

CROSS-INDUSTRY MARKETS

1988 - 1993

OFFICE SYSTEMS SECTOR

INPUT

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Office Systems Sector

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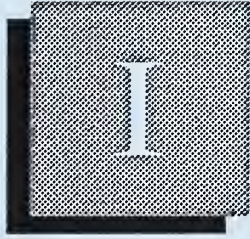
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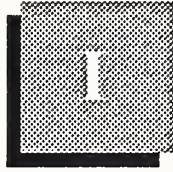
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Industry Overview





Industry Overview

A

Introduction

An Office Definition

Standard definitions of office systems technologies are elusive. However, it is clear that within the past three years, since the advent of the electronic desktop publishing era in 1985, office systems automation is rapidly evolving. Particular trends include the integration of the various technologies into single, integrated delivery systems and the incorporation of standard interfaces and protocols to promote interchange among applications and files in multi-vendor environments. In addition, office systems solutions are increasingly being integrated into the total information systems structures of corporations.

The functional definition of an office environment is also continuing to evolve from that of an area for ^{automated ?} clerical/secretarial support to include more professional and managerial administrative functions. In addition, with the implementation of sophisticated network applications such as electronic mail, group-ware programs, and the ability to access ^{multi-}multi-data base environments, the geographical location of the office is expanding from a department division to the total department and will eventually involve significant inter-departmental activity.

INPUT has identified ten basic technologies which represent significant market sectors in the office environment: word processing, desktop publishing, graphics, spreadsheets, data base management systems, voice processing, communications, electronic mail, image processing, and integrated office systems. Decision support systems (DDS) software ^{DSS} which is used primarily by executives and managers, is included in the INPUT cross-industry sector report entitled *Planning and Analysis*. Decision support and executive information systems include financial modeling and analysis tools which include spreadsheet applications. Spreadsheets have been included in this office systems report because of their wide spread use today across the corporate structure. However, in

terms of market size information, spreadsheets continue to be counted only in sizing the planning and analysis cross-industry markets.

Data base management software, although discussed in this report as an office systems application, is also included in INPUT's systems software category.

B

Industry Trends

1. Word Processing

Word processing packages address several levels of functionality, from large document generation to the production of single-page text. There are dozens of companies that provide word processing/text editing packages for mainframe, minicomputer, and microcomputer operating systems.

The leading word processors for the desktop (microcomputer) environment include:

- Microsoft's Word (for DOS, OS/2, and Macintosh systems); Apple's (Claris') MacWrite; WordPerfect; Micropro's WordStar; and Ashton-Tate's Multimate Advantage represent leading market share products for the high-end of the desktop word processing market among independent vendors. Programs such as Word, WordPerfect, and WordStar, all in their fifth version, also now incorporate several features found in desktop publishing programs, such as proportional spacing, style sheets, multiple columns, automatic hyphenation, and font selection.
- Microsoft Word runs on DOS, OS/2, and Macintosh systems; WordPerfect is available for the DOS, OS/2, Macintosh, VMS operating systems environments, and most recently, an IBM 370 version; WordStar runs on DOS; and Multimate is available for the DOS and OS/2 environments.
- Ashton-Tate has indicated it is completely rewriting Multimate Advantage for both OS/2 and DOS to produce a faster new word processor that will resemble its Fullwrite Professional word processor for the Macintosh operating system. Additions will include style sheets, graphics integration, and a graphics preview mode to show a page that combines text and graphics. Ease of use will also be stressed. This will make Multimate Advantage functionally more competitive with Microsoft Word and WordPerfect.
- MacWrite was recently bundled in a special promotion with Software Discoveries, Inc. MergeWrite, a mail merge utility, which lets users create personalized form letters from data files originated in MacWrite or from the FileMaker II Macintosh file management

system. MacWrite also provides file compatibility with MacDraw, MacPaint, and MacProject files.

- Software Publishing's PFS:Professional Write (for the DOS environment) focuses more on the intermediate-level power user in the corporate environment, with ease-of-use features.
- IBM's leading standalone word processing program, the PC-based DisplayWrite 4, is designed for larger document/text generation, and provides for file mergers from other leading word processing programs and the creation of charts and graphics. DisplayWrite/370 is available on a host-based systems for use on IBM 3270 terminals or IBM PCs with 3720 emulation as well as part of IBM's PROFS integrated office (network system). DisplayWrite 4 Version 2.0 was recently introduced for the DOS environment, and includes certain features only available on the DisplayWrite 4/2 text editor for the OS/2 environment that was introduced earlier in 1988. These features include enhanced import functionality (which includes the ability to merge data files from Lotus 1-2-3, Symphony, Multiplan, and dBase programs) and support for file interchange with other IBM programs, such as the Revisable Form Text-Documents Content Architecture (RFTDCA) Document Interchange Architecture. DisplayWrite 4 Version 2/PASF 2.2.2 IBM Personal Computer interface also allows users access to host functions such as Get, Save, Print, and Mail via PASF file transfer capability while still within DisplayWrite4 Version. Ease of use and ease of learning were also improved. IBM also recently announced DisplayWrite 5/2 Composer, a program designed for page layout and document composition for the OS/2 environment. DisplayWrite 5/2 Composer contains all of the functions of DisplayWrite 5/2 plus the document composition feature.
- DEC's WPS-Plus word processing package is the leading factor in the VAX/VMS market. The new WPS-Plus V3.0 product also incorporates several electronic publishing features. WPS-Plus also integrates fully with the DEC All-In-One office information system. Future releases of WPS-Plus will also support MS-DOS. The older DECMate III word processing product is a hardware/software solution combining DEC's WPS Software and dedicated hardware, which can also be used to access DEC's All-In-One communications capabilities.
- Lotus Development's recently released text processor, called Manuscript, is targeted for the production of reports, manuals, and other complex documents in the DOS and OS/2 environments. It also allows for the hot-line linkage into a document of 1-2-3 or Symphony worksheets.
- The high end of the market for word processing as well as other office functions also includes the integrated office systems products for power

users (primarily office managers, and other professionals), such as Lotus' Symphony and Ashton-Tate's Framework III for the DOS environment, Informix Software's Smart Software Systems for the microcomputer-based UNIX and DOS systems, and Microsystems Engineering Corp. (MEC)'s Mass-11 line of software products for the VAX word processing market. Mass-11 Version 7-A also provides for the conversion of documents from IBM DisplayWrite and is also compatible with several other word processing programs. Its integrated functionality of spreadsheets, graphics, text, and calendar products, also provides an alternative to DEC's All-In-One Office solution.

- The integrated systems offerings of the major computer systems vendors, such as DEC's All-In-One, IBM's PROFS, and Wang's OFFICE, all support word/text processing, integration with electronic mail, and other office systems functions, such as work scheduling (calendars), compound document management, and work group management within a common (usually proprietary) file format. These products also provide access to departmental and corporate databases.
- A number of new word processing releases for the Macintosh environment could challenge Microsoft Word's and the Apple MacWrite's leading positions. These include the new Macintosh versions of WordPerfect, WordStar, and FullWrite Professional from Ann Arbor Softworks which was recently bought by Ashton-Tate. Informix recently acquired Macintosh document processing software technology from Migent Inc. and Nova Development Corp. that is expected to be part of a future word processing product (Wingz). Wingz will initially be a Macintosh offering and is expected to be part of Informix's plans to integrate its office automation technology with its relational database systems.

Leading word processors for the entry-level users have been the integrated office systems packages from Software Publishing and Microsoft. These include Software Publishing's PFS:First Choice and Microsoft's Works.

(See Exhibit I-1)

The latest trend in microcomputer-based word processing is a continuation of the incorporation of more page composition/desktop publishing features into the newer releases. Such word publishing programs will likely represent the only real significant growth segment for word processing in future years. This will come at the expense of the low end of the desktop publishers' market. A competing trend is the inclusion of more full-function text processing capabilities in the increasingly integrated desktop publishing environment, particularly for the latest generation of networked-based document production programs.

EXHIBIT I-1

SELECTED WORD/TEXT PROCESSOR MARKET LEADERS BY OPERATING SYSTEM ENVIRONMENT

DOS

Microsoft Word
 WordPerfect
 Micropro WordStar
 SPC PFS: Professional Write
 SPC PFS: First Choice
 Microsoft Works
 IBM DisplayWrite 4
 Ashton-Tate Framework
 Lotus Manuscript
 Lotus Symphony

VAX/VMS

WordPerfect
 DEC's WPS-Plus
 DEC's All-In-One Integrated
 System

IBM/VM/MVS

DisplayWrite/370
 WordPerfect IBM 370
 IBM PROFS
 IBM DISOSS

Macintosh

Microsoft Word
 MacWrite
 WordPerfect
 Microsoft Works
 Ashton-Tate Full
 Write Professional

OS/2

Microsoft Word
 WordPerfect
 DisplayWrite 4/2 Text Editor
 DisplayWrite 5/2 Composer
 Lotus Manuscript

Wang/VS

Wang Office Integrated System

UNIX

Informix Smartware
 SCO's Office Portfolio
 (SCO Lyrix)
 Quadratron System Q-Office

Future word processing releases will also require support for networked environments as the demand for department-wide document generation accelerates.

(See Exhibit I-2)

EXHIBIT I-2

TRENDS IN WORD/TEXT PROCESSING

- Incorporation of Desktop Publishing Components— Blending of Word Processing and Desktop Publishing Functionally
- Incorporation of De Facto Format Standards in New Software Releases
- Integration of Word Processing and Graphics Editing Components
- Increasing Emphasis on Ease of Use with Graphic-based Interfaces
- Introduction of Server-based Applications

2. Desktop Publishing

The state-of-the art software in desktop publishing provides the following:

- Predefinitions of page formats and type sets in a wide variety of sizes and styles; kerning capability (adjusts spacing between letters); and graphics capabilities, which include the insertion and scaling of photos, charts, line drawings, and boxes, and the ability to automatically snake text around inserted graphics.
- Increasingly, it also includes the integration of file formats of other leading word processors, provision for document translation, and allowance for the input of image files produced by scanners and video digitizers. There are also elaborate document editing features for use in shared, network environments.

- In addition, the distinction between the functions performed by desktop publishing systems and professional publishing systems is becoming much less distinct. This also involves the porting of electronic publishing software to more powerful workstation platforms. Increasingly, this will mean that high-end publishing functions will be performed on PS/2, Macintosh, and UNIX workstations.
 - For example, Quark, Inc. and Software Consulting Services (SCS) recently announced an interface between an Apple Macintosh computer running QuarkXPress, a high-end desktop publishing program, and newspaper page layout systems that will allow the Macintosh to import page geometries and editorial copy from SCS's Layout-8000 and SCS 8000 systems for newspaper layouts.
- Graphics programs, which should be a part of any desktop publishing system, can either be utilized as standalone packages, for which graphics file format conversion features are provided, or be integrated within the publishing program.
 - Paintbrush by Zsoft, one of the de facto graphics standards in desktop publishing, allows a user to create, modify, and insert drawings, graphics, and charts, and to insert scanned images from a text, drawing, or photograph into the leading desktop publishing packages.
 - Dr. HALO graphics products represent another de facto standard in desktop publishing.
- Newer high-end solutions are designed primarily for project groups. They allow users to transfer files back and forth over a network, integrate files from different types of software into a single document, and import documents from spreadsheets, CAD/CAM systems, graphics programs, and word processors, automatically sizing them and converting them into typographic format. Providing network implementation of desktop publishing programs is increasingly important for desktop publishing vendors. Xerox's introduction of an initial network server package implementation of Ventura Publisher is expected in the fourth quarter of 1988.
- A less expensive approach to desktop publishing is provided by text formatters, which are programs that allow users to insert into their word processing programs commands telling a laser printer to produce certain effects. One of the better known text formatting programs is SWFTE International, Ltd.'s LaserWare.

(See Exhibit I-3)

EXHIBIT I-3

**LEADING TRENDS IN
DESKTOP PUBLISHING**

- Blending of Functionality of Desktop Publishing and Professional Publishing
- Porting of Popular Desktop Publishing Software Packages to New Platforms such as the High-End Workstations
- Transparent Linkages of Desktop and Mainframe Publishing Solutions
- Increased Integration of Text Processors, Graphics Editors, and Document Composition Programs
- Introduction of Distributed Groupware/Desktop Publishing Solutions
- Emphasis on Graphics-based User Interfaces

Desktop Publishing Vendors

The desktop publishing market continues to be led by Apple Macintosh solutions (with the original PageMaker software developed for the Macintosh), but Aldus' PageMaker package for the IBM DOS and OS/2 environments, along with Xerox Ventura Publisher for DOS and OS/2 operating systems, have helped provide a solid position for PC-based solutions as well. The number of desktop solutions for the IBM environment have increased significantly over the past two years, and with the introduction of products based on the Presentation Manager user interface, with its enhanced graphics capabilities, the market for IBM PS/2-based desktop publishing solutions could significantly expand.

- Aldus' PageMaker is now one of three industry standards. It is page oriented rather than document oriented, which means it is best suited for single-page or short documents.

- Ventura Publisher Software from Xerox is the chief competitor for PageMaker, and is currently the best-seller for IBM-type computers. Ventura Publisher is positioned to provide for a wide range of document sizes.
- Interleaf, the other leading desktop publishing vendor, also recently entered the Macintosh market. Interleaf's products are designed more for lengthy documents and provide extensive internal graphics capabilities. Interleaf also recently entered into an OEM relationship with IBM to develop desktop publishing software for IBM's PS/2 Model 70 and 80 machines as well as the RT PC.

All three of these vendors have several OEM relationships with major hardware manufacturers.

- At present, desktop publishing is still not well integrated into the total office systems environment. However, certain leading computer systems vendors, such as Digital Equipment, have developed integrated solutions for creating compound documents, including text, graphics, and spreadsheets. Digital's electronic publishing solution is called VAX Integrated Publishing. It consists of workgroup, department, and central production publishing solutions tied together via common VAX system, network, and document architectures. The Workgroup Publishing program consists of the Publishing Solution System (turnkey system), with a software publishing package from Interleaf; and VAXmate VIP Publishing System, with PageMaker software from Aldus Corp.
- Digital announced in the spring of 1988 its Compound Document Architecture (CDA), based on ISO network standards. It defines an integrated environment for creating, revising, storing, distributing, and managing compound documents across an enterprise. The architectural foundation for CDA is the Digital Document Interchange Format (DDIF), which is a specification for the storage and interchange of revisable compound documents. It has been endorsed by vendors such as Interleaf, Kodak, Datalogics, and Information Dimension. DDIF also is consistent with the general directions of the ISO efforts in defining an international standard for compound documents, the Office Document Architecture (ODA). Both Digital (within the framework of CDA) and IBM have also indicated their intent to support SGML (Standard Generalized Markup Language), which is a proposed ISO standard for publishing languages. It also includes support for DECpage pagination program.
- Integration of electronic publishing software for group document production was initiated by the leading high-end independent electronic publishing vendors,

- Xyvision, Compugraphic, and more recently, Interleaf, now provide integrated publishing systems for groups of publishing professionals with the ability to integrate and manage data bases and processes throughout the entire document production cycle.
- A new Ventura/Xerox Publisher LAN package supporting PC Net, Novell, and 3COM network operating software will also be available in the fall of 1988.
- Xerox also recently announced several enhancements to its ViewPoint document processing software for Xerox 6085 and 8010 Star workstations that provide groupware networking support for Ethernet-based networking architectures. Future support is also expected for Sun Microsystem hardware. The new ViewPoint 2.0 release supports group authoring and collaborative publishing and has a "shared books" facility, for distributing documents or parts of documents to multiple authors and illustrators, with specifications for who controls the document with tracking of revisions. ViewPoint is used in office publishing applications such as management report generation, sales presentations, technical reports, and engineering documentation. It also provides the underlying system structure for all of Xerox's VP Series application packages for document processing, including: VP Document Editor, various graphics packages, VP Spreadsheet, VP Office Accessories, etc.
- Byline from Ashton-Tate is a new mid-level desktop publishing program from Ashton-Tate for the PC environment. It also provides support for a number of file formats, such as PC Paintbrush, MacPaint, and Lotus 1-2-3. PIC files.
- Frame Technology Corporation, established in 1986, has found a significant market opportunity for its groupware professional document publishing software with Sun Microsystems platforms. Since the introduction of its FrameMaker professional/technical document publishing software product in March 1987, Frame has sold over 5,000 software licenses. Frame sells its products through distributors, VARs, and OEMs, as well as directly to end users. A version of FrameMaker for the Macintosh is also planned for early 1989. Frame Technology also recently licensed its professional publishing software to Hewlett-Packard. Under the license, H-P will resell the product worldwide for engineering and design documentation, as well as view-only documentation for the manufacturing floor. The programs will be available on the H-P 9000 Series 300 and H-P Precision Architecture (RISC-based) Workstations that use the H-P-UX operating system. The International FrameMaker product was an important factor in H-P's choosing Frame Technology solutions to address H-P's worldwide customer base.

- The corporate publishing market also includes IBM's SolutionPac Publishing System, VM Edition, which runs on VM-based IBM 4300, 9370, and 30XX series processors. The base IBM SolutionPac includes three standard software packages; Publishing Systems ProcessMaster, which allows for group document production; Publishing System BookMaster, which allows for the development of customized document styles and the development of multiple documents from source information; and Publishing System BrowseMaster, which lets users preview compound documents on their workstation display screens. Software installation and customizing, and on-site end-user training are also provided. Companion packages include Publishing System DrawMaster, which lets VM workstation users create and edit illustrations containing line art and text information, and the IBM 4250/II Electro-Compositor, which allows the Publishing System VM Edition to generate camera-ready masters or page negatives from which commercial printers can directly produce offset plates for final printing.
- In addition, future word processing/desktop publishing software programs based on such common application /communications interfaces, such as OS/2 Extended Edition/Presentation Manager and APPC (Advanced Program-to-Program Communications) will provide access to IBM's SAA and other corporate-wide implementations.

(See Exhibit I-4)

3. Graphics

There are currently at least seven basic types of graphics software offerings that are used in the office environment:

- Presentation graphics business graphics solutions
- Image scanning/OCR software
- Paint and line art graphics packages used primarily for electronic publishing applications
- Graphics-based program interfaces such as Microsoft's Windows and IBM's Presentation Manager
- Page description languages such as Adobe's PostScript
- CAD/CAM
- Electronic forms management

EXHIBIT I-4

SELECTED DESKTOP PUBLISHING MARKET LEADERS BY OPERATING SYSTEM ENVIRONMENTS

Macintosh

Aldus PageMaker
Interleaf
Adobe Illustrator
MacPaint
MacDraw

DOS

Aldus PageMaker
Media Cybernetics (Dr. Halo)
Paintbrush (2-Soft)

OS/2

Aldus PageMaker
Interleaf

UNIX

Frame Technology

VM

IBM SolutionPac Publishing System, VM Edition

Dominant trends in graphics software offerings today include:

- Much improved quality of graphics programs, which has been enhanced by the introduction of high-resolution laser printers, graphics plotters, and graphics terminals.
- The leading vendors of microcomputer graphics packages have broadened their product offerings over the past two years by porting to the DOS and OS/2 operating systems in addition to the original Macintosh operating system environment. Initial product offerings are now becoming available for UNIX-based systems.
- Graphics vendors are increasingly addressing mainframe and PC/workstation combinations that allow programs to be run locally on workstations and then be outputted from graphics output devices that are attached to the mainframe. In addition, many of these packages allow for the downloading of graphics functions onto PCs.

- For example, IBM introduced in mid-1988 an interactive graphics software package called DisplayGraphics for DOS-based 80286- and 80386-based PCs, that is an integrated software package that consolidates the facilities for creating and modifying pictures, charts, and text. A key feature of DisplayGraphics is that it uses the same graphic file formats as of its host-based systems, such as Graphics Data Display Manager (GDDM). This allows graphics objects created at the PC using DisplayGraphics to be sent to a host-based application. It also allows for integration into documents produced by DisplayWrite /370. Display Graphics replaces other major IBM 3270-PC Graphics Applications as its principal graphics editor product.
- The introduction of new higher resolution video displays based on IBM's new Video Graphics Array (VGA) standard, overhead projectors for such displays, plus the development of programming tools which allow for the selection, sequencing and timing of graphics screen displays are also stimulating growth, particularly in the presentation graphics market.
- With the emergence of certain product offerings as de facto graphics standards, word processor and electronic publishing software developers are increasingly embedding either compatibility for graphic file formats from leading graphics vendors or incorporating, on a kernel-level, graphics applications such as HALO under a licensee arrangement.
- There is a migration from monochrome to color graphics and to alternative output mediums such as color slides.
 - Aldus recently announced a desktop presentation package for the Macintosh, called Aldus Persuasion, which automatically formats text and charts into slides or overheads through the use of pre-designed AutoTemplates.
- In the graphics-related market, closer linkages are being developed among presentation graphics products, word processing, spreadsheet, data base management, and electronic publishing solutions.
 - Ashton-Tate introduced in mid-1988 Full Impact, a Mac spreadsheet program with graphics. This is an addition to its Full Paint Mac graphics product.
 - Ashton-Tate also recently updated its Framework integrated decision-support software, to provide for automatic linkages between the program's spreadsheet and graphic representations of spreadsheet values.

- Migent software provides an integrated package with automatic linkages between word processing, spreadsheets, and graphics. Migent has also recently introduced a Lotus Development Corp. 1-2-3 data base add-in, called Summit, that allows users of 1-2-3 to use Migent's Emerald Bay's data base management capabilities from within 1-2-3.
- Lotus Development's Graphwriter II also provides for automated spreadsheet and data base linkages with graphics.
- High-end mainframe graphics programs, such as ISSCO (now part of Computer Associates), have traditionally provided such linkages, but have in much more costly versions than what graphics packages usually cost for microcomputers.
- IBM's Presentation Manager, which provides a user interface similar to that for the Macintosh environment, is a major product introduction for the graphics market in 1988.
- Packages integrating vector and raster graphics, along with text composition, also represent a new product direction. This is particularly important for integrating CAD drawings into technical desktop publishing reports.
- Qubix Corp. has recently announced application software to integrate vector and raster graphics, text compositions, and table and form creation. It is originally available on the Sun-3 family of workstations.
- Xerox has announced support for such file conversion in recent product releases.
- In the area of presentation graphics, demand for Macintosh presentation applications is beginning to build, driven in part by the color option of Macintosh systems first available in the spring of 1987.
- A number of Macintosh presentation packages that incorporate color have been recently released. These include Ready-Set-Show by Manhattan Graphics Corp., Cricket Presents by Cricket Software, and Symantec's More outline processor, with others expected from Aldus Corp. and Software Publishing.
- Also, Powerpoint from Microsoft, which was part of the acquisition of Forethought by Microsoft, is gaining in popularity related in part to the color availability on the new Powerpoint 2.0 product.

- The Postscript page description language from Adobe Systems Corp. has become the de facto standard in systems software for type font generation in desktop laser printers. A number of manufacturers of clones of Postscript fonts have introduced products in 1988. It remains to be seen what level of success these companies will achieve.
 - Sun Microsystems recently acquired Folio, Inc., which has some interesting font generation technology that could provide a new level of competition in printer graphics technology.
 - LaserTools Corp. recently introduced a software tool called Trading Post that allows users of Lotus Development Corp. 1-2-3 spreadsheets and Ashton-Tate Corp.'s dBase data base manager, among other similar applications, to communicate with PostScript printers for the first time. In particular, it allows users of software packages outside the traditional desktop publishing environment to communicate with PostScript laser printers with a non-software emulation product.
- Top-of-the line product offerings in OCR scanning provide one-pass scanning for practically any type font, regardless of origin: typeset, typewritten, or output from a laser or dot matrix printer, as well as photocopies, mixed text and graphics, and page layout.
 - Such a product offering is available from Calera Recognition (formerly Palantir Corp.). Its graphics editing package, known as Top-Scan, can also take text and convert it into a number of text formats such as WordPerfect or convert graphics formats into other graphics packages, as well as edit its own graphics, and can process up to 1500 pages in an 8-hour timeframe.
 - Calera also recently introduced a software scanning/ editing recognition product called TrueScan for the IBM PC AT, which reflects the company's entry into the low-end of the scanner market. It consists of a PC AT bus-compatible board and software on a floppy diskette. The product works with most scanners, including AST Research's IX-12, Dest Corp's PC Scan, H-P's ScanJet, and IBM's model 3117. It also supports facsimile cards marketed by AT&T and Datacopy, a Xerox company. TruScan converts optically-scanned documents into formats of a number of leading word processing, desktop publishing and spreadsheet application packages. It can also be used to create files for loading information into a data base and can process pages at speeds up to 100 characters/second while capturing text and graphics at a single pass.
- A graphics-related market that is on a fast-growth track is the electronic forms management market. Products for the Macintosh in this market segment include SmartForm designer and SmartForm Manager. Claris Corp., an Apple Computer software subsidiary, and SoftView are

companies that are expected to launch new products for the Macintosh market, and Columbia Software is preparing a product for the personal computer market.

(See Exhibit I-5)

EXHIBIT I-5

TRENDS IN MICROCOMPUTER-BASED GRAPHICS SOFTWARE

- Improving Quality of Graphics Output
- Broadening of Operating System Support for Graphics Packages
- Development of Mainframe to PC/Workstation Computer Graphic Program Combination
- Emergence of De Facto Graphics Standards
- Closer Programming Linkages between Graphics and Other Office Systems Applications
- Integration of Text and Graphics Scanning/OCR Capabilities in High-End OCR Products
- Rapid Emergence of the Electronic Forms Management Market

4. Spreadsheets

Although Lotus Development Corp. continues to be the dominant factor in the spreadsheet market, there are a number of more recent entrants with a variety of alternative strategies.

- Lotus will be defending its leadership position in a rewrite of 1-2-3 in C language to provide portability to all major hardware platforms, from IBM mainframes to low-end microcomputers. Lotus is also promoting a new user interface called Blueprint that allows Lotus applications to extract data from a variety of data base software programs. In addition,

Lotus has announced the Extended Applications Facility, a high-level language for custom applications based on 1-2-3. Enhancements to 1-2-3 include linked spreadsheets, three-dimensional spreadsheets, and enhanced graphics capabilities.

- The major competitive challenges to 1-2-3 have come from Microsoft Corp. with Excel, which provides high-resolution graphics and Windows interface (which is written in C language) for both the Macintosh and the PC, and Borland International's Quattro Intel microprocessor based technologies. Microsoft's Multiplan spreadsheet program for both the MS-DOS and Macintosh operating systems environments has also sold well over a million copies.
- WordPerfect offers a spreadsheet product, called PlanPerfect, which shares a common interface with its word processing WordPerfect software, as well as a data base product, DataPerfect. They are all compatible with the company's shell program, Library.
- One of the latest challengers to Lotus 1-2-3 is Cruncher, a \$99.95 spreadsheet from Simon and Schuster Software. It is purportedly completely compatible with 1-2-3. Cruncher also allows users to enter new data and to calculate without changing the worksheet's structure or formulas. Many standard statistical, mathematical, financial, logical, and other functions are built into the program. In addition, the program can also convert data into various kinds of bar, pie and line graphs, and includes a data base manager.

Technological innovation in spreadsheet programs today is providing for three-dimensional linkages and viewing. These include program offerings such as Boeing Calc, MicroCUBE, and TM/1. Javelin Plus from Javelin Software Corp. is one of the most flexible new spreadsheet offerings.

(see Exhibit I-6)

5. Data Base/Text Information Management Systems

There are now three basic categories of information management systems:

- File Management Systems that are based on flat-file data base models that use data only from one file at a time. These are practical in the office environment for many types of general record keeping, and have particular value because of their relative ease of use.
- Data Base Management Systems

EXHIBIT I-6

TRENDS IN ELECTRONIC SPREADSHEET PROGRAMS

- Broadening of Operating System Support
- Incorporation of Graphics Interfaces
- Introduction of Low-Priced Lotus 1-2-3 Compatible Packages
- Tighter Integration of Spreadsheet Functionality with Other Office Systems Applications
- Introduction of 3-Dimensional Spreadsheet Packages

- There are two basic data base management systems models: relational and hierarchical. Relational data bases represent the state-of-the-art for new office-based networked applications. They allow for the linking of files through a number of logically-shared relationships and thus allow for linking of data bases among various horizontal and vertical programs and for multi-user access. In addition, support for the IBM SQL interface is becoming increasingly important as a standard user interface for data extraction, and report generation from relational data bases.
- In particular, the new SQL Server network relational data base product being co-developed by Microsoft, Sybase, and Ashton-Tate, could become a formidable competitive product in the LAN-based relational data base management systems market.
- Report generation front-end tools for workstation/PC-based data base management systems are becoming increasingly important for tailoring micro-based data base management systems functions for the office environment. Difficulty in programming in dBase has reduced its flexibility in the office environment. However, 4GL non-procedural programming languages (such as Informix-4GL) and eventually 5GL natural languages should be major stimulants to the use of data base management systems for report generation in the office systems environment.

- Two new personal programming language packages for creating less-complex data base applications include Cause from Maxem Corp. (available for the IBM PC and Macintosh) and The Personal Developer from Clarion Corp. (for IBM PCs).
- Information Managers that retrieve unstructured text and data: these are also known as Full Text Retrieval Systems.
 - These enable search and retrieval of information from text files, such as company documents and magazine articles, without the use of key search word directories. They have been popular to date in law firms, libraries, and government offices. These are particularly valuable for on line cataloging and accessing word-processor-generated textual material as well as printed mail, and as part of an image processing system.
 - Some of the products currently available on the market include Access Softek's Dragnet, Executive Technologies' SearchExpress, Information Dimensions' (BATELLE Subsidiary) BASIS, and ZyLAB Corp.'s ZyIndex. One of the newer products is from Verity Corp. that uses an expert systems approach to enhance the search process. IBM's product offering in this area is Stairs.
 - Goal Systems International recently introduced a new computer-based reference software product for text searching and cross-referencing (IBM) mainframe-based reference material, such as corporate policy manuals, procedures manuals and training materials.
 - Informix is also developing a combined data/text storage systems (using phrase references for text) for linking data management and text file retrieval. This will eliminate the need to know particular text file names in locating reports and other referenced material.
 - Future Full-Text Retrieval Systems will be more tightly integrated with other types of data bases as well as other office functions. Verity, for example, has signed a number of joint marketing agreements with the leading relational data base management systems software vendors that will eventually lead to a tighter integration of the data base and text management information structures.
- Other related products representing potentially high growth market segments include:
 - Agenda, a DOS-based product shipped initially in mid-1988 from Lotus Development, which is a personal information manager. Lotus describes Agenda as a data base without a predefined structure that stores and organizes textual information. Such data presumably would be located on a variety of personal notepads. Competing

products are available from Symantec Corp. (GrandView) and Valor Software, Inc. (Info-XL).

- Stackware for individual information organization

- The most widely used stackware product is Hypercard, which Apple has bundled into its Macintosh product offering. Hypercard, which includes HyperTalk™, an English-based programming language), can be used to create customized management of textual, graphic, sound, music, voice, and animation-based information.
- Another stackware product is Focal Point, provided by Activision/Mediagenic.
- Although at present such stackware products have not had impact on the office systems environment, there is potential for product use more as an individual's application development tool. An emerging use of HyperCard in the office environment is its use as an "interface toolkit" for the development of front ends to remotely located mini- and main-frame online data bases. Oracle's new data base management software product for the Macintosh uses HyperCard as a standard user interface, which provides users access to relational data base information residing in a multiple vendor and multiple operating system environment.
- HyperCard is also used for preparing presentations and instructional and training materials in office settings.

(See Exhibit I-7)

6. Voice Processing

Voice processing, the manipulation of voice messages by a computer, can be divided into three market segments: voice recognition, voice response, and voice messaging.

a. Voice Recognition and Voice Response

Voice recognition and voice response involve call interaction with a computer either through touchtone phones or through speech recognition devices for touchtone extraction of computer files, and for voice delivery of electronic mail.

Voice recognition systems involve modified personal computers that can accept speech as input. Because low-priced systems that can recognize different voices and continuous speech have not yet been perfected, the major area of acceptance of voice recognition systems to date is on the factory floor which doesn't require as extensive a vocabulary.

EXHIBIT I-7

**TRENDS IN DATA BASE/TEXT
INFORMATION MANAGEMENT SYSTEMS**

- Increasing Acceptance of PC-Based Relational Data Base Technology
- Growing Sophistication of Report Generation Front-End Tools
- Initiation of the Market for Personal Information Management Software
- Expansion of Text Managerial/Retrieval Technology through the Use of Expert System Technologies

- Computers can perform speech recognition in one of two ways: by responding to the speech of a particular individual, or by recognizing a restricted set of words without regard to the speaker.

The first method, known as speaker dependent recognition (SDR), requires a computer to be trained to a particular user. A number of different users can store word vocabularies in memory or on a disk. Before running an application, a user's vocabulary is brought online and the computer matches the pattern of each spoken word with the templates stored in the user's private vocabulary.

- VOTAN provides a continuous voice recognition system that works under the SDR technology.

The second method of speech recognition, called speaker independent recognition (SIR), allows a computer to respond to a fixed set of words spoken by a wide range of speakers. VOTAN also provides tailored applications with SIR technology. The latter, however, is still constrained by limits on the size of the fixed vocabulary.

- IBM's voice-recognition product, Voice Communications Option, can be used in the office environment with a PC, and provides the IBM Voice-Activated Keyboard Utility. This utility allows users to activate keystrokes on a microcomputer by voice.

- DEC has recently added DECvoice Response System to its enterprise-wide message services. It provides for the integration of digitized voice, text-to-speech synthesis applications, and voice recognition systems through phone accessibility.
- Kurzweil Applied Intelligence has a new product, called Kurzweil Voiceworks, that represents an early version of the voice-activated word processor. Voiceworks can recognize up to 20,000 words, but has a current limitation; the speaker must pause between words. It can handle a rate of dictation of about 60 words a minute, whereas, normal speech ranges from up to 125 words a minute.

Issues that remain for the lower-cost solutions include: support for more than a 1,000 word vocabulary, speaker-independence (without having to retrain the system), and support for continuous speech.

Future voice recognition and voice response applications in the office environment might be used to transcribe voice dictation directly to the computer screen.

- Convergent Technologies' Voice Processor™, in conjunction with the company's Document Designer™ integrated office automation software package, allows for voice annotation of compound documents through voice/text conversion from telephone input.
- The new Freestyle System recently announced by Wang Laboratories provides for the voice annotation of compound documents within its integrated electronic messaging architecture.

b. Voice Messaging

Voice messaging, a more mature technology, is a voice form of electronic-mail transmission. Instead of a computer, the caller uses a telephone to relay a message and the message can also be stored on a computer disk, as with electronic mail. Basically, the computer is used to digitize the voice, dial numbers, and play or store a message in a voice mailbox.

- Computer-based voice messaging systems address four principal market segments: large corporations, service bureaus, telephone answering services, and small businesses.
- Octel Communications and Rolm/IBM sell total voice processing systems which provide voice messaging as well as several other software-based functions: voice mail, telephone answering, call processing, automated attendants, and a voice bulletin board or mailbox.

- In larger companies today, such equipment is integrated with private branch exchanges (PBXs) or Centrex equipment that provides for wide-area networking of voice messaging and voice mail. This capability, plus the continuing reduction in systems costs and other enhanced functionality, have stimulated the market growth rate for voice messaging systems solutions in the past few years.
- Judge Greene's recent decision to allow RBOC's to provide the delivery of enhanced services products such as voice messaging, electronic mail, and videotex should stimulate the growth of intercompany voice messaging, in particular. It is likely that the RBOC's will move more quickly to offer voice messaging services than other enhanced services products, such as electronic mail, because of their expertise in the voice systems technology. The interconnection of corporate, computer-based voice message and electronic mail services with wide-area, RBOC-provided networks also could provide an opportunity for RBOCs to enter the professional services and systems integration office systems market.
 - It should also stimulate the implementation of needed voice-mail standards among voice mail equipment vendors.
 - The impact on leading voice and electronic mail messaging Service Bureaus and Value-Added Network (Enhanced Service Providers) depends in part on the final interpretations of the exact nature of such services. The initial RBOC's operating plan, called the Open Network Architecture Plan, is currently a topic for discussion among such interested parties such as the independent Service Bureaus, VANs, computers systems vendors, ADAPSO, the RBOCs, the FCC, and Judge Greene. Issues involve the need to unbundle the capabilities of the public switched network and fear of monopolistic control over delivery networks and tariffing.
 - The greatest negative impact could be to the telephone-answering services industry. Pacific Bell's initial product for the voice message market, announced in mid-1988, is a service that will give telephone-answering companies the ability to automatically let their customers know when they have messages. The new connections will allow a telephone answering service to intercept incoming calls for customers when they are on the phone.

Ultimately, voice communications technology will involve the integration of voice recognition, voice messaging, voice mail, and electronic mail, as well as data and image transmission.

(See Exhibit I-8)

EXHIBIT I-8

TRENDS IN VOICE PROCESSING IN THE OFFICE ENVIRONMENT

- Incorporation of AI Technology to Achieve Continuous Voice Recognition and Speaker Independent Recognition
- Text to Voice Application
- Integration of Voice with Applications such as Document Annotation and Distribution
- Anticipated Entry of the RBOCs in the Voice Messaging Market
- Future Integration of Voice Recognition, Voice Messaging, Voice Mail, Electronic Mail, and Data and Image Transmission

7. Communications/Local Area Networks (LANs) Operating Systems

Microcomputer-based LANs operating systems for the office environment currently allow for the following capabilities: file and application sharing, sharing of peripheral devices, document management, and electronic mail. With the development of more sophisticated network operating systems, distributed application processing and access to corporate wide information management resources will also be available.

a. Standards

Three network operating systems based on dedicated file servers currently represent the de facto standards in the DOS network operating environment: Novell's Netware, 3COM's 3+ network operating systems software (3+Share and 3+Open), and Banyan System's VINES. 3COM Corp. recently began shipments of its 3+Open networking systems, which is a version of OS/2 LAN Manager. Microsoft and 3COM jointly developed and are co-marketing the MS OS/2-based LAN Manager products. Product support for OS/2 LAN Manager was also re-

cently announced by DEC and H-P. This significantly increases the competitive ante in the LAN operating system/network management software products market for Novell, the current leader in the MOS-DOS-based LAN operating systems market. DEC will incorporate LAN Manager in its DECnet network environment, which will allow DOS- and OS/2-based computers running LAN Manager to access VMS-based networks. LAN Manager protocols and interfaces will be implemented under VAX/VMS services allowing DOS and OS/2 workstations using LAN Manager to access VMS Services software.

- DEC is currently using Microsoft's MS-DOS and MS-Net products in its DECnet DOS and VAX/VMS services for DOS.
- LAN Manager will also be able to interoperate with the UNIX environments as a result of a pact between Microsoft and X/Open Co., which will publish LAN Manager protocol and interface specifications as part of X/Open's portability guide. The X/Open agreement involves a UNIX-based version of LAN Manager, LMX, which is being developed by Hewlett-Packard Co. Such support for the LAN Manager by the leading minicomputer vendors could enhance minicomputer-to desktop computer/OS/2 connectivity by allow minicomputers to be used as network/application servers in local-area networks.
- LAN Manager on the proposed SQL Server will also significantly enhance the multi-user capability of the PC LAN environment.
- Novell has announced its intent to provide compatibility with LAN Manager with its Advanced Netware network operating system. Novell recently began shipping its Netware Requestor product for OS/2. Netware Requestor enables OS/2 workstations to run on Novell networks and is compatible with OS/2 Extended Edition 1.0 as well as Netware for VMS, which allows Netware networks to share resources with DEC VAX computers.
- Interlan, Inc. recently announced bridging software to provide transparent interoperability between workstations running Novell, Inc.'s network software and Microsoft's OS/2 LAN Manager-based servers. Although Novell said it does not plan to license LAN Manager, it does plan to provide OS/2 connectivity and will support LAN Manager's Named Pipes application program interface under OS/2, not DOS.
- Novell was also expected to support the SQL Server, which will provide an interface between the NetWare network operating system and Microsoft's OS/2 LAN Manager. However, recent conflict has developed over a proposed partnership between Ashton-Tate and Novell on the SQL Server, related to competitive issues between Microsoft's (as a partner with Ashton-Tate on the SQL Server) PC/LAN network operating system and Novell's Netware network operating system.

The release in the fall of 1988 of IBM's OS/2 Extended Edition with a bundled network manager as well as data base management system could provide a formidable challenge to the independent communications software/hardware suppliers. The OS/2 Extended Edition PC-to-mainframe connectivity solution appears to be a principal driving force for PS/2 sales. In particular, current problems of PC-to-mainframe connectivity in the IBM product line have provided independents with opportunities to provide gateway/bridge solutions.

For the DOS environment, Intel Corp. and Digital Communications Associates recently introduced a communications programming interface, Communicating Applications Specification (CAS) Version 1.0. This interface, which has been placed in the public domain, provides independent software developers with a programmer-friendly interface for writing MS-DOS applications with embedded communications protocols. This will allow PC-based applications to communicate directly with mainframes, share data with remote PCs, and facsimile machines, as well as download communications while concurrently performing other tasks. Essentially, this allows independent software developers to more easily provide for communication linkages in their programs by merging CAS into an application rather than having to write to a number of different vendors' network protocols, terminal emulation formats, or wide-area connections. The existence of CAS could prolong the life of DOS-based networking solutions and provide some significant competition to the OS/2 LAN Manager product.

The development of broad standards for interapplication portability as well as other levels of network communication is made more difficult because of the numerous standards-making organizations that exist. At present there are over 20 world standards organizations. Among those with the most direct impact on office systems are: the ruling standards bodies, ISO, CITT, and ANSI; the National Bureau of Standards (NBS); (Gaithersburg, MD.); IEEE; and X/Open, a consortium of U.S. and European vendors promoting truly portable standards.

The NBS has been working with government agencies, systems integrators, and large corporations to develop an Application Portability Profile (APP), that would provide a guide to the most open interfaces and standards among the various tiers of networking models.

Among the many de facto networking standards impacting the office systems environment are Token Ring; Ethernet; PC LAN; DECnet; IBM distributed document exchange architectures and formats, including DISOSS, DCA, DIA, DDM, APPC/LU6.2, SNADS (SNA Distribution Services); FTAM (File Transfer and Access Methods); DEC's Digital Document Interchange Format (DDIF); Macintosh file formats, such as AFP (Appletalk File Protocol); MacWrite; Sun's Network File System; AT&T's System V (UNIX) Interface Definition (SVID); the DOD-

supported Standardized Generic Mark-up language; scanner file formats, such as MacPaint®, PICT, and TIFF; X.400 (CCITT standard for electronic mail); TOP (Technical and Office Protocol), the 802.3 LAN-based cluster model; 3+Share/3+Open, NetWare; Advanced Netware LAN operating system software; and Adobe Systems' Display Postscript.

Over the next two to three years, the OSI seven-layer networking model will eventually displace many of the de facto standards for the several implementation levels. Current OSI-compliant/OSI-transition standards being implemented by U.S. manufacturers include the Manufacturing Automation Protocol (MAP) for the factory floor and the Technical and Office Protocol (TOP) for office systems applications. In addition, organizations such as the Corporation for Open Systems (COS) are working on developing conformance testing procedures for vendors implementing the various OSI seven-layer networking model. Current tests under development are for the Internet Protocol, Transport Protocol, FTAM (File Transfer and Access Methods) Protocol and MHS (Message Handling System, including X.400) for electronic mail.

IBM recently unveiled a number of communications products to provide for information exchange with non-IBM machines. These are primarily based on comparable Open Systems Interconnection (OSI) protocols. These include: Open Systems Message Exchange (OSME), an X.400 (OSI) electronic mail system designed to let users of different office computer networks running X.400 software send and receive electronic mail; X.400 PROFS Connection and X.400 DISOSS Connection, programs that provide protocol conversions into X.400 format for IBM-formatted messages and provide routing through OSME; OSI/Communications Subsystem, which supports operations of applications on local and remote systems; and OSI File Services, a software offering conforming to the FTAM protocol for file transfer between IBM and non-IBM systems. These IBM OSI products will be implemented under SNA, leaving SNA intact.

- IBM also recently announced its Office Interconnect Facility (OIF), co-developed with Aratek International, Inc., which is a collection of programs designed to manage E-mail and revisable document exchange across a multivendor environment consisting of IBM, Wang, and DEC equipment. These software programs also will coexist with the CCITT X.400 products previously announced by IBM.

SAA is also likely to be a future bridge between SNA and OSI. The Common Programming Interface Communications (CPIC), an SAA programming interface along with SNA's LU6.2 APPC interface will facilitate communications between IBM and non-IBM platforms and operating systems.

Retix Corp. and Touch Communications, Inc., leading independent vendors of Open Systems Interconnect (OSI) software to OEMs, have indicated plans to enter the end-user market in 1989.

- Products from Retix include Retixmail and the Open Server 400 message server, which are X.400-compliant electronic mail products. Key features of Retixmail include a graphical interface (Microsoft Windows) and the ability to interface with any E-mail front end or server via Open Server 400's application programming language. This will also allow for remote links with minicomputer or mainframe E-mail services that support the X.400 standard. Components include the Open Server 400 message server package called Message Transfer Agent and a wide-area network (WAN) coprocessor board that handles OSI WAN in the lower layers; the MS-DOS based Open Server 400 will be promoted as a standard X.400 network access platform to third-party application developers and OEMs. UNIX and OS/2 based versions are scheduled for introduction later in 1989.
- Touch Communications' products include a family of Technical Office Protocol 3.0 based end-user networking software that will support the Macintosh, the IBM PC, and the DEC VAX/VMS family. OSI network services include file, print, terminal and security. Touch, 10% of which is owned by Apple, claims that with the Touch OSI Macintosh software it is the first vendor to provide an end-user OSI product for the Macintosh. Its Touch OSI product family is also compatible with the Government OSI profile and the Manufacturing Automation Protocol (MAP).

Eight computer and telecommunications vendors recently formed a new standards group, the OSI/NM Forum, for ensuring that network management products developed by the individual vendors (Amdahl, AT&T, British Telecom, H-P, Northern Telecom, Telecom Canada, STC plc and Unisys Networks, Digital Communications Associates) will be capable of operating with each other through adherence to Open Systems Interconnection (OSI) protocols. The association will be focused specially on defining OSI-based interfaces for various network management schemes of individual vendors. This will involve working on agreements on protocol options and message sets within each of the seven layers of the OSI model to be implemented in the individual interfaces. OSI/NM is depicting itself as an implementation group, rather than a certification organization, such as the Corporation for Open Systems (COS).

- OSI/NM has already selected the CCITT's X.25 wide area network standard and the IEEE's 802.3 local-area network standard for the first three layers of a seven layer profile. At the top layers, the group has indicated it plans to adopt the draft OSI proposal for the Common Management Information Services and Protocol (CMIS/P) that specifies the format of network management messages.

- OSI/NM also plans to include ISDN signalling protocols in the future.

Hewlett-Packard and many other systems vendors, such as DEC, IBM, and AT&T, have endorsed OSI as a networking standard. Currently AT&T is supporting X.400 in its AT&T Mail offering that was announced in early 1988. In addition, a 10-Mbit version of Starlan, its LAN solution, will address the first four layers of OSI.

AT&T has also indicated that it plans to provide a combined communications offering including both integrated services digital networks (ISDN) and OSI-based networking standards. Provided that other computer systems vendors support the combined standards, AT&T's approach should allow customers to unite products made by AT&T and other manufacturers into local, regional, and international networks carrying both voice and data. AT&T is thus attempting to expand OSI standards by combining them with the implementation of ISDN standards. This will allow for the combining of local and remote data centers into a single, unified OSI/ISDN network. This could be an opportunity for third-party software developers to provide some of the OSI products for AT&T. The upper layers of the OSI standard will be implemented into the AT&T UNIX operating system offering.

During the transition to the implementation of OSI standards, a variety of gateway and other types of transitional solutions will be required to provide linkages between today's de facto standards and the initial implementations of OSI.

X-Open, which is an international consortium of computer vendors committed to developing the Common Applications Environment, will help applications developers write programs that can run on hardware and software variations of common operating systems, such as UNIX.

(See Exhibit I-9)

b. LAN-based Interconnectivity

A growing role for LAN servers will be as gateways to corporate-wide information resources. Novell, for example has recently introduced two SNA gateway programs to enable local-area networks to be linked to IBM mainframes. This will allow PC/workstations to communicate with an IBM host with connections via-token-ring or remote-assist SDLC. Novell has indicated that these are the first in a series of gateway products currently under development.

IBM recently announced a LAN Channel Station, which is a lower-cost alternative for connecting LANs (Token Ring, PC Broadband, and Ethernet) to IBM hosts than routing through IBM front-end processors.

EXHIBIT I-9

**COMMUNICATIONS STANDARDS
IMPACTING OFFICE SYSTEMS
TECHNOLOGIES**

- De Facto Microcomputer-based Network Operating Systems Software Standards
- International Standards Organization's OSI Communication Protocol Model
- De Facto File Management Standards—DCA, SNADS APPC/LU6.2, FTAM, TOPS, AFP (Application File Protocol)
- Graphics Standards—TIFF, PICT
- Electronic Mail—X.400
- Standard Communication Interfaces—SAA

The most advanced of the gateway/bridging solutions and other leading product development trends in LAN systems software represent initial attempts at implementing peer-to-peer communications among various computer architectures and operating systems. Currently, much of the gateway product solution has been provided by third-party developers. Various implementations of these strategies include:

- Recently DEC significantly enhanced its gateway products, including DECnet-to-Appletalk linkage for VAX/VMS and DECnet-to-IBM host connectivity. This includes a Microvax II with a new operating system that improves upon its current PDP-11 based gateway products. This DECnet SNA Gateway-CT will connect directly to an IBM host channel and support through-Put of more than 1M bit/sec. Previous IBM gateways from DEC connected to an IBM front-end processor, which limited throughput speeds to 56K bit/sec. The new product will continue to support all current software for DEC's DECnet/SNA Gateway, including IBM 3270 terminal emulation, remote job entry, data transport facility, and LU6.2.

Another product introduction, the DECnet/SNA Gateway-ST will provide a upgrade for DEC's current PDP-11-based gateway. This will increase throughput from 50K bit/sec from 24K bit/sec. DEC is also expected to announce a multifunction communications server that will function as a gateway between DECnet and an IBM SNA host front-end processor. It will also serve as a DECnet router offloading functions from a VAX host and as a gateway between DECnet nodes and CCITT X.25 wide-area networks. DEC is also expected to announce an implementation of the Open Systems Interconnect file transfer protocol, FTAM, as well as support of Sun Microsystems's Network File System on VAX/VMS. The latter would be directed toward users of UNIX workstations for accessing VAX-based files. Along with IBM, DEC is also pursuing a definition of an enterprise networking architecture.

- Apple Computer recently introduced network software called MacTCP, which is integrated into the Macintosh operating systems and supports multiple concurrent TCP/IP protocol services. This allows the Macintosh to operate in a multivendor environment without relying on third-party bridges to connect other vendors' systems. It is also licensing the software to third-party developers to create applications software that will perform functions such as electronic mail, virtual terminal access, file transfer, and distributed applications' processing. MacTCP was co-developed by Ungermann-Bass, Inc. (now part of Tandem), which recently announced a set of end-user applications for MacTCP in its Net/One TCP product family. Applications include file transfer, virtual terminal support, and E-Mail. The Net/One TCP product family also includes TCP-PC.
- Apple Computer is promoting a number of different types of bridges between its Macintosh computers and IBM hosts. The Macintosh will be positioned as a terminal in an IBM network. One such product is Digital Communications Associates, Inc.'s recently announced Maccirma TLPM, that will enable Mac II and SE users to graphically display mainframe applications written to Apple's Macworkstation in an IBM 3270 environment. Apple will bundle this software with Macworkstation to provide users and developers with a graphical interface to host applications such as IBM's VM Notes.
- LU6.2 and PU2.1 are IBM's basic program-to-program SNA protocols for peer-to-peer communications among microcomputers, local-area networks, minicomputers, and mainframes. A version of APPC, LU6.2 called Standard Peer-to-Peer Communications (SPPC), has been submitted to the International Standards Organization (ISO) by IBM, Groupe Bull, and Siemens AG.
- LU6.2 and PU2.1 are integral to interapplication communication that allows applications to be split and run on different computers at the same time. Ultimately, however, this level of interapplication com-

munication also requires the PC and mainframe applications to run on various operating systems and levels of hardware platforms.

- IBM is working with Interlink Computer Sciences, a third-party marketing partner to provide application sharing and network management between Systems Network Architecture (SNA) and DEC systems, as well as SNA to general Ethernet connectivity. Interlink has been selling software gateway products for IBM-to-DEC connectivity with IBM's sales force. The new Interlink connectivity products include enhancements to Interlink's recently introduced SNA/937X software, which turns an IBM 9370 into a communications controller to extend communications between IBM mainframes and DECnet-based systems, a DECnet-to-SNA gateway based on IBM's LU6.2 peer-to-peer protocol, and software that allows DECnet Phase IV networks to be managed from IBM's Netview network management software. The latter is being developed with technical assistance from IBM.

This is an important acknowledgement on the part of IBM that it has to coexist in the DEC world as well as that of the Ethernet network standard, which dominates in the general LAN environment. Currently, none of IBM's Ethernet products support SNA.

- Another alternative is the use of LU6.2 gateways that run on LANs and concentrate most of the LU6.2 code in the gateway, which reduces heavy memory requirements for LU6.2 on individual workstations.

3COM Corp. recently strengthened its position in the SNA peer-to-peer connectivity market with the purchase of Communications Solutions, Inc. (CSI). CSI's LU6.2 Maxess SNA gateway gives 3COM users access to distributed applications based on LU6.2. CSI also plans to support OS/2 LAN Manager with a new version of the Maxess SNA gateway.

- Within the last year, Apple Computer acquired SNA software developer Orion Network Systems, Inc. and Network Innovations Corp., a developer of an SQL-based language. As part of co-developed projects with these two communications software companies, Apple now offers MacAPPC, a tool kit that implements LU6.2 and PU2.1 SNA protocols that allow the Mac to talk to IBM hardware. In addition, Apple and Network have recently introduced programmer tools for Mac-to-DEC connectivity.

In addition, Apple's new Macintosh IIx is able to read files recorded in the MS-DOS format as well as other common floppy disk formats.

- Digital Communications Associates makes the MacIRMA board for MacII-to-mainframe communications.
- Cetram Systems provides interface cards and software to link Apple's AppleTalk network to PCs and UNIX-based machines.
- OS/2 Extended Edition will allow PC users who have programming expertise to use the Server-Requester Programming Interface of IBM's Enhanced Connectivity Facilities (ECF), Extended Edition, to access data bases on IBM mainframes. It uses APPC for remote data services. However, initially it will not support remote access to DB2 but rather for SQL/DS data bases running on TSO and VM/CMS operating systems.

A major plus for IBM's OS/2 Extended Edition is the linkage provided between personal computer networks and SNA networks.

- In mid-1988 Communications Solutions/ 3COM also announced its version of IBM's Data Distributed Management software, called Access/ DDM, that provides connectivity for files on IBM/370 processors and on System 3/X midrange systems.
- Wang provides a gateway that allows PCs to communicate with each other and with the VS environment. IBM PC users can also participate with the VS environment and run standalone Wang PC word processing. In addition, while using the PC as a local terminal on the VS, it is possible to access VS applications programs such as PACE and Wang OFFICE.

Among the leading computer systems vendors, Wang has probably been the most aggressive in providing connectivity between its computer systems and network architectures and those of competing vendors. More recent product announcements include: Interoffix, a gateway developed by Boston Software Works, Inc. that links VS Office electronic mail to UNIX-based systems; a market license for Santa Cruz Operations's SCO Xenix System V and related applications for Wang's PC 200/300 series of IBM PC AT products; and an LU6.2 Applications Program Interface that enhances its family of VS Access communications products that allow IBM users and applications to access Wang VS resources.

Wang also recently announced a statement of direction that said it will focus future product development resources on providing connectivity and integrated products that comply with SAA common communications support along with support for IBM's PU2.1 and IBM's Token Ring architecture. In addition, Wang will support IBM's Netview network management system by providing a gateway

that will allow VS systems running Wang's network management system to deliver status and administrative data to mainframe-based Netview programs.

- An ISDN bridge for LAN-to-LAN connection is expected from Lachman Associates, Inc. The initial product will be used to link Sun Microsystems' Network File System (NFS) and Transmission Control Protocol/Internet Protocol (TCP/IP). The product will include software, a non-dedicated workstation based on the 80386 microprocessor, and AT&T's UNIX System V, Release 3 with an ISDN Basic Rate Interface board, which will monitor traffic on its local area network for packets address to nodes on remote LANs. The ISDN connection could be cheaper than alternative linkages in that the user only pays for the link when it is carrying LAN-to-LAN traffic.
- There are also a number of IBM PC to DEC VAX solutions available:
 - IBM provides the IBM PC Network Integration Package which allows PCs to participate in local-area networks using DEC VAX/VMS Series for MS-DOS applications. This provides for the integration of the VMS and MS-DOS environments with transparent access to all files, data, and resources stored over the network.
 - As part of the Apple/Digital linkage program, Network Innovations Corp., an independent subsidiary of Apple Computer, has recently announced the publication of the CL/1™ Connectivity Language Description. CL/1 is a connectivity language to be used by software applications developers, which will allow for the sharing of data from within desktop applications, masking the differences among Host operating systems, DBMS brands, and network protocols. The first CL/1 application will provide transparent access from Macintosh applications to Host data on Digital VAX systems. CL/1 basically insulates a software application from variations in Host operating systems, DBMS brands, and network connections. Without CL/1, software developers have to code separate facilities for each Host operating system, DBMS, and network connection. The next step in the development of CL/1 will be the availability of CL/1 Toolkits and Servers, for the Macintosh, MS-DOS, and Digital VAX/VMS environments.
 - Network Innovations is also developing a set of HyperCard external commands that allow VAX Host data to be presented through HyperCard stacks on Macintosh computers.
 - ROSSDATA Corp. in the spring of 1988 introduced a DECnet-based MS-DOS application server for VAX networks called V-Server. V-Server is a hardware and software product that allows

any terminal or workstation on a VAX network to operate MS-DOS and eventually OS/2 applications. It also allows for the V-Server users to access data stored on remote VAXs as well as local VAXs. The V-Server system software also takes advantage of VMS operating system resident DECnet I/O routines, which increases response times and reduces use of VAX overhead. It also provides separate processors for each users, which thus provides support for OS/2 applications.

In addition, the V-Server provides Macintosh and VAX stations access to MS-DOS applications without the need for co-processor boards in each workstation.

- Certain independent networking companies are also developing technology partnerships with Microsoft and/or IBM.
 - For example, IBM is a reseller of Novell's Netware product, and Novell and IBM appear to have a software development relationship.
 - Novell's CXI, Inc. subsidiary builds communications server and terminal-emulation products that provide file transfer and IBM 3270 emulation. Indisy will incorporate CXI's SNA protocols in its micro-to-mainframe communications software products.
- A number of Mac-to-PC connectivity alternatives have also emerged in the past year.
 - Northern Telecom provides a method of connecting dissimilar systems through its line of PBX telephone systems. This system uses Calera Recognition's (formerly Palantir) InTalk software on Macintosh computers and Apple's MacTerminal in the PBX system. These programs exchange files through the PBX with PCs running communications programs such as Crosstalk.
 - Hayes Microcomputer Products markets both PC and Macintosh versions of its Smartcom II communications software. Another approach is to use dissimilar microcomputers as terminals on a minicomputer system.
 - 3COM Corp. recently indicated its intent to support the Macintosh computer on its 3+Open LAN Manager network operating system with a single server solution. This will include support of AppleTalk Filing Protocol, Apple's Printer Access Protocol, and AppleShare, Apple's workstation software, as the Macintosh user interface to a 3+Open server. This approach will allow users of Macintosh, DOS, and OS/2 workstations to share files and data transparently while using the Macintosh interface to access the 3+Open network. 3COM

also has introduced an EtherLink/SE Ethernet adapter for the Macintosh SE, which is compatible with 3Com's 3+ network operating systems for Macintosh, Apple's AppleShare, and Sun Microsystem's TOPS network operating systems.

- Apple has also strongly signaled its intent to emphasize IBM connectivity by acquiring Orion Network Systems. MacWorkStation is a software toolkit from Apple that lets developers create a Macintosh interface for program operating on host computers. In addition, AppleShare PC, which is a desktop communications product, allows users to integrate MS-DOS documents into Macintosh applications. Touch Communications, a company in which Apple has an investment, has introduced the Touch OSI Macintosh Developer's Kit, which allows applications for the Macintosh to communicate with other systems on a network using OSI protocols. Apple has also implemented IBM's LU6.2 and PU2.a to provide peer-to-peer communications with various levels of IBM computer systems.
- Apple also jointly introduced with Novell a version of the NetWare LAN operation system for Macintosh.
- One approach to application interoperability is with applications that run under data base management systems that communicate among a number of operating systems and hardware platforms. One example is the recent announcement by Oracle Corp. of a number of financial applications that run under its Oracle DBMS. Under this approach, an application will look the same to all the platforms and systems that run Oracle's DBMS products.

(See Exhibit I-10)

c. Network Management Systems

Another product area with potential significant market potential is network management systems that can provide integrated management solutions for multi-network management. In addition to IBM's Netview, other network management packages include AT&T's Unified/Network Management Architecture, and Cincom Systems' Net/Master. Cincom recently reached an agreement with AT&T to integrate Net/Master, which competes directly with Netview, into the Unified Network Management Architecture, which provides network management beyond the SNA gateway. DEC recently disclosed an end-to-end network management program that includes support from several third-party hardware and software developers that is designed to challenge IBM's NetView and AT&T's United Network Management Architecture (UNMA). Communications vendors supporting the DEC internetworking program with interfaces from their equipment and network management products

EXHIBIT I-10

SELECTED CONNECTIVITY SOLUTIONS

- LAN-Server-Based Gateways—LAN to Wide Area Networks
- DECnet SNA—Gateway-CT—DEC to IBM Solution
- PC to Mainframe Solutions—Digital Communication Irma Boards
- Peer-to-Peer Communications (Cooperative Processing)—APPC/LU6.2
- A Number of MAC to PC, MAC to VAX Announced Solutions

to the DEC architecture include Siemens USA, Digital Communications Associates, Inc., Timeplex, Inc., Cincom Systems, INC., Vitalink Communications Corp., StrataCom Inc. and Codex Corp. DEC is also expected to announce an applications programming interface this year which would ease the process of connecting third-party hardware and software to its network management monitoring system.

IBM announced in the fall of 1988 an OS/2 Extended Edition version of NetView/PC which will run on a multitasking IBM Personal System/2 running OS/2 Extended. The current version of NetView/PC runs on a single-tasking PC-DOS. A future edition is also expected to include a graphics-based user interface. It will also allow software developers to write applications in C language for sending network management information to IBM's Netview via the new NetView/PC interface. The current version of NetView/PC requires the use of assembler language. The OS/2-based NetView/PC presumably will be a liaison between networking devices and Netview and also act as a local network management system. It also overcomes the 640K-byte memory restriction of the PC-DOS version of NetView/PC.

MCI has indicated that an important future direction of the company is to provide integrated network management services (INMS). It has licensed

IBM's NetView/PC and is interfacing it with its own MCI View product. This will allow for an internetwork viewing at an individual workstation that allows for polling of detailed records on network operations. MCI is addressing a number of vertical markets with this strategy along with the office systems, cross-industry market.

IBM, as part of its NSFnet network development project for the National Science Foundation, is also developing linkages to NetView from non-IBM systems. Currently, MCI's network services and Network Equipment Technologies' (NET) IDNX T1 switches have the ability to send network alerts and other data to NetView via the NetView/PC interface.

d. Network Application Software

Network server-based software applications represent another new class of applications software products that is rapidly emerging related to the increasing acceptance of LANs, more powerful LAN hardware servers, and more efficient inter-networking capabilities.

- Such applications are designed to improve the efficiency of LANs by boosting workgroup productivity. They make it easier for workgroups to schedule group events, exchange information, and otherwise work together to perform various tasks. In addition, server software solutions can often be more cost effective, through discount/site-based purchasing, and provide more centralized control over office applications software use. Future server-based applications will also include more data base management integration.
- Some of the current workgroup applications products for the office environment include:
 - Future Soft's Right Hand Man, the Coordinator from Action Technologies, Spectre Software's Command Performance, PCC systems' cc:Mail LAN Package, and Consumer Software's the Network Courier.
 - KeyLogic's LANBatch allows anyone on the network to send work to a dedicated machine for processing as well as to tell another workstation to do some type of processing.
 - Connect Computer's Landscape is a data base management system that helps manage network resources and supplies network and user activity reports, as well as handling software license metering.
 - Broderbund Software's ForComment and Jurisoft's CompareRite are LAN document editing programs. Such programs provide for the circulation of a text file for editing and comment through red-lining in document review.

- Some of the programs focus on easy-to-use interfaces to the network. These include: Delta Technology's Direct Net, Bartel Software's LeMenu, and Deere Soft's Magic Menu.
- Several word processing packages have recently been released for network servers.
- A new network electronic publishing product scheduled for release in late 1988 is a network version of Ventura Publisher. Network solutions for desktop publishing should help extend the strong growth in this office systems market.

(Exhibit I-11)

EXHIBIT I-11

TRENDS IN NETWORK APPLICATIONS SOFTWARE

- Rapid Growth in PC E-Mail Solutions
- Groupware Document Editing Applications
- Networked Versions of Word Processing and Electronic Publishing Packages

8. Electronic Mail

Electronic mail, which is an electronic delivery system for textual information, can be transmitted over LANs, telephone lines, or by satellite or microwave channels. With the definition of the X.400 body of electronic mail standards by the CCITT (Consultative Committee in International Telephone and Telegraphy) and ISO (International Standards Organization) nearly complete, the intercorporate, and international electronic mail delivery markets should substantially increase.

The largest vendors of electronic mail services at this time are the third-party telecommunications-based Service Bureaus which provide public electronic mail services, such as Western Union's Easylink, MCI Mail, and ITT's E-Mail with their electronic mail box services.

With the increasing implementation of international electronic mail standards such as X.400, the electronic mail market will soon become an interconnected network of LANS and corporate (enterprise-wide) networks with extensive, external, worldwide linkages.

A finalization of the international standard for electronic mail (X.400) by CCITT and OSI should stimulate the development of electronic mail networks.

A current concern among manufacturers of office systems equipment is that there needs to be conformance testing standards to ensure true compatibility among various electronic mail implementations. The Corporation for Open Systems (COS), a consortium of an estimated 70 national and international computer and communications vendors and major corporate users, has developed a conformance testing product for MHS (Message Handling Systems, including CCITT X.400). This is a part of the TOP 3.0 conformance standard program.

Initial X.400 connectivity between systems vendors and electronic mail service providers will be more through gateway solutions. Later implementations will be more of a native implementation of X.400 from upgrades of systems vendors equipment.

As part of the Consent Decree to deregulate the public telephone system, in early 1988 Judge Greene allowed the RBOCs to provide electronic and voice mail transmission services.

The RBOCs will be able to provide five information gateway functions:

- Data transmission (not content)
- Address translation
- All types of protocol conversion
- Billing management
- On-screen introductory information for videotex

AT&T is also expected to be offering electronic mail services in 1989. This will be offered over AT&T Mail, its public E-mail service.

Considerable opposition has developed to date from the Computer and Business Equipment Manufacturers Association and ADAPSO to the Open Network Architecture plans filed by the regional Bell operating companies to implement the delivery of enhanced services such as electronic mail. A principal concern is to ensure that the RBOCs provide non-discriminatory pricing and/or availability of service.

MCI Inc.'s current electronic mail offering, MCI Mail, provides PC-to-mainframe electronic mail interchange. The company also provides

integration for MCI Mail with all the major computer systems integrated office systems programs, such as DEC's All-In-One, IBM's PROFS, DISOSS solutions, and Wang's Office Link, as well as with LAN operating systems from Novell and 3COM. It is also integrated into Lotus' Express offering for automatic polling of messages at the desktop level and for binary information transfer.

Certain of the independent mainframe systems software vendors, such as ADR/Computer Associates, offer electronic mail, calendaring, and word processing systems. The ADR/PC e/MAIL (now part of Computer Associates) is a personal computer component of the company's mainframe-based e/MAIL product. It lets users access mainframe e/MAIL functions at a PC workstation and also allows users of popular PC software packages to distribute messages, documents, and spreadsheets created at the PC.

Among the leading intracorporate vendors of electronic mail solutions are the major computer systems companies that offer broad integrated systems offerings for the automated office environment. Digital Equipment with its MailBus electronic messaging system is the leading vendor at this point. MailBus, through a series of gateways and its Message Router transport software, provides communications among different electronic mail systems, including Digital's All-In-One, VAXMail, IBM's PROFS and DISOSS, MCI Mail, and other systems that support the X.400 standard. It also includes a central directory and a network management system. DEC also offers DECTalk which translates E-mail text into voice. (Talk to DEC at end of August regarding expected new All-In-One product announcements). In early 1988, Interleaf, Inc. and DEC announced the capability to integrate Interleaf's Technical publishing Software (TPS) with DEC's All-In-One office management systems. With this integration, Interleaf TPS and All-In-One users can electronically exchange Interleaf's text-and-graphics documents worldwide. It also allows Interleaf documents to be managed with All-In-One office tools, which include time and resource management, file storage, communications, and directories.

DEC has also extended its Network Applications Support™ Program to provide corporate-wide access to DECnet for users of Macintosh, MS-DOS, OS/2, and UNIX operating systems for sharing electronic mail, files, printers, document creation, and access to data bases and printer resources.

IBM has its shared PROFS and DISOSS product, available on its Information Network, that provides multi-enterprise communication through electronic mail.

Hewlett-Packard, Wang, DG, and Prime also provide such solutions.

H-P provides H-P DeskManager, an electronic-mail system on the H-P 3000. Through H-P DeskManager, PC users can also communicate with other vendors' messaging systems, including IBM PROFS and DISOSS, Telex and in general, systems using X.400. H-P recently introduced an enhanced version of its electronic messaging systems for PC and H-P Vectra users, called the H-P AdvanceMail II. It downloads most of the processing to the PC from the H-P 3000 and uses batch transfers to the H-P 3000 during off-peak times, which reduces the cost of the electronic mail system for PC users. Also, it allows for the use of AdvanceMail II offline on a H-P Portable Vectra CS personal computer, with later connection with the H-P 3000 to transfer information from H-P DeskManager.

Cooperative relationships have already been developed between the RBOCs and systems vendors. DEC and Pacific Bell, for example, are jointly developing an X.400 electronic mail service. DEC also plans to market its software to other Bell companies. Corporations with proprietary electronic mail systems will need to buy or develop X.400 software interfaces that link their systems with the RBOC X.400-based services. DEC's System Administrative and Subscriber software is a version of its All-In-One integrated software product offering. DEC's MailBus is also being used to merge Pacific Bell's several internal electronic mail systems into a cohesive systems based on the CCITT standard X.400 format.

In the future, it is expected that the RBOCs will tie in electronic mail delivery with an all-digital, integrated service digital networks (ISDN).

In the integrated office environment, electronic mail is also used to transmit files among word processors or personal computers in a LAN configuration. In fact, X.400 could become the basic standard for intra- and inter-office document transmission.

Another development in electronic mail networks is its use to deliver other types of traffic such as EDI (Electronic Document Interchange) and image scanned/processed data. However, this will also require the further development of standards for these additional services, in particular for complex documents that mix text and graphics on a single page.. This could lead to the development of cross-referenced standards on the same delivery systems and the further development of widespread public document exchange. Evolving standards in this area include office document architecture (ODA) and office document interchange (ODIF), as well as X.400, which are complementary. ODA and ODIF address the structure of complex documents.

Fax networks are also increasingly being used for electronic mail delivery and will probably continue to be a significant growth area in office

systems technology. The introduction of intercorporate fax directories should also be a major stimulant to this market segment.

a. Microcomputer-based Electronic Mail Solutions

An emerging market in electronic mail is for PCs and LANs. A leading vendor in this market is Action Technologies with its electronic mail interconnectivity MHS software product that allows various electronic mail systems running on PC LANs to communicate without going through a mainframe or minicomputer.

Ashton-Tate's recent addition to its Framework Integrated Software Package, Framework III, includes electronic mail support. It will use the Standard Message Format of MHS developed by Action Technologies and Novell. The Framework II LAN version includes integrated electronic mail for Framework III workgroups and electronic mail is offered as an option for the single-user version.

Symantec Co. recently introduced an electronic mail package for the Macintosh called Inbox 3.0.

E-Mail software for LANs is also now a rapidly developing market. Many of the leading LAN software companies have recently introduced E-mail systems for their LANs. In addition, Microsoft recently introduced a PC LAN mail system.

A number of PC LAN gateway products for both private and public electronic mail systems are also beginning to appear.

b. Future Electronic Mail Scenarios

A future stage of electronic mail will involve the linkage of electronic mail with data, voice, and video transmission in a total information network. ISDN delivery systems implementation should correlate with the development of such total information delivery systems.

(Exhibit I-12)

9. Image Scanning/Processing

Within the last year, the image processing market has become one of the "hottest" market segments in office systems. This relates in large part to the rise in popularity of desktop publishing, where scanned images (text, charts, graphics, photographs, and video images) permit desktop publishers to transpose text and graphics from paper to electronic format without having to retype, redraw, or rephotograph it.

EXHIBIT I-12

TRENDS IN ELECTRONIC MAIL

- Implementation of the X.400 Body of Electronic Mail Standards
- Availability of Conformance Tests for Ensuring Vendor Compliance with X.400 Standard
- Solutions for Inter-Corporate E-Mail Distribution
- Entry of the RBOCs into the Electronic Mail Markets
- Rapid Growth in Microcomputer-based E-Mail Software Applications

Image processing in the office environment involves the scanning (electronic capture) of documents, processing, and storing of the documents under some type of structured indexed approach (usually on optical disk) and retrieving the documents on an image-based terminal or monitor that provides for page viewing. Type of files stored and processed can include text, graphics, photos, video, and sound.

a. Scanner Products

Historically, there have been three types of scanner product: graphics scanners, optical character readers (OCRs) and facsimile transmission (fax) units. Graphic scanners make electronic copies of drawings and photographs and convert them into a bit-mapped format that can be edited with a paint program for desktop publishing. OCRs scan primarily text and converts it into a format such as ASCII that a word processor can understand.

In the latest generation of scanner technology, new high-end integrated systems are now capable of scanning both graphics and text, the high-end of this technology is represented by Calera Recognition (formerly Palantir) with its Compound Document Processor (CDP). This system can scan proportional type without having to be taught the typefaces, handles page formatting automatically, and also processes graphic images. Calera Recognition's (formerly Palantir) CDP is also the only scanner capable of scanning areas of data selectively rather than the full page.

Lower-cost scanners in the desktop environment either scan graphics images or text.

Others with the combined capability include: Datacopy, Compuscan, DEST, Eastman Kodak, SpectraFAX, and Tecmar.

Apple Computer recently acknowledged the growing importance of optical image scanner product in the desktop publishing environment with the recent announcement of Apple Scanner, a flat bed scanner that can scan text, line art, and images into any applications supporting Picture File Format (PICT), Tag Image File Format (TIFF), or MacPaint® file formats. Accompanying software applications include: AppleScan™ and HyperScan™. The scanned images and graphics can be imported into any painting, drawing or page layout application supporting, PICT, TIFF, or MacPaint® file formats.

HyperScan allows images to be scanned directly into HyperCard stacks.

Software controls all scanning functions. Most scanner vendors today bundle their own software with their scanner engines. However, DataEase International, Inc. recently introduced a new imaging software package, called Imag-In, based on its DataEase MS-OS relational data base system. Imag-In links the DataEase 2.5 data base package with the AT&T Overview scanner to form relational imaging data base systems for use on IBM and compatible AT and 80286- and 80386-based personal computers. It can convert letters, documents, contracts, photographs, and three-dimensional objects (under 1.5 inches in height or 8 by 10 inches in size), into images that can be stored as portions of records within a DataEase data base. Images cannot be changed with the Imag-In software. However, the software can be used in conjunction with image editing programs such as PC Paintbrush. They can also be exported to desktop publishing programs such as Aldus PageMaker or Xerox Ventura Publisher.

Many of the OCR packages also include extensive formatting capabilities for popular word processing programs. This provides linkages between scanned material, word processing, and desktop publishing.

Most scanners convert images into bit maps that can be edited with paint programs, such as Halo DPE, PC Paint, and PC Paintbrush Plus (Z-Soft Corp.).

Some of the bit-map formats emerging as standards for scanned images include: TIFF, or tagged-image file format, PICT (picture file form), MacPaint®, and PC Paintbrush Plus. It also provides for portability of graphics applications between the Macintosh and PC environments.

Adobe (PostScript) has provided an image standard, called Encapsulated PostScript (EPS), which stores scanned images using a format based on PostScript. With EPS, the storage and manipulation of images is done with bit maps, but it provides for the printing of the images using device-independent PostScript code.

Another basic image standard is the Group IV standard for facsimile communication.

Much of the change in the scanner market in the past year has come from changes in the software. New features added to the software offerings include new methods for processing halftones, editing graphic images, compressing data, and combining text and graphics.

Although word processing and desktop (page composition) programs allow for the merging of scanned graphics with text in compound documents, the text and graphics are still stored in separate files related to the different bit-map, raster, and ASCII file storage approaches. In addition, most scanning software does not allow for single pass capture. Calera Recognition Systems products are an exception with their integrated scanning software programs.

IBM's image scanning software products include:

- **ImagEdition Version 2.0** is an image capture editing program designed to operate on an IBM PS/2, PC AT or PCT XT, Model 286 system. Photographs, line art, and other graphics can be scanned as gray and bit-level images, edited, and saved for use in IBM's Personal Publishing Systems and other applications. The program runs under Microsoft Windows 2.0 and the menus are consistent with other Windows applications such as Aldus PageMaker. Images can be captured using the newly announced IBM 3119 PageScanner™, the IBM 3117 and 3118 Scanners, as well as scanning equipment from several other equipment manufacturers.
- **TextReader Version 1.0**, which is an OCR program, converts typewritten or printed pages into Revisable Form Text Document Content Architecture (RFTDCA) or American National Standard Code for Information Interchange (ASCII) files for use with the IBM pushing system and word processing software. It is designed to operate on the IBM PS/2, Models 50, 60, 70, and 80, the IBM PC AT (except AT/370), the PC XT Model 286, and in the IBM Version 3.3 and Microsoft Windows Version 2.03 environments. TextReader Version 1.0 also supports the new IBM 3119 PageScanner™ as well as the IBM 3117 and 3118 Scanners. It also accepts binary image files containing scanned documents in TIFF as created by ImagEdit Versions 1.0 and 2.0 or IMDS files.

Digital Equipment recently announced specifications, including formats and interfaces, for its enterprise-wide messaging service which involves compound documents. Called Compound Document Architecture (DDA) it is an integrated architecture for creating, revising, managing, and distributing compound documents with "live links" to text, graphics, image, and applications data across multiple platforms via DECnet/OSI. It essentially provides specifications for independent software developers and systems integrators wanting to integrate compound document applications (such as electronic publishing and image processing) into the DECnet/OSI environment.

Datacopy's software, called Word Image Processing System, (WIPS) includes scanning software, a graphics editor, and OCR software. A menu utility also allows for the display of third-party programs. The image processing main menu offers options for image capture, image edit, scan parameters, and image-file management and printing. The system also provides for the merging of text and graphics. The WIPS Editor, which is a modified version of Zsoft's PC Paintbrush, can be used to further manipulate the graphics image.

Graphics-scanning, optical character recognition software, and fax software can run on the same scanner engine, but many scanners require separate passes of the document to scan for graphics and text.

Leading OCR scanning companies such as Calera Recognition (formerly Palantir) and Dest Corp. also work closely with VARs to develop applications for vertical markets such as medicine and forms processing.

The recent improvements in OCR scanning technology is also contributing to the increasing popularity of image processing.

In particular, recently developed lower-cost PC scanners are now able to read a much wider variety of fonts which has been a significant limiting factor to their wide-spread adoption. In addition, scanning and word processing software developers are providing formatting capability with leading programs that allow for a correctly formatted document reproduction in the PC in terms of the original document.

This is also increasing the market for OCR scanners used for word-processing, desktop publishing input.

b. Image Processing

In terms of specific image processing solutions, DEC currently has a cooperative arrangement with Eastman Kodak for the KIMS image processing solutions. However, specific image processing solutions are expected from DEC within the next six months. Linkages to mainframe systems is provided through SNA and other gateways.

The Kodak KIMS system 500 is an integrated office system combining computer data bases, image processing, and communications technologies for delivery of image documents to multi-function workstations linked over a high-speed local area network.

Current leading factors in the image processing market include Wang Laboratories, Inc. with its Integrated Imaging System (WIIS), and FileNet Corp.

Wang's WIIS product involves a proprietary Wang document processor with an integration of Wang's PACE data base system with the image indexing and retrieval. Other components of the system such as optical storage subsystems and optical scanners are purchased on an OEM basis from outside suppliers.

FileNet's optical system provides for the scanning, processing, and storage of documents as well as the automatic routing to the appropriate person. This also allows for the routing of a work-in-progress documents. A recent FileNet product allows for the viewing of document images on a microcomputer rather than requiring a special image terminal.

Micro Dynamics, Ltd., provides a lower-cost, Macintosh-based (\$100,000 + range) multi-user archival and retrieval system, called on Micro Dynamics MARS™, which digitizes and stores text graphics, photographs, slides, and video images. In addition to scanned documents, it also captures and archives documents from other computers such as IBM or compatibles, VAX and UNIX machines. It provides searches by key words, freeform text searching, and an interactive browsing feature.

LaserData is also a more recent entrant with a low end, microcomputer-based image processing system.

In response to increasing competition, FileNet recently introduced a low-end configuration of its 3500 system Series document image processing system. The entry level price was cut from the \$270,000 to \$500,00 range for its high-end 3500 systems to the \$135,000 range. It includes a server, 300 Mbytes of magnetic storage, a display workstation, laser printer, optical disk drives, and systems software. The optical storage system includes an optical storage and retrieval library (OSAR), or jukebox, for automating data access on the optical storage system. The new 3100 system is based on a single 68020 microprocessor server rather than the distributed, microprocessor architecture of the 3500 system, which accounts for the lower-cost of the 3100 system.

Another recent entrant into the image-processing systems market is Document Technologies, Inc. that provides the DP-2000 and DP-4000

Series Document Image Processor workstation that is designed to add document image functionality to the numeric, text, and graphic capabilities of present data processing systems. The system competes with Wang Laboratories WIIS system, but does not require a VS minicomputer. DTI's Document Image Processor workstations transform paper documents into electronic images that can be captured, stored, indexed, annotated, copied, and reprinted. The Documents can also be accessed by several users in various locations of a single company. DTI also offers applications development software to facilitate coordinating document image processing with data processing applications. The product is designed for the OEM, systems integration, and VAR marketing channels.

Plexus Computers Inc. is another early entrant in the image processing markets with its Extended Data Processing System.

Several of the other major providers of integrated office systems products (in addition to Wang) have also recently announced adding new image processing products as part of their total office systems solution.

IBM, following the AS/400 announcements in June 1988, put its endorsement on the image processing market with the announcement of a main-frame-driven, imaging system called the ImagePlus Document Management System. Initial delivery of the product is scheduled for early 1989. When the final products are available some time in 1989, IBM will provide image processing solutions on MVS/ESA, OS/400, System/3X, and OS/2 operating environments. Currently, the program is being implemented in a systems integration configuration, which can include the 5363 Optical Library Server (based on the Filenet Jukebox systems) for the attachment of the IBM Optical Storage Subsystem Products in the AS/400 and System/36 environments. IBM's Folder Management Software will be an integral part of the final ImagePlus system. Product availability of IBM's off-the-shelf components for ImagePlus will be announced during the first half of 1989.

IBM has also indicated that it is integrating its image and data (storage) management software systems.

The initial users of imaging processing systems in the office environment have tended to be in industries with excessive paper flow problems such as the insurance and medical industries.

IBM has also indicated that it plans to market the ImagePlus Document Management System for more customized, high-volume image processing applications to the government and to businesses such as the insurance and banking industries.

The initial IBM image products were developed under two systems integration imaging contracts with Citibank in Sioux Falls, South Dakota and the United Services Automobile Association (USAA) in San Antonio, Texas.

In the USAA contract, in particular, IBM acted more as a systems integrator, providing the system software, but with other systems hardware and software elements being supplied by Filenet and Eastman Kodak. It is believed that Filenet's optical jukebox and Bell & Howell scanners may be part of the ImagePlus offering.

Fax machines can also be used as scanners in an image processing system with fax images entered into data base management systems as computer files.

Facsimile machines also provide for image transmission over data networks. In particular, fax can be used to provide for remote image transmission.

- Wang recently introduced a gateway product that allows images captured on its fax machines to be transmitted on a directory-base to a variety of fax networks on an automatic dialup basis.

(Exhibit I-13)

10. Integrated Office Systems

a. Definition

Integrated office systems provides comprehensive office solutions. Originally designed for departmental-based large document production and for electronic mail distribution, recent additions to integrated office systems have included gateway linkages to PC-based local-area networks as well as access to corporate-wide information services. At the hub of the integrated office systems solution is usually a minicomputer, on which resides various general-purpose applications for the office, data bases, and communications software solutions with multi-user access from workstations, PCs, or computer terminals.

The integrated office systems (IOS) approach to office automation provides for the integration of such functions as word processing, desktop publishing, graphics, spreadsheets, data base management, voice, time and resource management capabilities, data entry and retrieval, and electronic mail on a shared resources/distributed processing basis. Some of the latest functions to be integrated into the IOS solution are image storage systems and electronic mail gateways that provide much broader electronic messaging capabilities based on the X.400 electronic mail CCITT standard.

EXHIBIT I-13

**TRENDS IN IMAGE SCANNING/
PROCESSING TECHNOLOGY**

- Introduction of Integrated Data/Text/Image Captured Document Storage and Retrieval Systems—(Wang's WIIS)
- Integrated Text and Graphics Scanning Capability in High-End OCR Scanners—Calera Recognition
- Initial Acceptance of Enterprise-wide Image Processing Systems—Insurance, Medical & Government Markets
- Increasing Use of Fax Technology of Image Capture and Distribution

Most of the departmental-based integrated solutions are provided by the larger minicomputer/ mainframe manufacturers such as DEC, IBM, Hewlett-Packard, WANG, Prime, and Data General.

Examples of the leading integrated systems offerings include:

- IBM's PROFS and DISOSS, DEC's All-In-One, Data General's Comprehensive Electronic Office (CEO), and Hewlett-Packard's Integrated Information Management package. Wang's Wang Office, Prime's Office Automation Systems (OAS), Quadratron's Systems' Q-OFFICE, Applix's Alis ® integrated office-automation system, and Convergent Technologies' WorkGroup Solutions (WGS) products.
- Wang's OFFICE, which represents one of the more comprehensive integrated office automation solutions, provides electronic mail, time and task management, and information storage and retrieval. It can also be networked to allow local and remote users to share information and resources anywhere within a distributed Wang environment. The standard VS OFFICE package also contains the following features: directory services, electronic mail, WP Plus integration, time, management, Infocards, correspondence log, user administration, online instructions, VS Traveling User facility, audit trails, VS Multi-Station, and computer-based training.

- Quattron Systems' Q-OFFICE product has become a leading factor in the UNIX-based office systems environment. The software also runs in the PC- and MS-DOS as well as VMS operating systems environments. The company has been particularly successful in establishing strategic partnerships with computer OEMs as well as VAR and VAD distributors. Q-OFFICE modules include a word processing package, a calendar/scheduler, notepad/index program, a phone directory, form generator, desktop calculator, an electronic mail facility, and a menu utility. Other recent office automation product introductions from Quattron Systems include the Q-TYPESET document composition software, DCA data interchange for the IBM DISOSS environment, and Q-CBT for computer-based training.
- Applix's Alis ® integrated office automation software product is also a leading product in the UNIX operating system environment. Alis ® also operates in the VMS and MS-OS environments. As with Quattron Systems' product, its principal focus has been on minicomputer integrated office-automation systems. Alis ® allows office workers to produce and edit documents that combine multi-font text, spreadsheets, sketches and business graphics, and other information in a network-based system with the presentation-quality output of a desktop publishing system. Applix also focuses on the OEM and VAR markets.
- IBM's newest approach to an integrated office-corporate wide integrated office/departmental systems solution is its SAA (Systems Application Architecture) that will provide a seamless communications system among IBM's current variety of operating networking architectures.
 - A major new endorsement of such a solution by IBM was its introduction of the IBM AS/400 and its integrated office systems solutions. The user interface of the AS/400 represents the initial implementation of IBM's SAA standard interface, which should also be a part of IBM's announcement of OS/2 Extended Edition in the fall of 1988. The SAA strategy is designed to improve ease of use and implement a more tightly integrated applications interchange strategy.
 - In addition, with the AS/400, the minicomputer becomes a data base file server and general network manager. Connectivity is provided between PC-based applications and the AS/400 through embedded file conversion utilities. Also, the AS/400 minicomputers and IBM's PS/2 personal computers are designed to work in large corporate networks and presumably to run the same software. In particular, IBM's midrange computers could not use APPC to talk to larger mainframe computers. However, with IBM's latest release of the Virtual Telecommunications Access Method (VTAM), IBM bundled

support for its LU6.2 and PU2.1 protocols, which makes it possible for the midrange processors to communicate with an IBM front-end processor or an IBM mainframe host. APPN (Advanced Peer-to-Peer Networking), which is a proprietary network system for the IBM System/36s and AS/400s, is based on PU1.1 and LU6.2. The latest releases of VTAM and Network Control Program support PU1.1, which enables users on one APPN network to communicate over an SNA backbone to another APPN network. Also, any node supporting PU2.1 can access IBM 370 hosts through multiple APPN network nodes that pass through the transmission to the correct host. However, the System/36 or AS/400 communicating directly with the host must do so as a 3270 terminal, and not as a peer, at this time. Speculation is that APPN will eventually be implemented into SNA and SAA to provide for application-to-application cooperative processing (on a peer-to-peer basis) between the AS/400 and 370 architectures. Not all functions of SAA OFFICE have currently been defined.

- Vertical applications are also provided which provide automatic linkages between data-based applications and text-based applications.
- The new AS/400 OFFICE applications are similar in concept to PROFS and DISOSS, but developed for the OS/400 operating system and communications environment. They include electronic mail; calendaring; a text editor; files of which are interchangeable with Display/Write 4 personal directories for message addressing; support for the DCA (Document Control Architecture) and DIA (Document Interchange Architecture), which provides for mail distribution to PROFS and DISOSS systems; access to WANG and DEC electronic mail systems; printer support for compound documents (text, graphics, and image); and the PC Organizer facility, which includes shared file capability for PC applications as well as access to files on other OS/400 programs.
- IBM also announced in early 1987 a Distributed Services (DS) offering, that is a set of software tools that run on top of its UNIX implementation (AIX) and facility data transfer. It is current shipping versions of DS for the RT/PC and is expected to ship versions for the PC/2 Models 70 and 80 in March of 1989. IBM also recently licensed Apollo's Network Computing System (NCS) which it plans to incorporate into AIX that will made it easier to IBM's larger systems to act as computer servers for other vendors' workstations. NCS is a set of utilities for building distributed computing systems that allows computers from different vendors to share information across a network and to distribute the processing of an application or parts of an application to the appropriate computer resource on a network. NCS also runs on a range of computers from micros to supercomputers, and has been ported to MS-DOS, UNIX System V, Berkeley 4.2, and DEC's VMS and Ultrix.

b. Standards

- In terms of inter-departmental and corporate-wide communications, Systems Network Architecture (SNA) is currently the dominate network architecture. Certain aspects of SNA's architecture are being increasingly supported by other equipment and software vendors. This also includes support for such IBM distributed processing solutions such as DISOSS, which provides for document interchange among mainframe, minicomputer and PC computer platforms, and SNADS and LU6.2/PU 2.1, which provides for document interchange among departmental computers. Also gateways are being installed to provide access to IBM's Token-Ring protocols that have become IBM's dominant LAN implementation strategy.
 - As part of IBM's new SAA Common Communications Support, IBM is including SNA, APPC, SNADS, SDLC (Synchronous Data Link Control), LU 6.2, DIA, 3270 BSC (Binary Synchronous Communications) data streams (at the applications transfer level), Token-Ring, and X.25.
 - IBM's two major office file interchange standards are Document Content Architecture (DCA), and Document Interchange Architecture (DIA), a way of packaging DCA documents for transmission. DCA and DIA are part of IBM's Professional Office System (PROFS) system software for mainframes running the VMS operating system and DISOSS which provide similar services for mainframes running other IBM operating systems and for departmental computers.
- The OSI Reference Model is expected to eventually dominate as the leading network architecture. It currently includes IEEE 802 standards for local-area networks and CCITT's X.25 packet-switching standards. At the highest (seventh) layer for application compatibility the International Standards Organization (ISO) standards for various functions are still emerging. X.400 is one that has been developed.
 - However, it is likely that OSI will also include a set of APPC functions.
 - Most of the major computer systems vendors, such as DEC, Wang, and Hewlett-Packard, as well as IBM, are committing to support OSI. DEC, for example, refers to its basic network architecture as its DECnet/OSI network solution. The finalization of such standards should eventually allow for the full implementation of cooperative processing solutions.

- The U.S. government has established a two-year deadline to begin implementing Open Systems Interconnect (OSI) standards. Currently, the federal government is supporting TCP/IP as the current network interoperable protocol stack. As a result, there will be an increasing demand for gateways allowing OSI and TCP/IP networks to communicate during a transition period. Vendors are just beginning to come out with gateways that translate between the two protocols at the application level—such as between OSI's electronic mail protocol X.400 and TCP/IP's Simple Mail Transfer Protocol (SMTP).
- Current product offerings include:
 - Sun Microsystems offers a gateway that allows its TCP/IP-based networking systems, Network File System to access files on an OSI FTAM system.
 - Sydney Development Corp. provides gateways to systems running TCP/IPs SMTP, as an option on its Messenger 400 X.400 electronic mail system for UNIX systems.
 - Proteon, Inc. provides a route solution that allows devices running disparate protocols to coexist on the same network.
 - Others which have indicated product offerings are Wollongong Group, Inc., Retix Corp., and Ungermann-Bass (Tandem Corp.).
 - The U.S. Government and the DOD are also currently about to release two government OSI Protocol implementation plans.
- Many of the leading IOS vendors are rapidly accelerating offerings to provide multi-vendor and multi-network interconnectibility. IBM and minicomputer vendors have introduced versions of Distributed Office Support Systems (DISOSS) in order to connect DEC, Data General, Wang, and IBM system. They also announced support for IBM's peer-to-peer communications protocol link, LU6.2.
 - Wang provides InterOffice, a software product designed for Wang by the Boston Software Works, Inc., that offers users of the Wang OFFICE the ability to exchange documents and mail with users of DEC's ALL-IN-One. For example, the software automatically translates Wang Word Processing and WP Plus documents to and from DEC's WPS-Plus. In addition, Wang also offers Wang/IBM gateways that allow VAX-based InterOffice users to exchange information with IBM Professional Office Systems and Distributed Office Support Systems.

- In late 1987, DEC introduced the Vida access software product that copies VAX data into data bases on IBM systems. Also DEC issued a new version of VAX SQL which includes changes to match the SQL standard.
- Boston Business Computing, Ltd., which sells DEC-compatible software for non-DEC environments, provides VMS emulator (shell) software that implements the Digital Command Language (DCL) with the use of VMS commands on UNIX and MS-DOS-based systems. This allows VMS commands to be used to interface to these other operating systems environments.
- The AS/400 also currently provides opportunities for third-party development of connectivity between PC Ethernet-based LANs and the Token-Ring Network approach of the AS/400.
- Third-party vendors are also developing communications software that provide a variety of linkages among the various multi-vendor network architectures. DEC's All-In-One electronic mail system can be linked to IBM's Professional Office System Support (PROFS) electronic mail system using Soft-Switch's, Inc. products; Keyword provides products to link Wang's Office System to DEC and IBM networks

A variety of integrated software products for the office environment are also available for the UNIX environment. Such solutions, based either minicomputer or 32-bit microcomputer hardware platforms, include:

- SmartWare from Informix software with its SmartWare office systems product and Altos Computers are currently market leaders in the UNIX office systems environment.
- Sun Microsystems is also entering the integrated office systems market with what it calls the "Office Automation Suite". This is being developed with several third-party software vendors. The Sun offerings will feature word processing, graphics, and spreadsheet functions and will be based on an embedded data base management system, report writer, and forms generator.
 - It will be designed basically as a single-user system with multiuser support. Although Sun Microsystems primarily supports UNIX systems software on its scientific workstation platforms, its office systems products will also target office automation software for the Macintosh and PC machines, as well as support
- Oracle, a leading factor in the data base management systems software, has also announced its entry into the integrated office systems market along with expansion into the financial application software products market.

The acceptance of a more general integrated strategy for the office systems environment has been deterred by the necessity to integrate incompatible equipment not only among competing manufacturers but also within the different product lines a company such as IBM. However, with the increasing acceptance of de facto applications/document interchange standards by developers of integrated office systems solutions, multi-vendor penetration of large corporations office systems solutions is facilitated.

Office management aids is a newer subsegment of the integrated office systems market.

- These include networked applications for scheduling, calendar management, file management and report generation facilities, telephone directories, videotex messaging, online user guides to other network applications, document file sharing facilities, cost allocation managers, interface translators between work processing documents from different vendors, and time management facilities.

- Particular products in this category include:

- Agenda Desk Management System from Datapoint; CEO Administrative Support from Data General; DECtalk Mail Access from Digital Equipment; NetView Host Based Voice Network from IBM, and Personal Manager from IBM

c. Future Integrated Office Systems Applications

- Voice messaging is an area yet to be well integrated into the data-based integrated networked office systems solutions. Currently, DEC offers DECTalk that translates E-mail text into voice. A major stimulus for the integration of voice and data within a common networked structure will come from the future implementation of ISDN solutions. Octel Communications, a manufacturer of the Aspen voice processing systems with its PBX Integration Device, can provide integration of its voice processing equipment with more than 20 PBX brands. This can provide for the wide area networking of voice messaging and voice mail services on a world-wide basis.
- Desktop publishing at present is also not well integrated into these total office solutions. In part, this relates to the fact that the leading desktop publishing software packages have come from the independent software developers and not the leading computer systems vendors with their integrated software solutions for the office environment.

(Exhibit I-14)

EXHIBIT I-14

TRENDS IN INTEGRATED OFFICE SYSTEMS APPLICATIONS

- Introduction of Common User Programming and Communications Interfaces—SAA DEC Windows, HP's New Ware (Presentation Imager)
- Linkages with Vertical Applications
- Multi-Vendor, Multi-Network Interconnectability
- Incorporation of the OSI Reference Model
- Increasing Support for UNIX-Based Office Systems Applications

C

Driving Forces in Office Systems Technology

The overriding direction in office systems technology today is towards the integration of software and hardware product on a corporate-wide level, which will increasingly require multi-vendor solutions.

- This implies integrating not only offices systems functions but also the total company information systems technology into multi-system communication networks.
 - For example, workstations/PCs are not only being integrated into PC LANs for workgroup computing, but LANs are increasingly being integrated into the broader context of a company's total informations systems through intelligent network gateways.
 - Image processing and storage and electronic mail are particular networking applications that are driving the trend to corporate-wide integrated office-systems based solutions.
 - Examples of such an approach include the new IBM AS/400 Office Systems solution, DEC's All-In-One, Data General's Comprehensive Electronic Office (CEO), Wang's Wang Office, and Prime's Office Automation Systems (OAS).

Another key driving force involves the demand for standards at all levels. This is also driving the demand for partnerships and thus increasing the scale of offerings by the major computer systems vendors, in particular. This could further lead to an acceleration in the acquisition rate, particularly of software companies that have established de facto standards in their market niches.

(See Exhibit I-15)

EXHIBIT I-15

**DRIVING FORCES IN OFFICE
SYSTEMS TECHNOLOGY**

- Corporate-wide Connectivity Requiring Multi-Vendor (Systems Integration) Solutions
- Demand for Standards at All Levels
- Search for Strategic Alliances to Help Provide a Total Solution Offering

D

**Information Systems/
Services Impacts**

The demand for integrated solutions will continue. This in turn will fuel the demand for open systems architecture, at the computer, applications, and network levels, that will increasingly involve standardized solutions.

- For example, the U.S. Air Force is requiring the UNIX operating system in a recent multi-billion dollar computer proposal. In addition, the federal government has intent to require OSI support in products bid for federal contracts in future years.
- One of the earliest implementations of integration in the office, primarily departmental level, is the Integrated Office Systems offerings provided by the major computers systems vendors. Usually these solutions include a minicomputer as the host-based applications/network server. The most elaborate of these solutions can provide the following features:
 - The bundling of hardware with word processing, data processing, and network applications

- Integration (gateways) across network architectures with compatibility between network operating systems for access to applications and a variety of record types as well as shared peripheral resources
 - Integration among multi-vendor hardware and between PCs and mainframes
 - Integration of document, textual, and graphical files through integration of de facto standards within integrated packages or through conversion utilities
 - Through the use of relational data base packages providing new levels of integrated applications, with automatic linkages between programs
- The trend among integrated office systems vendors is to expand the degree of office systems integration to include more of a turnkey, total solution as well as to provide transparent connectivity with a company's other principal information systems. This is evident in the recent IBM's AS/400 announcement.

The next stage for true office systems integrated functionality is the implementation of a cooperative processing environment, where end users have transparent access to programs, files, applications processing, and hardware peripherals on a peer-to-peer basis on an inter-network basis. IBM's implementation of SAA, emphasizing standard user interfaces, is one approach. Two such interfaces are the Common Program Interface (CPI) and its subset, Common Program Interface for Communications (CPIC). SAA will thus ultimately provide application development tools that allow for the creation of software programs that can run on a number of operating systems environments. The programming tools would incorporate the elements required for true application portability.

For the office environment, the IBM's AS/400 integrated office products and applications-based OS/2 Extended Edition (with Presentation Manager) are initial SAA office systems products.

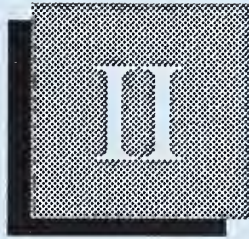
- The introduction of Presentation Manager, which provides a graphical windowing environment for OS/2 further extends the SAA model for the desktop processing environment.
- In that the OS/2 Extended Edition is not part of the IBM/Microsoft Joint Development Agreement, presumably Extended Edition will be available only from IBM and may not be licensed for sale by other hardware manufacturers. Also, although Microsoft's OS/2 1.1 runs OS/2 applications at the same time as DOS programs, non-IBM machines that currently run IBM versions of DOS will not necessarily be compatible with IBM versions of OS/2.

- Independent LAN/Communications software and hardware vendors, as well as the independent data base management software developers, are going to face a much more formidable level of competition with IBM's bundling of communications and data base management software in the OS/2 Extended Edition operating system. See Exhibit I-16.

EXHIBIT I-16

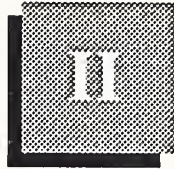
**INFORMATION SYSTEMS/SERVICES
IMPACTS**

- Support for Standard Solutions and Open Architectures
- Increasing Scale of Integration
- Resurrection of the Turnkey Solution with the Total Solution Approach
- Integration Across Network Architectures



User Issues and Directions





User Issues and Directions

A

Key Issues

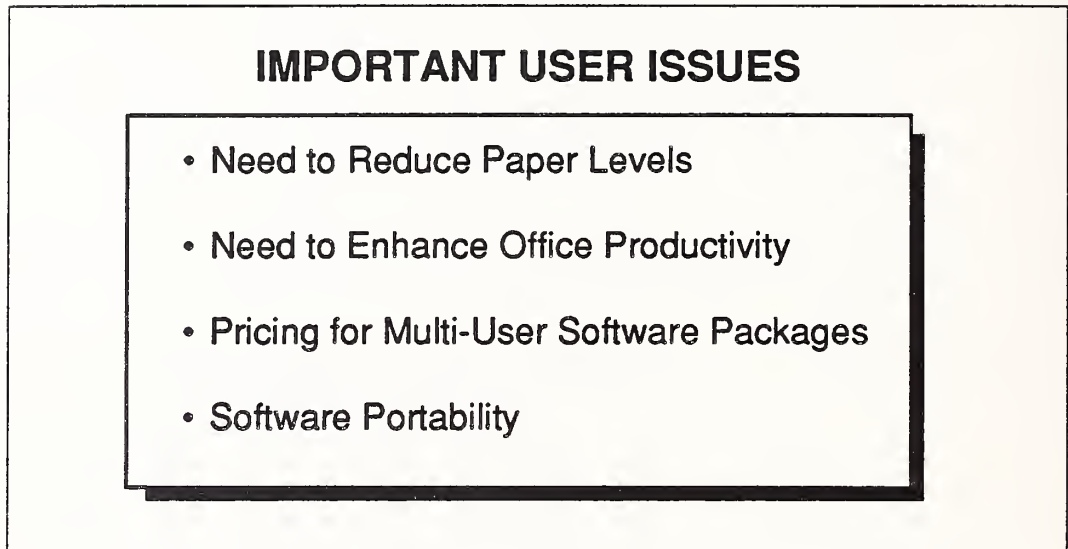
Continuing issues in office automation include:

- The need to reduce the increasing level of paperwork generated by computerized applications, which have oftentimes lead to increased clerical staffing levels and a reduction in productivity.
 - Implementation of image processing-based solutions for electronic mail storage and distribution are beginning to address this need. Initial applications are more paper-intensive industry segments, such as for the insurance and medical online document storage.
 - The fact that office productivity has not yet been noticeably enhanced by office automation requires a reassessment of the traditional measures used in justifying major capital expenditures in office automation. Since information produced in the office also contributes to the effectiveness of the company's total information system, experts in the office systems environment, such as Dr. Edward Thomas, Director of the Office Systems educational program at Cleveland State University, have suggested that expenditures for office systems will likely have to be included in the broader context of a company's total information systems technology.
- Pricing of office software products, particularly when implemented on LAN servers, is another current issue. In particular, a recent issue is pricing of network server implementation of office software products. Pricing discounts for additional users on DOS and OS/2 systems is an important competitive factor to consider in new product releases. Frame Technology recently introduced a new pricing program for its Frame-Maker professional publishing software for work group computing, called a Floating License Server (FLS). Under this program a work

group will only need to purchase enough license "tokens" for its maximum number of users rather than one license per workstation.

(Exhibit II-1)

EXHIBIT II-1



B

Key Objectives

A major efficiency bottleneck in offices continues to be the need to re-key dictated materials into a word processor. Although voice recognition has filled an application need on the factory floor with requirements for more limited vocabularies, the voice to text-on-the screen solution for the office environment is still elusive. However, prototype applications are available for continuous, natural speech recognition, and the issue now appears to be more of reducing the cost of such systems for general office systems affordability.

Another key objective is to further distributed office systems functionality through the implementation of true program-to-program joint processing capability: being able to run more applications across multi-vendor platforms. This implies more use of standard operating systems for particular popular office systems applications.

There is also the need to make microcomputer-based LAN solutions truly multi-user, as well as multi-tasking. For example, at present, new data base programs based on a network server support multiple users on a local area network in all major standard operating system environments.

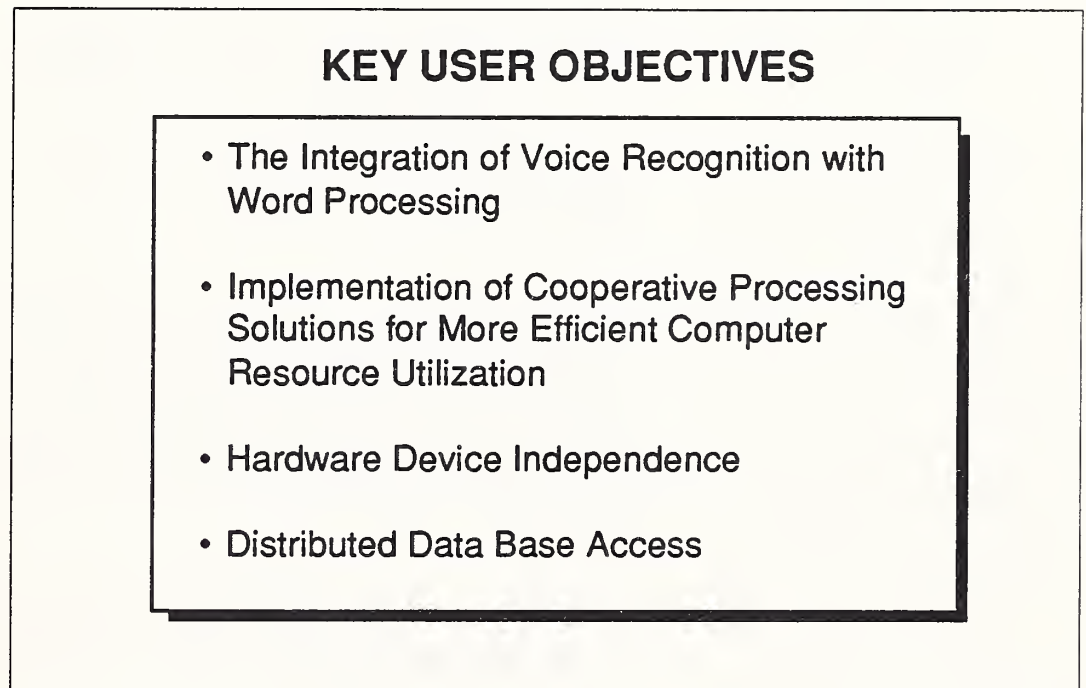
At present, there is still user resistance to the purchase of gateways between PC LANs and IBM SNA networks due to the uncertainties about what final communications and application standards will emerge,

particularly since the implementation of the Systems Application Architecture is just emerging. Also slowing the acceptance process is the fact that there are not many applications developed that can run on a shared program-to-program basis between PCs and host mainframes.

In the area of business graphics, there is the need to continue to expand data compatibility among applications, as well as to provide for hardware device independence—for graphics adapters and printers.

(See Exhibit II-2)

EXHIBIT II-2



C

Application Development Trends

The integration of office systems applications, including more bundled hardware-software solutions, represent leading software application development trends.

- The latest dimension of the integrated solution is image processing, representing the capture, indexing, and storage of textual and graphic hard copy material into an electronic, optical-based, storage subsystem.

Wang Laboratories recently announced an icon-based PC user-interface product, called Freestyle, based on technology developed for the Wang Integrated Image System. Freestyle provides for the integration of text data, voice messages, handwritten notes, and images in an easy-to-use electronic communications system for users of IBM PC ATs and compatibles. The Freestyle system can capture and transmit spread-

sheets, Wang Word processing or WP Plus documents, and records from Wang's PACE integrated applications development and data base management system. It features a special pencil and touch-sensitive tablet that replaces a keyboard or mouse for user input. Users can also electronically add synchronized handwritten notes to images of documents such as spreadsheets. A Freestyle user connected to Wang's VS minicomputer network with Wang Office can also send customized documents via electronic mail to other Freestyle users on the network. Options include a voice module for verbal message, a Wang SC300 flatbed scanner for hard-copy input, and a Wang laser printer for hardcopy generation of Freestyle documents.

Wang's ability to provide such a product reflects in part the level of data, text, and image integration that it has developed for the Wang Integrated Image System (WIIS). However, the first release of Freestyle is not fully integrated with WIIS or its integrated Office products. In the initial release, users will be able to use it only for annotating file information.

- Another dimension of the application development trend towards further integration extends to the operating system environment, with Microsoft's integrated OS/2 Standard Edition, LAN Manager, and SQL-based data base management File Server announcements and IBM's expected introduction in the fall of 1988 of PS/2-OS/2 Extended Edition with bundled communications and data base management software.
 - This ties in with the approach of many leading office software and systems vendors to increase account control over more of the general office systems solution.
- Groupware or work group solutions (combining applications such as word processing, electronic publishing, graphics with relational data base management systems, electronic mail, and image processing and storage) will become increasingly important along with the networking of personal computers. The current approach involves more of an integration of common file formats to provide for document editing on a multi-vendor network. In particular, there is a need for desktop publishing LAN-based software solutions with file management features that will eventually allow real-time file access contention to provide for inter-active group editing.
- Another integration software strategy is implemented in the PS/2-OS/2 offerings from Microsoft and IBM, which provide for the integration of computer and networking operating systems with data base managers and network management software.

- Object-oriented programming languages and object-oriented systems architecture are increasingly being incorporated by computer systems vendors and ISDs to improve the efficiency of the software development process, to increase systems flexibility, and to improve systems security, along with data integrity.

IBM has incorporated an object-oriented architecture in the AS/400, which assigns a set of operations that can be performed on each object in the system, which can be a program, index, process, text, or data file. In its OFFICE product offering for the AS/400, for example, this determines who has access to the object files (preserving data integrity) as well as providing for sharing of files and programs. For third party software ported to the OS/400 operating system, such as PC word processors, the PC Organizer is also available, which provides integrated file facility capabilities with other programs on the system.

- Although the traditional market for dedicated turnkey word processing systems is declining, a new type of turnkey offering in the form of IBM's SolutionPacs, which includes a bundled typing, text editing, some personal computing applications for particular vertical industries, and services, based on the PS/2 Series, reflects the new total solutions approach with a turnkey systems delivery mode in the office systems environment. Examples of SolutionPacs from IBM include: Personal Publishing Systems, Legal Profession Series, Doctor's Office Management, the Construction Industry Series, and the Personal Publishing System. IBM also provides a host-based publishing system. IBM also resells Interleaf desktop publishing software as a high-function desktop publishing solution for the RT personal computer. This program also integrates business graphics, line art, and drawings into the text program. It also allows for the sizing, rotating and annotating of Computer-Aided Design (CAD) drawings created on the RT PC, IBM host, and some-non-IBM host systems. Text from other of IBM's word processing programs, such as DisplayWrite, IBM's Document Composition Facility.
- Another application development trend that should accelerate over the next two years is the embedding of standards communications protocols and standard application file formats in the release of new office applications. This will include support for peer-to-peer document interchange standards such as APPC, LU6.2, the CCITT/OSI recommended electronic mail protocol, and X.400, as well as de facto standard file formats for market leadership products in word processing, graphics, spreadsheets, and electronic publishing. In particular, the Open Systems Interconnection (OSI) model for networking computers from different manufacturers is gaining in acceptance, spurred by U.S. Government endorsement.

- The development of a variety of architectures for the distribution of compound documents that combine data, text, voice, and video will require the development of interface standards.

Office functions are increasingly becoming a part of the total information system of a company—with ties into inventory and other financial functions as well as executive information systems (EIS) and electronic data interchange (EDI) networks. Eventually those should lead to computer-based communication among all functional units of an organization.

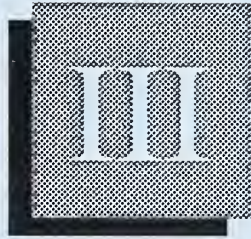
There is also a demand in many office environments that have already developed an integrated product strategy for more customized solutions.

(Exhibit II-3)

EXHIBIT II-3

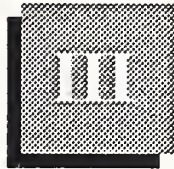
APPLICATION DEVELOPMENT TRENDS

- Integrated Solutions—such as WIIS & Freestyle Systems from Wang
- Bundling of Operating System and Application Solutions—SQL Server, OS/400 (Turnkey Solution)
- Groupware Product Offerings
- Personal Information Management Tools
- Embedding of Standard Communications Protocols Future Office Systems Technology
- Integration of Office Systems Applications with Corporate-wide Information Resources



Market Forecast





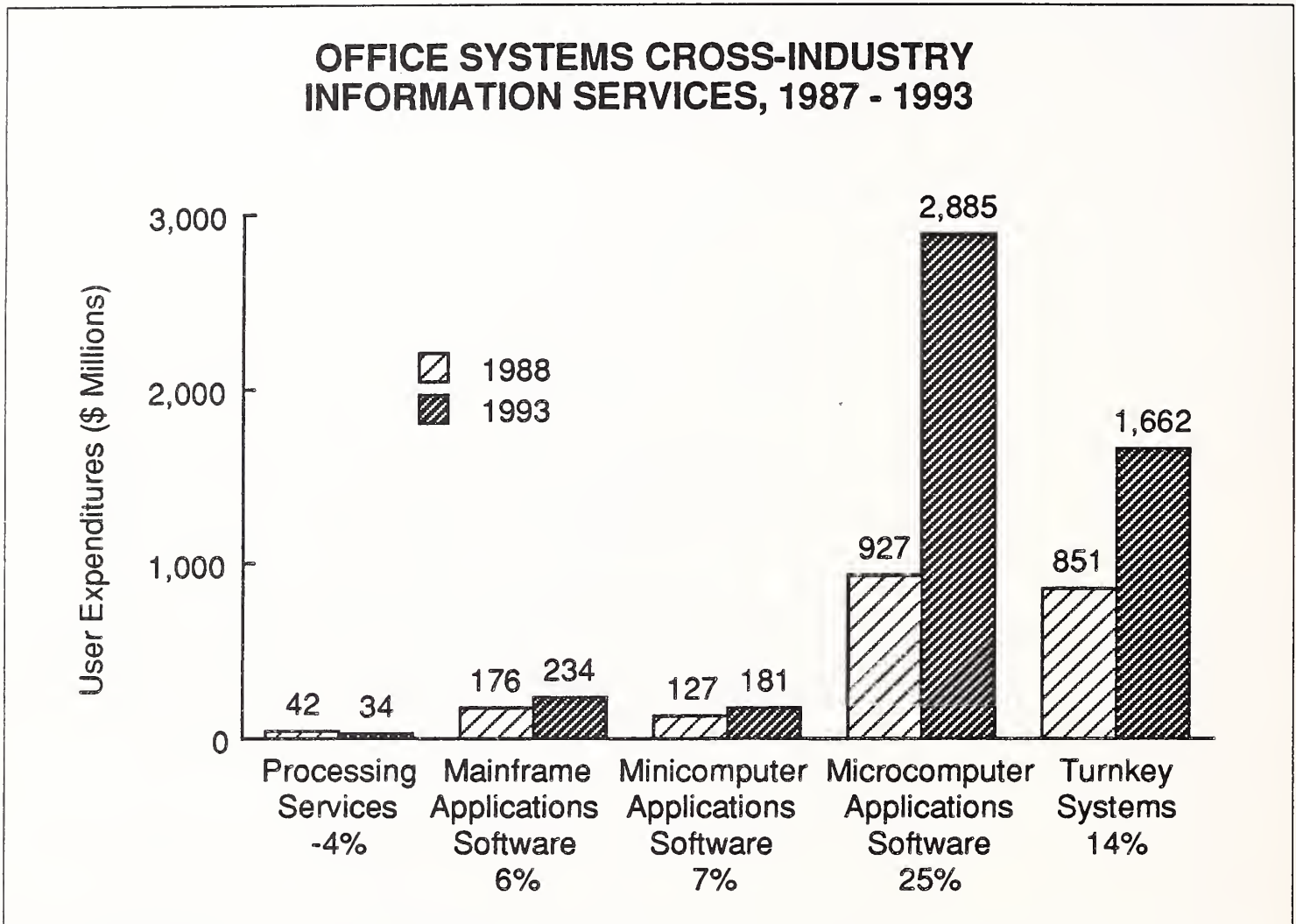
Market Forecast

A

Introduction

- User expenditures for office systems cross industry applications will grow 19% on a compound annual basis from 1988 through 1993, increasing from \$2,123 million in 1988 to \$4,996 million in 1993.
- The mainframe software products market for office systems applications will expand at a 6% compound annual rate from \$176 million in 1988 to \$234 million in 1993, reflecting the projected 3-4% annualized growth rate projected for mainframe platforms over the same time period and the trend to distributed processing in the office systems environment.
- Minicomputer-based office systems applications software is projected to grow at a 7% compound annual rate, from \$127 million in 1988 to \$181 million in 1993, based on expectations for a continuation of a trend in office systems to PC/workstation-based distributed processing.
- Workstation/PC applications software expenditures will increase at a compound annual rate of 25%, from \$927 million in 1988 to \$2,885 million in 1993.
- Turnkey systems for office systems applications will grow at a compound annual rate of 14%, from \$851 million in 1988 to \$1,663 million in 1993.
- User expenditures for processing services will decline at a compound annual rate of 4%, from \$42 million in 1988 to \$34 million in 1993.

EXHIBIT III-1

**B****Word Processing**

Word processing represents a fairly mature market with growth closely tied to shipments of personal computers, which appeared to have slowed significantly in the second half of 1988. With a continuing trend to distributed processing solutions, the word processing segments with higher than average growth potential include those for LAN-server based technology and for the commercial workstation market. Also, word publishers, or word processing programs that incorporate a number of desktop publishing functions, represent a stronger growth rate potential in this market.

Mainframe and minicomputer word processing expenditures will continue to be negatively affected by the continuing strong trend to distributed word processing/electronic publishing solutions.

The word processing market, including micro, minicomputer, and main-frame applications, is estimated at approximately \$450 million in 1987.

C

Desktop Publishing

This market should continue to show rapid growth based on the increasing perception of the value of an in-house publication capability related in large part to increased flexibility of production. Tighter integration of desktop publishing with other office applications also improves the quality of documents. In addition, new networked desktop publishing releases should stimulate the market for group document development and publishing.

The UNIX market for desktop publishing represents an opportunity for the independent software developer with the recent endorsement of UNIX or one of its variants by several of the leading computer systems vendors. At present, there are a limited number of UNIX desktop publishing solutions available. Frame Technology's recent growth with a UNIX-based product reflects this opportunity.

The high-end market leaders in desktop publishing were originally turnkey systems vendors. A trend among these publishers is to unbundle their hardware and software offerings and to port to a number of standard hardware platforms. In addition, they are marketing on an OEM basis to the large computer systems vendors.

The market size in 1987 for desktop publishing application software is estimated at approximately \$150 million.

D

Graphics

The processing services portion of the office systems information services market consists largely of presentation graphics (slides, etc.) services performed by outside service bureaus.

With the increasing availability of new high-performance microcomputer-based solutions, users are able to produce quality graphic products with ease in-house, which suggests a declining market opportunity in outside graphics processing services.

The area of microcomputer-based presentation graphics applications has been one of the highest growth segments in microcomputer applications sales in the past year, as reflected in the success of such packages as Software Publishing's Harvard Presentation Graphics program.

Graphics editing tools are increasingly being integrated into word processing and desktop publishing solutions, and the declining prices of graphics-scanning hardware prices in recent years has further stimulated the use of graphics applications. The declining prices in computer memory are also significantly reducing the cost of storing and processing graphics applications.

The trend will continue to microcomputer-based applications, with much slower growth rates in the minicomputer and mainframe graphics applications markets. The market for graphics applications software in 1987 is estimated at \$240 million, with the turnkey systems portions of the market at \$200 million, and graphics processing services at \$45 million.

E**Voice Processing**

Voice processing in the office environment is currently primarily a voice messaging application. Future high growth potential exists in the development of speech recognition technologies to provide an alternative input technology to computer keyboards. Also, considerable potential exists in technologies that contribute to the integration of voice and data networks.

The current market for voice processing technology, which is primarily implemented as a turnkey systems or systems integration solution, is estimated at \$250 million.

F**Image Processing**

The market for image processing over the past year has significantly expanded. Such highly visible corporate-wide implementations of image processing technology such as that of USAA, a major U.S. insurance company, has help spark the interest in this technology. The current leader is Wang Laboratories, which has a well-integrated document indexing and retrieval systems, along with the scanning and optical storage technologies, included in an image processing solution.

IBM's endorsement of the image processing market, with their entry into this market in 1988, also suggests that the technology is becoming mainstream. Major opportunities in the image processing market also exist for integrating text/data/image/video and graphics networks. The market for image processing in 1987, which consisted primarily of turnkey and systems integration-based products, was approximately \$100 million.

G**Electronic Mail**

The current market for electronic mail for the office environment includes the electronic mail services provided by the computer systems' vendors integrated office systems programs (included in the market size information on these programs in this report); Service Bureau processing services, which are included in INPUT's telecommunications vertical market report; and PC E-mail packages. There could be some major structural changes in the electronic mail markets in the near future, with the anticipated major entry into these markets by the RBOCs.

The PC E-mail programs currently represent the fastest growing electronic mail market segment.

The market for PC E-mail application software in 1987 is estimated at \$20 million.

H

Integrated Office Systems

The principal vendors of integrated office systems are the major computer systems vendors, such as IBM, DEC, Wang, H-P, and Data General.

The introduction of IBM's AS/400 Computer System, with its bundled operating system, data base management system, communications systems, and office application software, represents a new product direction in the integrated office systems with a total solution (turnkey-type) marketing approach.

The market for integrated office systems in 1987 is estimated at \$300 million.



Competitive Analysis





Competitive Analysis

A Applications

1. Overview

The competitive environment in office systems is increasingly being driven by an attempt to provide more of the total solution. This attempt has led to much more emphasis by more-traditional hardware systems suppliers on software solutions. IBM's new AS/400 Office package, for example, emphasizes the total application solution, with the bundling of systems software (operating, communication, and relational data base management) with vertical application software, and the central management of all hardware and software resources tied into the AS/400 network. The new package also provides for a bundling of word processing, electronic mail, word processing, directory and library services, and calendar management functions. The AS/400 was developed by IBM's Application Systems Division (ASD) as an integrated solution based on a relational data base. The relational data base architecture also provides for a much easier integration of other departmental applications (such as financial) into the AS/400 total solution.

- This reflects not only the idea that providing the solution is the key element in making the sale, but also reflects the recognition that higher profit margins as well as higher growth rates can be obtained from the sale of applications and systems software than from hardware, which is steadily becoming a commodity item.
- To more quickly and possibly more effectively gain a competitive edge today in key vertical markets, the leading computer hardware vendors are courting leading VARs and other remarketers with vertical market software product. This strategy was particularly evident in IBM's rollout of the Application System/400 (AS/400) product in which IBM highlighted the role of its independent Business Partners in helping the new system provide solutions for a large number of vertical markets. It was also mentioned at the product launching that over half of AS/400

sales will go through the Business Partners. In the office environment, business partnerships include not only VAR-developed products for AS/400 but also a number of alliances with leading ISVs such as Aldus (PageMaker), Interleaf, and Adobe (PostScript) for the PS/2 and PC product lines.

- Wang Laboratories is also in the process of expanding its VAR relationships. One of Wang's approaches is to provide conversion utilities to third-party software vendors to provide file transfer interfaces into Wang's software products. At the same time, Wang is also using its conversion utilities to provide linkages between its own office software packages and those of leading office software vendors that have become standards in the office environment.
- DEC also continues to court third parties such as ISVs and communications software specialists.
- A problem that has resulted is a shortage of enough high-quality VARs to work with the large number of computer systems vendors that are courting this marketing channel.

Another significant competitive development in the area of software applications is the formulation of partnerships among competitive applications developers. This relates in large part to the issue of standards. With the increasing demand by users to be able to integrate software solutions (at least on the file interchange levels), software, OEMs, VARs, in particular are increasingly attempting to either promote their product as a standard, such as Microsoft's Windows and Presentation Manager, or ensure that their value-added product incorporates file interfaces to other leading software standards. The major independent software developers are also continuing to make their programs conform to file formats of other leading office software products, as well as insuring compatibility of their newly developed products with established programs.

- HALO graphics applications represents an example of a product that has been integrated into a number of desktop publishing software packages.
- Other recent significant alliances among leading independent software vendors include the cooperation between Microsoft, Ashton-Tate and Sybase in bringing out a SQL file server product for the OS/2 systems environment. In addition, Novell, Inc., with its de facto networking operating system standard product, NetWare, has been developing a number of cooperative alliances for its Netware network operating systems software.

- Verity, an innovative new company in the area of text management, has signed a number of joint marketing agreements with the leading independent relational data base management systems companies. These agreements could eventually lead to product offerings that integrate the two technologies.

Still another competitive trend is the continuing strong merger activity from applications software vendors. The larger independent software companies in particular—such as Lotus, Microsoft and Ashton-Tate—continue to broaden their product offerings to provide more of total office solutions. Particularly in the case of Ashton-Tate and Lotus, much of this broadening is being done through acquisitions. As the trend expands among the larger vendors to provide more of the total office solution, merger activity in the industry should continue to be robust.

The leading computer systems vendors and software developers also appear to be accelerating their efforts to acquire new office systems technology—particularly in the areas of desktop publishing and communications software—through strategic alliances involving cooperative marketing and/or OEM and private-labeling arrangements.

The concept of being able to interface with leading standard solutions in the office environment is also promoting the incorporation of standard user interfaces. IBM's promotion of SAA and Presentation Manager will further stimulate this trend.

(Exhibit IV-1)

2. The Competitive Environment in Particular Office Systems Applications

a. Desktop Publishing

The desktop publishing markets consists of a few large vendors, several medium-sized vendors, and a multitude of small vendors.

- The leading players in the general office desktop publishing market include: Xerox (Ventura), Aldus, Apple Computer, IBM, Interleaf, Software Publishing, Microsoft, Ashton-Tate, Lotus, Quark Inc., Adobe, and Digital Research (with GEM Desktop Publisher, shipped initially in June 1987). Among the high end professional publishing systems market are: Xerox's ViewPoint, XPS, and XICS document processing packages; Interleaf's Technical Publishing Software turnkey system; Xyvision Systems; Bestinfo's Document Manager System; Ultimate, from Composition Technologies; and Archetype Designer from Archetype. A relatively new significant competitive factor in the electronic publishing market with a UNIX-base product is Frame

EXHIBIT IV-1

**APPLICATIONS SOFTWARE COMPETITIVE
TRENDS IN OFFICE SYSTEMS**

- The AS/400 Total Solution Approach
- Increasing Number of Product Alliances Among ISVs, VARs, and Computer Systems Vendors
- Strong Trend to Joint Marketing and Other Types of Strategic Alliance among Independent Software Vendors
- Continuing Strong Merger Activity
- Attempts to Establish Standard User Interface on Various Systems Platforms

Technology Corporation. Its FrameMaker professional software for workgroup publishing has become the leading electronic publishing software for Sun platforms.

Sun Microsystems has indicated its goal of becoming "the hardware platform of choice for electronic publishing." The company recently announced a series of new alliances for electronic publishing products available on Sun's systems. These alliances include recent agreements with suppliers of automated prepress systems, and of text- and graphics-processing products.

A new data base publishing program, called dbPublisher, was introduced by Digital Composition Systems (DCS), in the fall of 1988. It runs on IBM and compatible personal computers and is also compatible with most widely used data base, spreadsheet, word processing, and graphics programs. The key feature of the program is the ability to directly access data base, spreadsheet, word processing, and graphic files and then merge them into fully formatted typeset-quality pages. dbPublisher is targeted for the development of catalogues, directories, price lists, and other data base documents that must be produced frequently and have simple graphic requirements.

Docupro, Inc. recently introduced its Professional Publishing Software package for the Sun 386i workstation, which can work with both MS-DOS and UNIX files simultaneously.

Syntactics recently introduced an MS-DOS version of its Crystal DMS (Document Management System), which is file- and keystroke-compatible across the DOS, XENIX and UNIX operating systems. As a result, users wanting to share documents do not have to learn different programs to move between the single- and multi-user environments.

An emerging new low-end product is desktop word-publishing software, which involves relatively simple text and graphics documents without the need for professional page layout. Software Publishing's recent acquisition of Office Solutions, Inc. would suggest that Software Publishing's Professional Write program and Office Solutions's OfficeWriter would be core offerings for Software Publishing's expansion of a word-publishing software product line. Samna Corp. also recently announced a new lower-priced graphics-based word processing package for the IBM PC AT and PS/2 and compatibles. The package is called Ami, and is targeted at the more casual desktop publishing user that wants to use a less complex page layout program. It provides a graphics-based word processing environment that uses Microsoft's Windows and a mouse to develop text on a what-you-see-is-what-you-get display. It also features 25 style sheets (predefined page layouts) of memos, business letters, newsletters, reports, and other documents. A professional edition of Ami with mail-merge, thesaurus, and drawing capability is expected by mid-1988.

b. Data/File/Text Management Systems

Leading file management data base software packages for the DOS operating systems environment include: Software Publishing's PFS:Professional File, Ashton-Tate's Rapid File, Nashoba Systems' FileMaker (acquired by Claris Corp. in mid-1988), and Symantec's Q&A, which also includes an artificial intelligence module known as the Intelligent Assistant (IA).

Leading data base management vendors for the minicomputer market include IBM, DEC, Hewlett-Packard, Oracle, Relational Technology, and Informix. Leading PC-based data base management system vendors include: Ashton-Tate with dBase III Plus; Microrim with R:base; Borland International with Paradox; and Oracle with Professional Oracle, Oracle for 1-2-3, and LAN Server Oracle for XENIX-based servers. A strong contender in the 286- and 386-based UNIX (XENIX) environment is the Santa Cruz Operation's SCO FoxBASE, a dBaseIII-compatible package. A new offering for this operating systems environment is the SCO Integra, an SQL-based Relational Data Base model.

- The market segment of data base management systems with the highest growth today the segment for relational data base systems. Leading vendors of relational data base systems products that relate to the office systems market include: IBM, Oracle, and Informix. Data base systems products from Oracle and Informix have been ported to several operating systems (VMS, UNIX, and DOS) and hardware platforms, which provides for a strategy of multisystems integration. The next generation of data base management software for office systems will be based on PC LAN server technology. The leading contender for this market will be the SQL Server product being built through an alliance of Microsoft, Ashton-Tate, and Relational Technology. However, IBM's bundling of relational data base management system software in its new AS/400 Office product and its OS/2 Extended Edition represent formidable new challenges from IBM in data base management systems for the office environment.

Leading data/file management products for the Macintosh environment include: Nashoba Systems' FileMaker Plus, Microsoft's File (which also provides for report merger with Microsoft Word documents); Blyth Software's Omni 3Plus, Odesta Corp.'s Helix Family, Ashton-Tate's dBase Mac, and Borland International's Reflex Plus. Helix VMS, one version of Helix, provides for Macintosh-to-DEC-VAX minicomputer connection. A new data base product under development for the Macintosh is Acius's Fourth Dimension. Fourth Dimension will provide a Mac graphical interface qualities as well as an integrated programming language for developing Macintosh applications.

The competitive structure of the personal computer data base management system market in 1988-1989 could undergo a rather significant shift with the expected introduction of a number of new relational products with SQL language technology. In particular, shaping the future of the market will be the relative success of the new generation of data base management products: SQL data base servers for the LAN versus the single-user market. Nearly all major PC DBMS vendors have announced plans to support SQL and the client/server model, where the server handles the processing and the workstation handles the interface. Such products include: IBM's OS/2 Extended Edition; Ashton-Tate's dBase IV; and Microsoft, Sybase and Ashton-Tate's jointly marketed SQL Server™, Lotus' Lotus/DBMS; Oracle's Oracle OS/2 Service; and a possible single-user DBMS product tied to SQL Server from Microsoft. Oracle has also announced a dBase clone product that will interface to Oracle's current SQL-based product line.

- Ashton-Tate has also indicated it is likely that the company's future Mac data base management system software should be able to support dBase IV application code and SQL. Ashton-Tate's current Mac data base product, dBase Mac, cannot use dBase III application code but can read dBase data files. A competitor, Foxbase Plus/Mac, is able to run dBase II applications with little or no modification.

A continuing DBMS solution requirement for the office environment will be the accessing of DBMS mainframe software via PCs. Companies such as Informix are addressing this with 4GL Development Tools, that allow programs developed on a PC-DOS platform to be ported to a VMS environment, for example. Informix has also recently introduced object-oriented features in its SQL-based DBMS product line, which allows for the storage of spreadsheets, facsimile, digitized image, or word processing documents in its SQL data base. As part of the program, Informix will extend SQL with free-text search technology. This product is designed to provide an integrated indexing environment for its DBMS and office systems products. Oracle, the leading independent company in the relational data base management systems market, also provides portability of its product across PC, minicomputer, and mainframe product lines.

Textual search programs should also become an increasingly popular tool for the office systems environment, stemming from the need to quickly access word processing text files, as well as from the increasing use of optical storage of a variety of company documents. The more advanced product includes embedded expert systems programs, such as that from Verity Corp. At the other end of the spectrum is a product such as Turbosearch, a low-priced information retrieval program recently introduced by Ashton-Tate, that allows microcomputer users to search through application files (including word processing, data base, or spreadsheet files) for particular information; searching by a specific word, file name, or string of up to eight words that appear in conjunction with one another. The program (developed by Idan Software Industries, Ltd.) was designed to work with files from Ashton-Tate applications, such as dBase III Plus, but files from other DOS-based applications can be run with Turbosearch if they are converted to ASCII format. HyperCard applications also can provide this capability.

c. Graphics

Leading vendors of minicomputer-based graphics packages include DEC, Hewlett-Packard, IBM, Intergraph, SAS, Wang, Data General, and Computer Associates.

Leaders in the microcomputer-based graphics market include Ashton-Tate (Chart-Master), Lotus Development (Freelance, Graphwriter II), Microsoft (Excel and Windows, Chart, PowerPoint), Digital Research, Hewlett-Packard (Graphics Gallery), Micrografix (Windows Graph), Software Publishing (Harvard Graphics), Claris (MacPaint and MacDraw), Calera Recognition, formerly Palantir (OCR scanning software), and Autodesk with AutoCAD.

- Claris Corporation, which is now a separate subsidiary of Apple Computer, markets the leading draw and paint packages used for desktop publishing in the Macintosh environment. Adobe Illustrator has also become a successful graphics alternative for the Macintosh.

- Mediagenic's (Activision) Paintworks Plus graphics product for the Apple IIGS has become one of the more popular packages for this computer system.
- Autodesk's AutoCAD product is a dominant factor in the PC and workstation CAD software market.

Leading integrated packages with graphics components include Lotus' 1-2-3, Microsoft's Excel, and Computer Associate's SuperCalc, the second largest factor in the PC spreadsheet market. The new Release 3 version of Lotus 1-2-3 is expected to provide enhanced graphics capabilities. The graphics functionality of Excel has provided it with a major competitive advantage versus the current version of Lotus 1-2-3. In addition, Computer Associates began shipping SuperCalc5 for the PC market in October of 1988. The new package, which will be compatible with Lotus 1-2-3 Release 2.01, will include three-dimensional graphics, presentation-quality output capabilities, and the ability to link 1-2-3 and CA spreadsheets over a local-area network. Informix is expected to introduce its Wingz™ presentation spreadsheet product for the Macintosh market in the first half of 1989. It will include an application development language called HyperScript with hundreds of commands not directly related to traditional spreadsheet use.

Software Publishing's Harvard Graphics has become a strong competitor in the PC-DOS standalone presentation graphics market.

Aldus Corp. recently announced Aldus Persuasion, a desktop presentation software program acquired from an independent developer, for the Macintosh. The AutoTemplate element of the program automates the presentation-making process, and allows for the production of slides and overheads while the presentation is being created. With the selection of an Auto-Template slide format, the presenter types the ideas into the outliner, and the program automatically formats the outline text into slides or overheads ready to print.

Apple Computer has indicated that future types of Macintosh electronic presentation applications (involving electronic delivery of visuals) could include multimedia tools, such as HyperCard and video disks for creating unique audio and video effects, including animation and special sound effects. With the Macintosh, electronic presentations involve a Macintosh equipped with an LCD panel display and an overhead projector.

d. Word Processing/Text Editors

The word processing market includes several well-established vendors and many small vendors.

- MacWrite (from the Apple subsidiary, Claris Corp.) is the most widely used word processing software for Macintosh computers. Microsoft's Word for the Macintosh is also a major contender.

- Other leaders in the stand-alone word processing market are:

Ashton-Tate with Multimate; Wordperfect with Wordperfect; IBM with DisplayWrite; Microsoft with Macintosh and PC versions of Word; MicroPro with WordStar; Software Publishing with PFS:Professional Write; DECword/DP; DisplayWrite/370; Document Composition Facility of IBM; HPword from Hewlett-Packard; IVS Text Editors; NCR Corp.; System/88 Text Editor WP Plus, from Wang Laboratories; and Symantec with Q&A Write. Santa Cruz Operation, Inc., recently introduced a word processing program for the XENIX operating system, called Samna Plus IV, that blends desktop publishing capabilities with conventional word processing. The software also allows for the transfer of compound documents containing scanned images between XENIX and MS-DOS systems.

- Among the leading providers of integrated, multifunction packages are: Informix with SmartWare, a leader in the UNIX operating environment; Symphony from Lotus Development; Framework from Ashton-Tate; PFS:First Choice from Software Publishing; Microsoft's Works for the PC-DOS operating system; and Santa Cruz Operations, a leading factor in the 80386-based world for UNIX and XENIX applications with its SCO Office Portfolio offerings.
- New networked versions of the integrated packages, such as Informix Software's Smart Software System are creating a renewed interest in this approach.
- Ability Plus from Migent, Inc., represents the leading-edge technology integrated office systems packages. It allows the movement of a live version of a spreadsheet into a word processing report, where a change in a figure in the word processing document also results in a change in the original spreadsheet file. When the spreadsheet is updated, it also updates the report. This is also true for graphs and the data base manager. A graphic derived from spreadsheet data is automatically updated when the spreadsheet is changed. If the graphic is included in the report, it is also automatically redrawn and saved in the report document file.

e. Spreadsheets

Leading vendors of minicomputer-based spreadsheet packages include Access Technology, DEC, IBM, Hewlett-Packard, and Wang.

Leading providers of spreadsheets for microcomputer systems include Lotus, Microsoft, Computer Associates, Ashton-Tate, Access Technology, Paperback Software, Javelin, and Software Publishing.

- Paperback Software's VP-Planner Plus is compatible with 1-2-3 Release 2 worksheets and macros plus offers dBase file creation and access, multidimensional data base files, a text editor and report generator.
- The new SuperCalc5 integrated spreadsheet package from Computer Associates, with well-integrated graphics and data management capabilities, is also representative of the directional changes in spreadsheet offerings for the microcomputer environment.
- Software Publishing, Inc.'s PFS: Professional Plan integrated spreadsheet program combines IBM TopView support with the capability of producing text and graphics. It is targeted for the corporate manager who wants an intuitive-based interface that promotes ease of use. It also reads and writes Lotus 1-2-3 files and can be used to extract ASCII data from a mainframe environment, as well as export graphs to its Harvard Presentation software program. The creation of macros is also part of the ease-of-use functionality, which is aimed at reducing the number of keystrokes needed to create and use the macro programs.
- The Santa Cruz Operation's SCO Professional (an integrated spreadsheet, graphics, and data base package), provides a Lotus 1-2-3 "workalike" solution for 286- and 386-based PCs running XENIX and UNIX operating systems. The program can also read and write data to DOS.

f. Communications

A major competitive issue in LAN network operating systems is whether or not the new OS/2 LAN Manager network operating system will become the de facto standard for the next generation of LANs. It will be competing against Novell's NetWare, VINES from Banyan Systems, and 80386-based multiuser operating systems, such as Santa Cruz Operations's XENIX, and Digital Research's Concurrent DOS. The fact that OS/2 LAN Manager was co-developed between Microsoft and 3COM Corp. would suggest considerable support for the system based on the current customer base of these two companies. Novell, which currently has the largest market share in LAN-based network operating systems, has indicated it will provide compatibility with OS/2 LAN Manager by running OS/2 applications under NetWare on a dedicated LAN Manager co-processor.

g. Image Processing

At the high-end of the scanning market, Calera Recognition (formerly Palantir Corp.) offers the most comprehensive OCR omnifont capability. For PC OCR scanning, Kurzweil, DEST, and TransImage Systems are leading factors, and in image scanning/processing, leaders are Datacopy and Microtek Lab.

AVR Systems in mid 1988 announced MegaScan I system and MegaScan II system, a fully integrated PS/2-compatible system for graphics imaging and manipulation, desktop publishing and optical character recognition.

- MegaScan I system includes a new MegaBuffer/2 interface card designed for the micro channel architecture (MCA) and Release 3.1 of MegaScan text/imaging editing software, which serves as a high-performance scanner interface. MegaScan II also includes the AVR-302 flatbed image scanner, MegaRead OCR software, and MegaFont font-creation software.
- AVR Systems MegaScan product is targeted for OEMs, VARs, and distributors who offer complete desktop publishing solutions.

The leading providers of Image Processing Management Systems (integrated scanning, storage, retrieval, communications) include: Wang, with its WIIS product; Filenet, with its Jukebox optical disk storage system; and Eastman Kodak with its Image Management System (KIMS). IBM entered in the market in 1988 with a systems integration product based in part on third-party solutions. IBM is expected to announce a standard product offering in the spring of 1989.

h. Voice Recognition

Leading factors in the voice/speech recognition market include Votan, Speech Systems, IBM, ITT, Kurzweil, and AT&T.

The principal competition in voice messaging/processing equipment is provided by Rolm/IBM, Octel Communications, AT&T, VMX, Inc., Wang (which integrates voice messaging with other network delivery functions), and Unisys.

i. Integrated Office Systems

Among the leading products are WPS-Plus/All-In-One from DEC; AS/400 Office from IBM, Distributed Office Support System/370 (DISOSS/370) from IBM, Distributed Office Support System/8100/Distributed office Support Facility (DISOSS/8100/DOSF) and Professional Office System (PROFS) from IBM, and Wang's OFFICE.

- PROFS, which runs on the VM/CMS operating system, provides for electronic mail/message exchange among PROFS users. It also includes people and facilities calendars and scheduling, facilities for informal notes or formal documents, document preparation aids, online data filing, electronic document distribution, electronic routing slips, reminder functions; proofreading services, and problem determination aids.

j. Electronic Mail

With the increasing adoption of the international electronic messaging standard, X.400, the leading trend in electronic mail is towards intercompany communications. The anticipated entry of the RBOCs into information services delivery, such as electronic mail, is adding a significant new competitive factor to the market.

The third-party electronic mail services market is very competitive with over a dozen providers.

The use of PC LANs for electronic mail delivery is expected to be a major new growth market.

Oracle Corp. has recently entered the office systems market with the introduction of its Oracle * Mail product.

B

Technology

A continuing product development trend in office systems hardware/software solutions continues to be toward desktop, versus minicomputer-based technologies. This is also reflected in departmental office systems environment. Along with this is a continuing trend to distributed solutions, which will eventually be based on peer-to-peer, shared resource (cooperative) processing. The latest technology trend in distributed processing for the office systems environment is the client/server model that utilizes the LAN server and attached PC/workstations for distributed file, data base, applications, and communications processing. This trend is being fostered by the introduction of the OS/2 LAN Manager network management/operating system; the OS/2 Extended Edition, with the bundled data base management systems and communications software; the growing acceptance of multi-user systems software such as UNIX on the Intel 3086-based hardware platforms; and the introduction of such dedicated new LAN server products such as SQL Server™ from Microsoft, Sybase, and Ashton-Tate. As such, network-based applications and systems software (for network management and gateways to wide-area networking and PC-based data base management systems) should be strong growth areas for office systems products. It is also reflective of the comparative price/performance benefits of the distributed microcomputer approach.

Minicomputers will also likely play a significant role in the future in the area of wide-area corporate communications access and distributed data base processing, as well as for servers on larger departmental networks.

A major competitive factor in future software product releases will be the necessity to conform to application and communications standards.

- The International Standards Organization with Open Systems Interconnection (OSI), its seven-layer data communications system, will be finalizing standards over the next two years for the top two protocol layers (sessions and applications) which relate to inter-application/program communications. This will ultimately lead to office systems that provide a total integration of all media types (text, data, voice, graphics, and image) through a common workstation network interface.
 - Several leading computer systems vendors, such as Hewlett-Packard, DEC, Wang, and IBM, in 1987 and 1988 began to indicate support for OSI interconnectivity in future product releases.
- For developing future competitive office applications for the IBM operating systems environment, support for SAA common user and application programming interfaces will be required. Other major computer systems companies are also expected to announce their own systems development architectures. Digital Equipment, for example, announced a series of Network Applications Support information sharing services in early 1988. This series will include toolkits for third parties developing applications that can be integrated with other applications across an enterprise-wide DECnet/OSI network. It also involves support for such user interfaces as DECwindows.

The first product released for this programming environment includes specifications for DEC's Compound Document Architecture (CDA). CDA allows users to exchange revisable documents containing text, graphics, image, or application data: a feature that provides access to relevant information that can be located anywhere on corporate-wide network. The specifications for CDA define a complete networked environment for creating, revising, managing, and distributing compound documents containing "live" links to text, graphics, images, spreadsheets, charts, and tables anywhere on the network. Live links allow automatic updating of data contained in a compound document when the source information is changed. CDA specifications include support for the International Standards Organization's Office Document Architecture/Office Document Interchange Format (ODA/ODIF), Standard Generalized Markup Language (SGML), and Adobe's Post-Script page description language.

Image scanning/processing is a particular area where the presence of a number of smaller companies, providing various pieces of the total solution, has led to a multitude of software/hardware system solutions. However, within the past eighteen months, major computer systems vendors have entered the market, which should lead to some resolution of standards, particularly for scanning software, and probably to a shakeout of several of the smaller players in the industry. Part of the increasing acceptance of image processing in the office is due to price reductions. These reductions relate in part to improved costs from more powerful analog/digital semiconductor chips that provide much faster processing of graphic images and the reduction in costs of optical disk storage. In addition, there has been increasing support for standard microcomputer bus formats by image processing hardware vendors.

- At present, the major vendors of image scanning and processing equipment bundle their own proprietary systems software solutions with their product. One such OCR scanner solution for the office systems environment is provided by Datacopy, which has positioned its PreScript scanning software as a standard, somewhat analogous to that of PostScript, the page-description language used to drive display terminals and laser printers.
- The ImagePro library from Media Cybernetics and MIT-developed X Windows have also developed as de facto standards in the image processing arena.

(Exhibit IV-2)

EXHIBIT IV-2

TRENDS AND ISSUES IN OFFICE SYSTEMS TECHNOLOGIES

- Client/Server Distributed Processing Model
- Minicomputers as Communications/Database Servers for Larger Departmental Environments
- OSI as the Future Standard for Inter-office Networking
- Need for Standards in Image Processing and Compound Document Interchange

C**Vendors**

Currently, the major vendors in the office systems environment are the Independent Software Vendors (ISVs) and the leading computer systems vendors. However, with the trend toward integration of multi-systems products, there will also be an increasing opportunity for professional services organizations and systems integrators to provide customized solutions. In addition, it would appear that the leading telecommunication providers will be increasingly important in providing office systems solutions, in particular, communications gateways for electronic mail and voice messaging services, as well as for combined data, textual, audio, and video transmission.

(Exhibit IV-3)

EXHIBIT IV-3**MAJOR OFFICE SYSTEMS VENDOR GROUPS**

- Independent Software Vendors
- Computer Systems Companies
- Increasing Presence of Professional Services Organizations and Systems Integrators
- Potential Significant Entry Impact from the Leading Telecommunications Providers

There has been a significant degree of consolidation within the office systems group in the past two years, with only a partial list of mergers listed below:

- Informix acquired Innovative Software in integrated office systems products.
- Ashton-Tate acquired Ann Arbor SoftwAre in desktop publishing.
- Software Publishing is merging with Office Solutions in high-end word processing products.

- There have been several acquisitions of LAN-based communications software products companies, including 3COM'S acquisition of Communications Solutions and Apple Computer's acquisitions of Orion Network Systems and Network Innovations.
- The Master series (Chart-Master, Diagram-Master, and Sign-Master) is now owned by Ashton-Tate.
- Perspective is now a part of Boeing Graph.
- Lotus bought Graphic Communications to get Graphwriter and Freelance.
- GrafTalk is now part of DataEase.

D

Profiles of Key Vendors

1. ADOBE SYSTEMS INCORPORATED

(1585 Charleston Road, P.O. Box 7900, Mountain View, CA 94039)

a. Products/Services

Adobe is a software technology company that designs, develops, and markets systems software used in laser printers, typesetters, displays and other raster output devices to print integrated text and graphics for electronic printing and publishing applications.

The company's principal product, Adobe's PostScript interpreter, executes page descriptions generated from application programs that support the PostScript page description language to produce documents containing multiple typefaces and graphics. Adobe continues to expand its Type Library with over 200 typefaces, some of which are provided as standard in PostScript-equipped printers, and others are available separately for downloading.

With OEM customers that produce over 30 different printers, the PostScript page description language has become a graphics language standard.

The PostScript interpreter normally resides on a controller board in the laser printer or other raster output device.

In 1987 Adobe introduced the Display PostScript system for computer monitors that extends the PostScript page description language to workstation platforms. This was recently incorporated into the new computer from NeXT, Inc. and has also been endorsed by DEC and IBM. Display Postscript has the potential to become a systems software standard for the development of screen displays by independent application software

developers and computer systems vendors. A standard would reduce the need for application developers to write various versions of their software for different computer screen environments.

Also introduced in 1987 was Adobe Illustrator, an application software product that is a computer-assisted illustration tool for producing high-quality art and illustrations.

b. Markets Served

Adobe markets its PostScript systems software products to computer, printer, and typesetter (OEM) manufacturers.

Adobe Illustrator is marketed to the end user through software distributors.

c. Company Strategy

Since one of Adobe's goals is to promote the PostScript language as an industry standard, Adobe has placed the PostScript language in the public domain.

d. Recent Activities

In November 1987, Adobe announced signing of contracts with Fujitsu Limited for PostScript interpreter for Japanese and Western languages, NEC Corporation of Japan for Adobe's Kanji PostScript interpreter, and in mid-1988 added Matsushita Corp. of Japan. These contracts with the largest computer suppliers in Japan significantly expands the international market potential for Adobe's PostScript.

In January 1988 the company announced the Adobe Illustrator 88 program, which brings color and more sophisticated professional tools for more advanced applications in technical publications and color textbook.

In June 1988 Adobe announced that R. R. Donnelley, the largest U.S. printer, had become another licensee of PostScript.

In mid 1988 Adobe introduced Illustrator 88 for the Macintosh Plus, SE, or II. An upgrade to the company's Adobe Illustrator product, it provides an auto-trade feature for automatically turning templates from scanned art or clip art into PostScript art. It also has a blend command for making graduated colors and an average command for automatically calculating and drawing the stages or transforming one object into another.

In September 1988 Adobe announced for shipment at year end Adobe Illustrator, Windows version, a PostScript language-based drawing package for the IBM personal computer environment.

In 1988 Adobe Systems also signed an OEM agreement to license the Display PostScript system to Digital Equipment Corporation for use under Digital's DECwindows windowing system and with IBM Corporation.

e. Future Directions

Adobe will expand its system software technology into related electronic printing markets and will develop new products for selected end-user markets. Particular new product opportunities include color laser printers, the Japanese market (with graphic Kanji characters), and facsimile machines.

Other future product offerings should also expand the number of typefonts supported.

2. ALDUS CORPORATION

(411 First Ave. South, Suite 200, Seattle, WA 98104)

a. Products/Services

Aldus develops and markets applications software for the desktop publishing market. Its principal product is PageMaker, which is a market leader in the mid- to high-end desktop publishing market.

PageMaker Version 3.0 provides standard black-and-white layouts as well as color separation capability.

b. Market Segments

Aldus markets its products through both retail channels and through OEM relationships with major hardware vendors. In particular, PageMaker has a significant share of the Macintosh desktop applications market. PageMaker for the IBM PC product line was introduced in 1987 and has become a leading product. PageMaker is one of only three desktop publishing applications that operates with both Macintosh and PC systems.

c. Recent Activities

In the fall of 1987, Aldus announced the acquisition of two new products—the Macintosh drawing program, Aldus FreeHand, and an electronic photography program, Aldus SnapShot.

In mid 1988 Aldus announced shipment of PageMaker 3.0 for the PC, a new version that includes support for long documents, enhanced graphics capabilities, and user interface improvements, including built-in tem-

plates. New PageMaker graphics features include the ability to wrap text automatically around rectangular graphics and customize wraps for irregularly shaped graphics. With the release of PageMaker 3.0, Aldus is the only desktop publishing software vendor to offer image controls for scanned and bit-mapped images. PC PageMaker 3.0 also includes filters for Lotus 1-2-3, Lotus Symphony, and Ashton-Tate dBase software. Users can now place worksheet and data base files directly into PageMaker documents without intermediate file conversions.

In mid 1988 Aldus also introduced FreeHand for Macintosh Plus, SE, or II, which competes with Adobe's Illustrator 88 as one of the most powerful professional graphics programs for desktop publishing on the Macintosh. FreeHand allows drawing in color and creating and saving color palettes. It is also PostScript compatible.

d. Company Strategy

A major element in Aldus' business strategy is to pursue alliances with major computer hardware and software vendors. One such relationship is with Apple Computer, Inc.; Aldus first worked with Apple to develop a desktop publishing system based on PageMaker and Apple's Macintosh computer and LaserWriter printer.

Following the introduction of the PC version of PageMaker, Aldus worked with Microsoft and Hewlett-Packard to market a complete desktop publishing system based on HP hardware and the Microsoft Windows operating environment.

Other company OEM relationships have been developed with Digital Equipment, Wang Laboratories, Tandy, and Olivetti.

The company also works closely with developers of monitors, scanners, and printers and with software engineers of text and graphics programs to help establish desktop publishing software and hardware standards.

The company also emphasizes value-added distribution.

e. Further Directions

The introduction of the OS/2 Presentation Manager product from IBM should provide a major opportunity for PageMaker to penetrate the IBM desktop publishing environment—Aldus has considerable experience in working with the similar Microsoft Windows product.

3. ASHTON-TATE

(20101 Hamilton Avenue, Torrance, CA 90502)

a. Products/Services

Ashton-Tate develops, markets, and supports five product segments of the office systems market: data base management, word processing, desktop publishing, business graphics, and multifunction microcomputer software products. The company also publishes a series of books, periodicals, and book/disk packages related to computer hardware and software.

Leading products include: dBase III and dBase III Plus, Framework II, Multimate, and Multimate Advantage II.

b. Markets Served

The principal markets served include the business software and office systems markets. The company's software products are marketed worldwide through distributors, dealers, original equipment manufacturers (OEMs), value-added remarketers (VARs), and the company's own sales force.

c. Company Strategy

Ashton-Tate has indicated that a principal company strategy is to maintain its position as the leading microcomputer DBSM developer in an increasingly competitive marketing environment. Plans include providing added value to its microcomputer solutions through increased emphasis on connectivity between PC and Macintosh programs, as well as an accelerated development effort of software for the Macintosh product line.

d. Recent Activities

In September 1986 the company acquired Decision Resources, a leader in business graphics software. Decision Resources' Master-Graphics series (presentation graphics) of software positions Ashton-Tate in its fourth area of the microcomputer software industry, business graphics. The Master-Graphics series of business graphics products include Chart-Master, Sign-Master, Diagram-Master and Map-Master. In January 1988 it began shipping its advanced graphics product Draw Applause.

In February 1988, Ashton-Tate began shipping FullPaint, a product it acquired with its acquisition of the business and assets of Ann Arbor Softworks, Inc.

In fiscal 1987 the company also entered the low-end file management category of the DBMS market with RapidFile.

In fiscal 1988 the company introduced dBase DIRECT/36, a connectivity product that links dBase III Plus with data base files residing on IBM's System/36 minicomputer; Byline, a low-cost, easy-to-use desktop publishing program; and dBase Mac, a relational data base management system for the Macintosh computer.

Other product scheduled for 1988 shipment include: dBase IV/SQL and three new Macintosh products—FullWrite Professional, Full Impact (a spreadsheet product for the Macintosh), and dBase Mac Run Time.

In January and February 1988, Ashton-Tate announced a strategic alliance with Microsoft Corporation to produce and market the Ashton-Tate/Microsoft SQL Server. The product is an OS/2 data base server based on minicomputer technology developed by Sybase, Inc. of Berkeley, California.

e. Future Directions

Future Ashton-Tate data base products will address current issues surrounding SQL, micro-to-mainframe connectivity and 80386 compatibility. The SQL Server product also signals the company's intent to build a complete workgroup computing strategy, particular one that offers a workstation/server package. The company announced that an SQL Server-compatible version of dBase IV will be released in tandem with its server product.

The company has also indicated its commitment to expanding the scope of its product line to include data base software programs for UNIX, OS/2 Presentation Manager, VMS, and Macintosh.

The company is also working on extensions to the dBase/SQL language to allow users to hook into outside applications such as word processing, spreadsheets, and graphics. This will allow dBase users to ship data to other applications for analysis. Current work is also being done on the dBase Cross-Application Language (dCAL), which will allow stand-alone applications to be integrated into a data base.

Management has also indicated its intention to port dBase code to environments such as UNIX and DEC's VMS.

4. CALERA RECOGNITION

(2500 Augustine Drive, Santa Clara CA 95054)

Formerly called THE PALANTIR CORPORATION, named changed in the fall of 1988.

a. Products/Services

Palantir has developed a font OC/scanning recognition solution that is significantly more sensitive than the traditional methods of matrix matching and feature extraction. Its omnifont OCR page reader can recognize thousands of type faces in a wide range of point sizes without training or human intervention and with a high level of accuracy. In 1987, the company introduced its automated OCR product, which simultaneously captures text, images, and page layout information with single-pass processing.

Everything on a page, regardless of its origin (text and graphics from typeset, typewritten output from a laser or dot matrix printer, photocopy sources, etc.) can be scanned in one pass in seconds. It can recognize virtually any form of information on a page, making it convenient to use in applications like word processing, data base, or desktop publishing systems.

Its principal product is the Compound Document Processor 3000 XT, with a highly automated document capture capability, for the high end of the image processing systems market. It provides true omnifont character recognition capability.

Another product area is PagePro, an image-analyzer that allows for the transfer of data base data into spreadsheets on PCs, for example, by identifying fields by precise location according to a user's template.

b. Markets Served

The company markets to the high end of the image processing/OCR scanning markets. Customers include end users, OEMs, VARS, and Systems Integrators.

5. DIGITAL EQUIPMENT CORPORATION

(Maynard, Massachusetts)

a. Products/Services

Digital Equipment's principal office systems products is All-In-One, an integrated office systems solution that includes the following functionalities:

- DECTalk mail—for text-to-voice messaging

- Electronic mail support within LAN and across networks
- Time and resource management capabilities for scheduling
- Full-function word processing—including compound document capability (the ability to merge text and graphics)
- Data entry and retrieval
- Standard interfaces
- Ease of use
- Cooperative processing—where applications can be run either on the workstation or through a VAX file server.
- All-In-One is basically designed to tie department workgroups into an integrated network.

Other Digital networked applications for the office environment include: electronic conferencing, based on Digital's VAX Notes program, that allows multiple users to exchange information and to conduct dialogues on topics of interest; and its VAX/VTX Videotext implementation for broadcasting or posting information, such as online reference manuals, price changes, and personnel announcements for a mass audience.

b. Recent Activities

Oracle Corp. has given DEC non-exclusive U.S. marketing rights to Oracle's line of MS-DOS-based personal computer products under a recently signed agreement. DEC will sell the DECnet version of Professional Oracle and Net workstation Oracle products. The Oracle software will run in conjunction with DEC's VMS services for MS-DOS as part of its larger Personal Computing Systems Architecture strategy.

In June 1988 DEC introduced two emulation software packages that simplify connectivity between devices residing on DECnet and IBM's Systems Network Architecture.

Both software offerings provide IBM 3270 terminal emulation capabilities. DEC, however, has added direct access for DOS-based PCs and Ultrix workstations to SNA networks. Previously DEC required customers to route 3270 data bursts upstream to an IBM network through a DEC BX running VMS acting as a front-end processor to an SNA gateway. Now through DOS and Ultrix, customers can access the DECnet/SNA gateway from their native operating system.

6. FILENET CORPORATION

(3565 Harbor Boulevard, Costa Mesa, CA 92626)

a. Products/Services

FileNet is a leading manufacturer of integrated image and data processors (with WorkFlo® management software) that capture, store, retrieve and route, digitized document-images throughout an office environment. Paper documents are converted into digitized document-images that are permanent stored on optical disks.

With a FileNet system, documents are entered through digital scanners; indexed and stored in an image management system that includes one or more OSAR® optical storage and retrieval libraries; retrieved, viewed, and processed at multifunction, high resolution workstations; and printed by laser printers.

The system has the ability to retrieve any one of millions of pages almost instantly and to display any one of them on one or more workstations simultaneously. Pages can be annotated and electronically routed throughout an organization. All of this can be done under control of its WorkFlo image routing software. Its Forms Generation Package allows for custom design of forms. In addition, there are software packages for driving the workstations, laser printers, and document entry. Its Image Management System indexes and manages the optical library.

The optical system can also sequence office functions—when one person gets through with a task, the document is automatically routed to the next appropriate person. FileNet has recently added the ability to view images on a microcomputer—eliminating the need for a special monitor and a wide-area networking feature that allows one to quickly send compressed optical files over telephone wires.

The company has been a pioneer in this relatively new market. Its systems are normally integrated with customers' existing data processing systems through connectivity software provided by Filenet.

b. Market Segments

The system is particularly appropriate for companies that need to automate the handling of incoming documents. Early adopters have been insurance companies and medical institutions.

c. Recent Activities

In the first quarter of fiscal 1988, the company announced the ability to support remote facsimile machines as online input-output devices for

FileNet Systems. Using WorkFlo software, its customers will be able to automatically receive, route, process, file, and transmit facsimile documents through a company.

FileNet recently established a joint marketing agreement with Recognition Equipment, Inc. (REI), to combine REI's high-speed optical character recognition and image capture system with FileNet's document-image processing system for high-volume, high-speed scanning.

7. INFORMIX SOFTWARE, INC.

(4100 Bohannon Drive, Menlo Park, CA 90425)

a. Products/Services

In February 1988, Informix Software, Inc., and Innovative Software, Inc. merged; the newly combined company is called Informix Software, Inc.

Informix Software is a leading supplier of DBMS and applications development software for the UNIX operating systems environment. Through the merger it now develops and markets high-performance integrated office automation software (SmartWare), which includes word processing, spreadsheets, graphics, and DBMS packages. Informix Software also offers products for the Macintosh, MS-DOS, VMJS, OKS/2, and MVS operating systems and a wide range of networked computer systems.

b. Market Segments

In the integrated office automation environment, Informix Software is one of the leading suppliers of UNIX-based solutions through the merger with Innovative Software, Inc.

c. Recent Activities

During the first quarter of 1988, Informix announced the availability of office automation software for a number of new operating environments. Wingz, a WYSIWYG integrated spreadsheet, was announced for the Macintosh native and A/UX environments.

8. INTERLEAF INC.

(Ten Canal Park, Cambridge, MA 02141)

a. Products/Services

Interleaf designs, develops, and markets turnkey systems and software for computer-aided publishing (CAP) applications. Interleaf markets its software products separately or bundled with hardware as turnkey sys-

tems. Turnkey systems are available in networked or standalone configurations.

Turnkey systems are based on Interleaf's two software products:

- Technical Publishing Software (TPS™) is designed for use by publication departments or groups that require sophisticated composition and pagination features.

A TPS turnkey system includes a 32-bit workstation, a bit-mapped screen, a laser printer, and other peripheral devices. TPS is currently available on workstations manufactured by Sun, IBM, Apple (Macintosh II), DEC, and Apollo Computer, Inc.

- Workstation Publishing Software (WPS™) is designed for use by workstation users who do not require all the features available on TPS. The typical WPS user has purchased a workstation for some primary application other than publishing and acquires WPS as an ancillary documentation tool.

WPS is available on 32-bit workstations from most major manufacturers. Interleaf also markets its software through original equipment manufacturers (OEMs).

b. Markets Served

Interleaf markets to two segments of the computer-aided publishing market.

TPS is primarily marketed in the technical documentation market to corporations and government agencies. Technical documentation includes designs, drawings, manuals for commercial products, scientific and engineering reports, and technical bids and proposals.

Both TPS and WPS are marketed in the office publishing market to manufacturers, banks, insurance companies, investment banking firms, and consulting firms. Office publishing enhanced by the integration of graphics and text includes proposals, client reports, brochures, price lists, and memoranda.

Its turnkey products generally target the high end of the publishing market for larger company in-house publishing applications. Recent OEM contracts with IBM position Interleaf's software more to the mid-range of IBM's electronic publishing offerings.

c. Company Strategy

Interleaf follows a strategy of hardware independence, operating on workstations from a variety of manufacturers.

d. Recent Activities

In March 1987 Interleaf announced three new additions to its electronic publishing solution: Corporate-Wide Document Management; Multi-Lingual Publishing; and Long Document Automation, Spot Color. These products provide corporations with the ability to employ Interleaf electronic publishing solutions at every stage of a document production cycle, on the full range of business computers (mainframe to PC), and simultaneously in different languages.

Interleaf and IBM entered into a new development and marketing agreement in April 1988 that calls for Interleaf to develop software for a range of IBM systems. As part of the agreement, IBM recently introduced two publishing systems, bundling Interleaf software with the PS/2, Models 70 and 80, and the RT PC that be available in the fall of 1988. The new publishing systems will be marketed by IBM, with both companies' names on the packages, for the mid-range of IBM's document processing systems solutions and positioned between Solution Pacs and mainframe-based offerings.

These Interleaf-IBM publishing solutions provide for integration of text, page formatting, line drawing and editing, and scanned image processing and editing. Graphics capabilities incorporate ready-made clip art, and diagrams and line art can be produced using imported CAD/CAM files and system-generated lines, boxes, arcs, curves, and ovals. The solutions also provide automatic conversion of imported data into various chart formats. IBM Interleaf accepts files from several text, image, and graphics programs. With its windowing capabilities, it allows viewing and merging of separate files.

The company also recently announced a new desktop publishing offering for the Macintosh marketplace.

e. Future Directions

Interleaf will continue to develop enhancements and features for its products and to port Interleaf software to additional workstations.

9. INTERNATIONAL BUSINESS MACHINES CORPORATION (Armonk, NY 10504)

a. Products/Services

IBM's principal office systems product offerings include:

- IBM Professional Office System (PROFS), an integrated office system for managers, professionals, and administrative support staff, is IBM's principal office systems product for the System/370 VM environment, whereas DISOSS is positioned in the MVS environment. PROFS, Personal Services/PC, and DisplayWrite 4 are key office products for PC-based applications. The new AS/400 computer offering brings a total solution to the office systems environment for departmental, workgroup applications. It also ties in PC-based LAN office systems solutions with the capabilities of a minicomputer-based applications and communications server and provides the ability to share data and applications with the S/370 architecture.

PROFS capabilities, in particular, include personal calendars, electronic mail, document searching, memo preparation, proof reading, and electronic mail distribution. The availability of Professional Office System Version 2, Release 2.1 was announced in April 1988. Among other new features, it adds a Retention Management System (RM) feature that allows users to identify and retain documents in accordance with company record retention guidelines and to automatically discard information that is no longer needed. It also provides Image document support. When an ADMIMG file is stored in the PROFS data base, PROF will recognize it as a GDDM-supported filetype and will flag it as such in the PROFS data base.

- Electronic document distribution is supported by Document Interchange Architecture (DIA) and SNA Distribution Services (SNADS), which uses the LU6.2 protocol.
- Through its Multiple Virtual Storage Productivity System (MVSPS), IBM provides remote services access to its Office Systems and Text Processing product. Its Office Systems products form an integrated system for creating, editing, storing, and distributing documents and for automating a range of other day-to-day office functions. MVSPS Office Systems products can also function as an electronic mail system linking users in one office or in multiple offices located virtually anywhere in the country.
- Increasingly, IBM is providing compatibility among its various versions of its Office Systems products across its PC and mainframe hardware platforms. In particular, this will be implemented through SAA definitions, which should provide for common user and communication interfaces.

- CICS (Customer Information Control System) Office Systems products. CICS is a capability feature of MVSPS that provides access to MVSPS Office Systems products, Distributed Office Support System (DISOSS), Personal Services/370 (PS/370), and Integrated Processing of Data and Text (IPDT) on an information network.
- IBM's Publishing Systems VM Edition, Process Master, Release 2.0, provides a system structure for SGML file translation.
- IBM has further developed its integrated office systems approach with the introduction of the AS/400 for departmental-based office automation. The AS/400 also provides a networking structure for tying in its PC LAN applications as well as standalone office systems workstations. The AS/400, which introduces the SAA applications standardization concept from IBM, provides a total document management capability from a common user interface.

The new AS/400 solution also obviates the need to buy a LAN solution because it provides for communications management and data base systems management, as well as access to PCs and PS/2s on LANs. In effect, the AS/400 acts as a file server with a relational data base management system and other applications software features. It also provides automatic linkages to other business applications—such as accounts receivables and other financial applications.

AS/400 also provides much better linkage to other hardware than was available in IBM's other mid-range mainframe offerings. Before AS/400, PC to mainframe linkage was done by 3270 emulation or LAN adapters. SNA linkages had to have SDLC cards, and the Systems 36 and 38 had to have 51250 emulations—all involving different interface cards and software.

- A recent announcement was also made in image processing, with a new optical-disk based product named Image Plus.
- IBM's principal host-based word processing software package is Display/Write4. Display Write/370 enables users to create documents on large IBM mainframes with terminal access. For the PC, IBM's word processing offering includes the Assistant Series, which was developed for IBM by Software Publishing, Inc.
- IBM's principal publishing solutions for the office environment include such standalone PC and PS/2 product offerings as the Solution Pacs, Personal Publishing System (which uses PageMaker page composition software), and, for more complex document production, Interleaf Publisher software, developed for IBM by Interleaf, available on the PS/2 and Models 70 and 80, and the IBM Interleaf Publishing

Series for the PC RT (AIX operating environment). Both IBM Interleaf products can be networked on a PC LAN for workgroup production and editing. The Interleaf Publisher provides for automated layout where text and graphics revisions added to one page will automatically result in an adjustment of the layout of the entire document. Both IBM Interleaf products integrate text, graphics, and image capabilities into single packages. They also provide for the ability to import data from spreadsheets and generate a wide variety of business and scientific charts. Both programs support Adobe's PostScript®.

Through the use of special data export programs for use with the PS/2 Model 80 and RT PC, the IBM Interleaf offerings can be connected to IBM's mainframe-based publishing offerings for the sharing of text, graphics, or images.

IBM has indicated that under the new development and marketing relationship between IBM and Interleaf, Interleaf will develop additional products for a range of IBM systems.

IBM's Solution Pacs is tailored as a turnkey solution. There are also VM, System/36, and AS/400 versions of Solution Pacs for desktop publishing. Each offering includes electronic mail, text, notes, and calendar, and optionally includes decision support and data base query. On the VM Edition, the user can transparently operate between host mode and PC mode.

- IBM also recently established an equity position in Metaphor Computer Systems to develop object-oriented, advanced software applications for the office.

b. Company Strategy

It appears that IBM is moving towards a total solutions marketing strategy for the office environment, integrating all principal automated office systems functions into compatible operating systems with distributed processing architectures based on peer-to-peer application processing. The strategy also involves the integration of the SAA solutions into the office systems equipment through standard interfaces on all the disparate elements of the office automation solution.

In addition, The Systems Application Architecture (SAA) solution should ultimately provide an integration of systems from the PC to the 3090 level.

In 1987 IBM launched the Applications Systems Division (ASD) to promote the development of applications software. The company has indicated that one of the three major areas of focus in applications software is office systems; it recently indicated to a press source that about

one-third of this division's resources are focused on office systems products.

10. KURZWEIL COMPUTER PRODUCTS

(185 Albany St., Cambridge, MA 02139) Xerox Company Division

a. Products/Services

Kurzweil's principal product is the DISCOVER 7320, a relatively low-cost (under \$10,000), omni-font, flatbed scanning system that provides for automatic entry of typeset or typewritten text and graphics into personal computers. The scanner is equipped with a PC expansion card.

DISCOVER combines Kurzweil's Intelligent Character Recognition (ICR) software, graphics capture capability, PC processor board, and a desktop scanner. It also provides for a variety of document format conversion support.

b. Market Segments

The DISCOVER System can be used for a wide range of PC and PC network applications entry, including desktop publishing, data base management, word processing, document conversion, and editable electronic mail. It is used to send documents through LANs or other system programs supporting PC generated files, including mainframes, minis, OA systems, and typesetting systems.

11. LOTUS DEVELOPMENT CORPORATION

(55 Cambridge Parkway, Cambridge, MA 02142)

a. Products/Services

Lotus Development Corporation is a major developer and marketer of microcomputer software products. The company's principal products include 1-2-3® and Symphony™.

In recent years, Lotus has made several acquisitions, including: iL-INK®, a universal micro-to-mainframe link software product, developed by InfoCenter Software, Inc.; GNP Development Corporation with its HAL technology, a natural language interface for 1-2-3; and Graphic Communications, Inc. (CGI), a developer of business graphics software products for IBM and compatible microcomputers. Graphic Communications' primary products, Graphwriter® and Freelance®, can both take data or graphics generated by 1-2-3 or Symphony and turn them into high-quality images for paper, overhead transparencies, or 35 mm slides. Earlier acquisitions included: Dataspeed, which develops products that receive financial market quotations by FM sideband transmission, and Software Arts, Inc., which developed VisiCalc, TKsolver, and Spotlight microcomputer products.

An Electronic Mail Products Group was formed in 1986 to establish Lotus in the electronic mail market.

12. MICROSOFT CORPORATION

(16011 N.E. 36th, Box 97017, Redmond, WA 98073)

a. Products/Services

Microsoft designs, manufactures, and markets microcomputer systems and applications software and microcomputer peripherals. Approximately 87% of Microsoft's 1987 revenue was derived from software products (49% systems software and 38% application software). The remaining 13% of revenue was derived from hardware and book sales.

The company's largest selling software product to date is MS-DOS®, introduced in 1981. Its business application software products provide word processing, spreadsheet, file management, graphics, communications, and project management capabilities for both the MS-DOS and Macintosh environments. Other applications are provided on CD-ROM disk. Microsoft is the leading supplier of Macintosh applications software.

b. Markets Served

Microsoft markets its software and hardware products through four primary channels of distribution: domestic OEMs, domestic retail, international OEMs, and international retail.

c. Recent Activities

Major announcements/product introductions made during fiscal 1987 and the first half of fiscal 1988 include the following:

- Microsoft Operating System/2 (Microsoft OS/2)
- Microsoft OS/2 LAN Manager, an advanced local-area network operating environment
- XENIX System V/386, an 80386-based version of XENIX (Microsoft's implementation of UNIX System V)
- Microsoft Works, an integrated software product for the Macintosh that contains a spreadsheet, data base program, word processor, and communications tool
- Microsoft QuickC compiler for IBM and compatible microcomputers

- Microsoft PowerPoint, the desktop presentation program for Macintosh computers
- Microsoft Bookshelf, a library of 10 reference tools on a single CD-ROM disk
- An alliance with Hewlett-Packard and Aldus Corporation to promote the Microsoft-based solution (graphics users interface) for the desktop publishing market for machines running the MS-DOS operating system
- An agreement with American Airlines, to provide its integrated office automation software product, Microsoft Works, on the SABRE Travel Information Network
- The SQL Server, a relational data base server software product for local-area networks, being jointly developed by Microsoft, Ashton-Tate, and Sybase, Inc. SQL Server runs on top of OS/2-based networks, including MS OS/2 LAN Manger and IBM OS/2 LAN Server. The SQL Server is designed to facilitate the development of multiuser applications for workgroup computing problems. SQL Server can run on a network server machine with either the MS OS/2 LAN Manager or the IBM OS/2 LAN Server.

13. MEDIA CYBERNETICS

(8484 Georgia Avenue, Suite 200, Silver Spring, MD 20910)

a. Products/Services

Media Cybernetics develops and markets graphics and imaging software for IBM microcomputers. Its HALO-based software has become an industry standard for graphics and imaging. HALO-based products form the foundation for other products developed and distributed by 150 Independent Software Vendors (ISVs). HALO supports more than 100 graphics and imaging hardware devices and 15 programming languages. The success of the HALO product line makes Media Cybernetics one of the leading factors in the graphics and imaging software markets.

The company also provides custom graphics and imaging workstation configuration services for federal and state government agencies, educational institutions, research facilities, and Fortune 500 corporations.

HALO offers programmers and software developers a complete environment in which to develop graphics and imaging applications. HALO consists of a library of 190 graphics subroutines, 144 device drivers, and 18 language binds. HALO has become a microcomputer industry de facto graphics standard; it is used by more software developers (over 235) than any other program of its type.

HALO-based applications have been developed for use in such diverse industries as CAD, graphic arts, computer-based training, desktop publishing, telecommunications, mapping, etc. Dr. HALO III is most often used in developing video (slide show presentations) along with high-resolution (EGA) color video cards.

The company's principal product for the desktop publishing market is HALO DPE, a graphics editor that is a combination of image scanning software and a desktop publishing program that allows users to merge word processing text with graphics and scanned images. It is more frequently used as an add-on to Ventura and PageMaker. Graphics created or scanned with HALO DPE can be added to these programs easily because HALO DPE lets the user read and write CUT, TIFF, and IMG file formats. It is also bundled as part of other workstation-based integrated desktop publishing offerings.

Particular functions of HALO DPE include:

- Runs with over 90 graphics displays, scanners, mice, digitizers, and printers
- Manages full capabilities of scanners for input of photographs and line art
- Provides advanced printer drives featuring 300 DPI for laser printers and color dithering for inkjet printers
- Supports high-resolution monitors
- Provides HALO, Windows, and GEM compatibility
- Reads ASCII files and works with most word processing software
- Runs with Aldus' PageMaker, Ventura Publisher Edition, and other word-based desktop publishing software.

HALO 88, a library of graphics sub-routines, can be used to develop desktop publishing programs that incorporate the functions of HALO DPE.

The company's other principal product offering is the Image-Pro Library, which is the leading micro-based image processing software offering.

Image-Pro II has the largest installed base of micro-imaging users. It has also become a de facto standard for PC-based image processing. Image-Pro is currently being used in imaging applications such as publishing, medical research, remote sensing, and satellite image analysis.

b. Markets Served

Media Cybernetics is unique in the PC graphics and imaging marketplace in that it is the only company to offer software at both the programmers' toolkit and end-user application levels.

The company markets its products through a variety of channels that varies by product. The basic distribution channels include direct sales of packaged products to distributors, dealers, and end users; royalty agreements with software publishers; author and site licensing contracts with software developers and corporations; and bundling and coupon arrangements with OEMs.

c. Company Strategy

In targeting the Independent Software Vendors (ISVs) market, Media Cybernetics customizes a software licensing plan for each type of HALO implementation. The ISV can select single product, multiple product, unlimited product, and volume options. Large corporate ISVs often choose HALO's site, volume, author, or source code licensing plans. This helps make HALO licensing affordable for small to large software developers.

14. NOVELL, INC.

(122 East 1700 South, Provo, UT 84601)

a. Products/Services

Novell offers a full line of networking solutions and mainframe communication products that provide resource sharing, multiuser systems, inter-network bridges, and networking to host communications. Novell's NetWare operating system bridges over 30 different network topologies, including the IBM Ring and IBM PC Network, with total compatibility.

Advanced NetWare is a major factor in the file server operating systems market for PC LANs.

Advanced NetWare, also provides for fault tolerance as well as a company-wide network solution.

b. Markets Served

Novell markets through all major channels of distribution—OEMs, retail chains, distributors, dealers, VARs, and major end users.

c. Company Strategy

To maintain its leadership position in the PC LAN network operating system, Novell makes its software available to all eligible suppliers of PC LAN hardware and assists these suppliers in the market.

The company also has a major program to encourage independent developers of application software to port their programs to NetWare. Overall, the strategy is to maintain the position of NetWare as an industry standard in network systems software.

Novell also supports other major communications de facto standards as well as providing compatibility with most other leading network operating systems.

In addition, Novell works closely with IBM in product development. IBM is also a reseller of Novell's product.

d. Recent Activities

In June 1988, Novell announced a NetWare SQL network data base server product that will support a number of leading data base management systems software packages and a Message Handling Service (MHS), a message transfer and routing facility that is available as part of NetWare.

In the fall of 1988 Novell announced that it was acquiring a 60% stake of Indisy Software, Inc., a developer of multi-vendor and IBM connectivity products for NetWare. For Novell LAN to IBM mainframe connections, Indisy will port 3270 file transfer and electronic mail to Novell's MHS, which was developed by Action Technologies, Inc. MHS has two communications application programming interfaces for writing programs that support Systems Network Architecture (SNA), High-Level Data Link Control (HDLC), and X.25 wide-area networks. With the MHS Mailbridge Server, jointly developed by Action Technologies and Soft-Switch, Novell's MHS can also support IBM's Professional Office System (PROFS) electronic mail and Digital Equipment Corp.'s All-In-One office network system.

e. Future Directions

Novell has announced that NetWare will support OS/2 as a workstation operating system. It also plans to add value in the areas of connectivity to OS/2.

It is Novell's stated mission to be the connectivity solution for corporate-wide computing needs. The company Advanced NetWare product will

be enhanced to tie networked applications into corporate-wide networks with minicomputers, mainframes, and LANs from such vendors as Digital Equipment, IBM, Prime, Data General, Hewlett-Packard, and others. Novell has also announced that although it will support IBM OS/2 Standard Editions, it will not license the Microsoft OS/2 LAN Manager.

15. OCTEL COMMUNICATIONS CORP.
(890 Tasman Drive, Milpitas, CA 95035)

a. Products/Services

Octel Communications, founded in 1982, has become a leader in the area of voice processing/voice messaging/voice mail systems. The Aspen (Automated Speech Exchange Network) is its principal product line. The company's products can be integrated with a variety of PBXs and Centrex systems, including those of AT&T and IBM's Rolm subsidiary, and networked with each other through AspenNet to offer not only company-wide but international voice messaging as well. Its Aspen Maxum, which began shipping in the fall of 1986, supports up to 7500 users on a single PBX.

Octel's systems provide a multi-application voice processing/messaging functionality, with the ability to solve communications problems, as well functionality in the areas of call handling and routing, information dissemination, and transaction processing. In addition to its standard voice messaging (telephone answering and voice mail) software and automated attendant capabilities, the Aspen Maxum provides option features such as Information Center Mailboxes and Enhanced Call Processing.

Among its other benefits, integration between a voice messaging system and a PBX or Centrex allows outside callers to leave a message without a touch tone phone or without knowing the mailbox number of the person they are calling. The fact that Octel Communications voice processing equipment can be integrated with many different types of PBXs gives the company a competitive advantage in the Fortune 100 market where companies may be using a variety of different PBX products.

AspenLink, introduced in February 1987, allows Aspen to be connected to host computers, allowing callers to interact, using voice response technology, with a data base on a host computer by using their touch tone telephone as a terminal. This capability provides an opportunity for software developers to provide customized solutions in vertical markets for the AspenLink product. The first application for AspenLink was developed by Innovative Computing, a software VAR, for the trucking industry. It allows trucking companies to locate and dispatch drivers, track shipments, drivers and dispatchers to exchange information, and provision of driver services, such as approving cash advances and final

authorizations and recording hours of service. AspenLink currently interfaces with the IBM System 36/38 (5251-type terminals) and IBM mainframes (3270-type terminals).

b. Markets Segments

Octel Communications has established a strong market position in the large corporate and service bureau segments of the voice processing/messaging markets. In addition to targeting the Fortune 1000 companies, it also directs its sales efforts at the following vertical markets: pharmaceutical, computer, finance, insurance, manufacturing, aerospace, legal, and medical. Six of the Regional Bell Operating companies are also customers.

In addition to a direct sales force, the company distributes its products through major telephone interconnect distributors, which include, among others, Bell Atlanticom systems, PacTel infosystems, and RCA Service Company. The company also has marketing representatives in Australia, British Columbia, and Singapore.

AspenLink is targeted more for the Valued-Added Resellers, OEMs, and software developers who are developing voice response or voice transaction processing applications.

c. Company Strategy

Unlike many other voice processing systems, Aspen's technology has been designed to handle the special requirements of voice processing system applications rather than using computer equipment primarily designed for text or data processing.

16. SPEECH PLUS, INC.

(640 Clyde Ct., Mountain View, CA 94043)

a. Products/Services

Speech Plus, Inc., manufactures and markets the CallText family of voice response products that feature multiple host connectivity and application development tools. The products include both the common "stored voice" text-to-speech conversion capability for "speaking" any computer-resident information over the telephone to authorized callers.

b. Market Segments

A principal application for Speech Plus's product in the office systems environment is electronic mail. Speech Plus's principal sales channel is through resellers but it also markets to selected vertical markets.

c. Recent Activities

In early 1988, the company announced Voice Gateway System for Data Base Access. This new product incorporates the company's proprietary text-to-speech output technology with stored (digitized) voice output in the same system. The Voice Gateway System (VGS) gives companies and their customers direct access to any computer-resident information via a touch tone telephone. The text-to-speech output capability allows the CallText Voice Gateway System to convert data base information—names, addresses, product descriptions, electronic mail—into voice for appropriate responses to unpredictable queries.

17. SPEECH SYSTEMS INCORPORATED (18356 Oxnard Street, Tarzana, CA 91356)

a. Products/Services

The company developed the first commercially available phonetically-based speech recognition product, the Phonetic Engine.

After five years of basic research, the company's first products for natural speech recognition were announced in November 1986. The company's principal products include:

PHONETIC DECODE™ software that runs in a general purpose computer. It accepts phonetic code strings and translates them into word output;

SPEECH INPUT DEVELOPMENT SYSTEMS, which are operational systems with software products and tools to integrate natural speech recognition into applications.

These include: the Phonetic Engine (a computer peripheral) along with its support software, the Phonetic Decoder™, and the Phonetic Profiler™. This system permits true, natural speech input to computer-based equipment, allowing continuous speech with no required or unnatural pauses, and large vocabularies of over 30,000 words. Speech Systems also provides software development tools that permit system designers and integrators to add speech input to existing applications.

The key to the company's natural speech recognition is Speech Systems' proprietary technology, termed Empirical Artificial Intelligence or EAI. The model consists of a series of parameterized rules combined with expert knowledge and an extensive data base of phonetically labelled speech.

The competing technology is template-based, voice data entry (VDE), which forces a speaker to pause between words and limits choice of vocabulary and syntax because of the limited vocabulary of the system. The template-based technology is often limited to approximately 1,000 word vocabularies.

In 1986 NYNEX, the regional Bell operating company, signed an R&D contract with Speech Systems to work to integrate Speech Systems' VoiceLine, which transforms speech into computer-readable text. The objective is to integrate voice output with an electronic mail system.

b. Market Segments

The company markets its products primarily to OEMs and value-added resellers. A general market exists for interactive applications, where typed input can be replaced by speech.

The Speech Input Development System is sold to system developers for integration with applications that are to be driven by voice.

The major market for the company in the automated office environment will be the speech-to-text market, which is still in a development stage.

18. SOFTWARE PUBLISHING CORPORATION

(1901 Landings Drive, Mountain View, CA 94303)

a. Products/Services

Software Publishing Corporation (SPC) develops and markets micro-computer-based application software packages designed to increase the productivity of business professionals. The company's current product lines include PFS® for both entry-level and experienced computer users, and Harvard™, for specialized applications. SPC has sold over four million copies of its software products worldwide.

Two of SPC's current products (Harvard Total Project Manager II™ and Harvard Graphics) are enhancements of products acquired with Harvard Software.

b. Markets Served

SPC's customers traditionally have been small- to medium-sized businesses. Beginning in 1986, sales to large corporations, the company's primary new target market, increased significantly.

SPC currently markets the following categories of products:

- Entry products targeted to novice microcomputer users include PFS:First Choice 2.0® and PFS:First Publisher™.

- Professional products targeted to business professionals who are experienced microcomputer users. These products include PFS:Professional File™, PFS:Professional Write™, PFS:Professional Plan™, and PFS:Professional Network™.
- Harvard products, which address specialized applications, include Harvard Total Project Manager II™ and Harvard Graphics (presentation graphics).
- PFS:First Publisher, formerly ClickArt Personal Publisher, a page composition, desktop publisher is targeted for such applications as newsletters, flyers, announcements, and invitations.

The company's primary channels of distribution worldwide are software distributors, retailers, and corporate and small-business end users.

c. Company Strategy

Software Publishing originally addressed the low-to-medium level power users with an easy-to-use product approach. A more recent new product approach has been to provide more powerful programs while still retaining the relative ease-of-use features. This new market niche has been targeted for the office professional, in particular.

d. Recent Activities

In April 1988 Software Publishing and Autographix signed an agreement that allows Harvard Graphics users to receive 35mm slides and transparencies overnight. Through the agreement, users will be able to send chart files to Autographix Imaging Centers in several major cities via a modem or a floppy disk and receive slides or transparencies back in less than 24 hours.

e. Future Directions

SPC plans to continue to target its products to corporate end users, develop new products for the OS/2 environment, and continue to increase the power of its products operating under the MS-DOS operating environment. SPC will also continue the expansion of its international marketing activities.

The next stage of company product development will stress an integrated office solution with enhanced graphics and data base functionality. Additional software products will also enhance its strong Harvard presentation graphics application. The company's word processing focus will likely be more towards document processing in electronic publishing.

19. VERITY, INC.

(1550 Plymouth Street, Mountain View, CA 94043)

a. Products/Services

Verity is a document data base management company. In June 1988, the company announced the availability of its first document retrieval product, TOPIC, since the company was spun off from parent company, Advanced Decision Systems, Inc., in April of 1988.

TOPIC lets users search and retrieve text in large data bases using a special set of capabilities that go beyond standard Boolean search techniques to conceptual searches. TOPIC, as a rule-based approach to full-text document retrieval, is a powerful new object-oriented query language.

For each user query, TOPIC will compute the degree of relevance to every document in the data base and present the documents sorted by their relative score.

TOPIC accomplishes this relevance rating by using "weighted" keywords and subtopics.

TOPIC is also designed for a distributed computing environment where files exist in multiple formats on multiple computers. It can retrieve documents from personal computers and workstations, as well as from departmental computers in their native formats.

Essentially, TOPIC represents an implementation of an expert systems approach to the textual search market. It allows for a knowledgeable user at a company to create a library of topics selected by an "expert" on a topical area and thus provides casual users access to a retrieval expert's knowledge.

b. Market Segments

TOPIC can be used on personal computers, mainframes, and networked environments of UNIX, VMS, and MS-DOS computers.

The company markets its products directly to organizations in the commercial sector that are dependent on the quick and accurate retrieval of online text data. This could also have importance in the corporate office automation environment.

20. VOTAN

(4487 Technology Drive, Fremont, CA 94538)

a. Products/Services

Votan is a leading supplier of computer-based voice recognition systems.

In the office systems market, Votan's product line includes PC Executive Secretary, messaging software that accepts voice commands, screens calls, records, retrieves, and broadcasts messages. The PC Executive Secretary is a hardware/software package that adds a number of voice functions to IBM PCs, including continuous voice recognition, voice messaging, and telephone management.

Votan's voice recognition systems are incorporated into PC-based voice mail systems. Its principal product offering in voice mail is VOTAN TeleCenter, an interactive messaging system for companies or departments with 20 to 400 employees.

In late 1987, Votan announced a program to provide seamless integration between its TeleCenter voice mail system and PBXs from major vendors.

b. Market Segments

Votan is a leading vendor in the voice recognition systems market for the factory environment. Currently, the factory setting provides the largest segment of the overall voice recognition market.

21. WANG LABORATORIES, INC.

(One Industrial Avenue, Lowell MA 01851)

a. Products/Services

Wang is one of the leaders in providing integrated information technology offerings for the office environment.

Its principal integrated office systems solution is Wang OFFICE, which provides for the integration of text, graphics, data, image, and voice processing. Other office systems product offerings include WP Plus, an advanced word processing product for the workstation.

In May of 1988, Wang announced a three-tiered electronic publishing strategy. It has since released a proprietary low-end system based on its Word Processing Plus program for text and graphics. At that time it also announced a midrange system consisting of Wang PCs and Aldus Corp.'s PageMaker software. The high-end desktop publishing solution was to have been based on Sun Microsystems' workstations, with Texet Corp. providing the system's composition software, and possibly integrated

with the VS computer systems. Texet produces a product called the Live Image Publishing System, which supposedly would have been ported to the Sun-3 workstation. However, the Texet-Wang project has presumably been discontinued.

Wang's specific communications and networking products include WangNet, a local area networking system; and Wang Systems Networking, for wide-area networking which supports industry-standard and proprietary network architectures.

In particular, Wang has been a leader among computer systems vendors in providing multi-vendor connectivity with Wang's systems. WITA is Wang's basic document interchange architecture for the transfer of information among Wang applications and between Wang and non-Wang computing environments. Under WITA, architectural support is currently available for compound documents (including text, graphics, images, data and voice applications) among Wang's own systems, with automatic document translation to documents on Apple Macintosh, IBM PC, and several other computer systems.

Wang has established a number of third-party software relations to enhance its office systems product offerings.

Wang works closely with Keyword Office Technologies, Inc. and its document interchange software library in providing its integrated solutions. Keyword Office Technologies, headquartered in Calgary, Alberta, designs and markets a variety of systems solutions that allow documents to be exchanged and edited among incompatible office systems. Keyword's document interchange software library currently supports 45 formats covering major computer systems, personal computer, and dedicated word processing systems. Recent additions to the library include support of IBM DCA-FFT (IBM DisplayWrite 4, Microsoft Word (Macintosh), Multimate Advantage, and NBI OAS.

When Keyword's products are incorporated into various Wang applications, the resulting products will provide an effective document gateway from non-Wang to Wang environments.

In 1987, Wang introduced the first of several expected electronic publishing products. Its initial offering is a Desktop Publishing System based on its PC 200/300 series of Professional Computers, as well as the new LCS 15 laser printer. Software offerings include Aldus Corporation's PageMaker™ and Wang's Integrated Word Processing.

In April 1987, the company introduced the Wang Integrated Image System (WIIS), an image processing system that allows for the integration of paper-based image documents with data and text and for the incorporation of processed images into the company's proprietary PACE relational data base management system.

In June 1988 Wang also announced a new software product called Inter-office that was designed for Wang by Boston Software System, Inc. It offers the Wang Office Software System the ability to exchange documents and mail with users of DEC's All-In-One, using a RW-232C serial link to connect the Wang VS to the VAX. The gateway gives users transparent access to each other's office application products. In either environment, users can continue to work with their familiar screens and commands. The software translates Wang Word Processing and WP Plus documents to and from DEC's WPS-Plus without user input. In addition, Wang/IBM gateways currently in place will allow VAX-based interoffice users to exchange information with IBM Professional Office System (PROFS) and Distributed Office Support Systems.

A significant portion of Wang's office systems revenues also comes from education, training, and consulting services.

b. Company Strategy

Wang's strategic goal is to provide integrated solutions encompassing all forms of information.

Future technologies to be emphasized in its office systems strategy are image processing and voice processing.

In the spring of 1987, Wang introduced Wang Integrated Office System (WIOS). WIOS is based on the Wang Business Exchange digital telephone switch and the VS and provides an integrated voice and data communication strategy for the local environment.

A wholly owned subsidiary of the company, Wang Information Services Corporation (WISC) provides for a digital voice mailbox rental product.

22. WORDPERFECT CORPORATION

(288 West Center Street, Orem, UT 84057)

WordPerfect Corporation provides applications software products for a number of microcomputers platforms.

The company's major software program is WordPerfect 4.2, a leading word processing package for the for PC hardware environment. WordPerfect 4.2 is distinguished by its relative ease of use combined with a high-powered, document-oriented functionality. It also has a mail-merge, sorting, and math functions.

Additional products include the following:

- Student WordPerfect, a student version of WordPerfect

- MathPlan, a spreadsheet program
- SSIDATA, a data base tool
- WordPerfect Library, a utilities package designed to integrate other WordPerfect Corporation programs and facilitate sharing of data and switching of programs.

Features include the shell which is a program manager, a calculator, a file manager, a program editor, a calendar, a notebook, and a macro editor.

b. Markets Served

WordPerfect markets its products across all industry sectors. The company sells to educational institutions and large end-user corporations and through various distribution channels in the U.S. and internationally.

c. Company Strategy

A primary goal of the company is to support as many hardware platforms as possible with its application software packages. Among those currently supported are IBM and IBM-compatible PCs, Atari, Data General, and Apple machines, as well as the UNIX operating environment. Software packages, issued both as standalone and as networked versions, currently support PC LANs.

d. Recent Activities

In the spring of 1988, WordPerfect introduced two major new products: WordPerfect for the Macintosh and WordPerfect 5.0 for the IBM PC/PS/2.

A future product for the IBM PC/PS/2 will be WordPerfect Office Program, an extension of WordPerfect Library, that provides support for PC LANs. It will also include electronic file and scheduling programs and access to a shared data base that will support up to 99 data base users.

23. XEROX CORPORATION

(Xerox Square, Rochester, NY 14644)

a. Products/Services

Xerox's desktop publishing products include the Ventura Publisher 1.1 (the leading MS-DOS-based desktop publishing software), and recent introductions including Ventura Publisher 2.0, Ventura Publisher: Pro-

fessional Extension; and Ventura Publisher: Network Server. Ventura Publisher 1.1 and 2.0 run on IBM XT and AT/PCs, PS/2s and compatibles, including the Xerox 6065 personal computer. Both programs are positioned for a wide range of document production sizes, but Ventura Publisher 2.0 is particularly appropriate for longer, more complex document generation.

Ventura introduced the Release 2.0 product upgrade for Ventura Publisher in September of 1988. New features include pop-up menus for improved ease of use, 250 resident self-help features for improving ease of learning, automatic cross referencing features, support for the TIFF graphic file standard (Release 1.1 include support for most other de facto graphics standards), ability to print in color on PostScript color printers, a 130,000 word hyphenation directory, vertical justification for aligning columns with the page bottom, and gray scaling for reproduction of photographs and other graphics.

The new Ventura Publisher: Professional Extension package, an add-on product to the base Ventura Publisher upgrade, enhances the capabilities of Ventura Publisher for technical document publishing requirements. It is particularly well-suited for such market segments as finance, science, insurance, and engineering. It also incorporates Expanded Memory Support (EMS) for larger documents, such as books and technical manuals, and densely packed pages, such as telephone directories and catalogues. Other significant features are the extensive table formatting capability and ease of formatting advanced mathematical equations. It also provides complete WYSIWYG generation of equations.

Xerox Ventura Publisher: Network Server software provides for group work documentation generation, where multiple contributors participate in the writing, editing, graphics or layout of a document. It currently supports 3COM, Novell, and PC Net local-area networks, with other networks supported through the writing of customized loadable network modules.

The Xerox packages provide fully integrated text and graphics, offer multiple views of documents, and drop-down menus for creation or selection of style sheets, graphics, or line art. The programs permit users to generate as many as 64 chapters, with 100 pages in each. Chapters can be strung together to create documents of more than 5,000 pages. In a marketing agreement with Z-Soft Corp, Xerox also markets Z-Soft's PC-based paint software packages, PC Paintbrush+ and Publisher's Paintbrush. These Z-Soft packages also provide linkage between most electronic scanner devices and Xerox desktop publishing software.

Targeted new markets include the very high end of the publishing market, including magazine, newspaper, and book publishers that are currently working with typesetting solutions, as well as vertical markets, particu-

larly the scientific, military, and aerospace markets, which will be attracted by the new formatting features. In particular, the programs include a WYSIWYG (what-you-see-is-what-you-get) equation functionality, where complex tables can be generated and information can be imported from spreadsheet programs such as Lotus 1-2-3.

b. Markets Segments

Xerox, with Ventura Publisher, addresses the high end of the desktop publishing market. Xerox also provides several other systems configurations that address the corporate electronic publishing markets.

c. Recent Activities

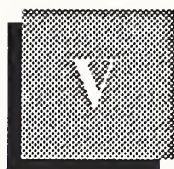
In September 1988, Xerox announced a series of product additions and upgrades to its document processing product lines. These include new Xerox Group Publishing Software, ViewPoint Release 2.0; new Professional Graphics Software, Pro Illustrator Software with IGES (raster) file conversion, Xerox Publishing Illustrator's Software Release 2.2; new ViewPoint Multilingual Enhancements, Hebrew, Vietnamese, and enhanced Chinese and Arabic; new Network Services Software, XNS Release 11.0; new Network Server Hardware, 8089 NS Multifunction Server; new Xerox Production Publishing Software, XPS Release 4.1; and new Xerox Mainframe Publishing Software, XICS Release 5.3.

Xerox has expanded its product offering in the document scanning market with the recent acquisition of Datacopy Corp. Following the acquisition, Xerox consolidated Datacopy with its previous Kurzweil Computer Products acquisition (1980) in document scanning products to form Xerox Imaging Systems, Inc. (XIS). Both companies offer a broad range of optical and intelligent character recognition scanners. XIS recently announced the release of PC Image software Version 1.5 to support Datacopy's family of image processing scanners.



New Opportunities





New Opportunities

A User

Apple Computer, Inc. has recently accelerated its efforts to provide for enhanced connectivity between the Macintosh and computer systems of other leading vendors:

In the IBM environment, Token-Ring and IBM 3270/5250 emulation boards for the Mac II are scheduled for shipment in early 1989.

In addition, DEC and Apple have announced a program to integrate Macintoshes and Appletalk 2.0 into DEC's VAX/VMS 1.0 architecture and DECnet/OSI network.

Other Apple-IBM PC integration solutions include:

- Insignia Solutions, Inc.'s SoftPC is a software package that allows Macintosh personal computers to run MS-DOS applications; however, the run-rate is somewhat slower than it would be on IBM PCs.
- AST Research, Inc. offers two coprocessor boards for running DOS applications on a Macintosh. The Mac 286 board provides the Mac II with the performance of an Intel Corp. 80286-based IBM Personal Computer AT; the Mac 86 is an Intel 8086-based coprocessor board for the Macintosh SE.

With the cost efficiencies of both multi-user and multi-tasking PC/workstation-based operating systems, UNIX will play an increasingly important role in future office systems products. A unique product from Hunter System called XDOS could help accelerate this transition. XDOS is a UNIX compiler that allows an end user, software developer, or computer systems vendor to relatively easily recompile specific DOS applications such as Lotus-1-2-3 into UNIX programs. This allows for more efficient processing than software emulation or coprocessor implementation strategies.

The new window interface offerings for PC/workstations, combined with the multi-tasking capabilities of operating systems such as OS/2 and UNIX, provides new capabilities such as simultaneous access and viewing of data and text data for a particular application.

A next stage in distributed processing integration, cooperative processing, which involves application-to-application coprocessing among multi-vendors, and multi-levels of machines from the same vendor, is beginning to materialize in real product introductions.

- Apollo Computer is offering a network application tool, which has been licensed by IBM and Hewlett-Packard, that will help facilitate this process.
- One of the principal goals of IBM's SAA strategy, synchronous program-to-program communication, is provided through the implementation of IBM's Advanced Program-to-Program Communication (APPC) LU6.2 protocol. (Asynchronous program-to-program communication is provided by SNA Distribution Services (SNADS). Document distribution is provided through its Document Interchange Architecture that provides for end-to-end distribution of documents.)
 - Eventually, this should lead to a much tighter integration of IBM's many hardware and software solutions through standard user interfaces and application compatibility among different operating systems. DEC currently provides a similar capability with multiple levels of hardware all running VMS software and all networked with a common network architecture, DECnet.

(Exhibit V-1)

B

Vendor

1. Graphics

The quality of graphics used for presentations, particularly in currently available integrated spreadsheet-graphics packages, still has considerable room for improvement.

In addition, there continues to be an opportunity for multi-media approaches, which could involve the integration of personal computers, software, video cameras, disk players, and large screen projectors into one system that merges computer-generated graphics with live or recorded video images.

2. Communications/LANs

The increasing demand for interconnectivity related to the demand for distributed data base access, in particular, requires a variety of communi-

EXHIBIT V-1

USER OPPORTUNITIES

- More Efficient Utilization of Resources in a Distributed Processing Environment
- Tighter Integration of Existing Disparate Corporate Resources
- Future Ability to Utilize Multiple Operating Systems and Hardware Platforms from a Single User Interface
- Multi-tasking Software, along with Windowing Technologies, Will Greatly Increase the Flexibility of PC/Workstation Use

cation gateway/bridging/routing solutions for internetwork communications. This provides a market opportunity for independent communications software vendors, VARs, and systems vendors.

Some of the current solutions provided by independent network software and hardware companies include:

- AST Research, Inc., has announced a micro-to-mainframe communications solution for the AS/400 and a LAN-to-AS/400 gateway.
- Mitek Systems Corp. provides a number of SNA connectivity software solutions. Its AS/400 Connectivity Software uses TCP/IP protocols to bridge IBM processors to other vendors' system platforms. Mitek's M2130 SNA Network Server provides a physical connection from an IBM SNA environment to an Ethernet LAN by performing the translation between SNA and TCP/IP protocols.
- Micom-Interlan, Inc. recently introduced a number of products to provide a migration path from TCP/IP to OSI connectivity.
- Other independent suppliers to this market include Digital Communications Associates, Inc. (DCA), Rabbit Software, Inc., and Communications Solutions, recently acquired by 3COM.

- Rabbit Software Corp. recently introduced a new series of IBM-based LAN gateway products, called RabbitGateII, including an upgrade of its remote SNA Gateway and versions for the PS/2. These products enable users from a DOS workstation or LAN to connect to SNA using X.25, binary synchronous communications (BSC), and DFT coaxial mainframe (3270 terminal emulation) sessions simultaneously from multiple windows.

Software for interfacing proprietary electronic mail systems also represents a potentially significant new niche market.

- 3COM Corp. has announced two 3+Mail products that integrate electronic mail services between Apple Computer Macintoshes and IBM minicomputers.
- DEC is working with Pacific Bell to develop interfaces between Pacific Bell's new electronic mail service and electronic mail networks within individual companies.

Another opportunity for communications software developers, in particular, is that of network management software. A network communications manager generally has three elements: data link importing, local network resource management, and support for various protocols such as IBM's 3270, LU6.2 and CCITT's X.25 that provide linkage to remote resources.

- IBM's NetView (for managing Systems Network Architecture (SNA) and NetView/PC (for non-SNA networks) have become de facto standards in this area. However, there is a need for more elaborate internetwork management solutions.
- A more recent IBM offering in this area is its OS/2 Communications Manager, which is an option under OS/2 Extended Edition. It provides access to information located in other local and/or remote systems, network management alerts, and also supports multi-user communications connections.

Peer-to-peer communications among office systems applications running on PCs, minicomputers, and mainframes in the office systems environment will ultimately require applications able to run on a variety of operating systems and hardware platforms. This can be partially implemented through coprocessors, software emulation, compiler tools such as XDOS, or by the development of common application environment software development tools, such as those that will be incorporated in SAA.

In addition, adherence to networking standards such as OSI and X.400 for electronic mail in new computer systems products will contribute to the implementation of a true distributed model that has access to processing resources within and between networks.

To more closely integrate microcomputers from other vendors with its own VAX minicomputers, DEC is rumored to be working with a Phoenix Technologies coprocessor product to provide a PC-compatible environment for 32-bit systems that are not based on Intel Corp. MPUs. Speculation is that this will lead to a new personal computer introduction called PVAX that could run VMS, DOS, and OS/2 in an emulation mode. In addition, DEC has product relationships with such major microcomputer vendors as Apple, Compaq, Zenith Data Systems, and Olivetti to extend its Network Applications Support facilities and provide common access to DECnet/OSI.

3. Voice

Further opportunities exist for product solutions in voice recognition and input, particularly in voice-to-screen transference. A major market opportunity exists for products that can eliminate the need for re-keying dictated material into a word processor.

There are currently a number of vendors in the voice recognition market, and some of the higher priced product solutions are providing natural speech voice recognition with vocabularies in excess of 30,000 words.

- Some of the current leaders in the market for voice recognition systems include Texas Instruments, Kurzweil Systems, Votan, Speech Plus, and Speech Systems, Inc.
- Current limitations of the lower-priced systems include limited vocabularies (approximately 1,000 words) and the necessity to train the system for different voices.

The integration of voice technology with data and other corporate media resources also needs to be addressed through intelligent networks, ISDN technologies and new types of information management architectures, such as object-based technology.

4. Image Processing

In the areas of OCR/image scanning software, there is a need for the following types of software solutions:

- The capability to enter scanned text into spreadsheet and data base formats

- A need for more software to integrate vector graphics used in CAD applications into desktop publishing-related software
- In desktop publishing, the need for more total desktop publishing solutions, that more fully integrate such components as the text processor, graphics editor, and document composition software

Desktop publishing products that more tightly integrate graphics and image solutions should be one of the fastest-growing segments of this market.

An interesting new font development technology in image processing is being pursued by Folio, Inc., which was recently acquired by Sun Microsystems. Folio is developing a totally automated font production tool that accepts character outlines from any of the major vendors and will work on any alphabet, such as Kanji, Arabic, etc. In particular, it could allow for much faster programming of type fonts and increase the quality of print output on laser printers, bringing laser printing quality ever closer to that of that of typeset.

5. General Office Markets

One of the major office systems markets that really hasn't been adequately addressed is that of the office professional. A principal reason why many professionals still won't use desktop computers for word processing or other office systems applications has much to do with the ease-of-use factor. Professionals oftentimes tend to be occasional users, and can find it annoying to try to remember command codes during the intervals of use for a number of programs. Along with this is the fact that many men, in particular, have never learned to type. Therefore, programs with an intuitive type of logic, based on a graphics-mouse drive interface, make a great deal of sense. The implementation of a standard interface also decreases use resistance.

The market for executive information systems could be a major growth segment over the next several years. The basic product concept is to provide in-depth information access for the executive with maximum ease of access. At present, industry studies suggest that less than 10% of senior executives use personal computers. Some current products which address the ease of access issue include:

- A product by Metapraxis which utilizes a number pad and a list of codes that call up charts and graphs on large screens in conference rooms by punching a two-digit number.
- Comshare provides access to financial information by touching a screen.

- Pilot Executive Software provides access to its system with an electronic mouse.
- Also part of new executive information systems is groupware that promotes managerial interaction. One product in this area is Coordinator, from Action Technologies.
- The executive information systems market will increasingly require more vertical software in addition to the generic horizontal programs now characteristic of much of the office systems applications market. This provides an opportunity for independent software developers and systems integrators to build such vertical applications for de facto office networking environments such as DECnet/OSI, SNA, and SAA. DEC recently released specifications for a compound document management architecture that is designed to encourage third-party application linkages.

Another product area for the professional or executive user in particular, is personal information managers or PIMs. A PIM combines the functions of a Rolodex, data and address book, note pads, etc. in a data base management storage and retrieval structure. One of the more versatile of the current PIMs is Valor Software's Info-XL for an IBM PC/PS2 environment, which is based on multiple windows for the various personal manager functions.

Document management, along with text search applications, will provide a major product opportunity over the next several years. This technology provides access to the unstructured data from word processing and other document sources. Verity, Inc., with its TOPIC (TM) full-text retrieval software that allows for searches based on conceptual structures, is a technology leader in this market. TOPIC uses expert systems technology to develop the library indexing structure.

Software and systems developers should address the quality of documentation for the office systems software. A professional, let alone a clerical staff member, should not have to read through several manuals, perform extensive cross referencing, and spend dozens of hours learning a relatively simple office application. If the help programs and the program introductions were written on a more conceptual level, the learning process would go much faster, the learning would be more easily retained, and again the resistance to use would be reduced.

A major opportunity in the office systems software area is for more UNIX-based applications. At this point, the commercial acceptance of UNIX is accelerating, and at the same time, there are far fewer major ISVs with office systems solutions for UNIX than for DOS and OS/2. The fact that UNIX also offers such flexibility as true multi-user and

multi-tasking capability is also a major endorsement for UNIX in the office environment. In addition, UNIX provides one of the lowest cost-per-user software solutions. If X/Open is successful in establishing a common application environment for UNIX, it should further accelerate the development of UNIX-based applications for the office environment.

Office systems applications with embedded expert systems could also provide a significant competitive edge in marketing to the professional/senior management level of the corporate office systems market. Such applications could increase ease of use as well as aid the pre-selection process in use of executive information applications. Specific programs might also include the incorporation of elements of artificial intelligence to reduce the number of keystrokes necessary in the use of office systems applications. Artificial intelligence also has a role in further perfecting such technologies as voice processing. Voice-to-text input of natural language commands could spur a major new development cycle in office systems solutions. In addition, embedded expert systems technology is being successfully incorporated into various text search programs. Text search management software programs, as a very productive way of reducing the paper file approach to information retrieval, could be a major growth area.

The integration of vertical applications with cross-industry office systems solutions into a total company-wide information systems strategy provides another opportunity for ISVs, computer systems vendors, and systems integrators. For example, Ross Systems has recently provided an interface for its MAPS family of VAX-dedicated accounting, executive information systems (EIS) to DEC's All-In-One office automation software system.

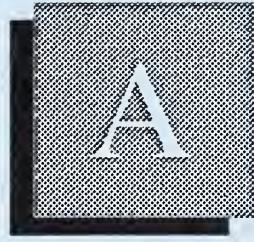
The utilization of standard user, programming, and communications interfaces, such as the IBM SAA model, in future office systems software, will more tightly integrate the office systems environment with the general corporate information and applications resources. This could have the effect of turning office systems technology into the computer information center for access to corporate-wide resources by a company's professional and managerial staff.

A growth area in electronic network services could be in store and forward fax services. With the development of international standards in the fax market in recent years, the use of private network fax transmission has grown substantially. However, there is an increasing need for public network store and forward "fax" mailbox service programs to provide local dialup access for multi-point delivery of fax services that further reduce the cost of large-volume transmissions. (See Exhibit V-2)

EXHIBIT V-2

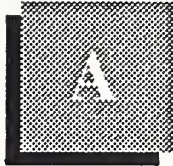
**VENDOR OPPORTUNITIES IN OFFICE
SYSTEMS APPLICATIONS**

- Integration of Structured and Unstructured Data/
Text Management Resources
- Integration of Voice, Data and Other Media in a
Single Storage and Delivery Environment
- Use of Expert Systems Technologies to Increase
Ease of Use and Flexibility of Both Traditional and
Future Office Applications
- Utilization of Standard Interface Architecture such
as SAA Will Increase Programing Efficiency and
Portability
- Perfection of Voice Recognition Technologies
Needed to Achieve Elusive Voice-Input Solution
for Word Processing EIS Applications



Appendix: Forecast Data Base





Appendix: Forecast Data Base

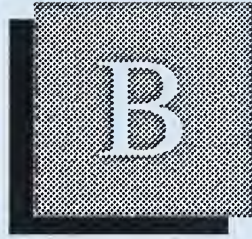
- This appendix contains the following forecast information on the principal office systems cross-industry delivery modes:
 - Market size by delivery mode for 1986 and 1987
 - Projected market growth rates by delivery mode for 1988-1993

EXHIBIT A-1

**OFFICE SYSTEMS SEGMENTATION
BY PRINCIPAL DELIVERY MODE, 1987 - 1993**

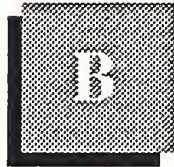
(In Millions of Dollars)

Sector by Delivery Mode	1987	Growth 87-88 (Percent)	1988	1989	1990	1991	1992	1993	CAGR 88-93 (Percent)
Total Office Systems Sector	1,755	21	2,123	2,524	2,994	3,550	4,209	4,996	19
Processing Services	43	-2	42	40	39	37	36	34	-4
- Transaction Processing Services	43	-2	42	40	39	37	36	34	-4
- Systems Operations	0	NA	0	0	0	0	0	0	NA
Network/Electronic Information Services	0	NA	0	0	0	0	0	0	NA
- Electronic Information Services	0	NA	0	0	0	0	0	0	NA
- Network Applications	0	NA	0	0	0	0	0	0	NA
Application Software Products	963	28	1,230	1,497	1,820	2,218	2,704	3,300	22
- Mainframe	166	6	176	186	197	209	221	234	6
- Minicomputer	119	7	127	141	150	161	171	181	7
- Workstation/PC	678	37	927	1,171	1,473	1,848	2,312	2,885	25
Turnkey Systems	750	14	851	986	1,135	1,295	1,470	1,662	14
Systems Integration	0	NA	0	0	0	0	0	0	NA
Professional Services	0	NA	0	0	0	0	0	0	NA



Appendix: Forecast Reconciliation





Appendix: Forecast Reconciliation

Office systems market coverage, apart from its inclusion in prior "other cross-industry sector" reports, was initiated with this report.

Remaining markets included in the 1988 "other cross-industry sector" annual report are: cross-industry sales, marketing, and distribution and the mid- to high-end segments of the electronic publishing market. The desktop publishing segment of the electronic publishing market is included in the data base of the office systems market.

Office systems market segments not included in prior "other cross-industry sector" reports include voice processing (\$250 million market, 1987) and image processing (\$100 million market, 1987) under the turnkey systems delivery mode.

Due to the market definition changes identified in the 1988 "other cross-industry sector", a data base reconciliation of the 1988 "office systems" and 1988 "other cross-industry sector" will be initiated in 1989.

