fiber	Microwave	Microwave
		Twisted Pair	Twisted Pair
SPEED	Very High	High	Low
MAJOR ISSUES	Terminal Support	Right-of-way	Distance
	Facility Issues	Line-of-sight	Regulatory Issues
MAJOR COSTS	Connect-costs	Installation	Tariffs
OWNER-SHIP	Private	Public or Private	Public or Private

Figure 2-2: Network Characteristics

LANs have only recently come to the attention of systems and data communications planners. Previously, office systems, data processing, voice communications, video services and data communications have developed along separate and independent paths. However, as systems continued to mature, it became clear that communications among many types of systems may become critical to the future. Stand-alone, independent data or office systems, (e.g., computer centers, word processing centers, etc.) will always have their place in organizations, but any organization-wide implementation that requires integration of the above applications can no longer rely on traditional data communications nor on traditional cabling solutions. There are two main reasons for this:

- Newer systems need to handle not only coded data (ASCII or EBCDIC) such as documents, graphs, programs, files, numbers, etc., but also non-coded data, such as image, voice, and even video. These all require higher throughput capabilities than those offered by traditional in-building data communications (110 to 9600 bits per second).

- With the advent of end user systems, such as office systems and personal computers, the terminal density in a local area, such as an office building, is increasing. In addition, these systems need to communicate with each other, and links to other locations may also exist. Hence the interest and growth in local area networks is a direct result of end user systems growth, and therefore the office or factory will be the major benefactors of local area networks.

It must be noted that there are different types of local area networks, each designed to serve special functions. For example, a high-speed link between two computers or a communications medium for the interconnection of factory systems can both be termed LANs. The primary goal of a LAN is the same in each case: to interconnect multiple systems and share resources within a local area through a common network. The major components of a LAN are:

a) the physical cable and its components

b) network hardware

c) network software

Elements of the last two items can be integrated within the terminals that are connected. The first component becomes a part of the facility.

One of the most significant characteristics of a LAN is that it uses a universal physical medium that interconnects multiple types of terminals and systems. For an office, the potential therefore exists to eliminate many of the physical cabling costs

and problems associated with multiple, independent wiring systems. Moreover, terminals are constantly relocated as organizations evolve, and one pervasive physical medium may reduce the need for rewiring.

This has led to the creation of a new, intermediate industry, i.e., premise wiring solutions. Major vendors, like IBM and AT&T, have realized that users may need to solve their cabling problems before they are ready to install a full-fledged LAN or instead of a LAN. Therefore, an intermediate wiring solution that can grow into a LAN is desirable in many instances. One example of such a system is the IBM Cabling System, announced in May 1984. Cabling solutions are further described in Chapter 5 under Wiring Alternatives as well as in Appendix A.

The decision to evaluate a LAN for an organization, therefore, can arise due to two main reasons. One reason is a genuine need to improve communications among systems in the facility. The other may be that the facility is facing a physical constraint in supporting all the wiring for systems, and therefore a more efficient method of installing, relocating and connecting systems is sought. Another possibility is a planned move to a new location, which presents a great opportunity to solve existing wiring problems and/or improve communications.

Both approaches may result in the same solution; however, the justification and implementation process may differ significantly. As the project progresses, the perspective on the problem may change from one reason to another. For example, an organization that assumes that a need for more interconnectivity of systems exists, may find upon closer study, that this need is minimal and not sufficient to cost-justify a LAN. However, the organization still faces the problem of supporting a large, growing number of systems from the facilities or physical point of view. In each of these cases, the problem must be stated precisely at the beginning of the project so that the results can be measured against the stated objective. At the same time, if the perspective on the problem changes, this must be explained and supported by the information gathered in the process.

In the final analysis, a LAN must improve communications or save wiring and/or communication expenses for the existing and future systems in the facility. At the same time, it must conform to the physical facility or facilities that it covers. Just as an application program has to satisfy the requirements of its users, a LAN must satisfy requirements of both the systems and the facility in order to be a successful LAN installation. The next sections describe the systems and facilities issues that must be considered when evaluating a LAN.

2.2. System Issues

A host of strategic systems issues should be considered in

the evaluation of a LAN. Although a methodology for gathering requirements is described in detail in the next chapter, this section lists the generic areas that one must look into, particularly from a strategic perspective. A word of caution - one should resist the technology push pressure of today's hyperactive computer industry, and balance it with a realistic assessment of current and future business needs. Particularly, in the local area network arena, vendors are promising users functionality that today's computers and workstations cannot even use. Even though some LANs are ready, the utility and applications most often are not and won't be for some time. An example is video capability, which some LANs can provide at every work area today. In most offices today this is not a current or even near future need and would be considered an extravagant expense.

Without reiterating all the impressive figures quoted throughout the industry about the amazing developments in computers, it is a well-known fact that technology is changing at a most rapid rate. Therefore, it is incumbent upon anyone evaluating a new, high-technology product to be aware of the most current trends. For example, a recent trend has been the application of RF technology to digital transmission. This trend may or may not be popular ten years from now. The more common medium of the future may very well be fiber or cellular radio. In any case, the evaluation of a LAN must be done in the context of the existing technologies, their status and long-term strategic value.

A strategic look at all of the following areas within the organization is necessary before embarking on a local area network study:

- Workstations - What type of workstations are foreseen for the next 5-10 years?

- Office systems - What is the company's office systems strategy? Is it host-based or based on multiple distributed systems? What level of penetration is expected over the next 5-10 years? What types of interconnections between office systems and other systems are anticipated? Will file, printer and communications servers or minicomputer systems be used?

- Host environment - What is the company's mainframe environment? Is it a multi-vendor environment or is it dominated by one vendor? Are the hosts located within the same facility or remote? If remotely located, what types of interconnections to this facility are expected? Are these links to be handled by the LAN or another network?

- Personal computers - What is the personal computing policy and strategy in the company? Is the personal computer the predominant workstation, and if so, which type is most used?