Distributed Data Processing

INPUT®

DISTRIBUTED DATA PROCESSING

DISTRIBUTED DATA PROCESSING

CONTENTS

EXHIBITS

I INTRODUCTION

A. PURPOSE

- This report is part of INPUT's Information Systems Program (ISP). It identifies issues that the Information Systems (IS) management must address to evaluate the feasibility of moving the IS function towards more distributed services.

- The report answers the following questions:

  - How has the concept of distributed data processing (DDP) changed over the past decade?

  - What impact has end-user computing had on the distribution of systems development and data processing?

  - How does office automation fit into the future DDP scheme?

  - What are IBM's strategies relative to DDP?

  - What are the pros and cons of selecting the UNIX operating system as the common thread between micros, minis, and mainframes?

- What role will the mid-layered or departmental processors play in future DDP environments?

B. SCOPE

- Distributed data processing can involve a variety of different hardware, software, and communication configurations, and can represent many different information systems environments, as listed in Exhibit I-1. This report will focus on the analysis of the distribution of information processing involving the integration of personal computing, office automation, and traditional transaction processing systems. It will examine the evolution of the integration of information systems from the DDP failures of the 1970's to the Integrated Electronic Office Systems period of the 1990s.

- The following people should find this report pertinent to their tasks and responsibilities:

  - IS senior management.

  - Information center management.

  - End-user computing consultants.

  - Managers of systems development.

  - Data center managers.

EXHIBIT I-1

TYPES OF DISTRIBUTED DATA PROCESSING ENVIRONMENTS

- Central Host with Terminal Access
- Central Host with Remote Job Entry
- Autonomous Multiple Host Processors
- Semi-Autonomous Multiple Processors
- Multiple Standalone Microcomputers
- Multiple Microcomputers Linked to Central Host
- Multiple Microcomputers Linked to Departmental File Servers Linked to Central Host
- Autonomous Multiple Office Automation Systems
- Integrated Data Processing, Office Automation, and Personal Computing Systems

C. RELATED INPUT REPORTS

- The Changing Dynamics of IS Organizations.

  - This report will forecast IS organizations' trends and recommend strategies that will improve IS responsiveness to the corporation's competitive needs.

- Micro-Mainframe: Corporate Impact.

  - This report will examine the organizational and technological effects of microcomputers in the corporation.

- Update on the Information Center.

  - This report examines and analyzes current product offerings, significant developments, emerging technologies, and important issues and trends.

- The Destiny of the Information Center.

  - This report provides an analysis of the information center evolution and examines the factors that will change the IC charter over the next 10 years.

- Micro-Mainframe: Connectivity.

  - This report examines the complex communications considerations affecting micro-mainframe links and analyzes the impact on corporate networks.

- LAN/CBX: Planning for Change.

  - This report relates current experiences with these data and data/voice communications technologies and looks at the future of office-oriented communications devices.

II EXECUTIVE SUMMARY

- The executive summary is designed in presentation format in order to:
  - Help the busy reader quickly review key research finds.
  - Provide an executive presentation, complete with script and exhibits, to facilitate group communications.
- The key points of this entire report are summarized in Exhibits II-1 through II-5. On the left-hand page facing each exhibit is a script explaining the exhibit's contents.

A. INTEGRATION EQUALS DDP

- The original DDP concept of more than an decade ago advocated the distribution of data processing applications across multiple minicomputers connected to a central host through a star network. This approach was planned, implemented, and controlled from the central IS development and technical support staffs. The primary reasons for the early DDP systems were increased availability and reliability.

- The emphasis of the original DDP concept was on distributing transaction-based processing systems. The microcomputer and the information center were not available in the mid-1970s, and office automation consisted of dedicated text processing equipment.

- Until now, end-user computing, office systems, and production data processing have been evolving in their separate arenas. There have been separate staffs responsible for overseeing these three environments, and, for the most part, there have been different vendors supplying the different pieces of hardware and software in support of these services.

- IS organizations and IBM (as well as other hardware/software/communications vendors) have begun to recognize the need to integrate these three separate information systems services to facilitate the sharing of information and resources. INPUT believes this integration will be emphasized by IS organizations between 1990 and 1995, and INPUT has identified this as the Electronic Office period.

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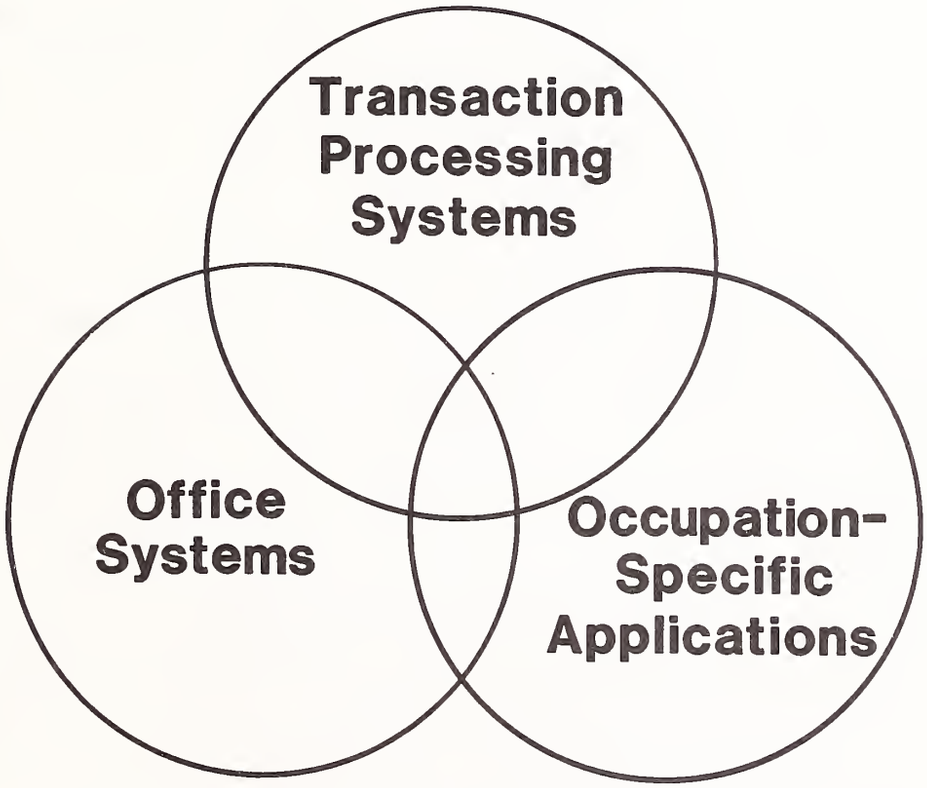
INTEGRATION EQUALS DDP



B. PRIMARY DDP COMPONENTS

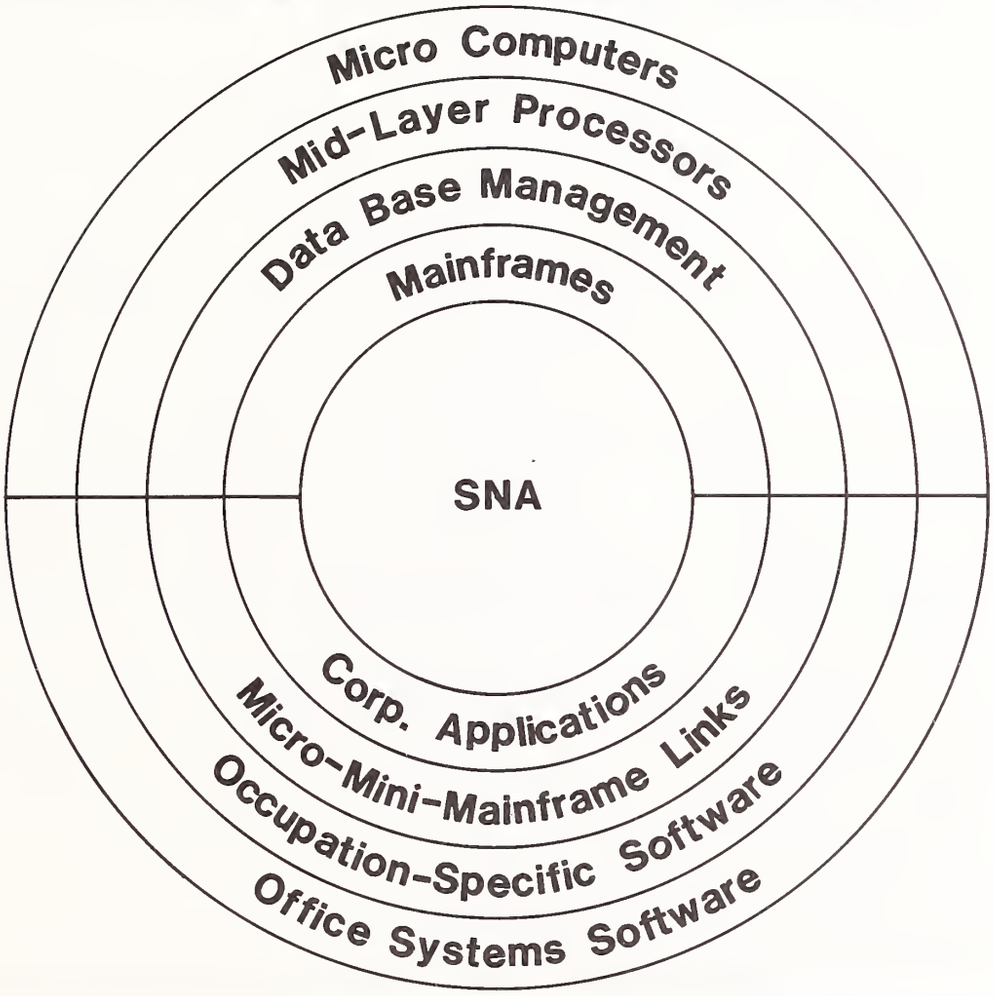
- The future DDP systems will focus on providing end users with more flexibility and antonomy in the development of solutions to their business information systems problems. This will require the movement of data from the host mainframe DBMS to the various modes in the SNA network.

- There will be a trend towards designing corporate information applications around the capabilities of the microcomputer, which will call for sophisticated micro-mainframe linkage software and custom microcomputer applications for end users.

- Microcomputer-based workstations are becoming commonplace for the knowledge workers and information handlers, who heretofore had relied on the capabilities of the dumb video display terminal connected to a host mainframe. Not only are some of the mainframe processing tasks being off-loaded to these workstations, but the workstations can handle local decision support activities and office systems tasks as well.

- The information traffic handled by the SNA networks will increase considerable as more office activities are automated. To reduce the communications traffic between the host mainframes and the microcomputer-based workstations, mid-layered processors will become prevalent. These mid-layered processors will act as file-servers and communications controllers.

PRIMARY DDP COMPONENTS



C. IBM WANTS CENTRAL CONTROL

- IBM is touting its Office Systems Family of software products in support of the future distributed data processing environment. IBM's emphasis is on office systems rather than data processing. IBM refers to this new environment as "Distributed Office Support Systems."

- The key components of IBM Distributed Office Support Systems are host-based products and architectures:

  - Systems Network Architecture (SNA), with its distributed services, and the Document Interchange and Content Architectures (DIA/DCA).

  - Distribution Office Support Systems (DISOSS) running under VSE or MVS and providing central library, distribution, and systems services.

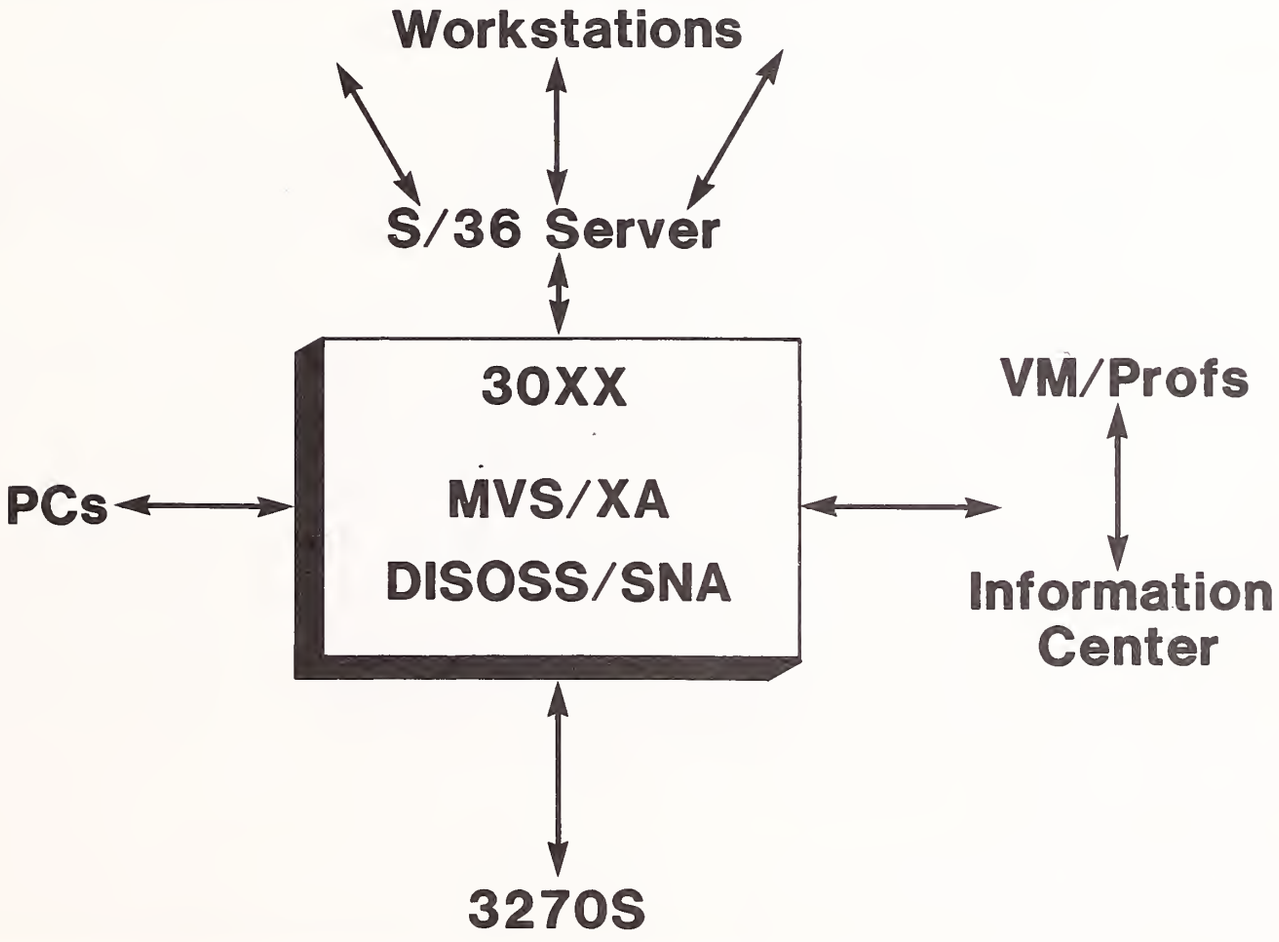
  - Displaywrite is a DCA text editor that allows revisable form document interchange between S/370s, S/36s, and PCs.

- Along with the PC family of computers, IBM has identified the System/36 as the distributed pieces of hardware of its Distributed Office Support Systems. IBM claims the System/36 was selected to serve as the departmental processor because of the following reasons:

  - The System/36 provides ease of operation through its advanced instruction set and built-in basic supervisory and resource management functions.

  - Because it was initially aimed at the small business market, there are numerous packaged industry applications developed for the System/36, and they are easy to install.

IBM WANTS CENTRAL CONTROL



D. THE INFORMATION SYSTEMS ORGANIZATION WILL CHANGE

- In the past, there tended to be four distinct functions in a corporation related to information and its delivery systems: Office Systems; End-User Computing; Traditional Data Processing; and Communications. These functions have been treated separately and in most cases have reported not only to different managers, but to different functional areas of a corporate entity.

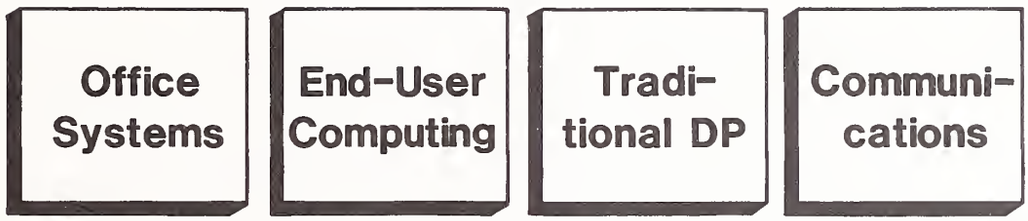
- These information functions are converging to form an integrated delivery system for the creation, storage, retrieval, and distribution of data, text, image, and voice information.

- The planning of future information systems will take these four information functions into account and, where possible, resources will be shared and single workstations will be capable of handling all types of information.

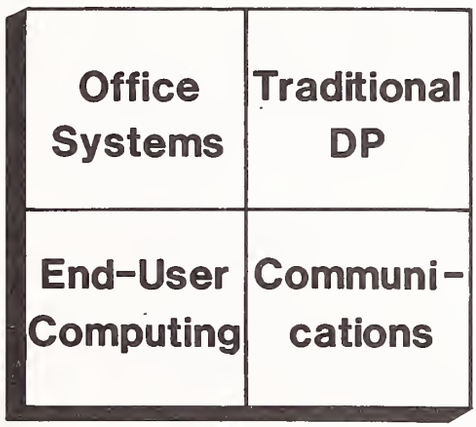
- In order to ensure the greatest return on the information systems resources investment, voice and data communications must be integrated under the corporate information officer and office systems, end-user computing support and traditional systems development should all report to the same subordinate under the corporate information officer.

THE INFORMATION SYSTEMS ORGANIZATION WILL CHANGE

Past Structure



Future Structure



E. PREPARE FOR THE FUTURE DISTRIBUTED DATA PROCESSING SYSTEM

- Identify a work group with intensive local data processing requirements. Develop or purchase microcomputer software that will satisfy this work group's needs. Determine the necessary interchange of information between the pilot work group and central IS.

- If not already in place, evaluate and select an office automation system that can act as a mid-layer processor between the work group environment and the central mainframe. IBM's System/36 and the Office Systems Family of products should be included in the evaluation along with products from vendors such as Wang, DEC, Data General, and Hewlett-Packard.

- Once the requirements of the interchange of information has been identified and the mid-layer system has been selected, the software needed to link the micros, minis, and mainframes can be acquired and installed.

- To prepare for the future distributed data processing environment, the IS organization will have to make some structural and philosophical changes. The design and development of information systems are steadily moving from central IS to the end users through program generators, fourth generation languages, and generic application packages. This movement toward the end users will require more guidance from IS in the form of consultation and education.

- If distributed data processing equals the integration of personal computing, office systems, and business transaction processing, then those IS staff members responsible for those separate functions should be brought together for systems architecture collaboration.

INPUT®

PREPARE FOR THE FUTURE DDP SYSTEM

- Select Micro-Based Pilot System
- Evaluate Departmental OA Systems
- Select and Install Linkage Software
- Merge IC and OA Under Systems Development
- Emphasize Training and Consulting
- Emphasize Distributed Systems Development

III THE CHANGING CONCEPTS OF DISTRIBUTED DATA PROCESSING (DDP)

A. ORIGINAL CONCEPT

- The original architecture of DDP systems designed during the 1970s was based primarily upon the star network concept as depicted in Exhibit III-1. Application development, control, and integration remained at the central host computer site with specific business transactions processed at semi-autonomous multiple minicomputer installations.

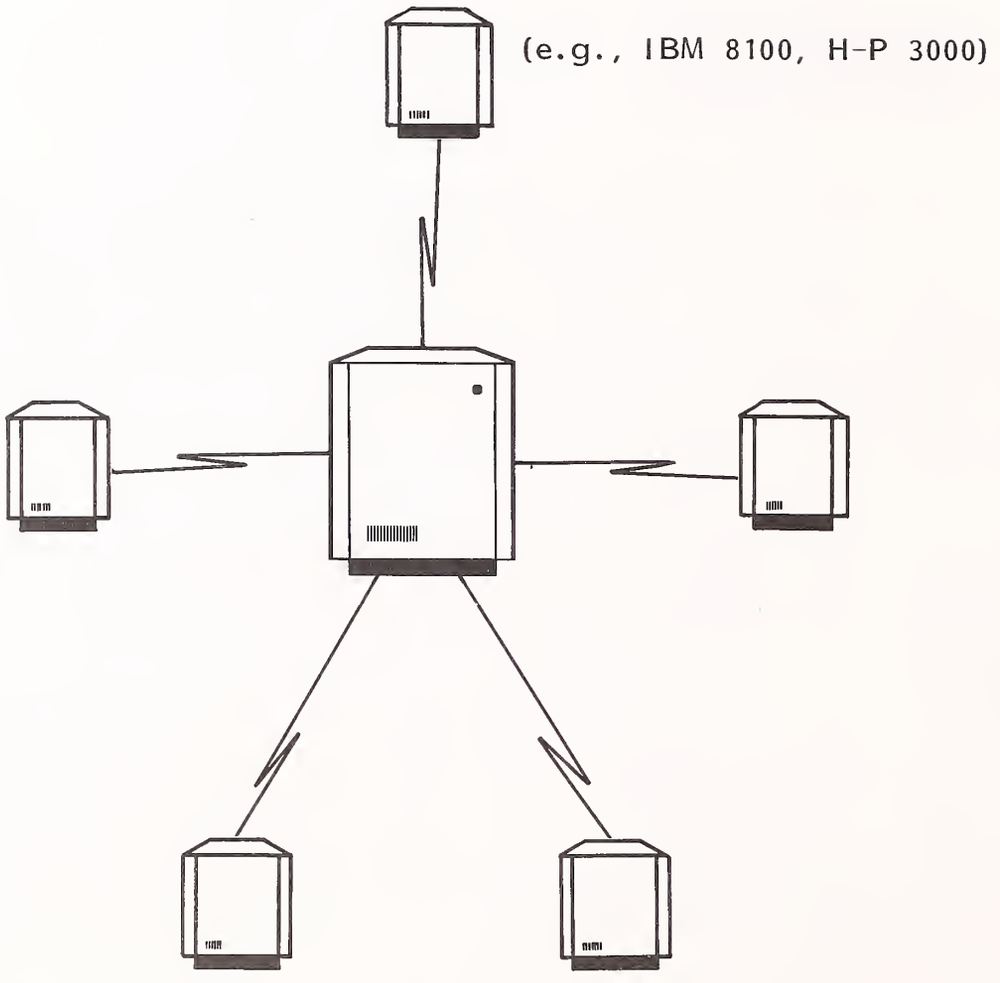
- The advocates of distributing the processing of business transactions among many remote minicomputers claimed several advantages over the traditional centralized host processing, which included:

  - Improved systems reliability and availability. In the DDP environment if the host mainframe were down for any reason, the distributed minicomputers could continue performing individual tasks. Local work groups could expect better responsiveness to information needs through the remote minicomputers.

  - Better adaptability to change. By breaking up large corporate computer applications into modules that reside on distributed minicomputers, changes could be made to the individual modules affected without impacting the total system.

EXHIBIT III-1

DDP STAR NETWORK



- Lower overall data processing costs. The price-performance of several minicomputers was thought to be better than the price-performance of equivalent host mainframe processing power. Also, communications cost would be reduced by performing many of the data processing tasks at the remote minicomputer locations.

- The problems encountered in the original star network architecture of the early DDP systems negated the advantages to a point where the concept was generally discarded, and larger central host configurations prevailed. Some of the problems that steered IS organizations away from DDP were:

  - The applications systems design, development, and maintenance was found to be more complex in a DDP environment, where each processing mode required unique sets of programs that had to interface with the host programs. IS had the sole responsibility for developing and maintaining the distributed portions of the applications programs.

  - The synchronization of data caused problems due to the need to maintain master files at the central host with portions copied for the distributed processors. Data base management systems employed by the host haven't been supported by minicomputers such as the IBM 8100 or the HP 3000, which are typical DDP processors. This duplication of data also increased the DASD cost, especially in light of the higher cost of minicomputer disk storage over equivalent mainframe disk storage capacity.

  - IS had to provide additional technical support resources to design, implement, and maintain the DDP configurations. The hardware and systems software at the processing modes of a distributed network were not compatible with the central host configuration, which required additional skills and experience.

- The biggest drawback to the original DDP architecture had to be its inability to provide flexible computing capabilities to the end users. Applications modifications were handled centrally so the distributed environment had little effect on reducing service request backlogs. When outlying departments began hiring programmers to assist them with their local information needs, the corporate IS organization intervened with policies prohibiting such practices. IS's main concerns were the loss of control over the segments of data and programs servicing the outlying departments, and the potential chaos resulting from incompatible, non-standard programs emerging throughout the organization. Senior management became concerned with the increased expense of these additional IS professionals.

- IBM's general software strategy of highly centralized systems has placed it in an extremely strong position to control major computer/communications network trends. IBM has done very little to support the concept of DDP in order to maintain its own centralized systems strategy and continue its business success in mainframe hardware sales.

B. IMPACT OF THE PERSONAL COMPUTER

- There has been much speculation from industry analysts about the ability of the microcomputer to provide the missing features of the original DDP concept deemed necessary to make DDP a viable alternative. The obvious microcomputer attribute that has triggered this speculation is the end-user orientation. The decision support aspects of information systems are being distributed to the end users through the microcomputers.

- Decision support activity, in itself, is not directly related to distributed data processing in the sense of distributing segments of a business system operational process to computers located in the departments being serviced. The business system is transaction oriented and the decision support focuses on

data analysis. Building and analyzing sophisticated business models from production data is an independent activity which can be accomplished by individual end users through microcomputer decision support software and downloaded corporate data.

- Unlike most computer technology, the microcomputer usage in business has been initiated by the end users rather than by IS professionals. Vendors of microcomputer software have concentrated on supplying end users with tools that they can employ directly to satisfy their individual information needs. The current micro-to-mainframe linkage products support this bottom-up orientation by allowing end users access to host data bases and files. With the exception of MSA's announcement of distributed PC applications, none of the software vendors are specifically targeting the distributed data processing market. This is due to the fact that there is no clear standard hardware/systems software configuration to support DDP.

- The inclusion of microcomputers in the architecture of future transaction-driven information-processing systems will have to be initiated by the IS systems development staff. Clustered microcomputers have started to appear in industry (especially banking and insurance) to support specific work group functions in a distributed environment. A small, remotely located work group can process its daily transactions through the microcomputers, which can be linked to the host mainframe for application integration. The microcomputers are less expensive than distributed minicomputers, and they can accommodate the personal computing needs of the individual members of the work groups.

C. ACCEPTANCE OF OFFICE SYSTEMS

- The resistance to automating the office functions associated with interpersonal communications (e.g., word processing, electronic mail, electronic filing, report and graphic preparation, etc.) was eased through exposure to the

information center and personal computers. The knowledge workers and information handlers have become familiar with the capabilities and limitations of information technology and are, therefore, more receptive to office systems proposals.

- What started out primarily as a productivity tool directed at the typists through word processing capabilities has turned into comprehensive office systems that include, in addition to word processing, such functions as:

  - Electronic mail, which allows the interchange of messages, data, documents, and graphics among the users in a network.

  - Electronic filing, with extensive search capabilities and filing schemes.

  - Administrative support, which provides calendar management and scheduling features.

- The major minicomputer vendors such as Digital Equipment Corporation, Data General Corporation, and Wang Laboratories are marketing office systems that include decision support software and data processing functions. These types of integrated office systems are beginning to be referred to as departmental computing systems and will become the nucleus of distributed data processing systems.

- IBM is positioning the System/36 minicomputer in the integrated office systems market to compete with the aforementioned minicomputer vendors. IBM has recently announced several products, under the general heading of Office Systems Family, that allow information exchange among PC users, System/36 users, and System/370 (370, 43XX, 30XX) users. There is more on IBM's office systems strategy in Chapter IV.

D. THE EMERGING DDP OBJECTIVES

- Departmental computing systems, as depicted in Exhibit III-2, will stress autonomy and flexibility for the work groups being supported. Minicomputers or small mainframes will be the heart of the departmental system. These mid-level systems will be connected to the central host mainframe and will be able to communicate with other departmental systems and down to microcomputer-based workstations. From a workstation, an end user will be able to access specific elements of data from corporate data bases transparently and transfer the data to decision support systems to perform such functions as:

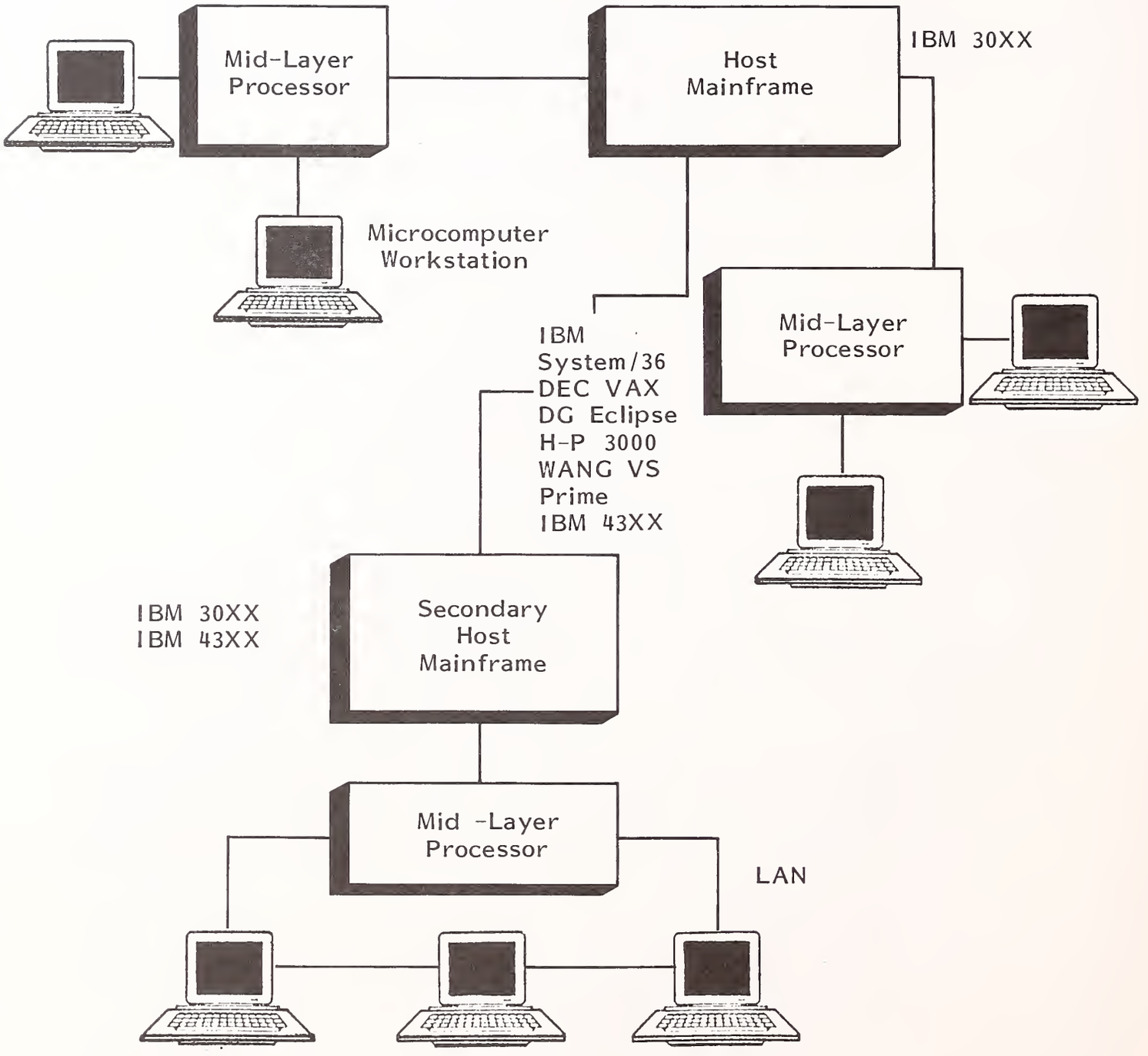
  - Financial modeling.
  - Statistical analysis.
  - Forecasting.
  - Report preparation.
  - Graphics presentations.

- These departmental or mid-layer processors will handle the office systems, the decision support systems, and production data processing systems. The data processing portion of the departmental system will focus on three functions:

  - Data collection. Transactions processed by the work groups within a business unit will be entered into the system via microcomputer workstations where most of the edits and control balancing will take place.
  - Ad hoc reporting. Information required to support the specific needs of a work group or department will be provided by end users through microcomputer software and links to host-stored data.

EXHIBIT III-2

DEPARTMENTAL COMPUTING CONFIGURATION



- Business unit-specific packages. Each business unit of an enterprise has specific data processing needs. For instance, the sales and marketing group needs to track sales activities and expenses. Sales forecasting and sales-lead management with contact profiles are all unique functions of the sales and marketing group. In the past, these business unit-specific information systems received low priority from the IS project priority-setting committee. In the future, more vendors will offer software packages for mid-layer processors aimed at the data processing requirements of specific business functions. These packages will require very little support from IS for implementation and maintenance. DEC and Data General have both announced occupation-specific software packages that run under their respective office systems.

IV DDP TECHNICAL ISSUES

A. MULTI-VENDOR ENVIRONMENT

- In the departmental computing configuration (see Exhibit III-2), it would not be unusual to find incompatible hardware and software. Even if all of the components were supplied by IBM, there would not be complete compatibility. The System/36, for instance, has basically a different architecture that the System/370 series, which includes its systems software, peripherals, and video display terminals. The IBM personal computers have incompatible architecture and systems software with either the IBM mainframes or minicomputers.

- Unfortunately, the concept of departmental computing systems evolved from several different origins, none of which were directed by any industry standards or guidelines. The suppliers of microcomputer applications software (i.e., word processing, spreadsheet processing, data management, report writing, and graphics) originally developed each product independently for a single user in a standalone environment; data generated in one application could not be automatically transferred to another application. This original incompatibility between microcomputer software products has been alleviated by the integration of applications, but there still remains the problem of compatibility between micro and mainframe file formats.

- The major minicomputer vendors seized the opportunity to market office automation products that filled a need not satisfied by IBM. DEC, Data General, and Wang each have office systems products developed around their respective 32-bit minicomputers and workstations. These office system products were designed for the work group environment and purportedly integrate office automation, personal computing, and data processing.

- The minicomputer vendors understand that if they are going to penetrate the large corporate market they must co-exist with IBM. This, of course, means the interchange of information with IBM host mainframes and IBM PCs. Each of the minicomputer vendors mentioned above supports IBM's SNA communication protocol, and they have all signed agreements with Cullinet that allow their systems access to a variety of IBM host data managers through Cullinet's Information Data Base (IDB).

- The minicomputer vendors are also recognizing the advantage of providing a way for users to connect their IBM PCs to the minicomputer system and emulate an office system workstation. This makes sense, especially in light of the large base of installed IBM personal computers.

- Another category of vendors that must be considered in a departmental computing environment is the mainframe software vendors. Companies such as Applied Data Research, Cullinet, Informatics, Comshare, MSA, and Information Builders have all traditionally developed their products around the concept of a centralized IBM host mainframe. Microcomputer versions of some mainframe decision support systems have emerged, and micro-to-mainframe link products are plentiful, but there is little available to support distributed transaction-driven data processing.

- Exhibit IV-1 illustrates the differentiation of primary functions among the three basic levels of computing systems co-existing in a corporate environment. Each of the three types (Host Mainframes, Minicomputer Office Systems, and Personal Computers) is targeted at a different information

EXHIBIT IV-1

LEVELS OF CORPORATE INFORMATION PROCESSING

COMPUTING SYSTEMS ENVIRONMENTS	
TYPE	PRIMARY FUNCTIONS
Host Mainframe	• Integrated Production Applications • Data Base Management • Information Center Support • Applications Development
Minicomputer Office Systems	• Word Processing • Electronic Mail • Electronic Filing • Administrative Support • Personal Computing • Occupation-Specific Applications
Personal Computers	• Word Processing • Spreadsheet Processing • Decision Support • Ad Hoc Reporting • Graphics Presentations

processing need and is supported by different products from different vendors. These computing systems have evolved independently and the vendors supplying products for these systems have just recently realized the potential market created from the integration of the three levels.

- Integration of host mainframe functions, minicomputer office systems, and personal computing has been aimed at the corporate knowledge workers and information handlers. The emphasis has been on moving production data from the host mainframe to the end user's personal computer, allowing the end user to manipulate the production data electronically instead of manually as in the past. The only way this can be construed as distributed data processing is if users are preparing management information reports on their personal computers that would otherwise have to be prepared on the host.

- The other significant movement towards integration, besides downloading production data to personal computers, is in the area of the exchange of data, text, graphics, image, and voice across a variety of IBM systems (PCs, minicomputers, mainframes).

B. IBMS' PC, MINI, MAINFRAME INTEGRATION STRATEGIES

- IBM is not touting distributed data processing per se, but rather an office systems environment that provides the ability to exchange information between any systems connected to the SNA network.

- To support its central mainframe control strategy, IBM has earmarked the Distributed Office Support System (DISOSS), a mainframe document filing, management and distribution system, as the nucleus for its Office System. DISOSS originated during the 1970s to provide filing and distribution for the 8100 series minicomputer text output. DISOSS runs under DOS/VSE, MVS, and MVS/XA mainframe operating systems.

- DISOSS has been extended to include the capability of handling images created by the IBM Scanmaster I facsimile system and of supporting Personal Services/PC, an application program that allows PC users to exchange text documents, messages, and files with System/370 (370, 30XX, 43XX) and System/36 processors.

- DISOSS (release 3.3) also provides text-file-transfer capabilities to Professional Office System (PROFS). PROFS is a program product that runs under VM and provides text processing, electronic mail, and administrative support (time management) to VM host users through 3270 terminals or PCs under 3270 terminal emulation.

- Because of the potential variety of processor systems possible in the SNA environment, IBM is providing text document and data file compatibility through its Document Interchange Architecture and Document Content Architecture (DIA/DCA) and SNA Distribution Services (SNADS).

- DIA handles the protocols and data structures being transmitted among diversified modes of the SNA network, and DCA supports the DIA functions by defining the format of the information being transmitted.

- To close the gap between mainframes and personal computers, IBM has picked the System/36, which was originally targeted at the small business market as a bridge between the System/34 and the System/38. The System/36 was selected for the role of departmental processor for several reasons:

  - Many of the basic supervisory and resource management functions normally found in operating systems are built into the System/36 architecture, which reduces the need for systems programming expertise.

- The advanced instruction set and the use of the RPG III programming language are designed for non-technical users.

- There are many application packages available for the System/36 that could be implemented by individual business units or work groups.

- The entry price of the System/36 is less than the 4331.

- Under the IBM Office Systems Family of products, there are three System/36 software products.

  - DisplayWrite/36, which is a DCA text editor similar in functions to the PC DisplayWrite 3. It is integrated with Personal Services/36 for document distribution and interchange.

  - Personal Services/36 includes distribution services to users of other System/36s, 5520 word-processing systems, or host DISOSS.

  - PC Support/36 provides information exchange and resource sharing between the System/36 and personal computers.

- The emphasis in the IBM Office Systems Family is on the creation of text documents and the transfer of those documents across the personal computers, minicomputers, and mainframe systems. The next major step for IBM in the Office Systems area will be the integration of graphic material and voice traffic under SNA and DISOSS. IBM is not suggesting that the System/36 be used for processing portions of the corporate mainstream transaction-driven applications; it is positioning the System/36 as a file/communications server to provide direct support to end users in a departmental environment.

C. INTEGRATING THE MICROS

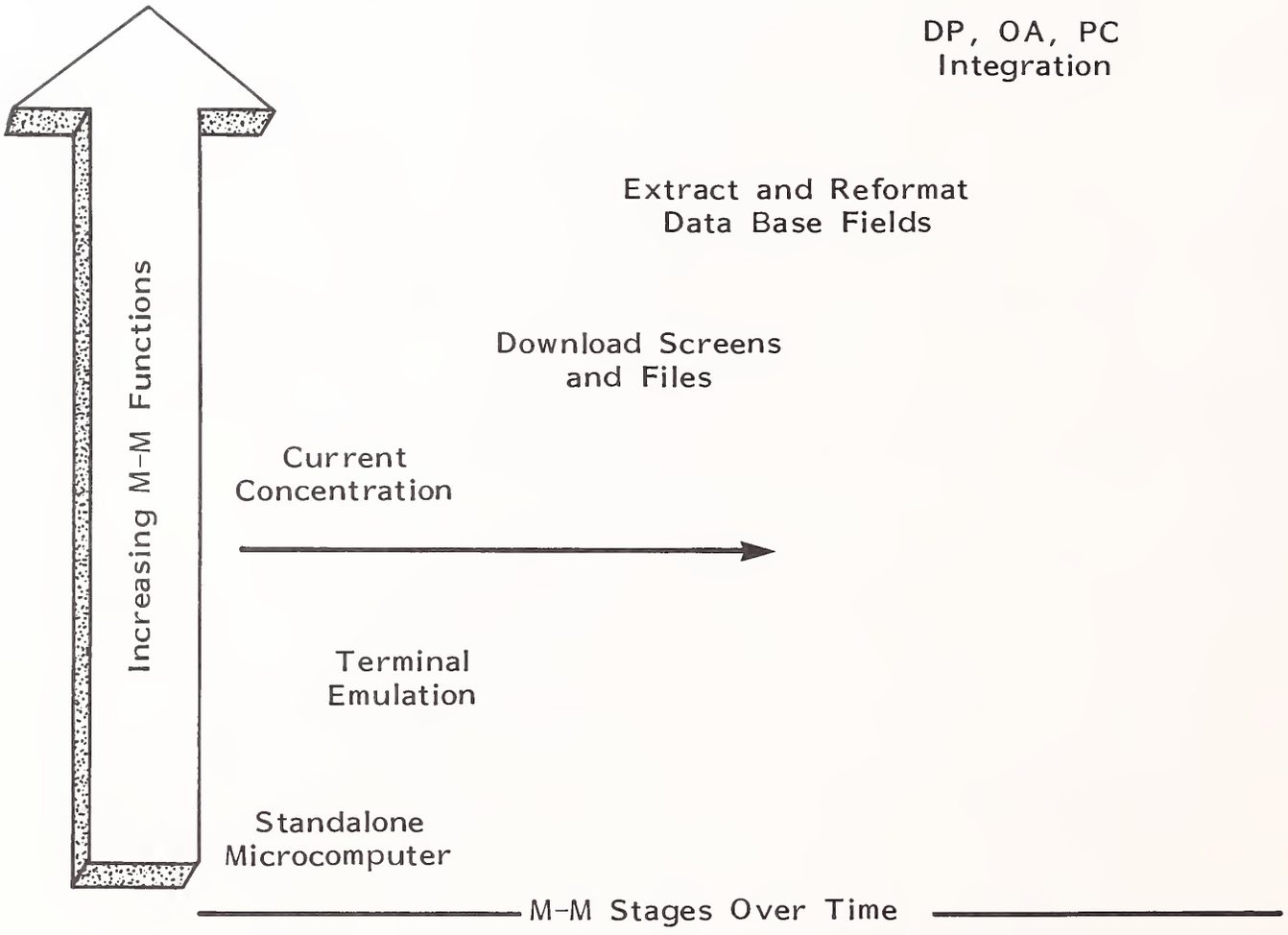
- Exhibit IV-2 illustrates the evolutionary steps of the use of microcomputers in a corporate environment. The microcomputer will become a strategic component of future integrated electronic office systems and will be assigned specific functions to perform to support the information processing needs of individuals and the production operations of the corporation.

- In order to integrate the microcomputer with the mainframe and departmental processors, IS must become more involved in planning, selecting, and installing the necessary links. In a recent report entitled Micro-Mainframe: Corporate Impact, INPUT recommends that IS view the micro linkages from a corporate perspective rather than merely from the perspective of satisfying individual requests for access to corporate data. The planned use of microcomputers should be considered in light of office systems integration, including future production systems.

- In a future distributed data processing environment there could exist many network nodes, each with unique data to support the information needs of the local work groups. Micro linkage software should be able to locate end user-requested information, regardless of where it resides on the network, and convert it to the appropriate micro formats. The search, extraction, and conversion of protocols and formats should be transparent to the end user.

EXHIBIT IV-2

MICROCOMPUTER INTEGRATION EVOLUTION



V OTHER DDP CONSIDERATIONS

A. WHY NOT UNIX?

- If the future distributed information systems environment will involve the integration of office systems, personal computing, and data processing, then there will be a definite requirement for the transparent connection of microcomputers, minicomputers, and mainframes. It seems reasonable to assume that a common operating system controlling all three levels of hardware would be more advantageous than three incompatible operating systems. Exhibit V-1 points out the pros and cons of considering UNIX for the role of a common operating system.

- The advocates of the UNIX operating system believe it provides the features and functions necessary to support the future multi-user, multi-processor systems. They base their beliefs on the following characteristics of UNIX:

  - A typical UNIX system will provide more than 250 utility routines, giving users tremendous flexibility and versatility.

  - In a multi-machine, multi-vendor environment the UNIX portability can be an advantage. With minimal modification, source code developed under UNIX can be moved to different hardware systems.

EXHIBIT V-1

UNIX: PROS AND CONS

UNIX OPERATING SYSTEM	
PROS	CONS
• 250+ utilities	• Difficult to Use
• Portability	• Numerous Versions
• Multitasking	• Poor Documentation
• Recruiting Advantages	• Limited Business Packages
	• No Clear IBM Strategy

- The multitasking feature of UNIX will enable concurrent execution of several tasks or jobs, which means it's ideal for handling many concurrent users in an interactive environment. The large mainframe operating systems (DOS-VSE and MVS) also offer multitasking, but the feature becomes less prevalent in the operating systems for smaller computers.

- AT&T estimates that 90% of the computer science graduates have been exposed to UNIX because of AT&T's policy of inexpensive licensing of UNIX for universities. This will give the UNIX shops a recruiting advantage.

- On the other side of the ledger are a number of disadvantages to UNIX that must be weighed against the advantages, which include:

  - UNIX was originally designed for scientific applications and systems software development, which supported sophisticated computer users. This origin makes UNIX difficult for the business user to use. New versions of UNIX have attempted to make it more user-friendly, but at the cost of efficiency.

  - There are 25 commercial versions of UNIX and an equivalent number of UNIX clones, with manufacturers adding enhancements for business applications support. Many of the versions are incompatible.

  - To support UNIX, an inordinate amount of disk storage is required: 1.5 megabytes minimum, with 5 to 12 megabytes typical.

  - The UNIX system documentation is considered extremely technical and difficult to follow even for the systems programming specialist.

  - Business users expect to find packaged applications software to satisfy their information processing needs. Unfortunately, there are very few business applications packages written for the UNIX operating system.

- IBM has several versions of UNIX, but this appears to be in response to the interest generated in UNIX by AT&T and the growing use of UNIX by the U.S. government and military, where it has become a standard. There is no clear evidence that IBM intends to make UNIX a standard operating system across all of its hardware lines. This uncertainty regarding IBMs' UNIX strategy makes UNIX less acceptable to the IS organizations.

- If an organization is in the process of designing a custom distributed data processing system where much of the application work is relegated to micro-computers in a multiuser environment, then a version of UNIX should be considered.

- System V is becoming the UNIX standard and will be available for the IBM Sierra mainframe. AT&T and Microsoft (developer of Xenix) have entered a joint agreement to develop Xenix V, which will be compatible with System V.

B. DISTRIBUTED DATA BASES

- Downloading data to a departmental minicomputer or individual personal computers from the central host data bases is a form of distributed data. In fact, this is the most common method of distributing data. The master data bases or files are maintained at the central host, and the end users initiate requests for specific data to be downloaded in support of local information processing requirements. Data may be uploaded to the host mainframe for updating the master records.

- Another common method of distributing data to the various nodes in a network is by transmitting a copy of the portion of the master data bases that support each node. This method gives a department or work group quick access to the data needed to support activities during the work day and

relieves the data traffic to and from the host. The host is also relieved of processing the daily activity. Normally in this approach, updating of the central data bases is done overnight in a batch mode, and the changes and additions are sent to the various modes each moring. Periodically, a fresh copy of the data is transmitted to each node to maintain syncronization.

- The concept of truly distributed data bases (DDB) suggests that application data files be divided by function or location and dispersed to the various autonomous nodes in an organization's network. The data management scheme of this DDB concept facilitates retrieval and updating of the individual fields and records from any node regardles of the location of the data or user. There are only a few DDB products on the market that come close to meeting the requirements of the DDB concept.

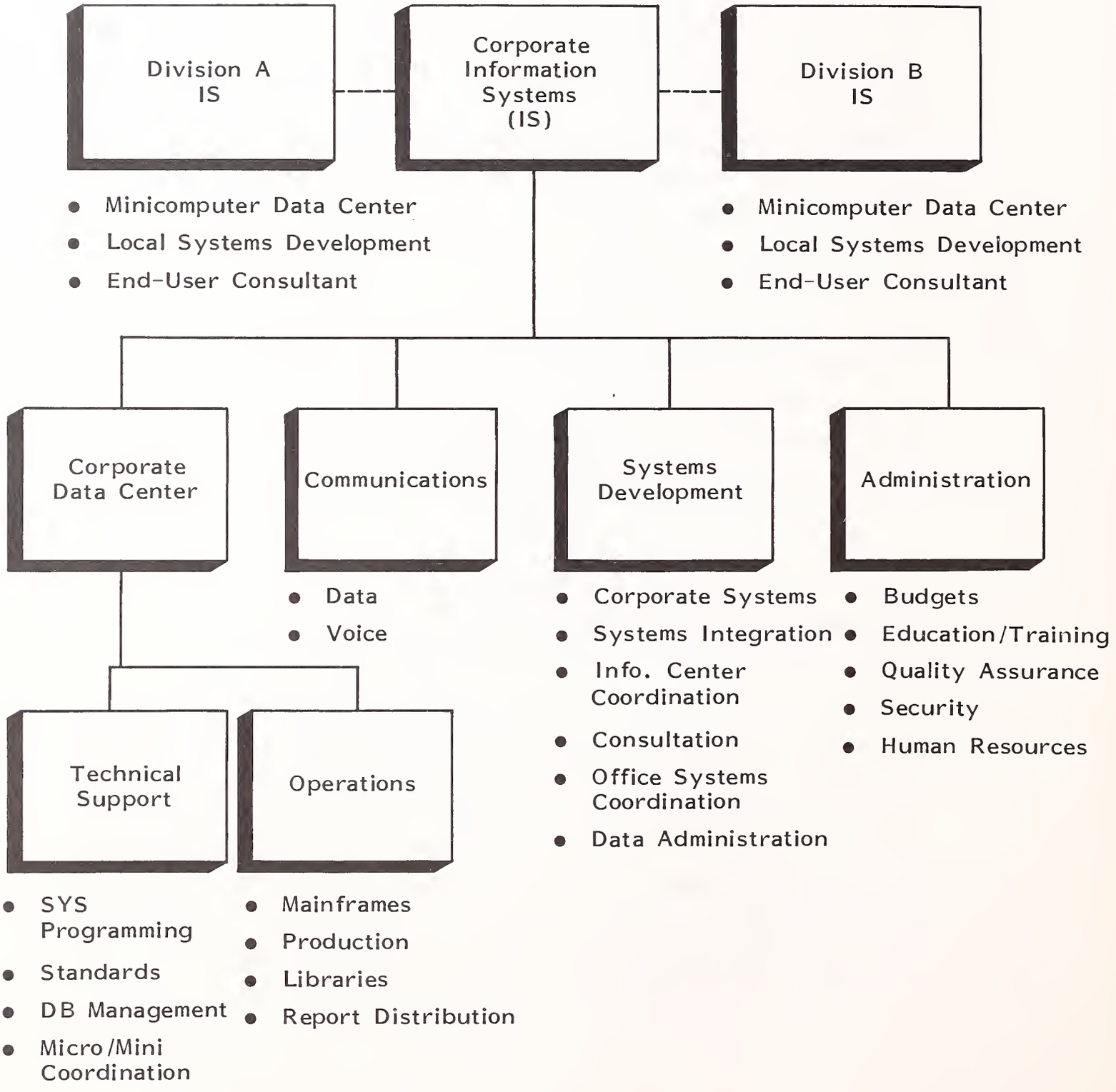
- In the design of a DDP, INPUT recommends that the distribution of data be accomplished through downloading via a linkage software product or by transmitting portions of the master data bases to the various network nodes with centralized data management. Trying the introduce a DDB concept at the same time that DDP systems are being implemented will increase the risk of failure, especially in light of the immaturity of the current DDB products.

C. DISTRIBUTED SYSTEMS DEVELOPMENT

- If the primary intention of a multiprocessor-distributed system is to provide flexible computing power at each strategic location of an organization, then distributed systems development should be included. INPUT has predicted that as computer technology becomes easier to use, the systems development professional will become more business oriented. Eventually, business systems analysts will be assigned to the business unit for which they have expertise. More companies may adopt the IS structure depicted in Exhibit V-2.

EXHIBIT V-2

DISTRIBUTED I.S. ORGANIZATION



- To facilitate the migration of systems development to the operational business functions of an organization, corporate IS must assume leadership by providing technical support, consulting, education, and corporate information systems strategic planning and integration.

- Education will become a key issue for the corporate IS organization if data processing becomes truly distributed. If systems design, development, and implementation become the responsibility of the local business units, then standards, guidelines, security procedures, and new technology will best be disseminated through education.

- More applications packages will be available from micro and minicomputer vendors to support occupation-specific functions. The end users will implement and learn how to use these packages, and it will be the responsibility of corporate IS to develop the necessary integration programs that will capture the transactions to update the corporate data bases.

D. IMPACT OF DDP ON THE I.S. ORGANIZATION

- Exhibit V-2 illustrates a feasible structure for an IS organization in a DDP environment. Corporate IS would consist of four functional units: Corporate Data Center, which would be comprised of both Technical Support and Operations; Communications, which would be responsible for both data and voice traffic; Systems Development, which would have the responsibility for designing the architecture for the integration of office systems, personal computing, and production information systems; and Administration, which would handle all IS-related education and training, IS budget administration, human resource issues, IS security administration, and quality assurance.

- In the DDP environment each major division or department would maintain its own distributed IS organization. There could be multiple minicomputers at

any one location depending on the size and information needs of the work groups being serviced. Each knowledge worker and information handler would have a micro-based workstation linked to the local minicomputer. The minicomputers would primarily coordinate the movement of information (text, data, images, graphics, and voice) between the individual workstations and the central host mainframe. Most of the day-to-day business activities would involve the capabilities of the microcomputer workstations, with daily transactions passed through the minicomputer to the mainframe for application integration and corporate data base updating.

- The concept of distributed minicomputers with linked micro-based workstations has several advantages over the traditional centrally controlled data center:

  - The individual departments and divisions that have distributed systems have autonomy in managing their own information resources.

  - The managers of these departments and divisions best understand the information needs of their organizations and can select the necessary occupation-specific application packages to satisfy those needs.

  - The majority of the data required to support the end users in their decision-making activities can be stored in and retrieved from the mid-layered departmental processor, reducing the time and traffic of interchanging data with the host mainframe.

  - The systems development professionals and the end-user computing consultants assigned to the departments and divisions would better understand the dynamics of the business function being serviced than would individuals from a central pool of analysts and programmers. These distributed systems developers and consultants would become intimately familiar with the business problems facing the local management.

- The corporate IS organization could concentrate more on the technical issues such as network design, equipment configurations, security systems, training techniques, data management, and systems integration.

VI CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

- The original distributed data processing concept from the 1970s was built around the notion that mainstream production information systems would be divided into logical segments, each of which would be placed on dispersed minicomputers.

- The design, development, implementation, and maintenance of these early distributed systems remained the responsibility of the central IS organization.

- Each minicomputer in the star network of the past distributed data processing environment could communicate with the host mainframe, but could not communicate with other minicomputers in the system.

- Besides the complex problems of systems design, development, and maintenance associated with distributed systems and the problems of data synchronization, the major shortcoming of the early distributed data processing systems was their inability to support the local information needs of the end users.

- When personal computers entered the corporate scene in the early 1980s, the evolution of end-user computing began and, in a sense, a new distributed data processing era was initiated. End users started processing corporate data through their integrated software packages to assist them in decision

making. Business transactions weren't being processed by the personal computers and corporate master files weren't being updated, but reports were being produced and graphic presentations were being created on the personal computers, so in that sense data processing was being distributed.

- Text processing has been prevalent for more than a decade and it was the first step in the movement toward office systems. IBM marketed DisplayWriters, 5520 word-processing systems, and 8100 series minicomputers to meet the demand for office systems. Wang Laboratories has built its reputation around its word processing equipment.

- DEC, Data General, and Wang all now offer "integrated" office systems akin to turnkey systems for the office. They not only offer sophisticated word processing features, but handle electronic mailing, filing, and administrative office support. The have links to IBM mainframes through SNA and provide software for decision support and data processing.

- IBM is positioning the System/36 as a file/communications server to provide direct support to end users with personal computers in a departmental environment. The emphasis in IBM's office systems strategy is on information distribution and interchange among the various hardware systems.

- To retain central control, IBM has identified the mainframe document filing, management, and distribution system, DISOSS, as the primary component of the IBM Office Systems Family of software.

- DisplayWrite is a series of IBM word processing products resembling the Textpack 6 software that runs on the dedicated IBM DisplayWriter and is compatible across IBMs PCs, System/36s, and mainframes. Personal Services are IBM applications for the above hardware systems that allow the exchange of DisplayWrite text document, messages, and files among the users of those systems.

- These IBM Office Systems announcements all but totally eliminate the DisplayWriter and the 5520 from IBM's product list. These announcements will also impact production of the 3270 host display terminals and the System/36 5250 display terminals which can be replaced by PCs with emulation capabilities.

- The next logical move for IBM in the office systems area is to integrate graphics material and voice traffic under DISOSS. This would give IBM host control under SNA for information exchange of text, data, voice, and images among users of PCs, System/36s, and IBM mainframes.

- The challenge for the minicomputer vendor is to counter each of IBM's software product announcements with compatible products that enable them to integrate into the IBM world. IBM is attempting to hold its control over the total corporate information resource market through SNA, DIA/DCA, and the DISOSS product, but the DECs and Data Generals are staying abreast with compatible products.

- With micros, minis, and mainframes all playing a role in the future DDP environment, there is a desire to have a standard operating system that would be compatible throughout the equipment hierarchy. The advocates of UNIX believe it is the operating system for the DDP job, primarily because of its portability and multitasking features at all system levels. The two biggest problems facing UNIX in its quest to become the standard are IBM's reluctance to tout it and its reputation of being difficult to use, hard on resources, and having a limited selection of applications software.

B. RECOMMENDATIONS

- Future distributed data processing systems are synonymous with future integrated electronic office systems, where micro-based workstations are

attached to departmental processors which in turn are linked to the host mainframes.

- Moving from standalone micros and information centers to an integrated electronic office systems environment is an evolutionary process and requires transitional steps.

- The systems development group of IS should collaborate with the end-user support staff to jointly identify a business function within a department of the organization that would be a good prospect for a system designed around the capabilities of microcomputers. The system should include production transaction processing and decision support that requires interchange of information with the host mainframe.

- This particular system identified by the IS staff as a candidate for microcomputer processing would act as a pilot for other distributed systems. The selected system should have requirements to support the local work groups, but it should also feed transactions to a related corporate system.

- The system candidate would be ideal if a portion of it had to be developed through the IS expertise and a portion could be developed by the end users tehmselves, through application software tools. For instance, the productoin transaction processing aspects of the system would be developed by the IS staff and the decision support function would be the responsibility of the end users.

- If not already underway, IS should launch an office systems project and begin installing processors at the departmental level that are capable of accommodating office systems activity and micro integration. Office systems that meet the criteria for future integration with IBM's mainframes and PCs are:

  - IBMs' Office Systems Family.

- DEC: All In-1.

- Data General: CEO.

- Wang: Office.

- IS management should start considering changes to the IS organizational structure that would better serve the future integrated electronic office. The first step should be to merge the information center, end-user support function, and the systems development function under a single manager. This will facilitate collaboration in the design of integrated systems. Also, this new structure will provide a single interface for processing service requests. The most appropriate service for each request can be determined through the combined efforts of the merged disciplines.

- INPUT is convinced that the trend towards moving the information resources closer to the end users will continue at a faster pace. Major competitive problems facing corporations will be solved through the implementation of microcomputer-based applications. These applications will provide computing power to the work groups to increase productivity, improve customer service, and assist in the decision making process. Departmental processors, in the form of minicomputers or small mainframes, will play a vital role in coordinating the movement and processing of information between the micro and the mainframe.

About INPUT

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions. Continuing services are provided to users and vendors of computers, communications, and office products and services.

The company carries out continuous and in-depth research. Working closely with clients on important issues, INPUT's staff members analyze and interpret the research data, then develop recommendations and innovative ideas to meet clients' needs. Clients receive reports, presentations, access to data on which analyses are based, and continuous consulting.

Many of INPUT's professional staff members have nearly 20 years' experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Formed in 1974, INPUT has become a leading international planning services firm. Clients include over 100 of the world's largest and most technically advanced companies.

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