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**Integrated
Voice and Data
Services**

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Information Systems Program (ISP)

Integrated Voice and Data Services

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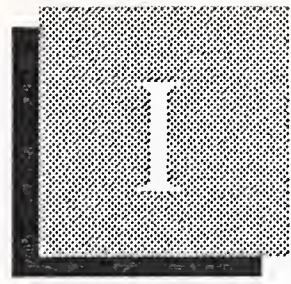
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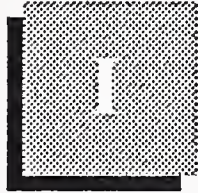
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Introduction





Introduction

A

Purpose and Scope

Offering possibilities of significant cost savings and improved productivity, integrated voice and data services is a topic discussed and planned for in large and small organizations. Numerous vendors are promoting equipment that is reported to either accomplish or contribute to integration.

With many organizations progressing toward an integrated environment, there remains a question about whether managers and planners truly understand what integration is, what it accomplishes, and the benefits that will result from integrating voice and data services.

The purpose of this report is to provide an assessment of what voice/data integration is, an assessment of management's understanding of voice/data integration, and an assessment of how integrated services should be considered in relation to an organization's strategic direction and technology plans.

B

Report Organization

Following the introduction, the report addresses a number of areas related to management's understanding of Voice/Data Integration, provides a summary of major technologies associated with integration, addresses internal and external driving forces, and provides a summary of the experience of a major company.

This is followed by an assessment of the relationship of Voice/Data Integration to corporate and technology strategies and plans. Finally, a number of conclusions and recommendations are provided.

C**Methodology**

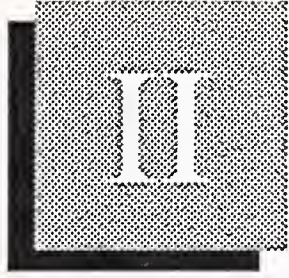
To prepare the report, INPUT conducted a review of industry and product literature and discussed management perceptions, needs, and requirements with a number of large organizations. In addition, an in-depth interview was conducted with a large organization having major requirements for a wide variety of voice and data services.

D**Related INPUT
Reports**

Integrated Voice/Data Communications, 1985

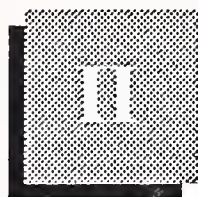
Network Services Directions, 1986

Network Integration, 1987



Management Considerations: Perceptions and Possibilities





Management Considerations: Perceptions and Possibilities

A

Integration and Corporate Requirements

1. Integration Defined

Prior to trying to assess management's understanding of Voice/Data Integration or assessing the impact on an organization, it is necessary to establish a definition.

The integration of 'voice/data/image/graphics' is at one end of a spectrum. Using this definition, unless all four are integrated, networks are not integrated. At the other end of the spectrum, integration could be considered complete if voice and data services (only) are sharing the same transport resources (lines).

Requiring all four (voice/data/graphics/image) is too restrictive because not all companies or company sites have a need to integrate image and graphics.

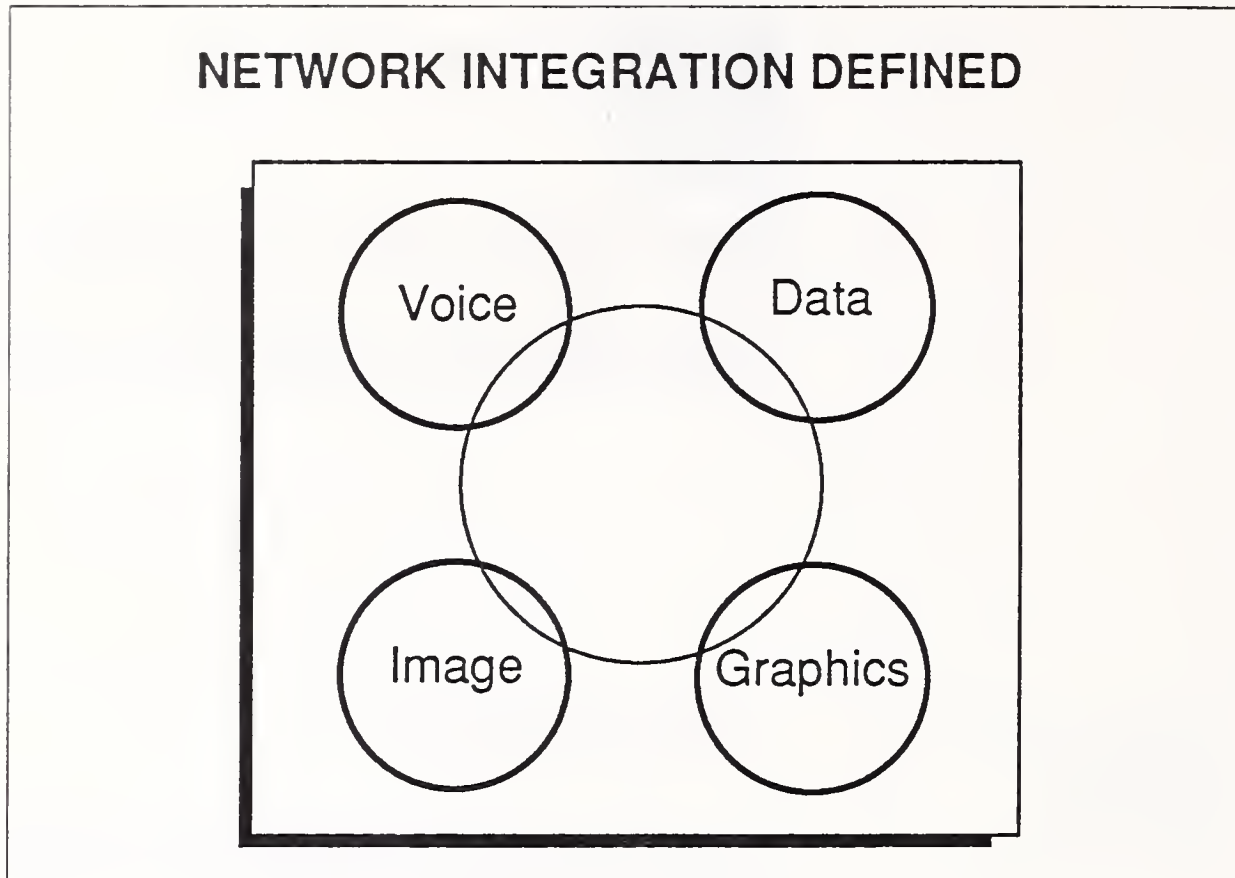
Requiring the integration of only data and voice is too general because that is not a new development and because the integration of either graphics or images is a different type of integration.

INPUT uses the word *integration* to mean that at least three of the voice/data/graphics/image types of information are required to call the process "Network Integration" (Exhibit II-1).

2. Driving Forces

Voice/Data integration is being driven by both internal and external forces. While many of these forces are not new, taken collectively, they provide compelling reasons for managers and planners to place greater attention on integration.

EXHIBIT II-1



a. Internal Driving Forces

Internal driving forces result from growing competition in U.S. industry. These forces are stimulating users to review network resources and develop plans to make more efficient use of existing facilities and services as well as provide functional capability to provide new services or support new applications. These forces will increase over time, increasing the need for Network Integration.

There are a number of driving forces that result from changes within organizations. Significant internal driving forces include the following:

- **New Applications**—Many organizations are developing or improving systems to make greater use of data to achieve competitive advantage.
- **Cost Savings**—The need to reduce operating costs is an ongoing requirement in most organizations.
- **Improved Quality**—Improvements in quality are an ongoing requirement for most organizations.
- **Strategic Advantage of Communications**—Increasing recognition is being given to communications as a tool to achieve strategic advantage.
- **Tactical Advantage of Communications**—Developments such as EDI support the need to make the best use of information.

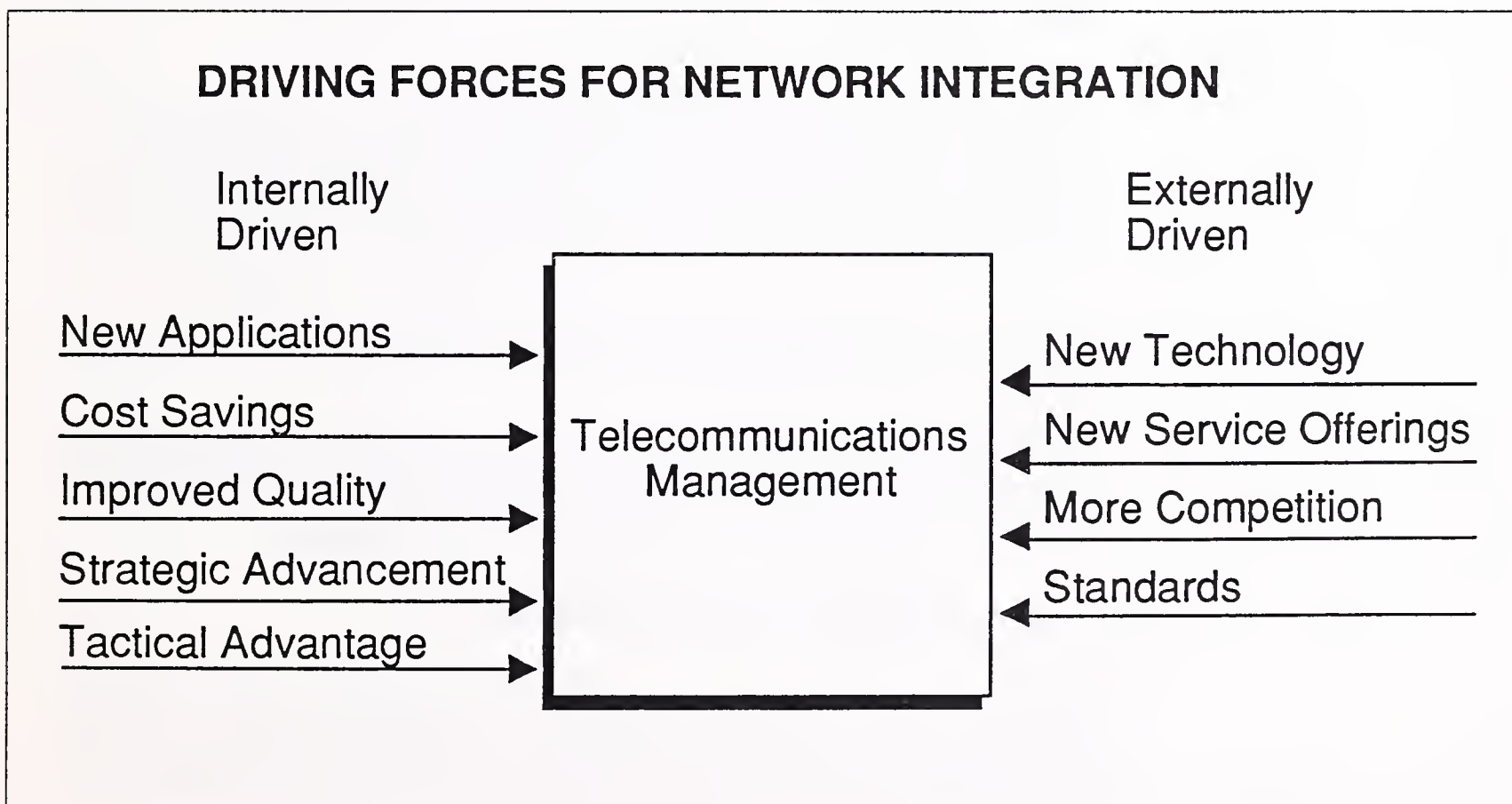
b. External Driving Forces

In addition to the internal forces, there are a number of external forces resulting from significant changes taking place in the industry. Significant External Driving Forces include the following:

- **New Technology**—Technology improvements are creating an increasing number of products and services that management evaluates and applies to meet specific needs.
- **New Service Offerings**—With digitization and microchips, an increasing number of services are being identified that need to be evaluated for their potential benefit.
- **More Competition**—Deregulation has brought an increasing number of products and services from an increasing number of providers.
- **Industrywide Standards**—Although standards should ultimately make life easier, they are causing organizations to make changes in the equipment they use and in the way processing is accomplished.

A summary of Internal and External driving forces is illustrated in Exhibit II-2.

EXHIBIT II-2



3. Network Service Trends

Lending support to the driving forces are a number of current trends in accomplishing integration. Corporatewide computer networks that handle voice as well as data communications, and digital PABXs that handle data as well as voice, are increasing in number. General development trends include the following:

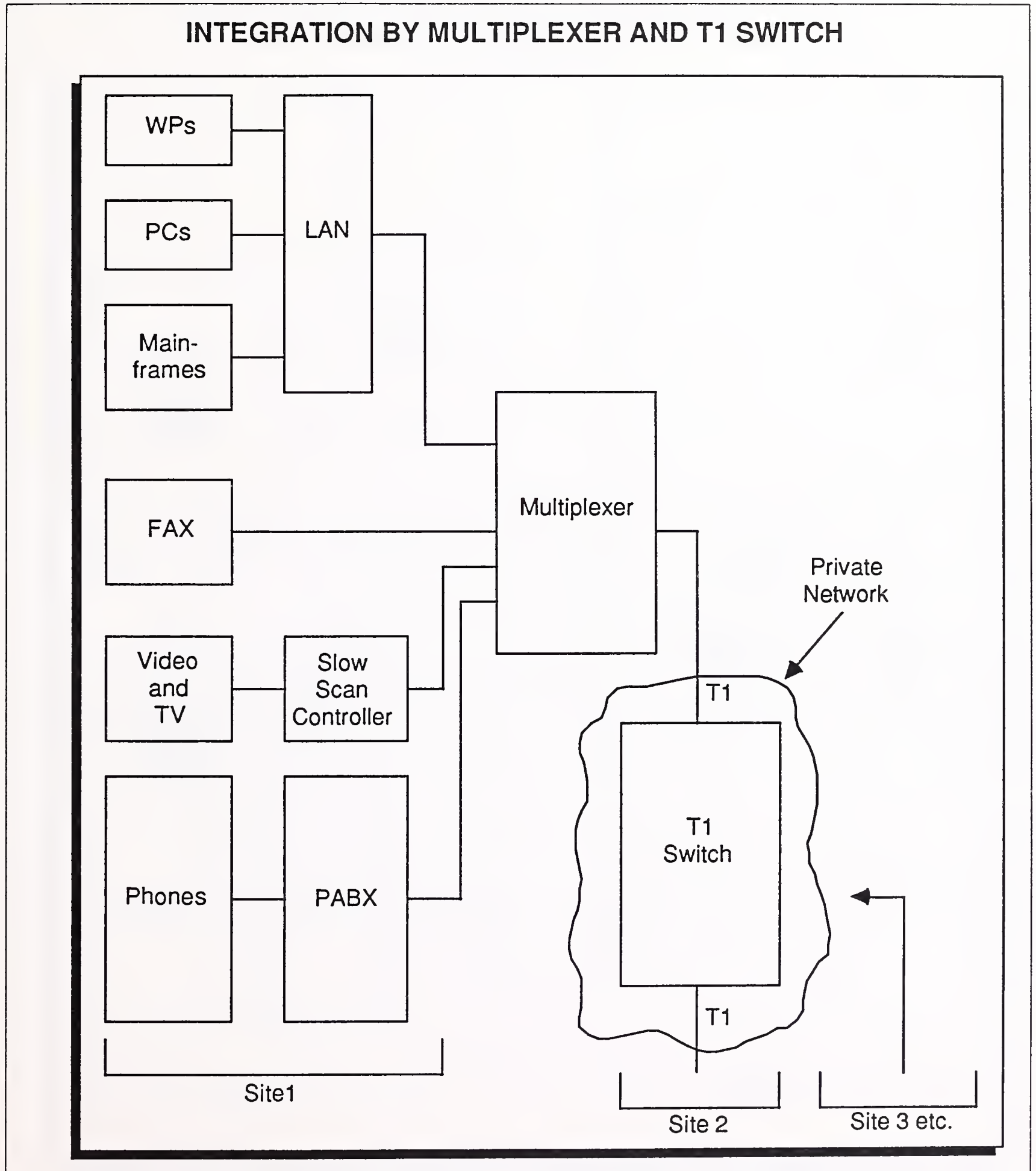
- LANs designed to support resource sharing on PCs are creating greater pressure to develop voice/data integration capabilities.
- Protocol packages with high-level protocols are becoming more readily available.
- Baseband chips and high-speed optimized switches add push to resolving the voice/data integration problems.
- Bridges linking dissimilar networks are growing in sophistication and popularity, thus providing public and private wideband network interconnection.
- Major PABX efforts are resulting in greater throughput, along with LAN interface capability.
- Fourth-generation PABXs are more sophisticated and are being developed by new entrants who hope to take advantage of the latest technological advances.
- Joint development efforts between PABX and computer manufacturers is adding leverage to providing integration solution opportunities. Computer manufacturers now have access to voice applications, and PABX suppliers have entrée to information-processing environments and new channels of distribution.
- Extensive software is being developed for distribution and integration of voice/data capabilities.
- Certification and development of high-speed PBX-to-computer interfaces as well as high-speed PABX links to microwave and satellite services are extending the open-system interconnection.

4. Plans, Perceptions, and Understanding

Discussions with managers and planners responsible for Network Integration result in a conclusion that there is no single solution. At a minimum there are a number of major approaches to accomplishing Integration. There are also a number of questions that result.

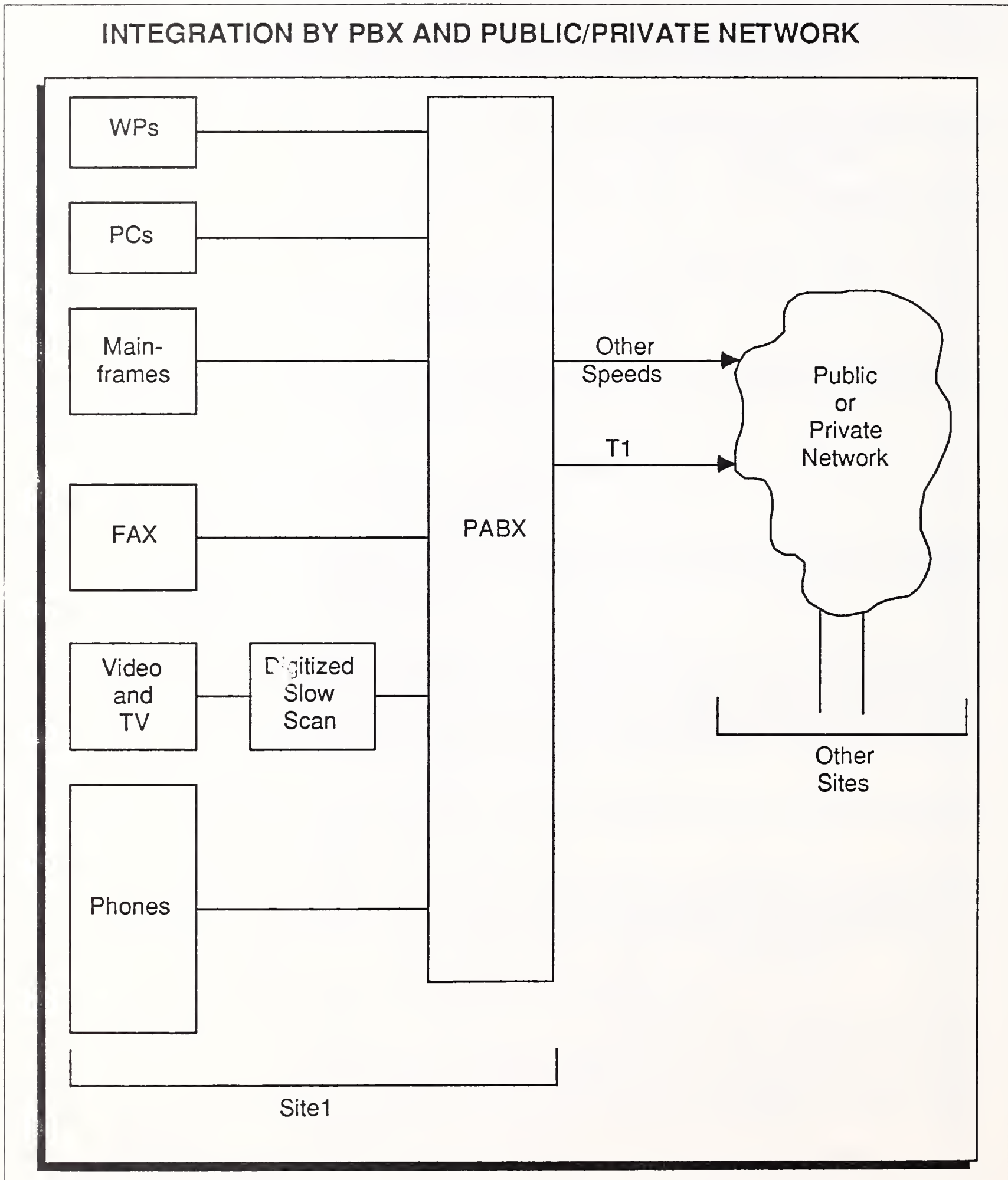
- Exhibit II-3 profiles an integration approach that combines an LAN, a PABX, and a video controller connected to a multiplexer that connects to a T1 switch for connection to other services and facilities.

EXHIBIT II-3



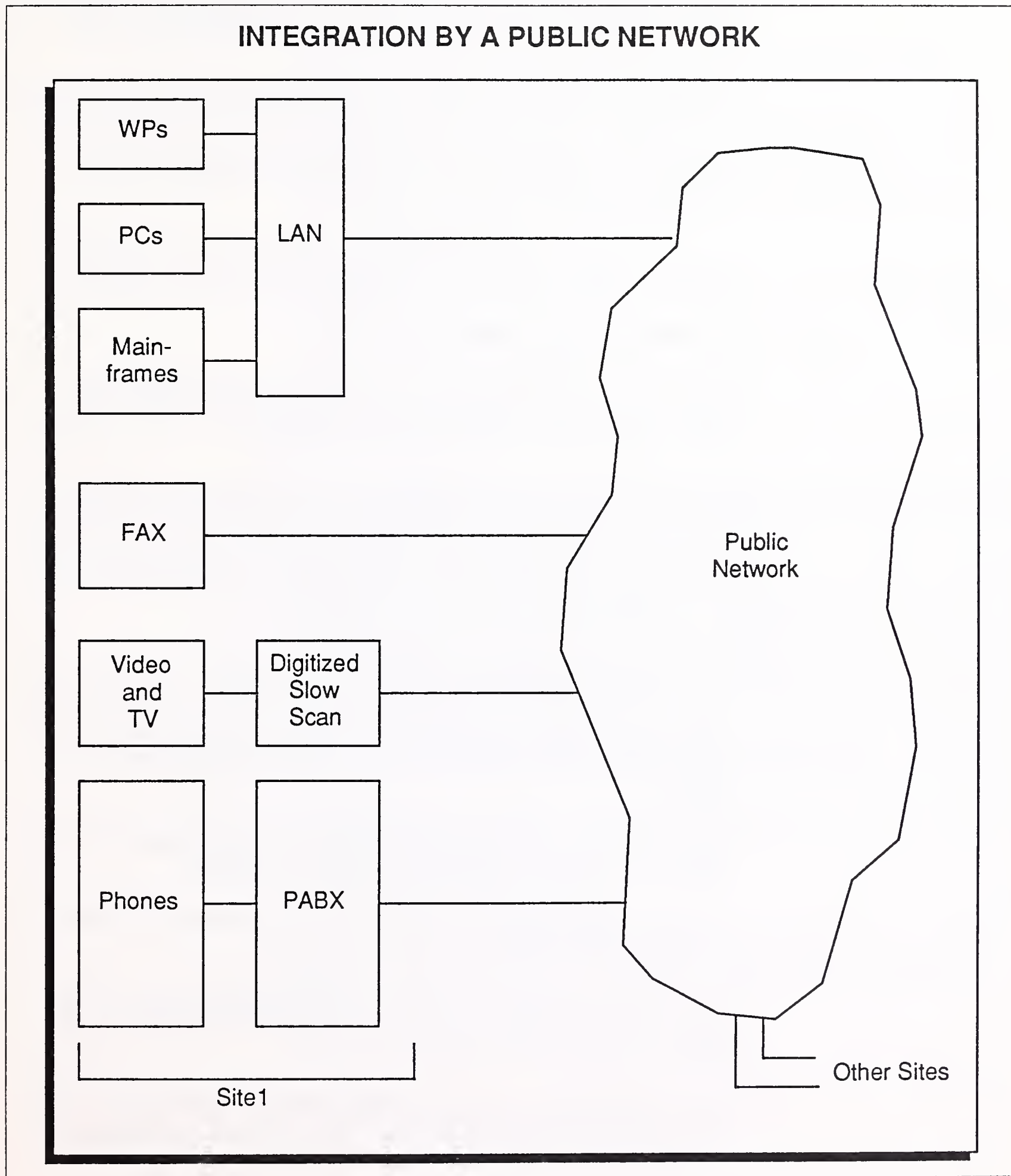
- Exhibit II-4 profiles an approach that uses a PABX to integrate all internal services and serve as a gateway to other services and facilities.

EXHIBIT II-4



- Exhibit II-5 profiles an integration approach that connects a variety of internal services to a public network for connection to other services and facilities.

EXHIBIT II-5



A review of the approaches results in a number of observations and questions that are significant to managers and planners concerned with providing integrated services.

- Exhibits II-3 and II-5 result in the integration of services between the organization (or site) and other locations. In this approach, there is little evident integration of services within the organization or site.
- Exhibit II-4 provides a single point for integrating internal services and connecting to outside facilities and services. However, considering the variety of resource requirements of the dissimilar types of data, the viability of successfully integrating 'all' services through a single device is speculative at best.
- Likewise, there is a significant question about whether organizations will want to place reliance on a single device as a point of control.

a. Management Plans and Perceptions

To identify management plans and develop an understanding of how planners and managers perceive Voice/Data Integration, INPUT conducted a survey of a number of large organizations.

Of those surveyed, the budget for telecommunications operating costs ranged from a low of \$2.5 million to a high of \$100 million. In nearly all cases, voice and data communications are part of the same organization, and Information Systems would be responsible for Integration decisions.

Key results from the survey are summarized as follows:

- Over 80% of the organizations have plans to integrate voice and data. Seventy-five percent of the same firms indicate that their voice and data services are already integrated. Further discussions indicated clearly that integration is an ongoing process, not a single project to be completed.
- More than 60% indicated that their graphics are not integrated. The same firms have no specific plans to integrate graphics.
- Of those surveyed, none have integrated video, and only 25% indicated plans to integrate video.
- Regarding the integration of graphics and video, most indicated that they will consider integrating them, but have little immediate requirement.
- Approximately 80% had conducted a functional or cost study of voice/data integration. For most, this was done by internal staff. Some had studies completed by both in-house staff and an outside consultant.

- When asked the method used to integrate voice and data services, 38% indicated that they would use a PABX, 23% would use a LAN, and 23% would use ISDN as a means for integration.
- 100% said that there is no single solution to integration.
- 75% indicated that an integrated network could be maintained more easily, and 63% indicated that maintenance costs would be lower.
- When respondents were asked to rank the importance of five considerations in decisions to integrate, cost was ranked the highest. Cost was followed by corporate strategy, then maintenance and control. Improvements in existing technology (better PABXs) and new technologies (ISDN) were ranked the lowest.
- While 50% did not know whether all data requirements could be integrated, there were indications that there are requirements that can't be integrated. One organization stated that as much as 40% of its requirements would need to be handled by a standalone network.
- The majority believes that an integration plan would require 1-2 years to complete.
- More than 80% have reviewed PABX products from AT&T, Rolm, and Northern Telecom. Of these, approximately 60% believe that current offerings meet integration requirements.
- Regarding the use of a PABX, many noted that they have not sufficiently addressed whether a PABX would be able to accommodate graphics, LANs, or video. However, they did indicate that PABXs would need to provide higher speeds to accommodate these services.
- 50% of those surveyed believe that ISDN is not important to an integration decision and that ISDN does not support integration.
- Only half those surveyed believe that fiber optics are important to an integration decision.

b. Management Understanding

In the same survey, managers were asked to describe Integrated Voice and Data in their own words. A consistent theme can be noted in the responses.

- Take advantage of point-to-point functionality.
- Facility Sharing. Active bandwidth management.

- Sharing of same facility. Cost sharing.
- Common method of incorporating disparate types of equipment into one network.
- Integration within given area or integration at network level.
- There are two aspects, physical and logical. Can mix different communications on physical wires. When possible, integrate at both levels.

A number of significant considerations emerge after considering the survey responses, the common views of integration alternatives, much of the literature that has been produced, and the descriptions by planning and operations management.

- First, most efforts focus on the integration of voice and data services between the organization or site and outside points of contact (other sites or organizations).
- Second, responses indicate that focus is primarily on current costs, rather than on what strategic and management benefits can result from integrated network services.
 - In the survey, few managers described Integration in terms of benefits to the organization.
 - In the same survey, only 15% of those surveyed indicated that corporate strategy was of greater importance than operating costs.

B

Case Study: Experiences of a User

Resulting from a merger of dissimilar organization structures, a major industrial organization has worked for more than two years to identify ways to integrate data systems and services as well as voice and data.

- Prior to the merger, one organization had an integrated systems and telecommunications group. The other had a separate group for systems and telecommunications. Study teams assessed the best method of combining the two organizations and concluded that a single, integrated group was the best to meet corporate needs.
- Today, a Chief Information Officer (CIO) is responsible to the Chief Financial Officer. Reporting to the CIO are four groups responsible for worldwide corporate systems and telecommunications.
- Of the four groups, Communications Technology is responsible for planning and managing worldwide telecommunications services (voice and data) for the organization. This group consists of more than 400 people. Within the group, a network design department has responsi-

bility for planning all voice and data services. This department's focus is primarily strategic and long-range planning.

- The strategic focus of the planning department is to develop a communications infrastructure that will permit the business to leverage communications to meet business needs.
- In general, the organization believes that its voice and data services are integrated. The organization believes, also, that voice/data integration is not a specific plan to be completed, but an ongoing process. Consequence integration is part of current planning efforts.
- The organization currently has approximately 150 PABXs in its voice network and 35 Front-End Processors. Of the PABXs, only two are still analog. The organization plans to replace these PABXs within the next two years.
- There are a number of LANs in the organization. Most are Ethernet. LAN development has been a problem for two primary reasons:
 - The organization does not have a comprehensive, corporatewide standard.
 - There are a number of highly technical individuals that conduct their own analysis and selection.
- While standards are being developed, many have an expectation that the LANs they select can be easily connected to the data systems.
- SNA is the primary transmission method for the backbone network, and the organization would like to combine X.25 on the same network, but has not identified a cost-effective means. Today, protocol converters are used to permit transmission of Asynch over the SNA network.
- The primary network is composed of T1 and microwave facilities and is viewed as a 'seamless transport' that should be able to meet all corporate requirements.
- There are currently data networks connecting eleven major processing locations. During 1988, installation of approximately ten long-distance T1 circuits will be implemented; the circuits will connect six major processing locations. The circuits are fully redundant and carry voice and data.
- A separate network, using X.25, provides services to more than 1,200 retail locations nationwide. The number of locations is expected to expand to 1,800 by the end of 1988 and to approximately 5,000 within the next 3 years.

- ISDN has been considered as a means to achieve greater integration, but is a low priority. In general, the company believes that ISDN will be tariffed as a value-added service and will not be cost-effective for general network services.
- To date, little preselling of integrated services has taken place, and plan delays have been experienced while individuals and business units are sold on the concept.
- The organization has just recently begun the process of integrating systems. As part of the integration planning, there has been only 'some' discussion with the telecommunications planning department.
- The organization recognizes that there is value in information, but has placed primary emphasis to date on evaluating ways to reduce the amount of paper produced.
- In general, plans have progressed slowly. Although the merger had a major impact, the size and complexity of the organization makes planning difficult.

INPUT believes that this organization is representative of many large organizations.

- The work of the Information Systems and Telecommunications departments is complicated by mergers, acquisitions, and extensive organizational changes.
- Corporate IS and Telecommunications groups are having difficulty formulating plans and strategies as user groups chart their own course in the application of PCs and the resulting LANs.
- Organizations, as yet, are not significantly addressing the value of information and its relationship to strategic and competitive positioning.

C

Integration Products and Services

Several products and services have been the key focus for accomplishing integration: PABXs, LANs, Public Networks, and ISDN. There are advantages and disadvantages of each approach. The following provides a brief description of factors related to each of these approaches.

1. PABX

A review of product literature and discussions with major users indicate that many PABX vendors believe that the role of the PABX is to manage information flow within a company site and to connect a site to external facilities and services. However, there is not an overwhelming drive

among users toward making the PABX the center of the Network Integration project.

In addition, the PABX is surrounded with products that are involved in Network Integration, but are not part of the PABX.

There are a number of reasons for this:

- Local-Area Networks (LANs) are separate from the PABX and may or may not transmit through the PABX. While LAN-PABX interfaces are increasing in number, there is doubt among managers whether PABXs can successfully accommodate the high data rates inherent in a LAN, particularly in the short term.
- Multiplexers are also separate from the PABX and may actually be connected to the network without going through the PABX. Ongoing development of intelligent multiplexers further differentiates them from PABX functions.
- Video and other wideband signals are connected to the integrated network or to another network without the PABX.
- Patch panels are used to switch fiber optics, without PABX involvement
- It may or may not be practical to attempt to integrate all voice and data services through a PABX. User comments reflect that there are a number of questions about whether a PABX can actually provide the needed functions and services.
- Many users have concerns about placing too great a reliance on a single piece of hardware for functions that are increasingly critical to the organization.
- Generally, PABXs provide a low capacity for data. Although this low capacity is changing, increasing requirements for high-volume data transmission suggest that a PABX will remain suspect as a single point of interface.
- Traditionally, PABXs have provided only limited ability to view and understand the network. The ability to monitor and analyze network operation is a critical requirement for many organizations. INPUT's survey indicated that more than 80% of users perform network testing and regard network testing and maintenance as critical to their businesses.
- Most indicated that they expect an integrated network to have at least the same level of testing ability as it has today.

In summary, there is concern among telecommunications managers about the ability to use a PABX as the means of integrating LANs or as an alternative to LANs.

2. LANs

As recently as five years ago, LANs were products of research and development. They were prohibitively expensive and designed to meet specific standalone needs. There were no standards, and a LAN that worked with one vendor's equipment would not work with another's. There was no ability to interconnect. In the five years, this has all changed.

- The cost of an LAN connection is now comparable to the cost of a port on a traditional PABX.
- Standards have been developed that provide a basis for future product developments. IEEE standards 802.3, 802.4, 802.5 and high-level protocols such as TCP/IP and ISO have been established and agreed upon.
- Once isolated applications, LANs now provide integrated solutions as vendors recognize the need to provide connectivity across LANs.

Among the alternatives, Ethernet, Token Ring, and Token Bus are the dominant forces.

- Ethernet is expected to be the dominant method and is the preferred approach for the scientific and engineering environment and many minicomputer-based applications.
 - Ethernet is highly adjustable to baseband and broadband COAX, fiber and twisted-pair wiring schemes.
 - Token ring is increasingly prevalent in data processing and office environments.
- Token Bus is expected to be the dominant force in the factory environment because of its ability to successfully handle high volumes of continuous-flow data.

From their fragmented, isolated orientation, LANs are being driven by internal and external requirements.

- Internally, LAN development is being driven by increasing needs to integrate departments and divisions within an organization. Recognizing the need to share information, organizations are requiring a higher degree of internetworking.

- Externally, LAN development is being driven by the development of FDDI (Fiber Distributed Data Interface), which will permit transmission speeds up to 100 Mbps. With the development of FDDI, networks will be composed of:
 - Long-distance “backbones”
 - Connecting subnetworks
 - Linking smaller clusters of workstations interconnected by Ethernet or Token Ring
 - Interconnection to mainframes
- Still not cost-effective, FDDI can be expected to replace existing de-facto standards over the next several years.

Also, during the next three-to-five years, TCP/IP will most likely remain the most popular protocol. In the long run, OSI will be the standard; however, there are still a number of areas that need to be resolved before OSI can be fully accepted:

- Directory service methods need to be resolved
- Network routing methods need to be resolved
- Network management methods need to be addressed

Considering the rapid development of LANs and the promise of the future, there are a number of considerations that users continue to express.

- **Application Needs**—Requirements of existing and planned applications should be a major consideration when selecting an LAN.
- **Connectivity/Compatibility**—Short-term and long-term connectivity should be a significant consideration, particularly in a growing organization. When in doubt, users should remain with the better developed products and vendors.
- **Fault Tolerance**—As users become more dependent on LANs, there is increasing need for fault-tolerant systems.
- **Hardware Selection**—The selection of hardware remains a problem; many users attempt to implement a low-cost solution that can often be unworkable.
- **Network Maintenance**—Many users have concerns about how to maintain a LAN network. Not large enough to have dedicated staffs, many companies discover that finding service providers can be difficult.

When considering Voice/Data Integration, there are a number of questions that relate to LANs.

- Should computers and/or workstations be linked by a network bus, ring, or tree?
- Should transmission be broadband or baseband?
- Should the access method be contention, token-passing, or slotted?
- Should wire be coaxial, twisted pair, or fiber?
- Is the LAN compatible with existing application software?
- Does voice belong on a data network?

3. Public Networks

Users generally believe that the public network can be useful to provide a number of services. They can:

- Fill in geographic application gaps for private networks.
- Provide software and unique applications.
- Provide network control and monitoring capability.

It would seem that providers of public networks must find ways to coexist with private networks, in order to maintain their business position with Fortune 500 companies. Some ideas to augment other services include the following:

- Provide backup in case of a failure at a prearranged fee. This service would be similar to disaster backup recovery services offered by some vendors for computer sites.
- Handle the tail end of the network.
- Offer unique applications, such as EDI.
- Combine forces with PBX and other suppliers of hardware.
- Offer very high reliability networks.
- Offer to handle the division networks of corporate telecommunications staffs.

4. ISDN

ISDN remains the enigma of the industry. Described by many as *the* answer to many connectivity problems, ISDN is only now beginning to materialize as a prominent consideration. Although it is expected to be a dominant force, the reality remains to be seen. There are many driving forces behind ISDN.

- **Deregulation**—Deregulation is causing RBOCs and OCCs to find more-efficient ways to make better use of facilities that currently exist and to achieve maximum leverage from new investments.
- **Needs and Requirements**—Users are placing increasing pressure on service providers to ensure greater functionality and flexibility.
- **Greater Bandwidth**—Users are increasingly in need of bigger electronic highways to transmit increasing amounts of data between company locations and between the company and external contacts.
- **Fiber Optics**—Compared to the costs of producing, installing, and maintaining copper or metallic wires, fiber optic cables are considerably more cost-effective. Seeking considerably greater capacity and reliability, providers are in need of finding ways to put the technology to use.
- **Business Globalization**—The increasing globalization of business is placing increasing pressure on developed and developing countries to provide standardized, cost-effective methods of communicating data.
- **Likewise**, organizations are expanding overseas and increasingly in need of cost-effective communications services.

When considering ISDN, there are at least three major areas of questions: Standards, Cost, and Speed.

- **Standards**—Users and vendors are concerned that standards have not been sufficiently well developed to be able to finalize product development plans. Vendors could be faced with expensive redesign, and users could be faced with equipment replacement or upgrade.
- **Costs**—Users are increasingly concerned with costs of ISDN services. Users generally believe that pricing, when it is known, will be on a value-added basis and, without being able to determine what value has been added, are reluctant to make major commitments.
- **Speed**—Speed has been noted as a significant problem. Users implementing T1 services and fiber optic cables generally agree that Basic

Rate Access (64 Kbps) does not provide sufficient speed to meet their needs. Most are waiting for Primary Rate Access (1.5-2.0 Mbps), which will provide much greater speed and flexibility.

In the long run, ISDN will be a significant consideration. However, it will be only one alternative way to meet the requirements of Network Integration.

D

Integration Now and in the Future

Discussions with users indicate that the perception of integrated voice and data could have considerably greater importance in the future than it has today. Characteristics of integration today include those below. The same characteristics serve to indicate areas of concern for the future.

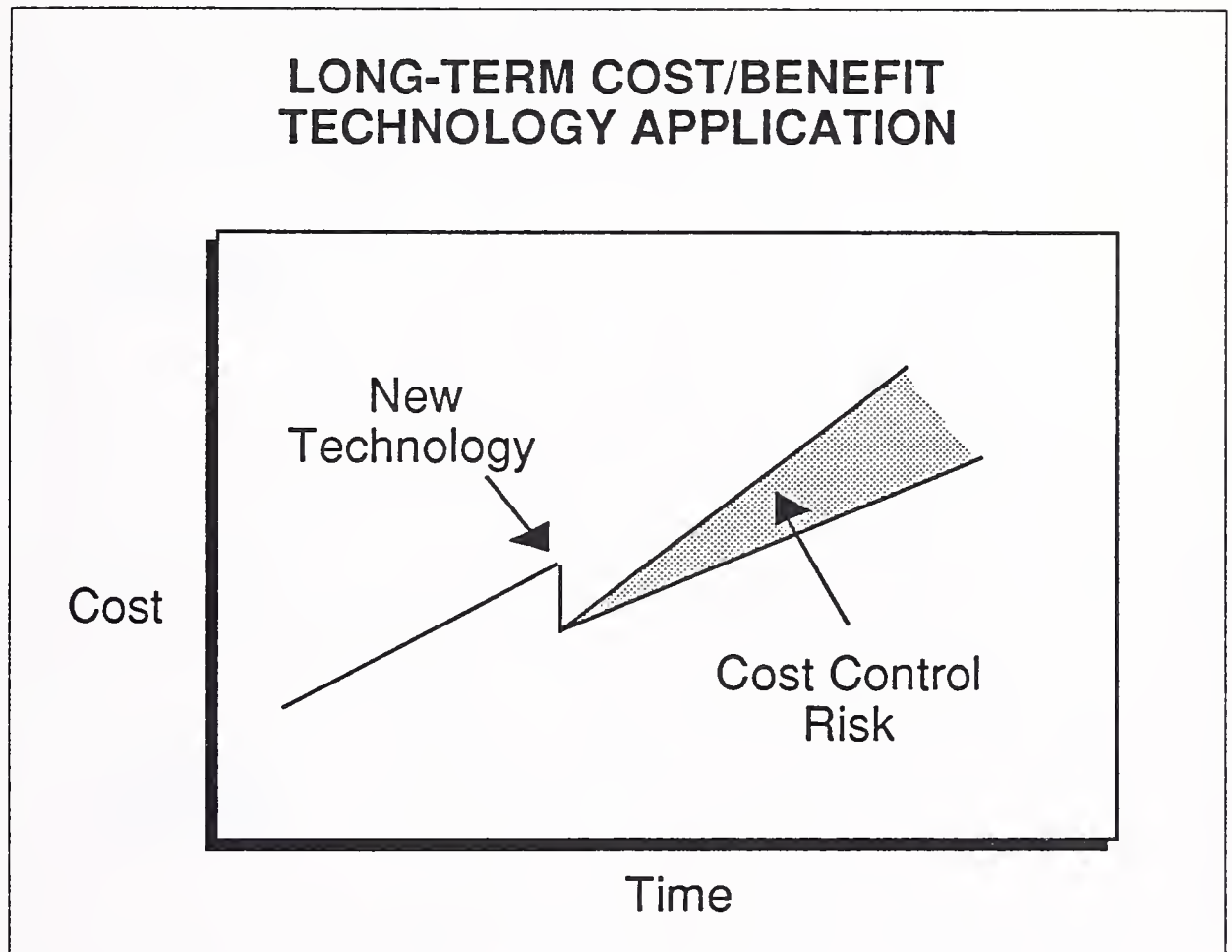
- **External Focus**—To date, most efforts have been directed at integration of voice and data between a site or organization and another site. Users do not indicate a high degree of concern about integration within a given site.
- **Short-Term Focus**—Most efforts appear to be directed toward short-term cost savings. Reductions in costs are a significant requirement, and appear to be a greater requirement than whether an investment is over the long term strategically advantageous to the organization.
- **Hardware Focus**—Managers and planners are faced with a continuing increase in alternative hardware products and services. However, the strategic importance of a particular selection does not appear to have a high priority.
- **Single-Use Islands**—LANs are being implemented in an increasing number of areas in organizations. However, few users have indicated concern over whether the selection and use is consistent with corporate-wide information needs.

Considering the focus to date, questions arise about the value of an integrated network. The questions are indicative of concerns that planners and senior executives may have in the near future.

- **Increased Data**—Increases in bandwidth that result in lower unit costs to transmit data can be expected to increase the overall costs of telecommunications within a short period after implementation of the 'cost saving' devices and services. Without an understanding of the benefits of the data being received, organizations may be faced with increasing amounts of data that have little value.
- Exhibit II-6 illustrates a situation that frequently results from the implementation of 'cost saving' technology. From the illustration, two trends are clearly identifiable.

- First, at the time the new technology is implemented, cost savings are realized.
- Second, like nature, information systems and telecommunications abhor a vacuum. Excess capacity resulting from the implementation of new technology will soon be consumed by new applications. Even with lower unit costs, the total costs to the organization will soon equal and even exceed the original costs.

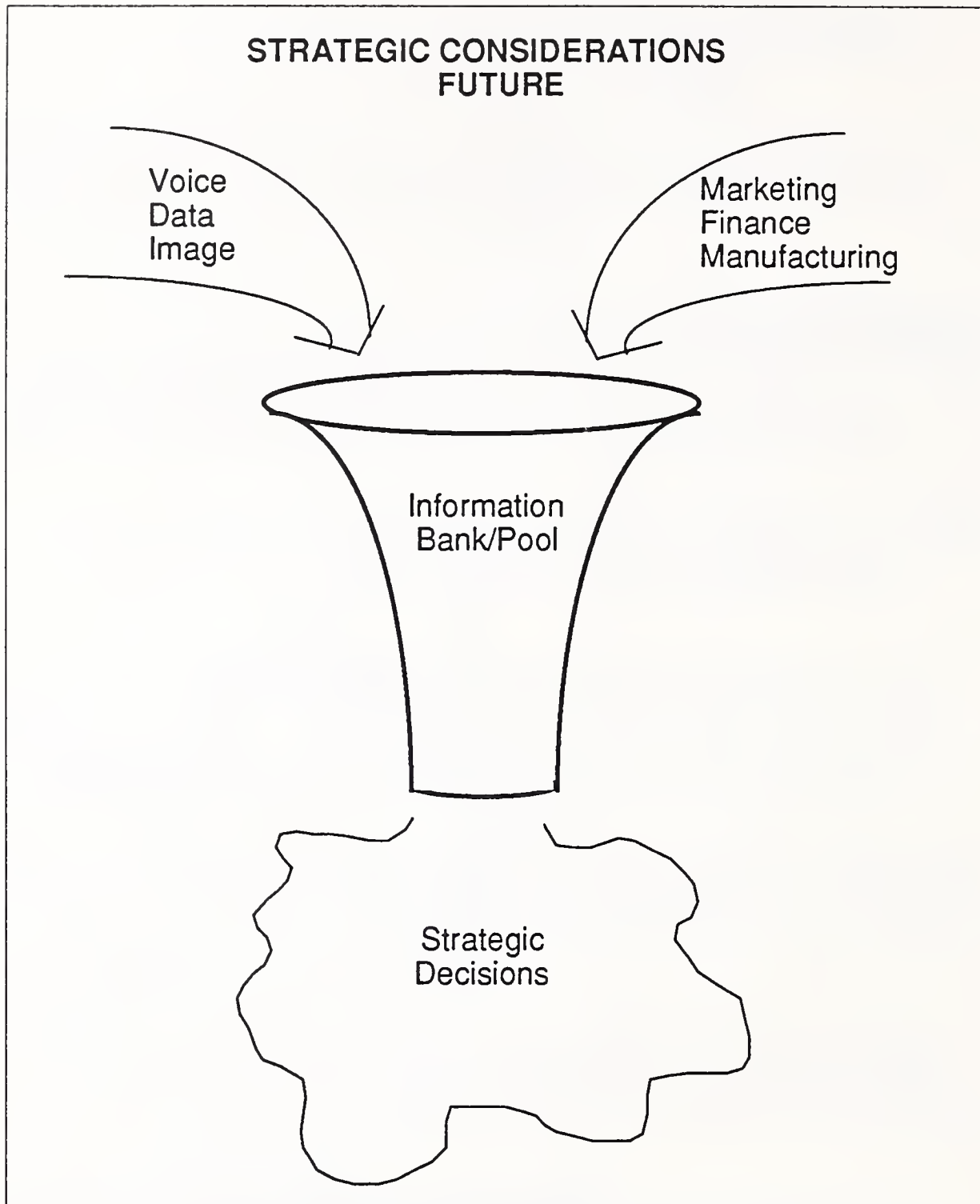
EXHIBIT II-6



- **Strategic Use**—Much of the information resulting from integrated voice and data communications has strategic value. Much does not.

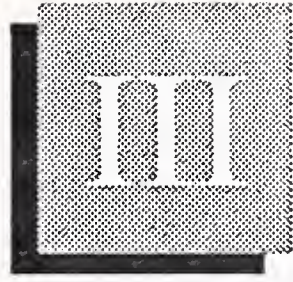
As illustrated in Exhibit II-7, much of the increased volume of information will flow into a large holding area that will continue to grow over time. Unless organizations are able to make use of the information, its value will be lost.

EXHIBIT II-7

**E****Integration and Corporate Strategies**

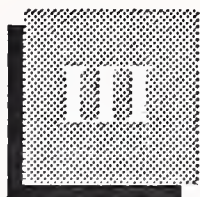
The integration of voice and data presents at least two significant considerations for management.

- First and foremost is why an organization should integrate. Cost savings are a major reason, but focusing solely on cost savings will result in a significant loss of the value of the information.
- Second is a consideration of what to do with the information that is received. Unless information is synthesized and analyzed, it cannot be used as a basis for strategic decisions. Information can be a key to achieving competitive advantage, but only if it is used. Little data is information at the time it is received.



Conclusions and Recommendations





Conclusions and Recommendations

One of the primary purposes of this report has been to assess management's understanding of how integrated voice and data services can contribute to achieving an organization's plans and strategies. Results of the research indicate that progress is being made. They also indicate that developments will continue for some time. However, as noted in the report, and in the conclusions and recommendations that follow, organizations are generally not prepared to make use of the significantly increased amounts of data that will result.

A

Conclusions

- There are a wide variety of approaches to achieving integration.
- There is no single solution.
- Organizations have generally been concerned with connection between one site and another, and have not placed great emphasis on internal integration.
- Users are generally reluctant to consider a single point for accomplishing integration. The risks are too great.
- Users have not generally considered graphic or video requirements when assessing PABX offerings.
- Short-term operating cost remains the overriding reason for considering integration.
- The strategic value of information has not been a significant reason for integration.
- ISDN is not a significant factor in integration decisions.
- Integration is a process, not a project.

B

Recommendations

- Recognize that integration is an ongoing process and prepare plans accordingly.
- Consider integration decisions in light of corporate and IS strategies.
- Make investments within the framework of future corporate information needs.
- Assess interdepartmental connectivity with increasing importance.
- Consider ISDN a significant part of long-term integration strategies.
- Place greater emphasis on the value of data transmitted.
- Integrate IS and telecommunications long-term strategies.

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