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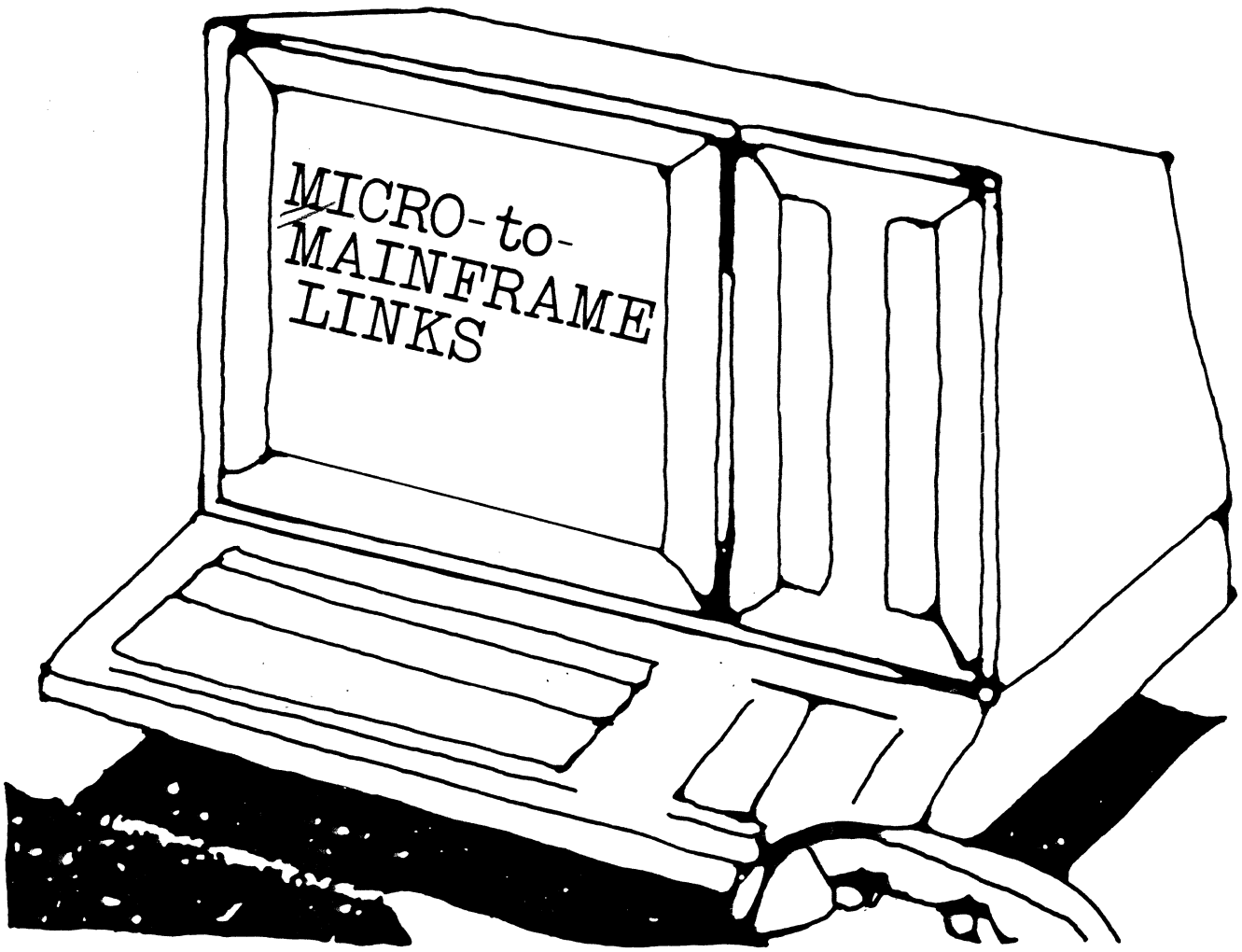

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CHAPTER ONE
OVERVIEW OF MICRO-TO-MAINFRAME LINKS: DBMS, COMMUNICATIONS, AND CONFUSION

I. Introduction

Even though microcomputers can talk to mainframes by emulating data terminals, this type of communications capacity often is not good enough. Users need help finding and recognizing information at the mainframe level and dropping the information into a familiar business microcomputer application in a usable form.

As a result, a new class of software, the micro-to-mainframe link, is being developed. On a very basic level, the Yankee Group defines micro-mainframe links as software that facilitates the movement of data between microcomputers, minicomputers, and mainframes. But there is a great deal more to true micro-to-mainframe links than just simple communications.

A. Definition of Micro-to-Mainframe Link

Although the terms micro-to-mainframe link and micro-to-mainframe system may be used interchangeably, the Yankee Group believes there is a distinct difference between micro-to-mainframe links and systems. Micro-to-mainframe links can be anything from a modem to a communications package to a full complement of software containing a microcomputer application, a communications link, and a mainframe application.

While many micro-to-mainframe links connect to database management systems (DBMS), these systems do not necessarily need a DBMS at the mainframe level to be "true" micro-to-mainframe links. (For example, McCormack & Dodge, General

Electric Software Division, Management Sciences of America (MSA), ADP Network Service, etc. offer systems that connect to accounting, general ledger, and payroll programs running on minicomputer and mainframe.)

While many vendors advertise micro-to-mainframe links, most of these products fall in the first two levels of the Micro-to-Mainframe Model described later in this chapter. Essentially, these products are "bridges" to the mainframe world, but often they don't supply the vehicle for moving information between microcomputers and mainframes.

(For the purposes of this report, business-oriented microcomputers and desktop computers [DTCs] are considered the same and these terms will be used interchangeably.)

B. Micro-to-Mainframe System

A true micro-to-mainframe system contains the following elements:

- a business microcomputer application(s);
- communications;
- upload capability (update is optional, but not always desirable for security reasons);
- download facility (into familiar applications);
- query capability (possibly for several levels of users with varying DP expertise);
- extract facilities (for moving data back from large systems applications to microcomputer software packages);
- large system application (DBMS, general ledger, payroll, acounting, inevntory, personnel, etc); and
- security facilities for determining levels of access.

II. Are Micro-to-Mainframe Links High Tech Snake Oil?

The term micro-to-mainframe link means about as much as such previously inducted members of the buzzword hall of fame as "integrated," "multifunctional," and "easy-to-use." There are a slew of products touted as "micro-to-mainframe" links, but in truth there exists only a limited number of products that actually fit into the Yankee Group's definition of this product.

A. Micro-to-Mainframe Myths and Fairy Tales

Why does the Yankee Group believe that many products called "micro-to-mainframe" links are little better than high tech snake oil?

- first, many of these products have only been announced, not delivered;
- second, many hardware products (modems, multiplexors, cluster controllers, protocol converters, 3270 boards, etc.) that are advertised as micro-to-mainframe links are only part of a micro-to-mainframe system. The software part of a micro-to-mainframe system is significantly more important than the hardware;
- third, micro-to-minicomputer links may be more appropriate than micro-to-mainframe since mainframe-based applications are frequently oriented towards programmers, and not end users.
- fourth, micro-to-mainframe links, even when sold as "complete" systems, are often only a transportation system. Organizations using these systems must still determine which users get various "licenses" to travel this system;
- fifth, many vendors claim the ability to move mainframe files into DIF (data interchange format) for use in popular microcomputer applications (such as VisiCalc, Multiplan, SuperCalc, dBASE II, and Lotus 1-2-3), but only VisiCalc can read DIF

files without the user specifying relationships between data files. Many times this rigorous task is beyond the expertise of microcomputer users. This situation is slowly getting better, but micro-to-mainframe buyers should be wary of DIF file compatibility claims and ask to have it demonstrated with their favorite microcomputer software package;

- sixth, few links work with other companys' software (e.g. they are tied to a particular mainframe application);

- seventh, software packages that run on both microcomputers and minicomputers/mainframes are not "true" micro-to-mainframe links unless they provide communications, query languages, and extract facilities;

- eighth, several vendors don't offer:

  1. high level error checking, which is important where accounting, inventory, and general ledger packages are concerned;

  2. ASCII to EBCDIC conversions (for moving data from mainframe applications to microcomputer applications);

  3. synchronous communications. All vendors offer asynchronous communications, but these packages often fail to meet users' needs for the higher speeds and better error checking offered with synchronous communications.

B. Benefits of Micro-to-Mainframe Links

Micro-to-Mainframe Links suffer from a variety of problems, but even current products offer users many benefits such as the ability to:

- upload data to general ledger, accounting packages, and personnel records;

- consolidate data at a mainframe level;

- take advatage of superior mass storage capacity, higher processing power, similar

applications (such as FOCUS and EPS) and graphics packages that are available on micrcomputers but lack some of the mainframe versions' high-level features;

- download data from mainframe applications to microcomputer applications (such as spreadsheets, word processing packages, database managers, graphics, etc.) without re-keying;
- share costly peripherals such as high speed printers, graphics devices, and phototypesetters that cannot be cost justified for individual microcomputers;
- replace data terminals with microcomputers at approximately the same cost or less while gaining the benefits of standalone processing;
- store and distribute (via electronic mail) data throughout an organization.

III. Scope of Report

The Yankee Group sees four levels of micro-to-mainframe links. This report will describe each level, but the major emphasis will be placed on the third and fourth levels, where the Yankee Group feels vendors are offering full-fledged micro-to-mainframe systems. Since micro-to-mainframe links are basically software, this report will concentrate on the software aspect of micro-to-mainframe links. Modems, multiplexors, and cluster controllers have their place in micro-to-mainframe systems, but they are only one part of these systems. Finally, this report seeks to analyze how individual micro-to-mainframe systems address the following questions:

- How does the user find, copy (or extract), and download data from a mainframe application to a microcomputer application?
- How does the user store this information in the proper file or document on the mainframe?
- How does a microcomputer user transfer or upload data to a mainframe-based application?

IV. Market for Micro-to-Mainframe Links

By the end of 1983 there were over 15,000 mainframes and more than 5 million DTCs installed in U.S. businesses. Moreover, users will spend over $1.5 billion on business microcomputer software and $1.8 billion on mainframe packages in 1984. All this represents a substantial market for micro-to-mainframe links, especially when one considers the fact that 49% of the respondents to a recent Yankee Group survey ranked micro-to-mainframe links the most important user interface with applications software. Nonetheless, just as any large new market encourages a rush of products, the micro-to-mainframe market has unleashed a deluge of both solid and questionable products on the market.

Micro-to-mainframe links encompass all the popular high technology buzz words (integrated software, mainframe communications, personal computers, database management systems, etc), but their vendors are making and breaking more promises than politicians. Numerous vendors are selling communications hardware and many software vendors also offer packages billed as micro-to-mainframe connections, but very few vendors have actually packaged and delivered complete systems.

V. Types of Micro-to-Mainframe Vendors

Within each of the classifications noted in Table 1-1, there are several different approaches to micro-to-mainframe links. Cullinet, Comshare, and Oracle have moved either a full implementation or a subset of their mainframe software to the DTC level. Other companies such as McCormack & Dodge and Lotus, Informatics and VisiCorp allow DTC users to move files from mainframe-based directories to commonly used DTC applications such as Lotus Development Corp.'s 1-2-3 and VisiCorp's VisiCalc.

MSA/Peachtree gives users another choice by providing the necessary communications software and file conversion utilities to allow DTC users access to mainframe-base application and data. GEISCO and ADP take still another approach by leasing and/or renting DTCs to their customers and providing software tools at both the mainframe and micro levels.

VI. Four Levels of Micro-to-Mainframe Links

As figure 1-1 (Linking Micros to Mainframes) shows, the Yankee Group sees several levels of micro-to-mainframe products. While all four levels fit under the banner of micro-to-mainframe links, only the third and fourth levels represent true systems, and many of the products lack some of the components described in the Yankee Group's aforementioned definition of "full" micro-to-mainframe systems.

These levels do not necessarily imply that the higher levels feature more friendly software. Overall, the third level contains the most "user-friendly" interfaces and access methods. Even though Level Four packages represent significant functional advantages, they also present many confusing implementations of this concept, as can be seen in the following four levels of micro-to-mainframe links. As the levels increase so does the "power" of the software.

A. First Level

Products in this category are principally communications programs. This group contains two subcategories: asynchronous and synchronous communications packages and hardware devices (modems and 3270 boards). This category also includes the built-in terminal emulation features offered on microcomputers like IBM's 3270 Personal Computer, Wang's Professional, and Digital's Rainbow.

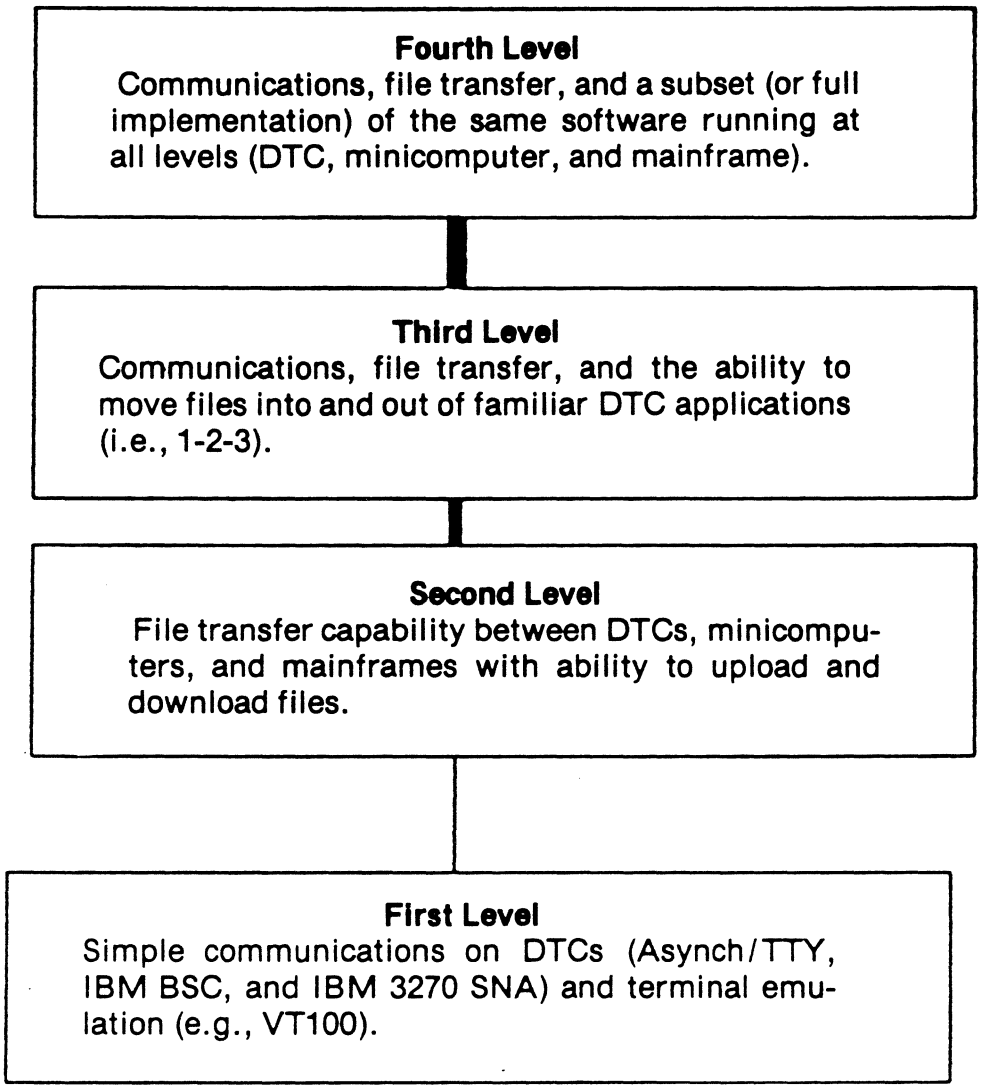
TABLE 1-1
TYPES OF MICRO-TO-MAINFRAME VENDORS

Mainframe Software Vendors	
Cullinet	MSA/Peachtree/Lotus
Oracle	Comshare
Information Builders Inc.	Informatics/VisiCorp
Cincom*	ADR/VisiCorp
CCA/Lotus	McCormack & Dodge/Lotus
Mathematica	
Service Bureaus	
GEISCO	ADP/Lotus
Hardware Vendors	
IBM	Honeywell
Wang	Digital Equipment Corp.
Data General	Apple Computer

* Unannounced

Source: the Yankee Group

FIGURE 1-1
LINKING MICROS TO MAINFRAMES



Source: the Yankee Group

B. Second Level

Products in this area enable file transfers from a microcomputer to a mainframe or minicomputer. While level I products can also transfer files, these products are generally limited to ASCII or binary text files. Second-level products, however, can transfer formatted files between microcomputer and mainframes without deleting format controls.

Basically, level II products are a new breed of "super-micros" that can run both microcomputer, minicomputer, and mainframe software on the same machine. Examples of level II products include: IBM's XT/370, Digital's Professional 350, Digital's micro PDP-11, Digital's micro VAX, Honeywell's Micro-System 6/10, and Data General's Desktop Generation Series.

Even though these machines offer the capability to run minicomputer software, their lack of query and extract facilities limits their use in micro-to-mainframe systems at present. In the future, these versatile microcomputers will certainly provide the basis for extemely powerful micro-to-mainframe systems, but software necessary for these systems is currently unavailable.

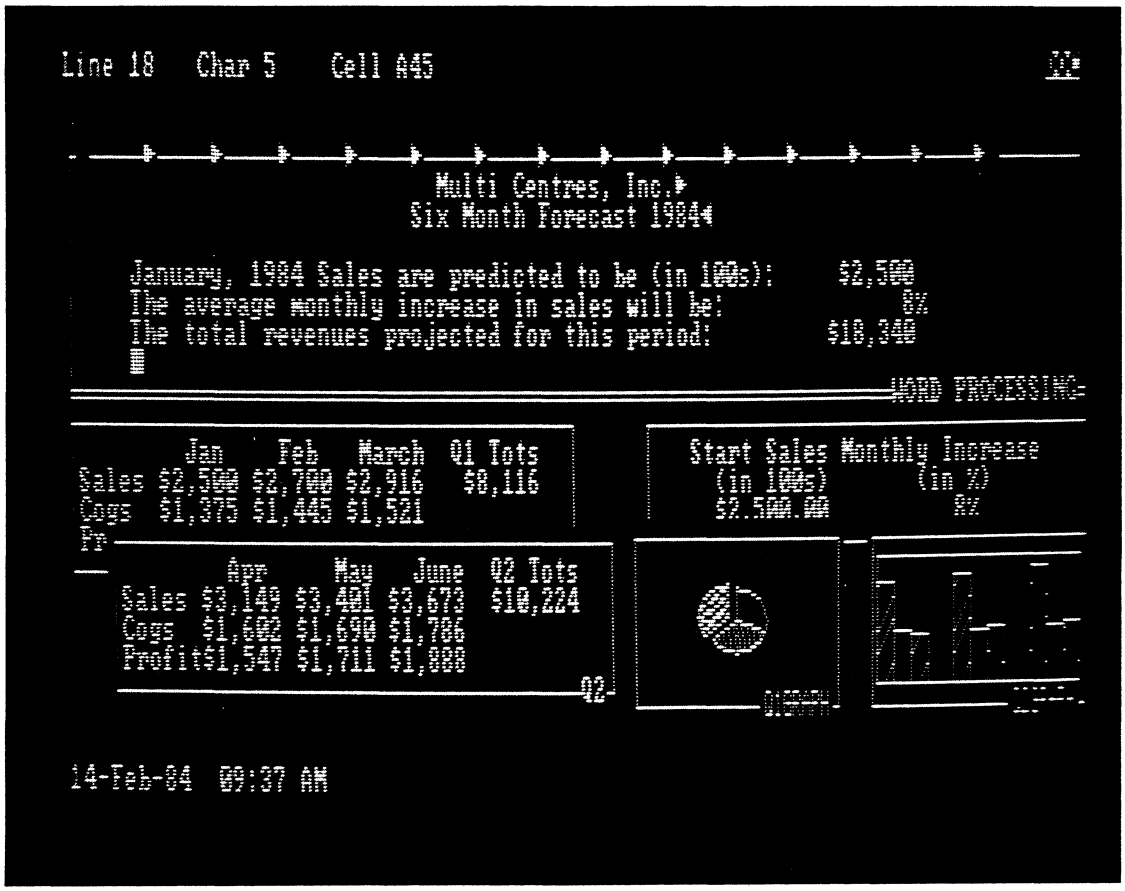
C. Third Level

Whereas level II products consisted mostly of hardware, level III micro-to-mainframe links are principally software package with several different components that run on both microcomputers and the associated minicomputer or mainframe. Products in this area have the ability to move files from mainframe applications or DBMSs into familiar micro applications.

1. Lotus 1-2-3 and VisiCalc

The most popular microcomputer packages are Lotus Development Corp.'s $495 1-2-3 and VisiCorp's $250 VisiCalc. Lotus 1-2-3

EXHIBIT 1-1
LOTUS SYMPHONY'S
WINDOW MANAGEMENT SYSTEM



LOTUS SYMPHONY'S UNIQUE WINDOW MANAGEMENT SYSTEM allows users to view various functions on screen simultaneously. Displayed here is a word processing window, three spreadsheet windows, and two graph windows. Symphony(tm) tightly integrates word processing, database, communications, spreadsheet, and business graphics. Symphony will have an introductory price of $695 and shipments will begin at mid-year.

is an integrated spreadsheet package that offers a spreadsheet, graphics, and a simple file management system. 1-2-3 had an installed base of "only" 190,000 packages at the end of 1983, though Lotus only started shipping in January of that year.

In February 1984, Lotus announced a new product called Symphony ($695) which offers enhanced versions of 1-2-3's applications along with word processing and communications promises. With the addition of communications, this product will be very attractive to Lotus' present value-added resellers (McCormack & Dodge, Computer Corporation of America, Management Decision Systems, Automatic Data Processing, Managament Science of America, etc.) and future micro-to-mainframe vendors. Lotus plans to ship Symphony by the middle of this year.

2. VisiCorp's VisiCalc and VisiOn

With over 700,000 copies of VisiCalc sold by the end of 1983, VisiCalc has also proven very attractive to some micro-to-mainframe vendors such as Informatics General, Applied Data Research (ADR), Management Decision Systems, and Mathematica Products Group. (The last three vendors also supply interfaces to Lotus 1-2-3.)

Informatics General has also announced support for VisiOn. Announced over a year ago, VisiCorp finally began shipping its "environmental" software package early this year. While it offers more capabilities than 1-2-3, VisiOn is also more expensive. Even though VisiCorp recently reduced the price of VisiOn's Window Manager from $495 to $95, a complete VisiOn system with mouse ($250) and three applications (word processing, graphics, and spreadsheet) still costs over $1,000. When a VisiOn system is compared to the $695 Symphony package which offers five applications and superior processing speeds, VisiOn's technological advantages wane in importance. In addition, the legal suit between VisiCorp and Software Arts

(which developed and now sells VisiCalc Advanced Version for only $99.95) is making some micro-to-mainframe vendors hesitant about fully supporting VisiCalc.

3. Third Level Conclusions

Level III products require software at both the micro and mainframe levels along with the appropriate communications software and hardware. These products may also require a separate "storage" space at the mainframe level to allow microcomputers users easy access to "permitted" data.

Products at this level are generally "friendlier." These products are also the most popular since they offer access to mainframe systems, but offer familiar applications at the microcomputer level. In other words, they only require the user to learn a few new skills. Level IV products, however, are often far more powerful, but they may require users to learn completely new packages.

Overall, the IBM PC is the driving force for micro-to-mainframe links at all levels. While the IBM PC will continue to be the machine of choice for the first and third levels (along with IBM software compatibiltiy at the second level), the 3270 PC will become increasingly utilized for third-level products targeted at the corporate market.

As for the fourth level, the XT 370 will gain prominence in fourth-level products as software is moved down from mainframe-level and high-level communications (with extract and query facilities) become more available.

D. Fourth Level

Fourth level products provide a subset or full implementation of mainframe software on microcomputers. This level includes products from Information Builders Inc., Comshare,

Cullinet, Execucom, and Oracle. In addition, time sharing bureaus (General Electric, ADP Network Service, and Dun & Bradstreet) offer third- and fourth-level products as well.

While providing the same packages at both the microcomputer and minicomputer/mainframe offers many advantages (such as less training, fewer compatibility problems, etc.), some vendors have temporarily chosen to ignore problems such as security, error checking, high-level communications protocols, and poor operating performance.

Many of these enhancements are coming in the future, but potential micro-to-mainframe users should remember that software developments periods tend to slip and revisions or updates that are promised in six months may not appear until nine months or even a year later. In other words, Caveat Emptor.

VII. Implementation Stages for Micro-to-Mainframe Links

The Yankee Group believes there are four basic stages of office automation. These stage also happen to coincide with the period during which a user would consider evaluating and implementing a micro-to-mainframe link.

The implementation of a micro-to-mainframe link is secondary to the real motive of this program. The real benefit of installing a micro-to-mainframe link is increased productivity which results from the immediate availability of corporate information along with the ability to easily manipulate that data on a microcomputer. The Yankee Group believes that a corporation's information is a major asset, and micro-to-mainframe links allow users to extend the benefits of that asset.

A. Stage One — Standalone Solutions

- word processors and/or DTCs primarily

serving secretarial/clerical personnel;

- a few DTCs are used by "pioneering" professionals and managers;
- essentially no networking or micro-to-mainframe links are offered at any level.

B. Stage Two — Rudimentary Integration

- a few word processors and DTCs communicate with one another (or a host computer) via a simple ASCII/TTY communications package or a small LAN. Basically, DTC users are into the first level of micro-to-mainframe links;
- clustered word processors are connected to a central processing unit in order to share printers and files;
- a few professionals and/or managers utilize DTCs mostly in a standalone mode;
- some experimentation is being carried out with networking/communications.

C. Stage Three — Integrated OA Pilot Programs Established

- OA services and/or software are available on minicomputers and/or mainframes. Possibly, a few "supermicros" have been installed for running large decision-support packages and databases at the workstation level. Basically, a few people are now experimenting with level II micro-to-mainframe links.
- on a company- or site-wide basis, a coherent Information Management Group is being assembled to coordinate activities between the communications, MIS, and DP departments;
- a total OA architecture for at least the next two years is being assessed;
- dedicated word processors are being phased out, and clerical personnel are being shifted to networked desktop computers;

- managers and professionals utilize a variety of DTC business applications such as DBMS, spreadsheet, graphics, etc. Electronic mail is also available to some DTC users;

- links to minicomputer- and mainframe-based information are also available to professional and managerial personnel. These links are still only first- and second-level products.

D. Stage Four — Total OA Integration

- a coherent Information Management Group is established with the cooperation of the OA, DP, MIS, and Communications departments;

- compatibility problems (hardware, software, and communications) have been solved via one of the following solutions: a single standard vendor, a "unified or standardized" network architecture, or a system of protocol converters.

  Both third- and fourth-level micro-to-mainframe products are contributing to the solution of these problems as well;

- as part of the corporate network, DTCs are used by most professionals and managers. DTCs are linked via LANs and/or PBXs with access also being provided to OA applications on minicomputers and mainframes. Easy access to DBMS and other resources is available at all levels, but closely controlled with security procedures.

  Third-level products are frequently used by upper-level management who quickly want information. Fourth-level products are used by managers who need more detailed information and are willing to invest the time necessary to learn these packages' commands langauges;

- all users have access to printers, plotters, slide generators, and other advanced peripherals through PBXs, LANs, and/or micro-to-mainframe links. (Micro-to-mainframe links will act as "front-end processors" for sending information to

peripherals on a shared basis with many other microcomputer users.)

VIII. Total Micro-to-Mainframe Costs

Obviously a $3,000-to-$5,000 DTC is not equipped to fit into the higher stages of office automation. Table 1-2 outlines the "hidden" costs of integrating one DTC in the OA environment. All costs are figured for a department with 15 IBM PC XTs, except for the micro-to-mainframe link. (The Yankee Group estimates that at least 75 microcomputers would be needed to justify this feature.)

A. Two Cost Breakdowns

The major differences between tables 1-2 and 1-3 are architectural. The configuration represented in Table 1-2 is structured to take advantage of a large centralized corporate database. The higher costs result from: the costlier IBM PC XT (vs. the cheaper IBM PC), a 3270-communications package for each IBM PC; a modem for each PC; higher communications costs (long distance charges); higher in-house time sharing charges; and a costlier maintenance contract.

As shown in Table 1-3, a simple LAN-based architecture (such as Corvus' Omninet) is less expensive overall. To a large extent the lower cost of this architecture results from sharing communications (protocol converter) and mass storage (file server). File servers enable many users to share mass storage, printers, and other peripherals, but actually offer less storage capacity.

Excluding floppy disk storage, 15 IBM PC XTs contain a total of 150MB of mass storage capacity; 15 IBM PCs connected to one 20MB file server would offer only 1.3MB of storage per user, which might suffice given that applications programs could be stored centrally, minimizing redundant files and

data. Also, remember that shared logic WP systems of three years ago held only 20MB on the average. (Although the largest hard disk available from Corvus is only 20MB, Omninet will accommodate several file servers as nodes on the network or two cartridge tape drives with 100MB or 200MB capacities).

Via the protocol converter, the LAN-based architecture containing a protocol converter also lowers costs, since every IBM PC no longer needs an expensive modem or 3270-type communications package. When remote processing or communications access is needed, the protocol converter provides shared communications. This shared communications feature eliminates the need for the installation of sophisticated communications software and hardware at the workstation level. For more information on file servers and specific products, see the November 1982 C/iS report, "Evolving DBMS."

As noted at the bottom of Tables 1-2 and 1-3, all component prices are approximate. These tables are intended only as guidelines, not as definitive pricing lists. Some readers may object to the inclusion of Corvus' low-speed Omninet LAN, and the exclusion of an Ethernet system. Using Ethernet would raise the connect cost by about $400 (see OAS/IS Technical Office report "Cable Based LANs"). The Yankee Group does not believe that the $400 difference between an Ethernet-based LAN and a low-cost, lower-speed PC Net from a company such as Corvus is a significant difference, especially when compared with the $1,990 difference between Tables 1-2 and 1-3.

B. Conclusions

Tables 1-2 and 1-3 reveal that DTCs are really "Trojan Horses." In other words, the purchase of a $4,000 IBM PC is only the start of a costly process. Integrating DTCs into a corporate information network will require the purchase of numerous products. Users increasingly will demand these products as their level of expertise rises. MIS and DP departments must pay very careful attention to these demands, as they will strain existing resources.

TABLE 1-2
TOTAL MICRO-TO-MAINFRAME COSTS DEPRECIATED OVER THREE YEARS

DESCRIPTION OF DEPRECITATED ITEMS	COST
IBM PC XT with a 10M hard disk, a monochrome display, 128K of RAM, and a dot matrix printers	$6,000
Communications (IBM 3270-type board with software)	$1,000
Modem (2400 - 4800 bps with error correction)	$2,000
Printer - high speed, formed character (assuming a $4,500 cost shared by 15 DTC users)	$300
Micro-to-mainframe link software at DTC level	$ 1,000
Micro-to-mainframe " " " mainframe level (assumung the $75,000 cost of the mainframe package would be shared by 75 users)	$ 1,000
Sub-Total	$11,300
SUB-TOTAL WHEN DEPRECIATED OVER THREE YEARS	$ 3,770
DESCRIPTION OF RECURRING ITEMS	
Software - Annual expenditures for DTC applications software	$1,000
Supplies - floppy disks, paper, printer ribbons, etc.)	$400
Remote Communications Cost - based on 25¢/minute with an average access of 30 minutes/day over an average of 200 days a year using a low-cost communictions link supplied by MCI, Sprint, etc.	1,500
In-house Computer Time Costs - based on $30/hour with an average of 1/2 hour per day for 200 days per user per year)	3,000
On-site Maintenance Contract - for an IBM PC XT with a IBM dot matrix printer, IBM SDLC board, monochrome display, display card, and shared cost for character printer.	1,000
Training and Support	?
Sub-total (for recurring expenses)	$6,900
TOTAL ANNUAL COST (average annual depreciated costs + sub-total for recurring expenses)	$10,670

NOTE: All prices are approximate; this table is only intended as a guideline, not as a definitive pricing list.

Source: the Yankee Group

TABLE 1-3
TOTAL DTC LAN COSTS
DEPRECIATED OVER THREE YEARS

DESCRIPTION OF DEPRECITATED ITEMS	COST
IBM PC with dual floppy disk drives, monochrome display, 128K of RAM, and a dot matrix printer	$4,000
Connect Cost to PC Net LAN such as Corvus' Omninet)	$200
Misc. LAN Wiring Expenses (assuming costs are shared by 15 PCs)	$500
File Server offering a shared 20M hard disk, asynch./TTY communications, and a total cost of $5,000	$75
Protocol Converter (that handles ASCII - EBCDIC conversions, permits 3270 communications, and costs $6,000)	$320
Printer - high-speed, formed-character ($4,500 cost shared by 15 DTC users)	$400
Sub-Total	$300
Average cost when depreciated over three years	$5,795
	$ 1,930
DESCRIPTION OF RECURRING ITEMS	
Software - Annual expenditures for DTC applications software	$1,000
Supplies - floppy disks, paper, printer ribbons, etc.	$400
Remote Communications Cost - based on 25¢/minute with an average access of 30 minutes/day over an average of 200 days a year using a low-cost communictions link supplied by MCI, Sprint, etc.)	$1,500
In-house Computer Time Costs - based on $30/hour with an average of 1/2 hour per day for 200 days per user per year)	$3,000
On-site Maintenance Contract - for an IBM PC with an IBM dot matrix printer, IBM SDLC board, monochrome display, display card, and shared cost for character printer.	$850
Training and Support	?
Sub-total (for recurring expenses)	$6,750
TOTAl ANNUAL COST (average annual depreciated costs + sub-total for rucurring expenses)	$8,680

NOTE: All prices are approximate; this table is only intended as a guideline, not as a definitive pricing list.

Source: the Yankee Group

IX. Software Trends Affecting the Micro-to-Mainframe Market

A. Increased Emphasis on Security

With the abuses of "hackers" and "computer crooks" becoming more frequent as the population of users grows, the Yankee Group believes that micro-to-mainframe links will dramatically increase security problems. These products provide new entry points into systems. The emphasis on ease-of-use exacerbates the situation since many more users will have the expertise needed to get into a system.

While the Yankee Group does not believe that teen-aged hackers represent a real threat in this instance, two other groups form a large potential threat to the integrity of a compay's database. Both these groups are principally users employed by the company. In the first group are experienced users of the system who have free access to the system. This group is a threat because they know the system and some individuals will attempt to manipulate the system either for personal gain or possibly for other reasons such as revenge. In the second group are inexperienced users who may destroy or change data without even realizing it.

As a result, security precautions need to go beyond simple password protection. Unfortunately, developing and maintaining security systems are a thorn in the side of most DP departments because:

- security levels must be determined on an individual basis;
- read/write capability (some users can only read certain files, some users can only write to certain files, and a few users have clearance for both actions) must be selectively awarded as well;
- turnover of personnel requires frequent changes;

- in conjunction with read/write privileges, the ability of users to update mainframe files must also be carefully considered since many DP departments do not want microcomputer-generated information moved into mainframe files directly.

  (Some DP departments permit microcomputer files to be uploaded, since this data is usually stored for common usage but does not change any mainframe files. Generally, the DP department will set up a separate area for storage of these files;)

B. Integrated Software

With communications becoming an important part of integrated software, the Yankee Group believes more DTC users will start accessing remote databases. Symphony, PFS:Access, MBA, Mosaic's Integrated 6, and other packages providing users with communications that are easy to use and allow information to easily be moved into familiar word processing, graphics, spreadsheet, and database packages. The ease with which corporate data can be accessed will in itself catalyze demand.

Moreover, some of these vendors have VAR (value-added reseller) agreements with minicomputer and mainframe vendors offering DBMS micro-to-mainframe links. For example, Lotus has signed agreements with McCormack & Dodge, Computer Corporation of America, MSA, Management Decision Systems, ADP Network Services, etc. Context Management Systems (MBA) has an agreement with UCC Computing. VisiCorp, which does not yet offer a communications package with VisiCalc IV or VisiOn, has agreements with ADR and Informatics.

C. Consolidation and Acquisitions

Consolidations, mergers, and acquisitions are exploding in the software market. In 1983, there were approximately 146 worth over $1 billion. Although many hardware firms offer their own software systems, major vendors in this area are also

strengthening their applications libraries by OEMing software from third parties, acquiring software companies, and increasing their own internal programming staffs.

IBM, DEC, Wang, HP, and other hardware vendors already OEM a significant portion of microcomputer software from third-party firms, but the Yankee Group expects many of these firms to develop more of their own applications software as well. For example, IBM has created an independent business unit (Information Service Business Unit) similar to the unit responsible for the development of the IBM PC. This group indicates IBM's interest in the software market, but IBM strongly believes that it increases its dependence on third-party software.

In addition, IBM acts as distributor and sales agent (through its National Accounts Division, its retailers, and its own IBM Product Centers) for numerous packages developed by independent software vendors. For example, IBM recently signed a joint marketing agreement with Comshare Inc. to offer Comshare's System, a decision support system (DSS) that runs on both IBM large machines as well as its PC line).

(The Yankee Group estimates that IBM derived $150 to $200 million from microcomputer software sales in 1983. This figure places IBM ahead of all other software firms in terms of microcomputer software revenues.)

Hardware vendors such as Digital Equipment, Honeywell, Sperry, and Wang are also signing agreements with independent software vendors. Even with internal development of software, these companies can meet only a small part for the demand of software.

As for software firms, large minicomputer- and mainframe-based software vendors are also signing deals with, or acquiring, microcomputer-based software companies. Lotus' VAR agreements with CCA (Computer Corporation of America), MSA

(Management Science of America), McCormack and Dodge, and ADP Network Services are examples. MSA has acquired Peachtree Software. (Its Peachlink software is one of the few micro-to-mainframe systems that has been shipped and installed on a commercial basis.) Martin Marietta Data Systems Company acquired Mathematics, which sells the the RAMIS II DBMS and RAMLink, a recently announced micro-to-mainframe link. In another acquisition, Crowntek, Inc.(a subsidiary of the Canadian company, Extendicare, Ltd.) acquired Computer Corporation of America (CCA) which sells a DBMS, Model 204, and a micro-to-mainframe link called PC/204.

D. UNIX: A Future Link

Developed by Bell Laboratories and sold by AT&T, UNIX is a widely known operating system that is surging forward in both the minicomputer and microcomputer areas. In the past, it has been held back by numerous problems (including the performance limitations of diskette-based DTCs), but with the rise of 16- and 32-bit microcomputers, it offers the power and sophistication needed by the next generation of microcomputer software.

The Yankee Group estimates that 75,000 UNIX-based systems will be installed by the end of 1984. By 1986, this figure will increase to 403,000 systems. While the UNIX market is still in its infancy, it holds the promise of forming a major software component of upcoming micro-to-mainframe links.

For example, micro-to-mainframe links will be able take advantage of UNIX's beneits such as:

- Portability -- UNIX runs on a variety of hardware types. In fact, UNIX operating systems are currently available on microcomputers, minicomputers, and mainframes.

  In addition, UNIX software developers are increasingly standardizing on the programming language "C." This allows applications written in "C" to easily be moved

from one type of hardware to another. Thus, the same applications could reside on both microcomputer and on larger systems as well.

- Multitasking -- Microcomputers users are increasingly looking for the ability to run several programs at the same time. Moreover, many users would like to have UNIX's multiuser capabilities for networking microcomputers with LANs (local area networks). A current limitation of PC Nets is the lack of concurrent update capability, file and record locking, and multiple security levels. This is because MS DOS is a single-user operating system.

  Digital Research is working with ATTIS to run Concurrent CP/M (which can run PC DOS as well as CP/M programs) as a guest in Unix. This should be available by early-1985, and will give Unix, as well as PC Nets, a big boost.

Still there are a number of drawbacks to UNIX. Some of UNIX's negative aspects include:

- Hardware requirements -- Hardware requirements have always been a major obstacle to the success of UNIX in the microcomputer market. At the minimum, running UNIX on a microcomputer requires at least 128K of RAM, a 16- or 32-bit processor, and a 5M hard disk.

  Nonetheless, hardware is rapidly becoming less of a problem as memory and disk drive prices steadily fall. (Microcompters capable of running UNIX are presently available for less than $6,000.)

- Ease-of-use -- Many people have commented that UNIX is "user hostile" and not designed for the business community. The Yankee Group believes this situation will change in 1984. First, enhancements from both AT&T and independent vendors (such as Microsoft) will reduce this problem. Second, many applications developing products for the UNIX environment will "hide" the OS from unsophisticated users. Frequently-used OS commands will be accessed through the application with familiar

commands or menus. (While Apple uses a proprietary OS, it exmplifies this approach by never letting the user see the OS. All the users see when they load their software is the application.)

- Poor error recovery -- Lack of good error recovery has been a serious hindrance to UNIX's success in the commercial market, but AT&T and its licensees are working on this problem.

- Too many flavors -- UNIX's biggest problem is that there are simply too many different (and incompatible) versions of UNIX. Even AT&T is guilty of propogating this confusion, since it regularly releases new versions. Moreover, many developers find AT&T's "plain vanilla" versions lacking in a number of ways so they have added "shells" and other enhancements that make for an extremely confusing situation.

  This confusion partially discourages hardware developers and purchasers. Users tend to stay away from confusing and evolving products, and when users stay away from a product it never gains a sufficient installed base to make attractive to applications developers. As a result, the munber of software programs for UNIX OSs is pitiful compared with the libraries available for other microcomputer OSs (such as MS-DOS and CP/M).

  These problems will take a lot longer to solve than the aforementioned drawbacks. The Yankee Group expects AT&T will play a strong role in finally establishing UNIX as standard for both its own forthcoming computer products as well as independent vendors' offerings.

IBM recent product announcements are one indication of UNIX's rising popularity. It has announced it will offer UNIX on two of its microcomputers -- the S 9000 series and the IBM PC XT.

1. IBM's 9000 Series

In February 1984, IBM announced it would offer Microsoft's

XENIX OS (a custom variety of AT&T's UNIX Version III) on the S 9000. Developed by IBM's Instruments Division of Danbury, Conn., this Motorola 68000-based microcomputer can handle three terminals in a multiuser mode. Through the XENIX OS, each terminal will also have multitasking capabilities allowing several applications to run simultaneously. When it becomes available in the second quarter of this year, an S 9000 system with XENIX OS, 10M hard disk, 640K of RAM, and a memory management card will cost $15,960.

The Yankee Group believes that IBM is only testing the waters with this product. This fact is substantiated by the fact that IBM will initially sell the S 9000 only through its Instruments sales force. Although this product will be offered on value-added reseller basis, it is questionable whether IBM's National Accounts, National Marketing, and National Distribution Divisions will offer this product.

2. Still to Come: the Datamaster's Replacement

The S 9000 is an interim product until IBM introduces a propietary multiuser operating system for a forthcoming replacement for the System 23/Datamaster. Based on Intel's new 286 chip, this machine will offer compatibility with present PCs and provide enhanced features unavailable with present microcomputer operating systems.

The Yankee Group also believes this product will contain part of a micro-to-mainframe system with built-in 3270 communications expected at the very least. There is also a possibility that IBM will place part of the SQL DBMS system directly into the OS. This feature would offer file compatibility, and with 3270 communications, provide a very strong micro-to-mainframe link for this product.

3. IBM's UNIX Version

Interactive Systems Corp. (ISC) of Santa Monica CA developed PC/IX for the IBM PC XT. PC/IX costs $900 (extremely high for an operating system considering that PC-DOS only costs $40 to $60 at retail). Moreover, PC/IX will only be available through IBM's large accounts division when it is shipped in April. PC/IX is targeted at corporations with a large number of technical user interested in applications development.

PC/IX is based on Bell Labs' UNIX System III. (Albeit Bell has already annnounced more advanced versions, System V and System 5.2.) ISC claims PC/IX is compatible with System V through an upgrade. Furthermore, although ISC has enhanced PC/IX with several features (such as full screen editor), it lacks the popular Berkeley extensions. Still, it can "co-reside" with PC-DOS on the same machine. PC/IX requires 256K of RAM and a 10M hard disk. Lastly, PC/IX was announced by the Information Systems Group, a division responsible for large systems, not the Entry Systems Division which developed the IBM PC.

What does all this mean? First, the Yankee Group believes IBM is moving to offer several operating systems across a broad range of its products, especially when the connection to the Information Systems Group is noted. Nonetheless, UNIX is only the first operating system, not the last, that IBM will leverage across a wide range of its products. Over the next two years the Yankee Group believes that IBM will place greater emphasis on applications development for the VM environment, not the UNIX area. The first indication of this trend is the XT/370 and the agreements IBM has signed with VARs such as Boeing Computer Service which will sell XT/370 systems with software that is fully compatible with their mainframe offering. (See the Boeing Computer Service profile in Chapter Five for more information.)

While both UNIX and VM operating systems will be available on the 286-based multiuser DTCs that IBM will offer by the end of this year, UNIX will be offered for two reasons on this product. First, IBM needs a multiuser operating system that supports a core of basic applications software. This software core is still a year away for the VM environment. Second, if 1984 is truly the year of UNIX, IBM does not want to be caught without a commercial product to sell. Finally, mainframes using the VM operating system will offer the ability to host "guest" operating systems (VM/CMS, PC/IX, and PC-DOS) to ensure viable micro-to-mainframe links for transporting applications software and files across a broad range of IBM products.

E. Implementations for Micro-to-Mainframe Market?

This means that micro-to-mainframe links are a growing business. An obvious conclusion, but this also indicates that microcomputer software vendors will pay much more attention to getting (and keeping) VAR agreements with both mainframe (and minicomputer) systems vendors in both the hardware and software areas. Just as Fortune 1000 companies are increasingly worried about compatible hardware across their entire DP network, large users will increasingly demand one software solution that can be bought from one (or possibly two) source(s). In other words, the microcomputer software vendor who wants to sell to the Fortune 1000 will need to sell their packages to both hardware and software systems vendors in order to succeed.

For the user, this consolidation will have two effects. First, it will reduce the problems of building a complete micro-to-mainframe system with disparate elements from several vendors. Users will have fewer problems moving files from microcomputer to minicompter and mainframe applications. Commands and user interface will become more standardized across a broad range of applications and systems. Second, some of the innovative integraded packages will be unavailable to Fortune 1000 users since large systems software houses will be wary of

supporting a new package from a young company. Users within these organizations will still be able to buy these applications on an individual basis, but they will be denied support if these products do not appear on the DP department's official list of "sanctioned" software. (The Yankee Group strongly believes that most Fortune 1000 companies will implement the same purchase policies for software as they have for microcomputers.)

X. Future Developments

How will micro-to-mainframe links improve? What is coming in the future? The first major development in this area will be the ability to access mainframe and minicomputer databases with simple English sentences and will be available by the end of this year from Artificial Intelligence Corp. (AIC). While IBM already offers a mainframe version of AIC's INTELLECT, it will be interesting to see if they also push the microcomputer version for ad hoc queries since IBM may offer a PC-version of SQL.

If IBM were to offer this new version, it would complement, not compete, with SQL (Structued Query Langauge) since Intellect's "echo" features translates the user's English sentences into SQL statements. This feature allows users to learn SQL's syntax gradually and could provide a smooth transition when a user grows interested in moving up to SQL.

VisiCorp's integration of VisiAnswer into VisiON may indicate another direction. Future products could automatically schedule a telecommunications session and automatically update certain spreadsheets with relevant data. Moreover, this data would not simply be reflected in certain spreadsheets, but would also make appropriate changes in connected reports, graphs, and DBMS files.

XI. Conclusion

Informatics, MSA, and McCormack & Dodge are the closest to actually producing viable micro-to-mainframe products. In fact, Informatics has actually installed a small number of VisiAnswer systems. Overall, large mainframe and minicomputer software vendors plus Cullinet, Cincom, GEISCO and ADR will dominate the micro-to-mainframe market for the following reasons:

- their sales force is familiar with Fortune 1000 market;
- they can offer complete product lines ranging from microcomputer to mainframe software along with the "bridges" between these various packages;
- these vendors have the experience with high-level operating systems (such as the XT/370's VM/CMS and UNIX) which are beginning to filter into the micro market;
- they have the cash to develop the next generation of micro-to-mainframe links that will contain artificial intelligence, voice recognition, advanced graphics, and distributed databases;

Still, these vendors will have to work hard to mitigate the confusion surrounding micro-to-mainframe links. In addition, they will have to sell their products to a much wider customer base whose purchase criteria will differ widely, even within the same organization. Most importantly, these software vendors will have to convince their own sales forces that they can make money selling a combination of microcomputer software, micro-to-mainframe links, and minicomputer/mainframe software.

CHAPTER TWO
FIRST LEVEL MICRO-TO-MAINFRAME LINKS

I. Overview of First Level

First-level micro-to-mainframe links are the foundation for the higher levels. Although this product level includes hardware devices (modems, multiplexors, cluster controllers, protocol converters, 3270 boards, etc.), this section will concentrate on communications software. First-level micro-to-mainframe links include two basic categories of products -- aysnchronous and synchronous communications packages. Terminal emulation, such as IBM 3101 or DEC VT 100 forms a third category.

II. Asynchronous Communications

Aynschronous communications are in common use for sending information between microcomputers and accessing on-line databases such as The Source and Compuserve. Asynchronous communications has two basic advantages. First, both the software and the hardware are relatively cheap. (A complete system with software and a 1200-buad modem is available for under $500-to-$800.) Second, the fierce competition in this area has ensured high-quality packages that are easy to use.

A. Evaluation of Asynchronous Communications Software

Since accessing YankeeNet requires a communications package, the Yankee Group decided that a brief evaluation of 12 selected IBM PC communications packages would be helpful. The Yankee Group does not make any recommendations for purchase, but a methodology was established (based on subjective and objective factors) for rating the various products.

Although 65 commercial communications packages were listed in a recent special issue of PC World, the Yankee Group chose only 12 popular packages to evaluate. The ratings are based on the Yankee Group's analysis of high priority features. The Yankee Group considered a long list of published specifications in this ranking of IBM PC communications software. The following features were considered more important than other capabilities and the ranking reflects their importance:

1. Top Rated Features

The Yankee Group believes the following features are important in the selection of communications software. Particular attention was also paid to these features when the Yankee Group determined ratings for communications packages on the following pages.

2. Ranking for Selected Communications Package

Taking all the above mentioned factors into account, the Yankee Group presents, in Table 2-2, rankings from best to worst. (Best possible score = 139, worst possible score = 0.)

3. Other Interesting Asynchronous Communications Packages

The following packages are not rated, but are notable due to advanced features and/or endorsements from major software/ hardware vendors.

a. BLAST from Communications Research Group of Baton Rouge LA

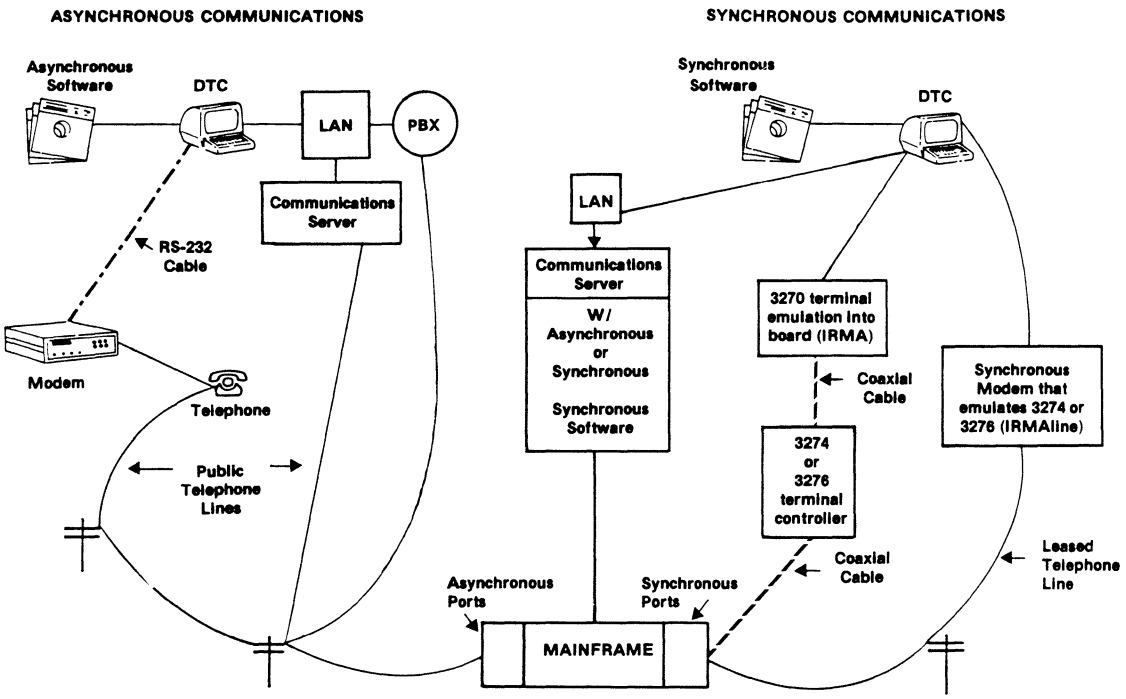
BLAST is currently offered on a wide variety of microcomputers (with Televideo probably the most signifcant vendor) and on several minicomputers such as Digital's VAX and PDP-11 series along with some Data General minicomputers. It simulates SDLC/HDLC-type communications in full duplex mode. It also

TABLE 2-1
IMPORTANT FEATURES IN ASYNCHRONOUS COMMUNICATIONS SOFTWARE

- data capture direct to disk;
- non-ASCII file transfer;
- auto-dialing modem support;
- return to operating system without hangup;
- on-line selection of communications parameters;
- on-line listing of selected parameters;
- on-line viewing of selected files;
- 1200 baud receive/download operation;
- save/reload customized parameters (very important);
- quality of the documentation (also very important).

Source: the Yankee Group

FIGURE 2-1
LEVEL I MICRO-TO-MAINFRAME LINKS



Source: the Yankee Group

TABLE 2-2
RANKING FOR SELECTED
ASYNCHRONOUS COMMUNICATIONS PACKAGE

SCORE	PACKAGE	VENDOR
104	Crosstalk Version 3.0	Microstuf Inc. of Atlanta, GA
95	Smartcom II	Hayes Microcomputer Products, Inc., of Norcross GA
87	ASCOM Version 2.1	Quantum Software Systems, Inc. of San Jose CA
81	Telios Version 1.0	Genasys of Rockville MD
72	PC-Talk Version III	Freeware of Tiburon CA
61	PCMODEM Version 1.4	Solution Software Systems of Mt. Prospect IL
55	Data Capture/pc	Southeastern Software of New Orleans LA
52	PC/InterComm Version 1.0	Mark of the Unicorn, Inc. of Arlington MA
39	IBM Asynchronous Version 2.0	IBM of Boca Raton FL
37	LogOn Version 1.3	Ferox Microsystems, Inc. of Arlington VA
36	Communicator/Text Editor Version 1.0	Electronic Data Systems Corp. of Dallas TX
35	LYNC Version 3.0	International Software Alliance of Santa Barbara CA.

Source: the Yankee Group

has a higher level of error checking than the "check sum" method used in most asynchronous communications packages.

b. Micro/Terminal from Microcom of Norwood MA

Microcom also offers a higher level protocol with error checking called MNP (Microcom Networking Protocol). While Microcom is principally in the modem business, its communications software and its MNP protocol have been endorsed by several major vendors. IBM has not announced public support for the MNP protocol, but IBM chose Microcom to develop the PCjr's communications software (which includes MNP).

Even though IBM only tacitly supports MNP, over 40 hardware manufacturers, software and systems houses, public network services and communications equipment suppliers have publicly announced support for this protocol. These supporters include: Apple Computer, Coleco, VisiCorp, Lotus Development Corp., British Telecom, Dow Jones Information Services, GTE Telenet, Comm-Pro, Systar, Applied Computer Communications, Stratus Computer, and Whitesmiths, LTD. Futhermore, support for MNP was recently announced by six more companies (such as Sorcim Corp., Hayes Microcomputer Products, and International Computer Limited of Britain).

c. PFS: Access from Software Publishing Corp. of San Jose CA

Best known for its highly popular PFS: series (PFS:File, PFS:Report, PFS:Graph, and PFS:Write), Software Publishing Corp. recently announced a communications package called PFS:Access. Reported to have some excellent features, PFS:Access is a basic aysnchronous communications package that can "learn" and record a user's log-on procedure. (Many other communications packages also offer automatic log-on, but the sequence must be written beforehand by the user.) PFS:Access

is also interesting since it offers an encryption package as well. Lastly, this communications package also has a very interesting price tag, $95. Coupled with the success of the PFS:series and the ability to easily move files from PFS:Access to PFS:File, the Yankee Group expects this communications package to be a significant competitor and an important part of many ad hoc micro-to-mainframe systems.

4. What Asynchronous Communications Packages Does the Yankee Group Use?

An interesting footnote to this analysis is a listing of the Yankee Group's own use of communications software. To date, members of the Yankee Group have used the following communications packages:

- Asynchronous Communications Support from IBM of Boca Raton CA;
- Smartcom II from Hayes Microcomputer Products, Inc., of Norcross GA;
- LisaTerm from Apple Computer Corp. of Cuppertino CA.;
- Polygon from Digital Equipment Corp. of Maynard MA;
- Wang Asynchronous Communications from Wang Laboratories of Lowell MA;
- Wang Laboratories' (Lowell MA) Telecommunications option (on a clustered Wang word processing system).
- PC-Talk III from Freeware of Tiburon CA.

III. Terminal Emulation

DTCs offering terminal emulation (such as the Wang Professional, Digital's Professional, H-P's 150, etc.) offer a slightly higher level of communications capability than

straight asynchronous communications packages. But terminal emulation for most popular terminals (Teletype, Digital's VT-100, IBM's 3101, etc.) are also available in many popular DTC communications software packages.

IV. Synchronous Communications

Synchronous communications devices forms a third category. IBM 3270 terminal emulation with its error checking protocol offers a high speed (up to 9600 baud vs. a limit of 2400 baud for asynchronous transmissions) link between a micro and a mainframe. But 3270 terminal emulation is generally expensive (over $1,000 for the hardware and software), and requires either a coaxial cable connected to a cluster controller or directly to a mainframe. If 3270 communications are needed with a remote mainframe, a costly leased telephone line is necessary. Moreover, true 3270 emulation lacks the ability to upload or download files (but several vendors offer this capability on micros). ASCII to EBCDIC conversions are also a problem for some 3270 boards. Lastly, 3270 communications requires some user training.

While many hardware vendors (IBM, HP, Wang, Digital, Apple, etc.) are offering IBM 3270 boards for their DTCs, there are also several products available from independent vendors:

1. AST Research Inc. of Irvine CA sells five boards that offer 3270 emulation, SNA/SDLC, 5251 terminal emulation for System 34, 36, and 38 IBM minicomputers, 2780/3780 bisynchronous protocols, 3270 and 2770 terminal emulation using SDLC and HDLC protocols;

2. DCA (Digital Communications Associates, Inc. of Norcross GA) makes the popular IRMA line of 3270 emulation packages. IRMA offers a coaxial cable link to 3270 networks. It supports standard text file transfer software for VM/CMS and MVS/TSO

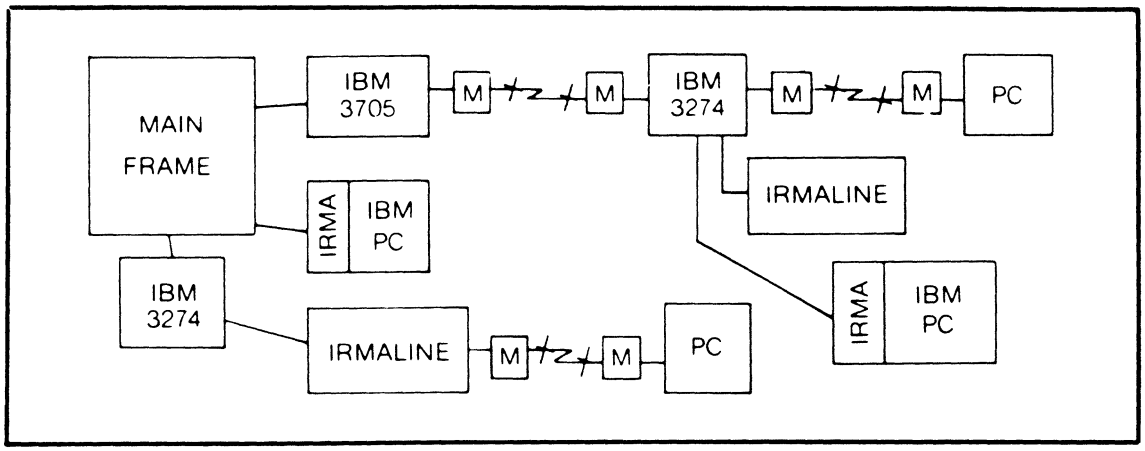
mainframe environments, IBM 3278 Models 2, 3, 4, and 5 and IBM 3279 Models 2A and 3A screen support, plus optional APL Terminal emulation. At present, the IRMA product has 25,000 installations worldwide. Contributing to this success is DCA's OEM agreement with several hardware vendors.

For example, Apple Computers sells AppleLine which enables Macintoshs and Lisas to emulate 3270 terminals. OEMed from DCA, this version of the popular IrmaLine package is basically Apple's micro-to-mainframe link. Costing under $1,295, AppleLine will be shipped this spring.

3. Phone 1, Inc. of Rockford IL sells an IRMA alternative, CLEO. This board and software combination offers BSC 3276 Model 2 emulation which allows an IBM PC to emulate a 3274 cluster controller. CLEO 3270 also offers 3278 emulation for ASCII CRTs. In addition, it enables handling seven other PCs for connection to a mainframe host. Phone 1 offers CLEO 3780 for IBM mainframes that do not support terminal clusters.

4. Protocol Computers, Inc. (PCI) of Woodland Hills CA offers an extensive range of communications products that handle ASCII-EBCDIC conversion along with terminal emulation (3270, System 34/36/38's 5251 terminals, etc.). PCI recently introduced PCIterm, an IBM PC software package for Systems 34/36/38 and 303X, 308X, 404X, etc. This package is unique because it supports a mouse and offers windows. It offers "pop up" menus, help screens, and supports color monitors.

EXHIBIT 2-1
IRMALINE FOR REMOTE COMPUTERS
IBM, LISA, RAINBOW
NORCROSS GA



Source: Digital Communications Associates Inc.

CHAPTER THREE
SECOND LEVEL MICRO-TO-MAINFRAME LINKS

I. Overview of Second Level Micro-to-Mainframe Links

Second level micro-to-mainframe (or mini) links are typified by Data General's Desktop Generation, Honeywell's 6/10, and DEC's Pro 350 that can run subsets or full implementations of minicomputer operating systems and applications. Even though these machines can run minicomputer and mainframe-based applications, the Yankee Group does not consider them true micro-to-mainframe links since:

- they are propietary (vendor specific) and will only run a small number of applications;
- their only connection with DBMS systems is through terminal emulation. Communications is not an "integral" part of these systems;
- they do not yet offer a full version (or even a subset) of the vendor's DBMS. (Although Digital's Datatrieve, a file management system, runs on the Professional 350, PDP-11 series, and VAX series computers, this product is not a full DBMS);
- they cannot move data into popular MS-DOS applications;

II. Products

These systems can move formatted files at a higher level than simple ASCII files or "screen dumps" (which are used for sending graphics and spreadsheets). Products in this area include:

1. Data General's Desktop Generation Series (which is capable of running its office system product, CEO);

2. Digital Equipment Corporation's Professional 300 series (which is capable of running Digital's office system software, All-In-One).

   Digital offers another product called the Micro PDP-11. Based on the Professional 350, this multi-user system will also run PDP-11 applications.

   Announced late in 1983, the Micro VAX is a powerful new addition to Digital's "super-micro" line. It also offers the capability to run VAX software;

   DEC Pro runs MAPS/Model, a DSS package from Ross Systems of Palo Alto CA along with CTOS, a WP package that also runs on larger Digital Equipment systems, and Access Matrix's Supercomp-Twenty, a spreadsheet that runs on the Professional 350 (and will shortly be available for the IBM PC and the Digital Rainbow as well).

3. Sperry Corporation's Sperrylink Model 30 Deskstation (which runs Sperry's office system software, Sperrylink);

4. Honeywell's Microsystem 6/10 has two processors and can run several of Honeywell's propietary DPS-6 minicomputer operating systems and associated applications software. The 6/10 will also run MS-DOS applications.

III. IBM's XT/370: A Foundation for the Future

Late last year, IBM announced two important products -- the 3270 PC and the XT/370. The XT 370 costs $8995 and runs VM/CMS, PC-DOS, 3277 emulation (which requires a terminal controller). IBM 3270 PC prices start at $4935, and it offers four interactivce 3270 windows, a fifth window for PC-DOS applications, and two more windows for "electronic notepads."

Just as the IBM PC set standards which encouraged software developers to research and develop sophisticated integrated software packages; the Yankee Group expects the XT/370 will play a major role in spurring the development of micro-to-mainframe systems. The XT/370 will also be extremely important to third-party software companies as a VM applications development machine.

A. VM and PCs

The Yankee Group believes that with the introduction of the XT/370, which supports the VM/CMS operating system (OS), IBM strategically has committed itself to VM for smaller systems (dedicated to specific applications) along with MVS for larger systems (dedicated to corporate databases). On larger systems, VM offers the interesting capability of supporting "guest" operating systems. Among the guests hosted by VM are large system OSs such as MVS, DOS, and UNIX. IBM is expected to offer this feature for microcomputer operating systems (MS-DOS, UNIX, and Concurrent CP/M) as well.

For micro-to-mainframe users, this means that users will be able to take advantage of new VM/CMS applications software without abandoning favorite MS-DOS applications (e.g., they will be compatible). Moreover, VM/CMS's guest facilities mean that all these applications could be stored in a software library resident on a large system, and downloaded to users' workstations on request. This capability will represent an attractive feature to DP managers worried about the uncontrolled proliferation of microcomputer software.

B. VM: A New Standard OS

Although the Yankee Group only expects IBM to ship 45,000 XT/370s in 1984, the small number of units shipped this year does not reflect the impact VM will have on software developers. The Yankee Group believes the VM OS will soon become a

"standard" for fourth-generation languages, ad hoc query DBMSs, report writers, and some applications software (as indicated by Figure 3-1). In doing so, it will certainly intrude on microcomputer OS's turf, as shown by Figure 3-1.

C. VM vs. MS-DOS and CP/M-86

With MS-DOS rapidly running out of power and the multitasking version of MS-DOS not expected until the summer or fall of 1984, many minicomputer/mainframe software vendors will turn to VM for the development of new applications in the decision support, DBMS, and financial planning areas. Moreover, with IBM expected to develop its own "Windowing" system for the PC (the 3270 PC is a precursor of this OS), the attraction of traditional microcomputer OSs will wane even further. As a result, MS-DOS applications developers will be forced to consider the following alternatives:

- develop closer ties to minicomputer/mainframe software vendors (as in VisiCorp's joint marketing and development agreement with ADR);
- build new applications in VM/CMS (a difficult task considering microcomputer software vendors lack of experience with the VM operating system);
- continue to develop integrated applications under MS-DOS and Concurrent CP/M (which now offers an MS-DOS interface);
- switch to the ATTIS/UNIX camp;
- become acquired by a minicomputer/mainframe software or hardware vendor (the most prominent example being MSA's acquisition of Peachtree in 1981).

As for the Digital Research Inc.'s (DRI) Concurrent CP/M OS, the Yankee Group believes this product is being positioned to fit into the UNIX environment. This belief is substantiated by the fact that DRI was appointed by Intel to develop the "official" version of UNIX for Intel's new 80186 processor, the

powerful successor to the IBM PC's 8088. ATTIS also recently announced an agreement with DRI to jointly develop a library of UNIX applications.

The Yankee Group believes that DRI will also announce an agreement with ATTIS to run Concurrent CP/M under Unix. This agreement will extend the life of CCP/M, since Unix will provide multi-user facilities (e.g. concurrent updates, etc.) even if a multi-user version of CCP/M is not forthcoming. While VM is more powerful, that power does not currently address the mainstream market. For example, users cannot even absorb the five features (word processing, spreadsheet, communications, file management, and graphics) of Lotus Development Corp.'s Symphony, much less anything more sophisticated.

D. VM vs. UNIX

As discussed in Chapter One, IBM plans to offer two versions of the UNIX OS:

- Interactive System's PC/IX on the PC XT;
- Microsoft's XENIX on the 68000-based S 9000.

The Yankee Group believes this introduction is a defensive measure designed to appease users who think they need UNIX. In reality, IBM is not serious about UNIX. The Yankee Group believes IBM will "play off" UNIX against its VM operating system in both the business and scientific marketplace. But IBM is hedging its bets just in case UNIX becomes a standard. IBM would rather compete against itself than ATTIS and UNIX Version V (UNIX's latest form, but certainly not its last).

Regardless of IBM's internal marketing games, the Yankee Group firmly believes IBM's own VM operating system will be IBM's primary OS. In fact, VM will be the standard operating

system for IBM's large microcomputers, small minicomputers (e.g. the unannounced 4361 Model 1), and systems that act as controllers/file servers on LANs.

1. IBM's Super Micros

VM will be offered on the unannounced, high-end microcomputers that will be based on Intel's 80286 chip and on IBM's own 32-bit processor that is expected in 1984. (The 80286 is an updated 8086 that contains a full 16-bit data bus, virtual memory, and 15-to-20 support chips.) This $7,000-to-$15,000 multi-user "supermicro" will replace the aged Datamaster and the Displaywriter some time in late 1984.

VM will also be the operating system of choice for even more powerful supermicros that will be announced in the 1985/86 timeframe. These machines will contain Intel's 80386 (an 8088/86 compatible chip with a full 32-bit data path).

2. VM Reasoning

Although UNIX will probably be offered on all these machines, the Yankee Group believes UNIX will take a back seat to VM for several reasons. First, VM is an "IBM OPERATING SYSTEM" that extends from the low end XT/370 all the way through the 3081. It will offer continuity and a common-user interface for IBM users accessing a number of applications and systems.

Second, approximately 8,000 VM licenses have been sold to date. Moreover, IBM VM licenses are increasing by 30%-to-40% annually.

Third, IBM's list of VM application software is much longer than any single UNIX vendor's list. Nevertheless, this only applies to technical applicatiions. Commercial applications are still in short supply for both operating systems. Still,

UNIX is gaining ground since there are over 300 software packages currently available from approximately 90 companies

Fourth, IBM severely limits the number of VM "flavors." In contrast, UNIX is offered in many different forms by a host of vendors such as Microsoft, Fortune, Unisoft, DEC, Wang, and even AT&T (through Western ELectric).

Lastly, IBM will increasingly offer more sophisticated tools for the VM environment. These packages include its relational database system, SQL, (which is currently being shipped) and its high-level communications protocol, SNA, (which will be shipped sometime in the second half of 1984).

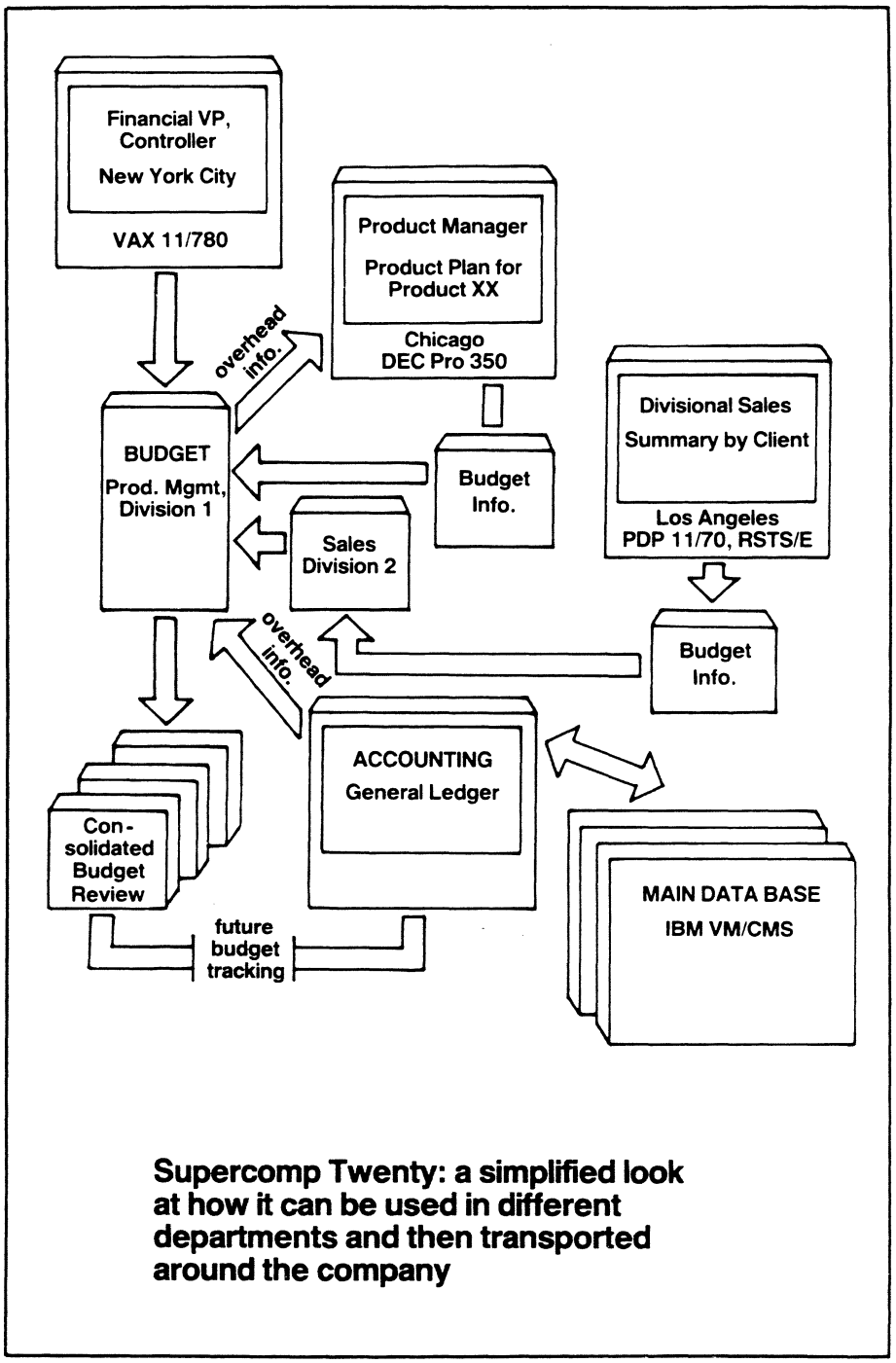
3. Outside IBM: UNIX and Peaceful Coexistence

VM is a clear winner in the IBM camp, but other minicomputer/mainframe hardware vendors are not likely to heartily endorse a propietary IBM operating system. Nor is IBM likely to freely license VM to its competitors. As a result, UNIX will become a powerful alternative to the minicomputer/mainframe vendors' propietary OSs. While these vendors will stress the unique advantage of their own OSs, many of their customers will demand UNIX.

In the microcomputer area, this will mean that UNIX and propietary operating systems will be on more equal terms. In fact, the vendors will encourage this "peaceful coexistance" by providing bridges. At first these bridges will simply mean that applications are written in a high level language (such as "C") that is common to both operating systems. At a later point, both these operating system will accommodate "guest" operating systems in much the same way as VM offers this facility.

These trends will occur for seveal reasons. First, the sheer numbers of Unix programmers and the high level of support in the IBM world will give Unix a strong impetus.

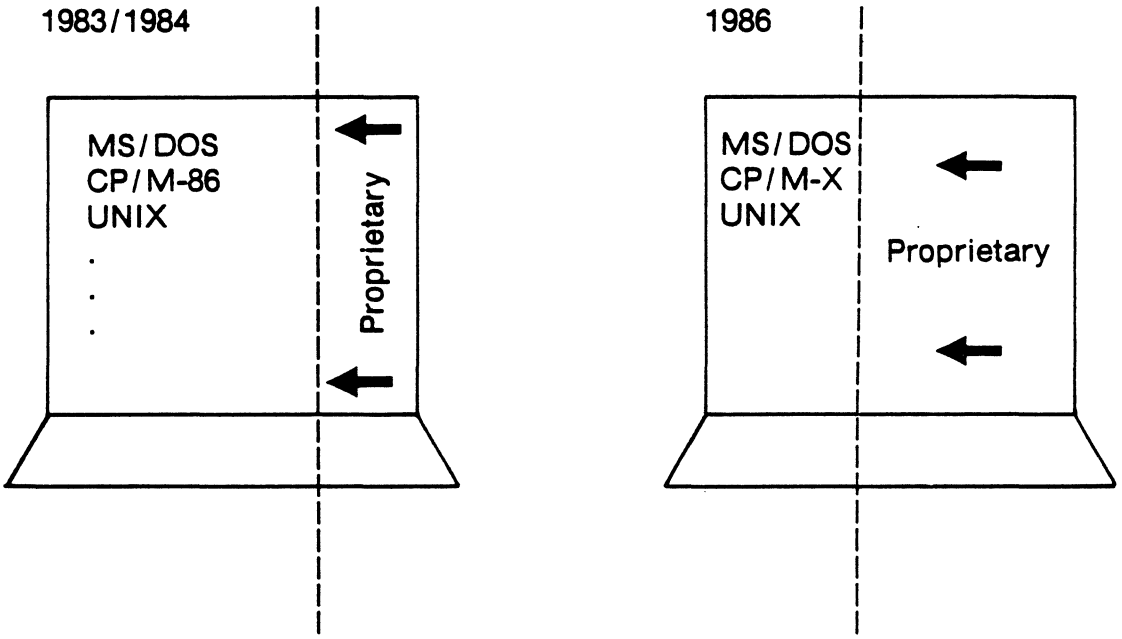
EXHIBIT 3-1
SUPERCOMP TWENTY



Supercomp Twenty: a simplified look at how it can be used in different departments and then transported around the company

Source: Hardcopy

FIGURE 3-1
IBM DESKTOP STRATEGY



Source: the Yankee Group

Second, there will be ample room in the market for two more powerful operating systems. Hardware vendors' most important task will be to ensure that their systems can run a large library of third-party software. Some of this software will be written for their proprietary OS. Most will be for a common denominator OS, currently MS/DOS, likely both Unix and VM later. If microcomputer OSs (MS-DOS, Concurrent CP/M, and UNIX) can run as guests on minicomputers, these vendors will not be at a significant disadvantage.

Third, the need to run the popular micro programs will not change, only the OS they run under. In fact, the Yankee Group believes that OSs will become "transparent." The vast majority of present micro users don't care, or worse, are intimidated by operating systems. The proliferation of OSs will only serve to confuse users. As a result, the Yankee Group believes that future systems utilizing guest OSs will not necessarily hide operating systems from users, but simply bypass them and place the user directly into the application. Figure 3-2 shows the evolving complexity of micro OSs.

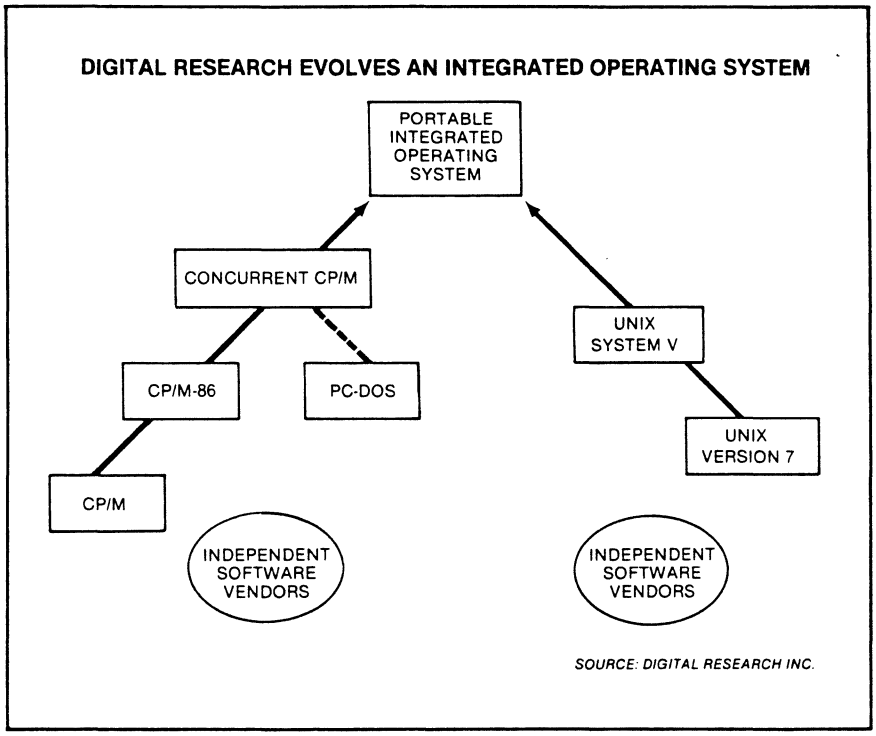
The "kernel" at the top of the "A" figure represents a future architecture for operating systems. This kernel is represented as a triangle since the number of users running applications will decline as they move up the triangle.

The vast majority of PC users will continue to run MS-DOS applications.

A smaller number will run applications under Concurrent CP/M invoking MS-DOS applications when necessary. (Digital Research recently started shipping a new version of Concurrent CP/M that handles both MS-DOS and CP/M-86 applications.)

Fewer users will require applications running inside UNIX. (Generally, these applications will be housed on a file server

FIGURE 3-2
EVOLVING OPERATING SYSTEMS



Digital Research plans to integrate its operating systems' approach *by developing, for release next year, a new portable integrated operating system consisting of CP/M, PC-DOS, UNIX and space for one more operating system. The four will access common files.*

THE DIGITAL RESEARCH/MOTOROLA AGREEMENT

- Digital Research will implement its Concurrent DOS operating system on Motorola's VME/10 development/OEM system.
- Digital Research and Motorola will develop 19 software packages in CP/M and Concurrent DOS. These include:

CP/M 68K-VME/10

— Digital Research C
— Pascal MT +
— C BASIC compiler

Concurrent DOS VME/10

— Digital Research C
— C BASIC compiler
— Pascal MT +
— FORTRAN 77
— PL/I (G)
— BASIC interpreter
— GSX graphics software

- Digital Research and Motorola will develop the same high-level languages (supporting Concurrent DOS on Motorola's VME/10) to support UNIX System V for the MC68000 family.

Source: Motorola Inc.

Source: Mini-Micro Systems

with UNIX offering the necessary multi-user capabilities along with guest facilities for running Concurrent CP/M and MS-DOS applications.)

Finally, a propietary operating system will occupy the highest level. Although these OSs will offer guest facilities for the previous layers, few users will need the powerful applications available at this level.

E. IBM Third Party Software Direction

The Yankee Group estimates that about 10% of IBM's revenues (or over $4 billion) are already software-based. In the microcomputer area alone, the Yankee Group estimates that IBM's software revenues of $150-to-$200 million outstrips all other software vendors. (By way of comparison, Tandy's 1983 software revenues were approximately $110 million and Microsoft sold almost $70 million worth of software last year.)

Moreover, software as a percentage of total sales will continue to increase as software becomes a more important accessory to hardware and IBM raises its prices for large systems software. However, IBM realizes that it cannot meet all its customers' needs through its own software development. In fact, it must actively support third-party development, particularly for vertical applications software.

The Yankee Group believes IBM itself is gearing up its third-party software program. IBM openly advertised its famous meeting a couple of years ago with invited third-party software suppliers, an effort aimed mostly at the PC. Since then, IBM has steadily nurtured its Value-Added Reseller (VAR) program for the following product lines: the 4300 series, the Personal Computer products from the Entry Systems Division, and S 9000 from the IBM Instruments Division. As a result of the success of these programs, the Yankee Group believes IBM will actively court both VARs and software developers for the XT/370.

F. IBM's Complementary Marketing Organization

Furthermore, IBM is developing a Complementary Marketing Organization (CMO) program, which will offer joint marketing arrangements with selected third-party software organizations (Artificial Intelligence Corporation, which offers a natural language DBMS interface product called INTELLECT; and Comshare, which offers System W, a decision support system that runs on both IBM mainframe and microcomputers). A number of microcomputer software vendors, like Microsoft and Digital Research, have already benefitted from a close marketing relationship with IBM. This program will include:

- joint advertising;
- joint sales;
- joint demonstrations;
- references by IBM salespersons to customers for particular third-party applications software programs.

Most minicomputer vendors have initiated similar joint marketing programs, with varied success. The Yankee Group believes that Wang and H-P, for example, have been more aggressive, while Digital has only, thus far, given lukewarm support to its third-party program. All these programs suffer from a time lag of three-to-six months between the time a product is submitted for evaluation and when it is finally approved. Many microcomputer vendors are not willing to wait for this stamp of approval from minicomputer vendors, the sales opportunities resulting from IBM's large direct-sales forces makes this channel very tempting to some software developers.

As for the micro-to-mainframe connection, the Yankee Group believes that the CMO program (which IBM has announced, but should become more operative in 1984) will virtually guarantee the success of third parties thus sanctioned. These vendors will have the inside track on IBM's product plans. Although

IBM has not announced any CMO vendors, the Yankee Group believes they could include the micro-to-mainframe and applications vendor, Management Science of America (MSA). IBM will encourage applications vendors to integrate their applications into IBM's own DBMS products (IMS, DL/1, SQL, or DB 2). Coupled with the fact that the Yankee Group expects IBM to encourage development of applications software for the XT/370 by CMOs, there exists a chance that a new generation of highly-integrated micro-to-mainframe links will arise from these arrangements.

While IBM's third-party program will sanction some third-party applications vendors, it will also create more direct competition for other third parties, like Cullinet and Cincom, which have their own applications software strategies. In fact, the Yankee Group believes there could be a "war" brewing between Cullinet and IBM. Even though Cullinet is a midget compared to IBM, it is challenging IBM for control over some key Fortune 1000 database sites (as discussed in Chapter Two). And the Yankee Group believes that database is the key software that will determine a user's "environment." This situation will make the micro-to-mainframe market even more competitive.

Micro-to-mainframe users can be helped or harmed by this situation. On one hand, competition will drive prices down, especially for the microcomputer portion of these packages. Competition will also spur the development of enhancements along with the introduction of new products. On the negative side, price cutting may place pressure on weaker vendors' margins, causing them to leave the market or forcing them to cut back on support. Moreover, rapid technological development could confuse potential customers as the melange of products becomes even more varied.

IV. Related Reports

For more information on office system software, refer to the second quarter 1983 OAS/IS report entitled Omnibus Office Systems Software. Additional information on microcomputers from Data General, Honeywell, Digital Equipment Corp., Wang, and IBM can also be found in The Technical Office report (Volume II, 1983) entitled The Professional Computer. Moreover, the Yankee Group's Infromation Systems will publish a report entitled Supermicros in July. More information on independent minicomputer/mainframe software vendors is also available from Information Systems' December 1983 report entitled Software Strategies.

CHAPTER FOUR
THIRD LEVEL MICRO-TO-MAINFRAME LINKS

I. Overview of Third Level Micro-to-Mainframe Links

In contrast with level II where the products were strictly hardware, level III micro-to-mainframe links are principally software packages. Products in this area come close to the Yankee Group's definition of a micro-to-mainframe link that was outlined in Chapter One.

Micro-to-mainframe links at this level are characterized by offering microcomputer applications that can receive mainframe data directly into spreadsheets and, less frequently, database and word processing packages. Even though spreadsheets impose restraints on the ways a user can manipulate the data, many users are comfortable trading off power for the ability to use a familiar application. As noted previously, the most popular microcomputer applications are Lotus Development's 1-2-3 and VisiCorp's VisiCalc.

Although a few vendors such as Management Decision Systems (which sells a decision support package called EXPRESS) offer interfaces to Ashton-Tate's popular database package, dBASE II, many other vendors simply state that their products are "compatible" with any software reading DIF (data interchange format) files. As noted in Chapter One, this statment can be misleading since the user may have to write a short program to ensure that his/her applications package is "compatible" with a particular micro-to-mainframe vendor's product.

Level III products require software at both the micro and mainframe levels, along with the appropriate communications software and hardware. These products may also require a

separate "storage" space at the mainframe level to allow microcomputers users easy access to "permitted" data. It should be noted that some packages lack certain features. For instance, most packages offer the ability to download file, but several links (such as Informatics General's VisiAnswer product) offer no facilities for uploading files to the mainframe.

Products at this level are generally "friendlier." These products are also the most popular since they offer access to mainframe systems, but offer familiar applications at the microcomputer level. In other words, they only require the user to learn a few new skills. Level IV products, however, are often far more powerful, but they may require users to learn completely new packages.

A. Why VisiCalc and Lotus 1-2-3?

Why are VisiCalc and Lotus' 1-2-3 so popular with vendors in this group? Basically, the large installed bases ensure a receptive client base for these micro-to-mainframe links. There are over 700,000 legitimate copies of VisiCalc in circulation, (and probably twice that number of pirated copies.) At the end of January 1984, Lotus had sold over 190,000 copies.

II. Selected Level III Vendors

This level contains the leading vendors in the minicomputer/mainframe software market. While Table 4-1 indicates the relative positions of these vendors, not all the companies listed in this table are profiled. Only the following companies will be profiled in this Chapter:

Independent Software Vendors

- Applied Data Research (ADR) of Princeton NJ;

- Cincom Systems, Inc. of Cincinnati OH
- Computer Corporation of America (CCA) of Cambridge MA;
- Cullinet Software of Westwood MA;
- Informatics General Corp. of Woodland Hills CA;
- Management Science of America (MSA) and Peachtree Software of Atlanta GA;
- McCormack & Dodge (M & D)of Natick MA;

A. Applied Data Research (ADR)

1. Introduction

ADR is attempting to explore the micro-to-mainframe market from several different standpoints. First, it wants to bring together some of the 700,000 VisiCalc users and its DBMS installed base. It also would like to extend those VisiCalc users into VisiCorp's newest product, VisiOn (a windowing "environment" that offers users the same command and files structure across a broad range of microcomputer applications). This strategy is suffering since ADR is depending on VisiCorp for the needed microcomputer software.

VisiCorp, however, is undergoing a period of transition as the sales of its leading product, VisiCalc, are fading in the face of challenges from Lotus' 1-2-3, Sorcim's SuperCalc, and Apple's Macintosh. Moreover, VisiCorp's investment in VisiOn may be a long way from fruition since independent software developers have taken a "wait and see" attitude, limiting the acceptance of VisiOn. Independent software vendors will not support VisiOn until it achieves a large installed based, but users will not buy VisiOn until more applications become available for it.

Second, ADR plans to take advantage of the IBM XT/370. ADR sees this machine as an opportunity to move its systems

TABLE 4-1
1983 REVENUES OF LEADING SOFTWARE VENDORS

	Total Revenues	Software Products Revenues	% Increase in 1982 for S/W Revenues
ADR	$ 88.0M (est.)	$ 88.0M	30.0%
Anacomp	$112.0M (est.)	$ 26.0M (est.)	7.5%
Boole & Babbage	$ 22.0M (est.)	$ 22.0M (est.)	47.0%
CCA*	$ 25.0M (est.)	$ 18.0M	75.0%
Cincom	$ 73.0M (est.)	$ 73.0M	35.0%
Computer Assoc.	$ 58.1M	$ 58.1M	35.0%
Cullinet	$ 78.6M	$ 78.6M	59.4%
Hogan Systems	$ 17.1M	$ 17.1M	114.0%
IBI	$ 30.0M (est.)	$ 30.0M	55.0%
Informatics General	$200.0M (est.)	$ 85.0M (est.)	25.0%
Insci	$ 20.5M	$ 10.5M (est.)	60.0%
Martin Marietta	$ 3.8B	$ 72.0M	40.0%
McCormack & Dodge	$ 1.5B (D + B)	$ 57.0M (est.)	45.0%
MSA	$146.0M (est.)	$146.0M	45.0%
Pansophic	$ 47.0M (est)	$ 47.0M (est.)	30.0%
SAS Institute	$ 26.0M (est.)	$26.0M (est.)	44.0%
PMS	$ 62.0M	$ 21.7M (est.)	45.0%
SWAG	$ 30.0M (est.)	$ 30.0M	30.0%
Systematics	$ 64.4M (est.)	$ 6.5M (est.)	50.0%
UCC	$155.0M (est.)	$ 70.0M (est.)	34.0%
Walker Interactive	$ 7.4M	$ 7.4M	147.0%
Total		**$989.9M**	**40%-45% Average**

NOTE:
$565.7 Million of total is systems software, or 57.1%;
$424.2 Million of total is applications software, or 42.9%.

* Recently acquired by Extendicare, Ltd., a Canadian company with over $200 Million in revenues.

Source: the Yankee Group

TABLE 4-2

APPLIED DATA RESEARCH

Vendor	Applied Data Research (ADR)/Princeton NJ
Vendor's Software Prices	
Mainframe Software	ADR/Datacom-DB for: MVS -- $76,700, DOS -- $59,600, Other systems (4300 and 370) -- $44,700
Host Communications Link	ADR/Link -- $10,000-$15,00 (average price around $13,500 with OS and DOS versions costing $12,000 and $13,500, respectively)
Microcomputer Software	ADR/Link (IBM PC part) -- $495, (ADR/Link is free if purchased with other IBM PC applications from ADR, but VisiCalc and VisiOn are priced separately)
Software Cost for 50 Users	Approximately $38,000
Vendor's Mainframe Software	ADR/Datacom/DB, Empire, Roscoe, ADR/EMAIL, etc.
Vendor's Micro Software	ADR/PC Datacom, ADR/PC Email, ADR/PC Empire, ADR/PC Vollie, and ADR/PC Roscoe
Hardware Required	
Mainframe	IBM Mainframe (OS, DOS, and CICS)
Minicomputer	Digital Equipment Corp.'s VAX series
Microcomputer	IBM PC, PC XT, and PC-compatibles
Compatible Mainframe Software	Limited to ADR's products
Compatible Micro Software	VisiCorp's VisiOn and VisiCalc, and ADR's own microcomputer software
Features	
Terminal Emulation	ASCII TTY; IBM 3270-terminal emulation later this year
File Downloading	selective downloading using Dataquery
File Uploading	no upload facilities to ADR/Datacom-DB at present, but speadsheets can be sent to mainframe-resident Empire DSS (a Decision Support System)
Menu-driven Query Languages	yes, via ADR/Link

NOTE: This table is only a guide. This table is not intended as a comprehensive product outline since pricing and specifications may have changed since this information was compiled.

Source: the Yankee Group

FIGURE 4-1
COMPETITIVE POSITIONING OF LEADING SOFTWARE VENDORS

	DBMS	Applications Development	Applications Software	Office Automation*	PC-Link	Performance Monitors, Utilities
ADR	•	•	no	•	A	•
Boole & Babbage	no	no	no	no	no	••
CCA	•	•	no	some	A	few
Cincom	•	•	•	F	F	some
Computer Assoc.	•	no	•	no	F	•
Cullinet	•	•	•	possible	A	some
IBI	•	•	no	possible	A	no
Informatics General	no	•	•	no	•	no
Martin Marietta	•	•	•	no	A**	no
McCormack & Dodge	no	A	•	no	A	no
MSA	no	possible	•	possible	•	no
Pansophic	no	some	no	no	no	••
SWAG	•	•	no	•	F	few
UCC	no	no	•	no	•	•

Source: the Yankee Group

* Decision Support Software, Electronic Mail, Word Processing, Graphics.
** With RAMIS.
A = Announced
F = Will offer in the near future.

TABLE 4-3
WORLDWIDE DBMS INSTALLATIONS
(As of October, 1983)

Vendor	DBMS Product	IBM Installations	Other Installations	Total Installations
ADR	Datacomm/DB	400		400
CCA	Model 204	215	-------	215
Cincom	TIS	80		80
Cincom	TOTAL	2,500	3,000	5,500
Cullinet	IDMS	1,300	-------	1,300
IBI	FOCUS	1,100	-------	1,100
IBM	DL/1	10,500		10,500
IBM	IMS	5,300		5,300
IBM	SQL	550		550
SWAG	ADABAS	1,100		1,100
Martin Marietta	RAMIS	1,150	-------	1,150
Other		**2.700**	**25,650****	**28,350**
Total DBMSS*		**26,895**	**28,650**	**55,545**

* Includes a 10% retirement rate.
** Includes HP 3000, IBM S/38 RDBMS, and other minicomputer-based DBMS.

Source: the Yankee Group

TABLE 4-4
IBM MAINFRAME APPLICATIONS INSTALLATIONS

	Number	Major Applications Area	Near Future Direction
Cincom	100	Manufacturing	Cross industry financial
Computer Associates	200	Distribution management	Financial applications for distributors
Cullinet	100	Manufacturing, cross industry financial	More financial, human resources
Hogan Systems	280	Large banking applications	More financial, human resources
Informatics General	100	Life insurance	Financial applications for distributors
Insci	1,100	Payroll & personnel	Pension Insurance administration
Martin Marietta	800	Manufactuirng	Cross industry financial
McCormack & Dodge	2,500	Cross industry financial	More financial applications
MSA	5,000	Cross industry financial	Manufacturing
Policy Management System	1,500	Property insurance	Financial applications for distributors
SAS Institute	8,600	Graphics & statistical analysis	Financial applicaitons for distributors
UCC*	2,000	Cross industry financial & banking	Financial applications for distributors
Walker Interactive	350	Cross industry financial	More financial

* UCC has over 6,000 IBM mainframe installations overall.

Source: the Yankee Group

software and decision support system down to the workstation level without having to contend with performance shortcomings inherent in the present 8088-based IBM PC product line. While ADR's XT/370 strategy will be analyzed in more detail later, it must be remembered that ADR is one of the companies to offer an XT 370 product. This lead may give an early lead in the XT 370 software sweepstakes and an important lead as IBM develops more PCs that are capable of running mainframe OSs and applications at the workstation level.

2. ADR - The Premier Third Party Systems Software Vendor

Leaving ADR's micro-to-mainframe strategy for the moment, the Yankee Group believes ADR is the premier third-party systems software vendor in the mainframe area. This success is highlighted by its revenues, which have been increasing by 30%-to-40% over the last few years. For example, fiscal year 1982 revenues were $68.4 million, and FY 1983 revenues were $89 million (FY ends with the calendar year), a 30% increase. While ADR actually reported a pre-tax loss in the second quarter of 1983, this situation was probably due to the negative impact of Cullinet's April announcement, and the unavailability of ADR's upcoming products (especially IDEAL).

ADR has an installed base of 17,000 products (at over 8,000 sites), all of which are based on IBM mainframes (supporting OS -- MVS and VS/1 -- and DOS operating systems). The Yankee Group believes that utilities software still represents well over 50% of ADR's revenues. ADR/The Librarian (a source program management system), which was introduced in 1969 and has an installed base over 5,000, is still a big revenue producer. ROSCOE (an on-line programming system running under OS), VOLLIE (ROSCOE's counterpart running under DOS), and LOOK (a performance monitor running under both OS and DOS) also have a significant installed base.

TABLE 4-5
ADR'S PRODUCT LINE

ADR/Product	MVS	DOS	Small Mainframe, Minicomputer (4321, 4331, 370/1xx)
ADR/Datacom-DB	$76.7K	$59.6K	$44.7K
ADR/D-Net	37.5K	29.1K	21.9K
ADR/Data Dictionary	34.2K	28.1K	21.1K
ADR/DC	51.5K	43.6K	32.7K
ADR/Roscoe	49.7K (MVS)	-----	-----
ADR/Vollie	-----	18.7K	14.0K
ADR/The Librarian	29.5K	20.2K	15.2K
ADR/DataQuery	18.8K	14.6K	11.0K
ADR/Data Reporter	12.9K	10.3K	7.7K
ADR/Ideal	75.0K	50.0K (1st Quarter 1984)	
ADR/VSAM Transparency	10.5K	8.3K	6.2K
ADR/Multi-User Facility	17.9K	13.8K	10.4K
ADR/Empire	50.4K (MVS and VM/CMS)		
ADR/EMail	37.5K	18.5K	14.5K
ADR/ETC.	24.8K	18.2K	13.7K

Source: the Yankee Group

3. ADR's DBMS: DATACOM/DB

ADR, with DATACOM/DB, entered the DBMS market late (through the acquisition of Datacom from Insyte Corp. in 1977). However, over the past few years, DATACOM/DB (an inverted file-based DBMS with "relational views" which can be used in large production environments) has sold well. The Yankee Group estimates that DATACOM/DB now has over 400 installations (which puts it fourth in third-party IBM DBMS installations behind Cullinet, Cincom, and Software AG). The Yankee Group believes DATACOM/DB installations are about evenly divided between MVS and DOS, but that MVS shipments are growing faster.

DATACOM/DB is growing at a 75%-80% annual rate. Moreover, the Yankee Group estimates that DATACOM Systems products (including the Data Dictionary, ADR/DC, ADR/D-Net, Dataquery, and Datareporter) account for a total of approximately 2,000 installations. Moreover, these products represent at least 25% of ADR's 1983 revenues.

4. XT/370 Plans

ADR has just begun to ship a VM/CMS version of DATACOM/DB. The Yankee Group believes ADR will convert other facilities and products to VM/CMS (ADR has a VM/CMS-based development program underway). Support of VM/CMS throughout ADR's product line will be very important -- as the IBM XT/370, which will be shipped in June 1984, will be an excellent programmer workstation.

ADR's strategy is to provide an integrated product line for what it calls the Relational Information Management Environment (RIME). DATACOM/DB is the primary means of storing and managing data in the RIME environment, and the Data Dictionary is the building block that interfaces between products like IDEAL, Dataquery, Reportwriter, the LIBRARIAN, etc.

The Data Dictionary provides active control of the entire RIME environment. Dataquery, for example, uses specifications from the Data Dictionary, which means that users need only specify data definitions once. This insures accuracy and consistency, and streamlines maintenance.

With IDEAL, ADR is greatly extending the breadth of its systems software capability. But ADR is also moving into some end-user applications areas (although its strategies are very different from Cullinet's). ADR offers EMPIRE, a Decisions Support System. In the past, ADR has typically sold EMPIRE (which runs on DEC VAX's) on a timesharing basis to service bureaus. However, ADR is just introducing EMPIRE on IBM mainframes with an interface to DATACOM/DB. ADR also offers EMAIL and ETC (Extended Text Compositor). Its micro-to- mainframe strategy is based largely on an agreement with Visicorp.

5. Micro-to-Mainframe Strategy

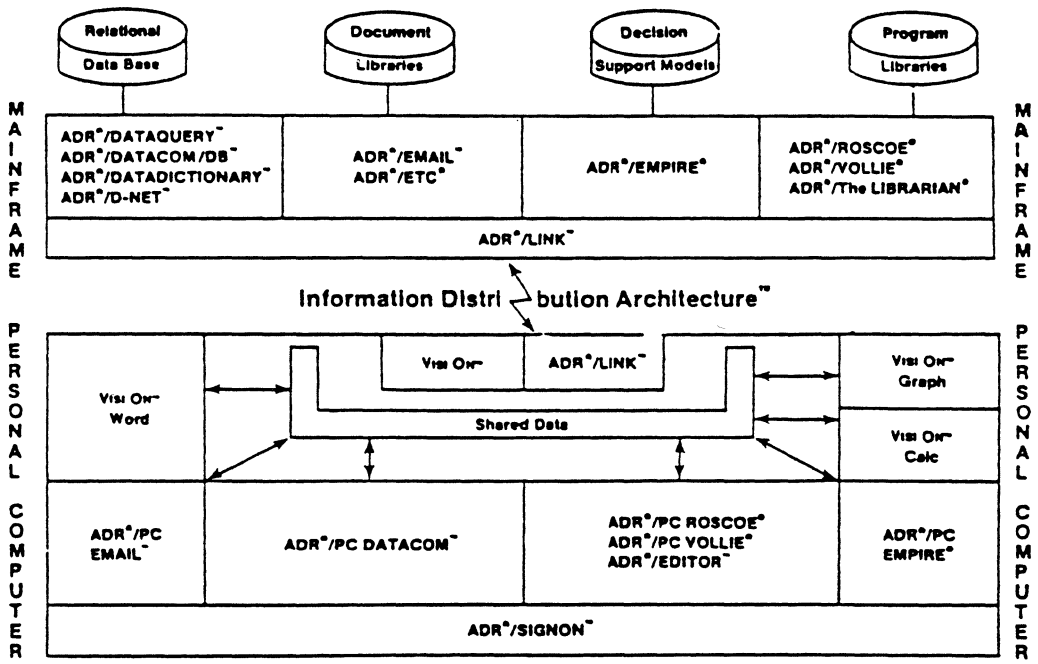
ADR has a two-pronged micro-to-mainframe strategy to:

- extend some related database capabilities to the PC; and
- offer PC applications through a third party (Visicorp); see Exhibit 4-1.

The new ADR PC products (some of which should be available by early-1984) include:

- ADR/PC DATACOM (which extends the data access and retrieval capabilities of DATACOM/DB and Dataquery to the IBM PC);
- ADR/PC MAIL (an extension of ADR/EMAIL to the PC);
- ADR/PC EMPIRE (an extension of EMPIRE to the PC).

EXHIBIT 4-1
ADR'S MICRO-TO-MAINFRAME STRATEGY



Source: ADR

ADR/LINK is the facility users must have to establish a communications link between their PCs and the mainframe with DATACOM/DB, etc. Initially, ADR/LINK will support ASCII, and connect to multiple mainframes. The Yankee Group expects ADR to announce an SNA/SDLC link in 1984.

The initial ADR/LINK version has limited capabilities. It enables end users to download data selectively using Dataquery (e.g. Dataquery is more powerful than simply an extract facility). Uses can qualify a set of data and then download; but there is no upload capability yet (the Yankee Group expects ADR to announce this with ADR/LINK's next release).

ADR is a value-added remarketer of VisiCorp's VisiOn. ADR will provide extensions of Dataquery/PC, PC/MAIL, etc., to the VisiOn applications. ADR's relationship with VisiCorp includes VisiCorp's technical and consulting assistance to achieve this goal. Exhibit 4-1 shows the VisiOn and ADR/PC applications that ADR will offer. ADR/PC EMPIRE, for example, will operate in conjunction with VisiOn Graph and VisiOn Calc (using VisiOn's windowing facilities), and PC users will then be able to upload data from VisiOn Calc to EMPIRE on the IBM mainframe (thus providing PC users with extensive modeling and analysis capabilities).

ADR/PC EMPIRE also allows simple and complex models to be prepared on the PC. Prompting features on an intelligent editor simplify this activity.

The Yankee Group believes ADR's agreement with VisiCorp is potentially hazardous. VisiCorp was very late delivering VisiOn. While VisiCorp recently reduced the the price of VisiOn to $95 from $495, VisiOn, with three applications and a mouse, can still cost well over $1,000. VisiOn also suffers from the fact that it is slow and only three applicatons are currently available for it. Moreover, integrated products like Lotus' 1-2-3 and Symphony, Ovation Technology's Ovation,

Softrend's Aura, and Ashton-Tate's Framework provide faster products, more applications, and lower prices ($500 - $800) than VisiOn (albeit without the expansion capabilities of VisiOn). Moreover, Apple's Macintosh and Microsoft's Window are drawing software developers towards their products and away from VisiOn.

As a result, the Yankee Group believes ADR, which will introduce most of its own PC products (those discussed above) by the first and second quarter of 1984, will not have its VisiOn version until mid-1984.

The poor initial response to VisiOn is an important indication of the success of ADR VisiCorp strategy. There is also a possibility that ADR will be able to sell VisiOn to its installed base in spite of VisiOn's shortcoming. This sales strategy could focus on the fact that ADR can deliver one integrated software solution that runs from the microcomputer to the mainframe. By offering this "seamless" package on the basis that ADR can supply all the pieces, ADR may succeed in selling this system to DP departments who want to consolidate and control the proliferation of software within their organization.

VisiOn's pricing is another factor. Pricing for the mainframe-based software is not available yet, and the Yankee Group expects VisiOn to be substantially higher-priced. ADR's micro-to-mainframe version of VisiOn could cost as much as $1,500 per workstation for all applications.

On the other hand, VisiOn does have an Open Architecture with strong windowing features, which could neatly tie together with ADR's PC applications (especially EMPIRE). Furthermore, the IBM 3270 PC, with its windowing features, is a good strategic hardware product for these functions, especially when IBM extends its windowing features to PC applications (the windowing features on the initial product support 3270 applications only).

The Yankee Group believes that ADR should provide some alternatives to VisiOn, supporting at least an interface to Lotus' newest product, Symphony, which already contains an aysnchronous communications package and expansion slots that could accommodate some of ADR's propietary software. Taking into account that approximately 25% of all IBM PC users own a copy of Lotus 1-2-3, an interface to this product would give ADR's micro-to-mainframe marketing push a much greater impetus. Although Lotus and VisiCorp are competitors, VisiCorp has an OEM agreement with both ADR and Informatics General.

6. Future

Following Cullinet's lead with Trendspotter (a sophisticated hardware/software query and report system costing upwards of $50,000), ADR plans to offer an executive workstation that incorporates color graphics and touch screen technology. Coupled with with an English-language query facility, this workstation will require no computer experience. In addition to query facilities, this workstation will offer electronic mail and a spreadsheet application as well.

Called ADR/EASEL, ADR and Interactive Images (Woburn MA) plan a joint effort to build this workstation. (Interactive Images has also announced that its EASEL software will run on the IBM PC XT.) Under the terms of the agreement, ADR and Interactive Images will develop EASEL software extensions to:

- ADR/DATAQUERY (an information retrieval and data manipulation utility),
- ADR/EMPIRE (a popular decision support systems)
- ADR/eMAIL (an electronic mail system).

Priced in the $5,000-to-$10,000 price range, ADR will sell this device exclusively through its direct sales force in conjunction with Interactive Images. However, a select number

of retailers may be used in the future. Since ADR will not manufacture the hardware for this workstation, the Yankee Group expects ADR to OEM an IBM-compatible PC from a well-known manufacturer in this area. Expected to debut by the end of 1984, this product will allow ADR to sell a "complete" low-end solution to its existing customers. Moreover, the incorporation of IBM PC-compatible software, a micro-to-mainframe link, and simple database query facilities into one hardware/software package will give ADR's sales force a very effective sales tool against Cullinet and other mainframe software vendors.

7. Summary

In the microcomputer area, ADR desparately needs interfaces to other microcomputer applications. While its pricing for 50 users (around $38,000) is very competitive, VisiOn could increase this cost substantially. Still, ADR is positioned very strongly in the DBMS and DSS areas. Furthermore, forthcoming versions of ADR's popular Empire DSS will come at a time when microcomputer users are looking beyond spreadsheets and towards more powerful DSSs.

ADR is positioned very strongly in IBM mainframe and minicomputer systems software. With IDEAL tied into its "relational" DBMS and Data Dictionary, the Yankee Group believes ADR will continue to grow at 30%-35% annual rates, with a gaining marketshare of installed DBMS. But the Yankee Group believes that ADR must develop a VM/CMS version of IDEAL and DATACOM/DB to take advantage of the IBM XT/370.

ADR's ability to compete with an integrated "Information Center" offering is largely dependent on its VisiOn strategy (just as Cullinet's strategy depends on the acceptance of the Information Database). Conceptually, the Information Database is more powerful and easier to use (it doesn't involve knowledge of any query language or commands), and Cullinet controls

development of its product line from top to bottom. However, in fairness to ADR, neither product has been proven in the field yet.

III. Cincom Systems Inc.

A. Introduction

Since Cincom Systems is the leading third-party DBMS vendor (over 5,500 TOTAL installations), the Yankee Group believes it is in a very strong position to take advantage of the micro-to-mainframe market. Cincom has taken a cautious approach to this market, but in Janauary of 1984 it announced its link software (PC Contact). In addition, Cincom announced three mainframe applications that simulate microcomputer applications such as word processing, spreadsheet, and graphics, but run on an IBM mainframe. At the same time, Cincom also announced Cricket, a new product that provides "the same powerful development capabilities of MANTIS, Cincom's fourth-generation application development system," according to Cincom. All in all, an adventurous series of products that address Cincom's strengths and avoid its weaknesses in the PC area.

As for Cincom's financial details, Cincom is still a privately held company with fiscal year 1983 revenues estimated by the Yankee Group at $73 million. This represents an increase of 35% over FY 1982 revenues of $54 million. Overall, the Yankee Group expects Cincom's 1984 revenues to grow 25%-30%. Looking towards 1985-86, the Yankee Group expects even greater growth potential.

B. Installed Base

Of the 5,500 TOTAL installations (see Table 4-6), the Yankee Group estimates 2,500 are IBM mainframe-based. Aproximately 52% of these installations are in DOS environments. The

remaining installations are based in the OS (MVS) operating environment. Aside from IBM, Cincom has the largest installed base of DBMSs running on IBM mainframes.

While Cincom has a large installed base, it is also aging. TOTAL, a network CODASYL DBMS, is almost ten years old and, although it has been enhanced, it has recently suffered in competitive situations against Cullinet, and even IBM. Cincom's new product, TIS, should remedy this situation, but a number of IBM TOTAL installations have become inactive or secondary to other DBMSs. Therefore, the Yankee Group believes that Cullinet, with 1,300 IDMSs installed as of October 1983, has actually displaced Cincom as the leading IBM third-party DBMS supplier. There is no question that Cullinet's DBMS base is growing much faster than that of Cincom's.

But Cincom has another leg to its strategy. There are about 1,300 PDP-11-based TOTAL installations (the VAX ran TOTAL in a PDP-11 mode until Cincom introduced a VMS version of TOTAL in 1983, and currently has over 120 VAX/TOTAL installations), and the remaining 1,700 installations are other minicomputer-based versions of TOTAL (including the IBM S/34, Wang VS, Data General Eclipse, Honeywell DPS 6, and others). TOTAL is supported on more than 20 different mini systems.

C. MANTIS and CRICKET and the XT 370

Over the past few years, Cincom has also offered MANTIS, a fourth-generation programming language. As of January, Cincom states that MANTIS is installed at over 1,300 sites around the world. In January of 1984, Cincom announced CRICKET, a special version of MANTIS designed to run on the XT/370 under VM/PC, a scaled-down version of VM/CMS. CRICKET provides all the facilities of MANTIS but can only access CMS and CRICKET files. Designed to enhance programmer productivity, CRICKET's

TABLE 4-6
TOTAL DBMS INSTALLATIONS

TOTAL	5,500
IBM-Mainframe	2,500
Minicomputer-Based	3,000

Source: the Yankee Group

TABLE 4-7
TOTAL DBMS INSTALLATIONS, 1983

IBM Mainframe	2,500 TOTAL DBMS
DEC PDP-11	1,300 TOTAL DBMS
Other Minicomputer-Based	1,700 TOTAL DBMS
TOTAL	**5,500 TOTAL DBMS**

Source: the Yankee Group

availability is dependent on the shipment of the XT 370. Cincom has tentatively set delivery for Spetember 1984, but this date could be delayed if IBM postpones XT/370 shipments. In connection with Cincom's micro-to-mainframe link, PC CONTACT, CRICKET files can be uploaded and downloaded between IBM 370 architecture mainframe and PCs. Coupled with PC CONTACT, CRICKET will become a real boon to programmers, since programs can be downloaded to the XT 370 for revision and uploaded to a mainframe for storage and execution.

On the mainframe side, MANTIS has opened up new markets for Cincom (just as ADS On-Line, IDEAL, and NATURAL open new opportunities for Cullinet, ADR and Software AG, respectively). MANTIS is sold as a standalone product and has accounts for approximately 700 new installations, including about 80 TIS installations. Since MANTIS is integrated with TIS, all TIS sales include MANTIS. The remaining 500 MANTIS licenses were sold to TOTAL users.

D. ULTRA

The Yankee Group expects Cincom's minicomputer systems software revenues (e.g., the Ultra DBMS for VAX) and applications revenues to more than double. The Yankee Group believes the applications software market should represent at least a 50% annual growth rate, assuming Cincom's applications packages offer users the same advantages that Cullinet's offer. There is currently a great need among installed VAXs for a relational DBMS, and Cincom is the only vendor among the leading third-party DBMS suppliers (Cullinet, ADR, and Software AG) to offer a VAX-based R-DBMS (although there are other third-party R-DBMS products for the VAX, such as Oracle Corp.'s ORACLE and Relational Technology Inc.'s INGRES.

Although Cincom offers no micro-to-mainframe/minicomputer link for ULTRA at present, the diversification of the VAX product line into workstations such as the microVAX and the

low-end VAX 725 could result in a software product for these machines.

E. TIS

TIS is a network DBMS for both heavy production and end-user environments (it offers a relational view). Cincom's introduction of TIS was mandatory, both to maintain its installed base of IBM mainframe TOTAL DBMS, and to open new market opportunities. As mentioned earlier, TOTAL is an older product that requires heavy maintenance costs, and does not lend itself to end-user facilities. Cincom developed TIS over several years, and currently has about 80 installations (as of October 1983); it is growing by at least 30%-to-35% per month.

TIS is a mainframe, heavy production-oriented DBMS. The smallest mainframe that can use TIS is the 4341. It is essentially meant for the MVS operating environment (a DOS version will be available in 1984). TIS can be layered over TOTAL, and can also be layered over IBM's DL/1 database (e.g. a large DL/1-based 4300 shop can plug TIS on top of DL/1, and can use all the relational facilities of TIS). Thus, Cincom offers a distinct advantage over IBM (IBM users must take a separate copy of DL/1 for SQL to do reporting).

Furthermore, Ultra is file- and command-compatible with TIS -- VAX satellite processors in an IBM host environment (with TIS) can communicate easily. This is a cornerstone of Cincom's strategy -- enabling distributed databases between IBM (TIS-based) hosts, and various satellite processors in the field.

While IDMS-R (and Datacom/DB) are driven by the data dictionary, TIS is driven by its directory.

TIS is offered in two versions:

1. $180,000 for CICS (an IBM teleprocessing monitor) users;

2. $250,000 for users who want Cincom's teleprocessing monitor.

This bundled price includes the DBMS with all the foundation tools (including the directory, the data manipulation language, the logical view and maintenance utilities, as described below).

Since TIS is bundled with MANTIS, and PC CONTACT extracts data from MANTIS files, information can be extracted from TIS files to a PC.

F. PC-to-Mainframe Link

Cincom has taken a cautious approach to the micro-to-mainframe market. Unlike Cullinet, which announced its micro-to-mainframe link product (the Information Database) last April, but had not shipped any products as the end of April, (even though Cullinet said the product would be available by year-end 1983), Cincom has taken a less aggressive posture towards the PC. There are reasons for this:

1. Cincom has spent its R&D developing TIS and applications software;

2. Cincom is waiting for the dust to settle in the PC market.

As stated previously, Cincom announced its micro-to-mainframe link, PC CONTACT, in January. Cincom states that PC CONTACT is presently in beta test and is scheduled for general release in April 1984. PC CONTACT costs $60,000 per mainframe and $1,000 per PC (with quantity discounts available). There is also a $1,000 installation fee as well as an annual usage charge based on 15% of the full package price. All in all, an expensive package when compared with other micro-to-mainframe products.

PC Contact provides three different communications capabilities -- asynchronous, coaxial attachment via DCA's IRMA board to an IBM 3274 cluster controller, and SNA/SDLC. The first two types of communications will be supported on the initial release of PC CONTACT, but SNA/SDLC is scheduled for a future release.

While PC CONTACT only provides an interface to MANTIS at present, the Yankee Group expects Cincom to announce an interface to a third party (e.g. Lotus 1-2-3, or some other reputable micro software supplier) in the near future. The Yankee Group believes that Cincom has also developed a PC-DBMS (with a third party) that links to TIS and Ultra. PC CONTACT provides downloading and uploading capabilities, and is written in MANTIS (thus requiring MANTIS on the mainframe). In the near future, PC CONTACT will link with TIS and Ultra along with supporting the DEC Rainbow as well as the IBM PC. It will be marketed with Cincom's product line (Cincom will not, like Cullinet, attempt to sell its "Information Center" as a standalone product).

G. Too Much Caution

Cincom's cautious entry and expected quick delivery of its products is good strategy for Cincom, since it involves minimal risks. Moreover, PC CONTACT will be delivered in the same timeframe as (or possibly before) Cullinet's Information Database and ADR's VisiOnLink.

However, another side of the coin says that Cincom should "go for it" with a highly competitive, integrated commercial PC-DBMS (like dBaseII from Ashton-Tate) that could exist as a retail standalone PC product or as an integrated one. This strategy could vault Cincom back to the software forefront. While such a strategy would move Cincom into the highly volatile microcomputer software market, such a product could be

used to leverage multiple PC-DBMS users toward an Ultra or TIS "total" solution for their environment. It would also supply Cincom with a new market and a new revenue source. This strategy will probably be employed by IBM to some extent, using PC 3270 with SQL (a database), and DIA/DCA (document transfer architecture) as the lever. It is, however, an unlikely scenario for Cincom, which prefers a more conservative approach.

H. Summary

In the PC-to-mainframe area, the Yankee Group expects Cincom to save development costs and time, and minimize risk, through a joint venture or by acquiring and/or supporting established third-party PC software. This will enable Cincom to satisfy a market requirement for its installed base, and to grow the TIS/ULTRA environment top-to-middle-to-bottom. Moreover, the Yankee Group expects Cincom, like ADR, to offer end users substantial applications capability, with decision support software, graphics, electronic mail, word processing, and the like. However, Cincom will offer these applications in conjunction with TIS, etc., rather than aggressively addressing the substantial new market opportunities that exist.

V. Computer Corporation of America

A. Introduction

Whereas McCormack & Dodge emphasizes power at the expense of ease-of-use, Computer Corporation of America (CCA) takes a different stand. Called PC/204, this micro-to-mainframe link allows users to download data from CCA's mainframe DBMS packages by simply following familiar commands for filling in a Lotus 1-2-3 spreadsheet. The user simply determines the appropriate heading for rows and columns in the spreadsheet and data is automatically downloaded into the selected area of the spreadsheet. Moreover, the menu selections offered by PC/204 after each selection are coordinated to avoid errors.

TABLE 4-8
COMPUTER CORPORATION OF AMERICA

Vendor	Computer Corporation of America (CCA) of Cambridge, MA (a subsidiary of Crowntek International)
Vendor's Software Prices	
Mainframe Software	Model 204 -- $155,000 - $235,000
Host Communications Link	PC/204 -- $10,000 (mainframe component of PC/204)
Microcomputer Software	PC/204 -- $750 (Lotus 1-2-3 costs an additional $495)
Software Cost for 50 Users	$47,500 (without Lotus 1-2-3) $202,500 - $282,500 (with Model 204)
Vendor's Mainframe Software	Model 204 DBMS, COMET/204 (electronic mail), and TEXT/204 (word processing)
Vendor's Micro Software	PC/204
Hardware Required	
Mainframe	IBM mainframes (MVS, DOS/VSE and VM/CMS)
Minicomputer	None
Microcomputer	IBM PC, PC compatibles, and selected MS-DOS machines (unannounced)
Compatible Mainframe Software	CCA's Model 204
Compatible Micro Software	Lotus 1-2-3 and software reading DIF (data interchange format) files
Features	
Terminal Emulation	ASCII TTY with a propietary block-mode protocol. PC/204 can emulate 3270 block-mode with translation.
File Downloading	only on IBM PC part of PC/204
File Uploading	None
Menu-driven Query Languages	available on both mainframe and IBM PC parts of PC/204

NOTE: This table is only a guide. This table is not intended as a comprehensive product outline since pricing and specifications may have changed since this information was compiled.

Source: the Yankee Group

B. Computer Corporation of America and Crowntek, Inc.

Computer Corporation of America (CCA), founded in 1965, was privately held until its November 1983 acquisition by Crowntek, Inc. (a wholly-owned subsidiary of Extendicare Ltd., a Canadian Company based in Toronto) for $40 million. (The acquisition is still pending, but the parties have announced a letter of intent.)

The Yankee Group believes CCA's annual growth rate is around 40%-to-50%, with FY 1983 revenues around $25 million (FY ends with calendar year). In 1983, about $8 million will come from its Contract Research and System Development Services (government contract work done for the Department of Defense), and the Yankee Group estimates that in 1983 $18 million will come from commercial sales (almost all from MODEL 204, but also including $1 million in EMAIL sales). CCA also recently won a major multi-million dollar contract with the Australian Social Security System.

C. Model 204

CCA's MODEL 204, a relational DBMS for large IBM mainframes, is growing at 80%-100% in revenues, with about 200 MVS installations, and 15 DOS installations (as of October 1983). Also, a version for VM is now available. MODEL 204 was originally designed for DEC, and still is available for the VAX, although marketing has shifted to IBM environments. The Yankee Group expects CCA, which is a leader in technology, to become a significant competitor in the commercial market, and it could become a real competitor for Cullinet and Cincom (and of course, IBM). CCA's potential to compete is limited not by its technological capability, but by its current marketing capability (the pending acquisition should change this).

A fully configured MODEL 204 (for MVS) costs $235,000 (see Table 4-8). For DOS, the fully-configured price is $150,000 (CCA began shipping the DOS versions in second quarter, 1983). CCA's pricing is competitive with Cullinet's.

MODEL 204 is an inverted list DBMS with relational views designed for end-user and production environments. According to CCA, MODEL 204's unified architecture provides very high performance with large numbers of concurrent users. MODEL 204's proprietary implementation of advanced inverted file techniques allows all fields to be defined as KEY, without degradation of system performance. This is a significant advantage over older inverted file DBMS's, like ADABAS, that suffer degradation with multiple concurrent updating.

D. Model 204 for VM/CMS

Indicating a possible move towards the XT/370, CCA recently introduced a version of MODEL 204 running under VM/CMS (Conversational Monitor System) in native mode, with no loss of performance (according to CCA). By utilizing OS-format disks under direct management of MODEL 204, CCA was able to get equivalent MVS performance without modifying either CMS or the VM system control program. The CMS version can support a multi-user environment, allowing large numbers of users to access and update MODEL 204 databases concurrently under the control of a MODEL 204 virtual machine without performance degradation. A single CMS user can also utilize the multi-user version of MODEL 204 on a virtual machine. The CMS MODEL 204 version costs $195,000 (fully configured).

CCA claims that the CMS version is for OS users who want to convert to CMS because of its ease-of-use and design. As such, MODEL 204 can run under a guest operating system. The native CMS implementation of MODEL 204 permits users to use the guest operating system for batch updates to the MODEL 204 database during off hours, and CMS is used for ad hoc queries to the

MODEL 204 database and for analyses during regular business hours. But the Yankee Group also believes that this version is more significant because it fits directly into the recently announced IBM XT/370, which is based on VM/CMS. This could be extremely useful in distributed and/or multi-mainframe environments, where MVS is used at the host, and VM in the Information Center and at distributed nodes.

E. CCA's Micro-to-Mainframe Link — PC/204

In October 1983, CCA announced PC/204 (with shipments expected in first quarter 1984). PC/204 is an intelligent link between MODEL 204 and the IBM PC (see Exhibit 4-2). It gives the IBM PC user transparent access to the IBM mainframe database (e.g. the PC user does not have to log onto the operating system and find the desired program). PC/204 consists of four products along with an asynchronous link:

1. the Communicator: establishes the session with the mainframe via an asynchronous block mode. The protocol performs automatic error detection, and gives the user an economical and functional alternative to synchronous alternatives.

2. PC Software Integration: PC users can select, from a menu-driven program, which mainframe and PC applications they want, and the Communicator automatically connects the user with the mainframe database and the desired PC application. There is no user intervention needed.

3. The Retriever: is designed especially to extract information from the database for spreadsheet applications. The PC user does not have to re-key any information. The Retriever uses a double-window screen layout enabling users to select data on a menu in the upper window while the lower window displays the retrieved data in spreadsheet format.

4. The Distributor: offers a subset of the USER language to the PC user, which creates consistent syntax throughout, and

enables PC users to perform MODEL 204-based screen management and screen definitions.

PC/204 costs $10,000 for the mainframe, and $750 per PC. CCA is also a value-added reseller of Lotus 1-2-3 (CCA also offers Lotus 1-2-3 with PC/204 for $500 per PC).

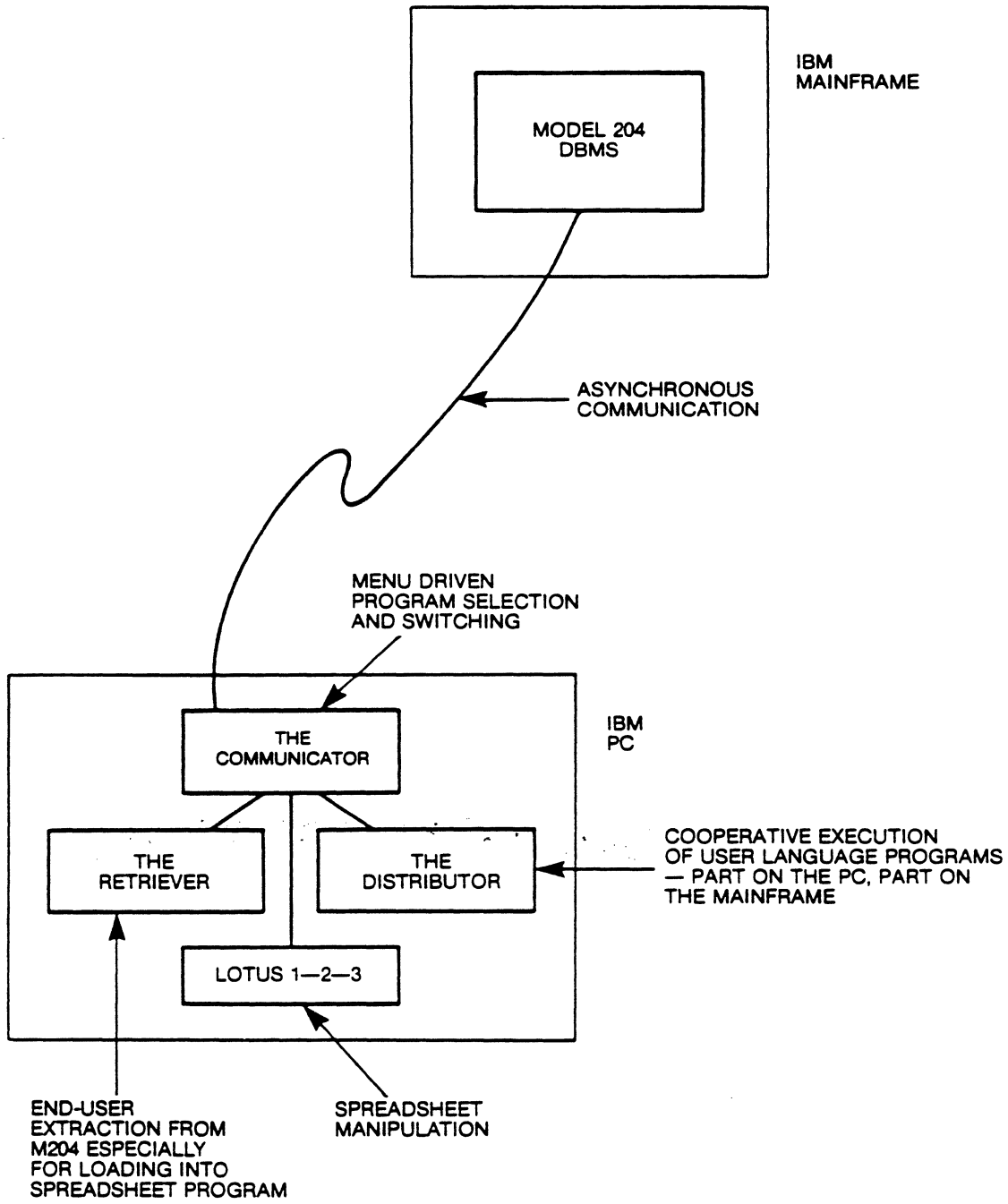
The Yankee Group believes CCA's PC-Link is very price competitive (Cullinet's Information Data Base, for example, costs $75,000 for the mainframe version), very functional, and meets established standards (by supporting currently-used spreadsheets for the IBM PC, and by offering Lotus 1-2-3). One advantage (besides price and greater ease-of-use) CCA may have over Cullinet and ADR is the ability to deliver the product. With Information Data Base, Cullinet has gone the proprietary route, and might encounter some bugs. ADR's agreement with VisiCorp for VisiOn could be troublesome, as VisiOn has already encountered delays.

In the future, the Yankee Group expects CCA to offer more proprietary PC applications, such as graphics, EMAIL, and word processing (as discussed below).

F. Summary

The Yankee Group believes that CCA is a technological leader, with great potential. The PC/204 micro-to-mainframe link offers users what they need; a good basic communications package with easy-to-use query and extract facilities. While it sacrifices some power with its menu-driven approach, CCA offers this link at a competitive price of $47,500 (without Model 204). Overall, CCA's weakness is its small sales and marketing force, but this should be overcome with the Crowntek acquisition.

EXHIBIT 4-2
ARCHITECTURE OF THE PC/204 FAMILY



Source: CCA

CCA's MODEL 204 is gaining in installed base, despite CCA's relatively weak marketing efforts. PC/204 is an exceptionally cost-effective product which supports market standards. And with the VM/CMS offering, it would appear that CCA will have little trouble offering an extensive product for the IBM XT/370.

With COMET and 204/TEXT, CCA is positioned to offer more extensive PC capabilities. Furthermore, CCA has specialized graphics capabilities, which could give it an edge in fast-growth specialized market niches.

Finally, CCA's other technologies -- in distributed data-bases, integrating multi-IBM DBMSs, and with ADAPLEX-- indicate that CCA will be a very important competitor in the long term. The acquisition by Crowntek should enable CCA to exploit its technological expertise/development further, as well as to develop a strong marketing organization.

VI. Cullinet Software Inc.

A. Introduction

Cullinet Software, of Westwood MA, is a 16-year old company that specializes in mainframe DBMS (IDMS and IDMS/R) and applications software. In April 1983, Cullinet announced its micro-to-mainframe link, the Information Data Base (ID). While this product still has not been delivered at the time of this writing, Cullinet has announced its intention to enter the microcomputer software market as well. In fact, it was privately showing its microcomputer software to selected customers at this year's SOFTCON show in New Orleans. While Cullinet is entering the microcomputer and micro-to-mainframe market, this process has not affected Cullinet's overall growth.

B. Cullinet Financial Performance

In fiscal year 1983 (which ended on April 30, 1983),

TABLE 4-9
CULLINET SOFTWARE

Vendor	Cullinet Software of Westwood MA
Vendor's Software Prices	
Mainframe Software	IDMS-DB--$35,000 IDMS/R--$68,000 (Average IDMS sale is $250,000--$450,000)
Host Communications Link	Info DB -- $75,000 (on the mainframe)
Microcomputer Software	Info DB -- $1,000
Software Cost for 50 Users	$125,000 (without quantity discounts or mainframe application such as IDMS-DB and IDMS/R)
Vendor's Mainframe Software	DBMSs--IDMS, IDMS/R, and other DBMS packages
Vendor's Micro Software	Propietary integrated software containing the following applications: spreadsheet, DBMS, graphics, word processing, and electronic mail
Hardware Required	
Mainframe	IBM mainframe (OS/MFT, OS/MVT, OS/VS2, DOS/VS, and DOS/VSE)
Minicomputer	None
Microcomputer	IBM PC and PC compatibles
Compatible Mainframe Software	Cullinet's software and other DBMSs such as IBM's IMS and DB 2
Compatible Micro Software	Only Cullinet's software applications at present
Features	
Terminal Emulation	ASCII TTY and 3270 emulation with DCA's Irma board
File Downloading	on IBM PC part of Info DB (mainframe files are not updated unless a special program is written to move data from Info DB to production database)
File Uploading	with microcomputer part of Info DB
Menu-driven Query Languages	available on both mainframe and IBM PC part of Info DB

NOTE: This table is only a guide. This table is not intended as a comprehensive product outline since pricing and specifications may have changed since this information was compiled.

Source: the Yankee Group

Cullinet reported revenues of $78.6 million; an impressive 59.4% increase. Most of this increase was due to Cullinet's vanilla database product (IDMS), and the additional facilities which it began to ship in FY 1982-1983 (in particular, Applications Development System). The Yankee Group expects Cullinet's superb growth to continue (although there are some important hurdles it will face in FY 1984-1985), as Cullinet enters the third phase of its existence (as discussed below).

The Yankee Group believes that, of all the vendors discussed in this report, Cullinet has the best potential to emerge as a dominant force among independent software suppliers. With 1,300 IDMS installations (and a total of 8,600 software products installed at 1,800 sites), the Yankee Group believes that Cullinet is the leading third-party supplier of large IBM mainframe DBMSs (Cincom has more installations of TOTAL, but the Yankee Group believes Cullinet has the edge among active large production site DBMS installations).

Taking all the available IBM sites that can handle a large production-oriented DBMS (from 4341 Group I Systems at the low end, to the largest 3081 mainframes), the Yankee Group believes that Cullinet has, about, a 3% penetration. The Yankee Group believes that only 51% of all IBM sites currently use a DBMS (see the November 1982 C/iS report, "Evolving DBMS," for an elaboration), and there is excellent opportunity for DBMS growth, not only on large systems, but on minis and micros as well.

C. 1984 — A Crucial Year for Cullinet

The Yankee Group believes that FY 1983-FY 1984 represents a dramatic breakthrough for Cullinet into the applications software arena. The Yankee Group estimates that, in the 1983 fiscal year, only 4% of Cullinet's revenues were in the non-database (applications software) area. In contrast, Cullinet's first

TABLE 4-10
CULLINET'S DATA BASE FACILITIES

Product	Price
IDMS/R	$68K
Applications Development Systems(ADS)	$35K
IDMS - DC (Teleprocessing Monitor)	$35K
IDMS - DD	$35K
On-Line Query	$30K
On-Line English	$55K
Culprit (Report Writer)	$27K
Interact (OnLine program development and test editing)	$30K
EDP - Auditor	$25K
Information Data Base (Micro-mainframe link)	$75K*

* Plus $1,000 for each PC with volume discount.

Source: the Yankee Group

quarter (1984) idicated that about 20%-to-22% of its revenues were in the non-database area. Moreover, Cullinet's database revenues are still growing at the rate of 50% and higher.

To help sell its applications software, Cullinet is developing a sales force with experience in the manufacturing and financial areas. (It currently has about 120 salespeople in the U.S.)

The addition of applications software in both the microcomputer and mainframe areas enables Cullinet to address new markets, as well as to offer its installed IDMS base an appealing array of additional products (which are, of course, integrated with IDMS/R).

D. Applications Software Packages

As discussed above, Cullinet has met with some early success in the applications software area. This success confounded some industry experts who didn't believe Cullinet could sell or support applications packages. (This also indicates that Cullinet's microcomputer efforts should not be taken lightly. In fact, the Yankee Group believes that Cullinet intends to compete with MSA, which has a strong footing in both areas.)

Cullinet began shipping applications packages in December 1982 and has installed manufacturing applications (Material Requirements Planning) at 35 sites, and general ledger at 50 sites as of October 1983. The Yankee Group believes that about 50% of these are new sites, and the other half are installed IDMS-based sites.

Cullinet's leap into the applications software market is a new venture. Marketing applications software is decidedly different from selling systems software, and while Cincom has also

entered the applications software market, ADR and Software AG have decided to develop cooperative relationships with leading applications vendors rather than compete directly with them. While some experts have been critical of Cullinet's move into applications software (lack of marketing, lack of experience, etc.), the Yankee Group believes that it is critical to Cullinet's total strategy.

The Yankee Group expects Cullinet to focus on the Fortune 1000 manufacturing market, but its market opportunities could grow even faster than planned as suppliers like Insci approach Cullinet directly.

A major "war" could be shaping up between Cullinet and IBM, especially if IBM develops joint-marketing agreements with MSA for its mainframe applications software.

Cullinet has also announced a joint marketing and development agreement with Artificial Intelligence Corporation, and Cullinet currently offers On-Line ENGLISH (for $55,000) with IDMS/R.

E. IDMS/R

Announced by Cullinet in April 1983 (along with the Information Database), IDMS/R gives IDMS/DB relational capabilities. When IDMS/R is delivered in early-1984 (Cullinet claims its delivery target date is on schedule), IDMS/DB will be delivered as IDMS/R, and Cullinet will offer those installed IDMS/DB users, who have subscribed to the annual maintenance contract, the relational upgrade.

Cullinet claims that IDMS/R is the first commercially available DBMS to combine the full advantages of both network and relational DBMS into a single system (Cincom is offering TIS, a relational DBMS built over TOTAL; ADR and Software AG use an inverted file architecture with relational features).

In fact, Cullinet's introduction of IDMS/R was inevitable -- for Cullinet to offer end-user facilities it had to develop a relational view to the production database. With IDMS/R, all production and end-user applications share the same database information, and end users, with menu-driven and screen generation facilities, can create their own applications, and extract data from IDMS/R.

The Yankee Group believes that IDMS/R's advantage is that it can be used interchangeably with the production database for production and end-user applications. There is only one database, and IDMS/R offers a relational view of the data in the production database. However, the Yankee Group believes that intervention by a database administrator is still required, and there is a trade-off involved (either IDMS/R is difficult for end users to use, or the intervention of a DBA is required, which inhibits real-time use). As IDMS/R is just being delivered, end users have not had much experience with it yet, but the Yankee Group expects Cullinet to offer future enhancements.

F. Cullinet's Micro-to-Mainframe Link — The Information Database

Cullinet announced the Information Database -- its micro-mainframe link -- in April 1983, with IDMS/R (for $75,000 per mainframe plus $1,000 per workstation, the Yankee Group believes that the Information Database is very expensive). Cullinet claims its delivery schedule is on target, but first deliveries were scheduled for December 1983. This date has now "slipped" and Cullinet will no longer state when it expects to ship.

The Information Database requires the relational features of IDMS/R. It is not a database (thus its name is misleading), but a repository of information, which is extracted in real-time from the production database, and accessed by end users (who typically use the IBM PC).

Using the menu-driven facilities on the PC, end users simply make requests for information. The information's location (whether in local storage, or in the Information Database) is transparent to the end user. The menu structure of the PC is similar to that of the Information Database. There are elements, folders, and groups. Each folder has a name (similar in concept to the Apple Lisa), and the end user selects a name and relevant information (whether it resides locally, in the production database, or in a public database) is entered into the end user's PC application.

Once processed locally, updates cannot be transferred to the production database directly by the end user, but the end user can upload to the Information Database. The database administrator controls security, and can grant the end user authority to upload the production database directly, or the database administrator could update the production database when appropriately using IDMS facilities (probably ADS On-Line).

The Information Database resides on an IBM mainframe (like IDMS/R), or it could run on a separate 4300. Presumably, the MIS department would run the Information Database from the central site, but smaller remote corporate sites, which need to tie their personal computers with the corporate database, will also be attracted to the Information Database. The Information Database is expensive ($75,000), and requires a database administrator for implementation.

With the Information Database, Cullinet intends to give end users (e.g., corporate managers) a central repository of data, which provides security (only end users designated by the database administrator will have access to the Information Database) and ease-of-use (end users, presumably managers, need not know how to access the database). The Information Database does not require IDMS/R, and Cullinet obviously sees this as a significant new market opportunity. For example, large IMS

shops are desperately seeking a solution to integrate PC applications with IMS. IBM's DB2 provides no connection between the production database and PCs. Cullinet's Information Database could be an attractive product. Some IMS shops might even consider converting to IDMS/R (using a conversion facility which Cullinet offers called ESCAPE-IMS; Cullinet also offers an ESCAPE-DL/1 facility).

Cullinet's decision to implement the Information Center at the MIS department site (as well as at end user sites) is a smart marketing move for three reasons:

1. Cullinet's traditional salesforce has credibility with large MIS departments;

2. large MIS departments, which have felt threatened by the autonomous PC end user, must integrate these users with corporate information systems;

3. IBM has yet to offer a product which does this.

Cullinet believes the Information Database will replace end-user file management and query systems, like RAMIS and FOCUS (but the Yankee Group believes that RAMIS and FOCUS will still be important niche products). Furthermore, the Information Database is not price competitive, and many micro-to-mainframe link products being introduced are very price competitive: FOCUS, RAMIS, and CCA's MODEL 204 PC. Unlike the DBMS and DBMS facilities, which are not price-driven (e.g. users are willing to pay more for more functionality and features), the micro-to-mainframe products are price-driven.

Cullinet is very confident about the Information Database. While the initial version will support the IBM PC, it hopes to make it a standard for corporate personal computer users (although Cullinet claims corporate users have shown interest in only one other PC product thus far -- the Wang Professional). But, since the micro-to-mainframe products are price- driven,

the Yankee Group believes that Cullinet's Information Database will not become the "standard" that Cullinet hopes.

The Yankee Group believes that some initial enhancements of the Information Database might include a sophisticated reporting/monitoring facility for database administrators.

G. Cullinet's Answer to Lotus' Symphony

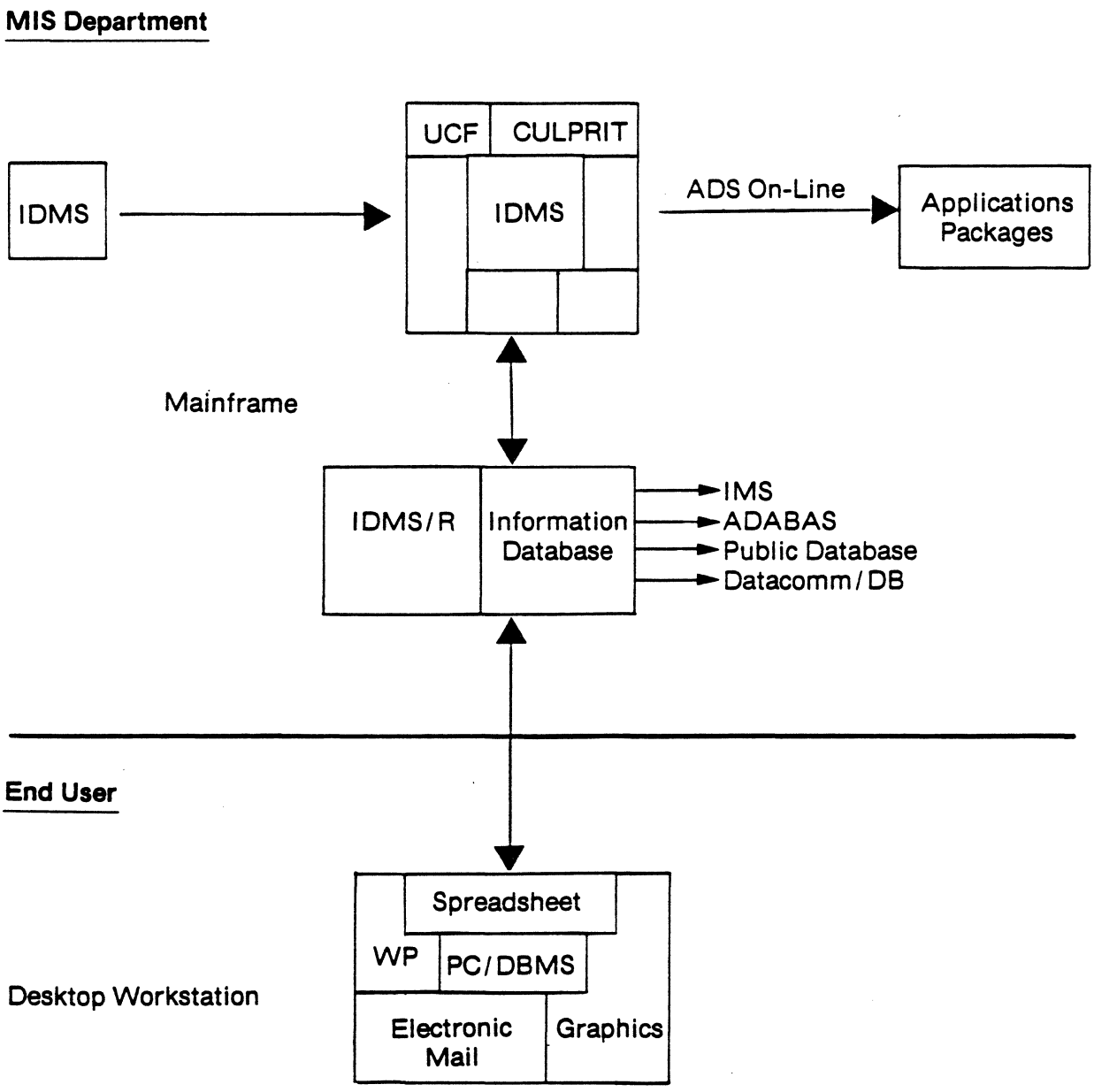
Along with the Information Database, Cullinet is planning to announce its own integrated package. (Similar to Lotus' recently announced Symphony -- an enhanced version of 1-2-3 with word processing, communications, and a $695 price tag.) Cullinet is reported to have picked Knowledgeman and integrated that database management package with other third-party software as well as products gained from the acquisition of Computer Pictures. Cullinet is providing a link between its microcomputer packages and its database management systems (IDMS and IDMS/R) along with its other general ledger, accounting, and manufacturing control programs.

Cullinet's inetegrated packages is expected to contain the following applications:

- database;
- spreadsheet;
- graphics;
- word processing;
- electronic mail.

The price of these applications, which are totally integrated, will be $1,000 (plus the $75,000 for Information Database), with discount pricing for multiple copies. They will be sold only by Cullinet's sales force to Fortune 1000 corporations, and will not be sold through retail channels.

FIGURE 4-3
CULLINET'S EXPANDED PRODUCT LINE 1982-1984



Source: the Yankee Group

While Cullinet has not officially announced its microcomputer software packages, it has privately shown these products to selected customers, and the Yankee Group believes that Cullinet will formally enter the microcomputer software market by this summer. Cullinet's microcomputer software contains five applications: spreadsheet, financial modeling (a DSS/DBMS package that may be based on MDBS' Knowledgeman), graphics, word processing, and electronic mail. Cullinet is expected to charge around $1,000 for this software.

Cullinet has entered this area because its customers and sales force asked for a complete software product line from one source. Moreover, the increasing popularity of micro-to-mainframe links is an area where Cullinet could take a large lead if it delivers fully functional products within the next six months.

Targeted at Cullinet's traditional clientel, Fortune 2000 corporations, these packages are Cullinets answers to demands for a complete set of software from one source. Cullinet also plans to expand its customer base by targeting small businesses with telemarketing and direct sales. Although no retailers are being considered because of possible conflicts with Cullinet's direct sales force, selected OEM (original equipments manufacturers) are being considered.

H. Cullinet and Apple

At present, Cullinet only supports the IBM PC and compatibles. As for supporting other microcomputers (aside from IBM PCs, XTs, and compatibles), Cullinet is uncertain about moving its software onto other microcomputer vendors' hardware. Although Apple and Cullinet announced an agreement when the Apple Lisa was first introduced last year, both parties could not decide who would do the actual work. As a result, that agreement has lapsed. Considering Lisa's poor sales, the Yankee Group believes that Cullinet is taking a "wait and see"

attitude towards the Macintosh (which will probably need the 512K model, that is expected later this year, to run Cullinet's software) and the new Lisa2 before reconsidering supporting Apple's products.

I. The Computer Pictures Acquisition

In November 1982, Cullinet acquired Computer Pictures Corporation for about $13M. The Yankee Group estimates that Computer Pictures had revenues under $10 million at the time of the acquisition. Computer Pictures offered a turnkey presentation graphics Information Management System, priced at around $60,000. The Yankee Group believes Cullinet has already incorporated some of Computer Pictures' graphics technology in its PC graphics package (moreover, the Information Database was developed by personnel from Computer Pictures); but Computer Pictures also offers Cullinet the capability to develop a truly sophisticated graphics package integrated with IDMS/R. Cullinet is currently offering a turnkey package (called TREND-SPOTTER), which interfaces with IDMS.

This package also incorporates some statistical capability, and when integrated with IDMS/R (the Yankee Group believes it could be ideal for the new IBM VM-based workstation) it could offer Cullinet a powerful Decision Support System capability. This would compete with other third-party packages (like Execucom's IFPS and Management Decision Systems' EXPRESS) for financial modeling and strategic planning.

J. Summary

Cullinet is in the midst of a radical expansion. It is moving from a production-based IBM systems software vendor (offering a hierarchical and network DBMS to large MIS departments), to become an applications and Information Center software provider (offering solutions to both the MIS department and to corporate end users). As such, Cullinet will greatly

leverage its installed base, attract new sites with IDMS/R (with all the additional products), and open new markets (offering new vertical applications software and selling the Information Center products independent from the production database).

If, in fact, Cullinet does what it intends to do, it could leverage its position even further by supporting other standards in the corporate office. For example, the Yankee Group believes Cullinet will support an interface with Lotus 1-2-3. (But first Cullinet will establish its own microcomputer software before it endorses competitors' packages.) This would provide an additional attraction for the MIS department. Even if Cullinet's personal computer applications are superior to those of Lotus (Cullinet offers more integrated applications, including electronic mail and a personal relational database package, and the graphics package has statistical and more powerful editing capabilities, with improved quality output), many PC users with Lotus will probably stay with Lotus.

Furthermore, if most large corporations use different DBMSs for particular applications on different mainframes (as the Yankee Group believes is the case), Cullinet might decide to support other leading DBMS products. This could make other third parties more vulnerable, and could make Cullinet the driving force in MIS. In fact, the Information Database, which extracts information from other DBMSs besides IMS (as well as from public databases), is perhaps the first step toward such a strategy.

The Yankee Group believes Cullinet will support other standards as they emerge. For example, when the dust settles, the Yankee Group expects Cullinet to support whatever LAN standard(s) are important.

K. The XT/370

The Yankee Group believes the new XT/370 fits very well

with Cullinet's capabilities, and should greatly benefit Cullinet's market opportunities (since Cullinet's software runs under VM, and most of its software runs under VM/CMS). While much of Cullinet's current thrust is toward the corporate manager using a PC, the Yankee Group expects the IBM XT/370 to be used extensively as a programmer workstation. This is good for Cullinet, since the Applications Development System (ADS On-Line) will run on the XT/370.

In addition, the XT/370, which supports up to 4MB in main memory with 416K available for applications programs, could support some of Cullinet's applications (it might be well suited for some graphics/decisions support software).

To conclude, while the jury is still out on IDMS/R and the Information Database, the Yankee Group believes that Cullinet has laid the groundwork for the remainder of the 1980's. The next two years will determine how dominant a force Cullinet will become among all third-party software vendors. The bottom line is that Cullinet is the best positioned third-party vendor to become a driving force in both systems and applications software.

VII. Informatics General Corp.

A. Introduction

Informatics announced its micro-to-mainframe link in November 1983. Called VisiAnswer and developed jointly with VisiCorp, this product allows users to extract records from Answer/DB, a report writing facility that runs on a mainframe. Informatics claims that VisiAnswer will work with any micrcomputer software package. Coupled with Answer/DB's ability to work with a large number of other vendor's DBMS, this combination of features makes VisiAnswer and Answer/DB extremely flexible. With 50 VisiAnswer links and Answer/DB, this system costs $45,000.

TABLE 4-11
INFORMATICS GENERAL CORP.

Vendor	Informatics General Corp. of Woodland Hills CA
Vendor's Software Prices	
Mainframe Software	Answer/DB -- $45,000
Host Communications Link	Propietary asynchronous communications protocol contained in VisiAnswer
Microcomputer Software	VisiAnswer -- $795
Software Cost for 50 Users	$45,000 (This is the total cost for a minimum 50-unit order.)
Vendor's Mainframe Software	Mark V (an applications generator for IMS/DC and CICS) and Answer/DB (a report writer)
Vendor's Micro Software	VisiOn (in the near future) and the Visi series through an agreement with VisiCorp
Hardware Required	
Mainframe	IBM mainframes running following OSs: MVS and DOS/VSE. (VM/CMS version due in 1984 with potential for XT/370 version.)
Minicomputer	None
Microcomputer	IBM PC and PC compatibles
Compatible Mainframe Software	ANSWER/DB interfaces with range of products: IBM's IMS, Cullinet's IDMS, Cincom's TOTAL, Software AG's ADABASE, IBM's VSAM, Execucom's IFPS, and ISSCO products .
Compatible Micro Software	VisiCorp's VisiOn series in near future and Visi series (VisiCalc, VisiPlot/Trend, etc.) VisiCor
Features	
Terminal Emulation	Asynchronous TTY with a propietary protocol in VisiAnswer
File Downloading	VisiAnswer only
File Uploading	None
Menu-driven Query Languages	VisiAnswer and Answer/DB

NOTE: This table is only a guide. This table is not intended as a comprehensive product outline, since pricing and specifications may have changed since this information was compiled.

Source: the Yankee Group

B. Revenue Information

While Informatics General is a major third-party software vendor (FY 1982 revenues were $170.2 million and FY 1983 revenues were approximately $200 million), software products represented 40%, or $68.0 million of its revenues. Professional services (consulting and custom software development) represented $45.4 million; and remote computing services represented $60.3 million.

Informatics General's strategy is to build a diversified software product line through acquisitions. The Yankee Group expects that software products will exhibit 25%-to-30% annual growth rates over the next few years, thus becoming the company's dominant division. In 1983, the Yankee Group estimates that software products will have $85 million in revenues, and by FY 1984, software revenues should easily exceed $100 million, as new products and acquisitions are shipped in higher volumes. However, the Yankee Group believes that Informatics' future growth rate will become increasingly dependent on its ability to acquire good third-party vertical software vendors. The Yankee Group believes Informatics may encounter growth difficulties with the MARK IV and ANSWER/DB products.

In 1982, the Yankee Group estimates that 54.4% of Informatics software revenues were MARK IV and MARK V-related, and the remaining 45.6% were from vertical applications (see Table 4-12 for estimated figures). The Yankee Group expects this percentage to shift even more towards vertical software in the near future, as this becomes the predominant revenue generator.

The vertical software products are marketed by three autonomous divisions within Informatics General (all of which were acquired). These vertical software divisions represent the fastest growth areas, by far, for Informatics. The Yankee Group expects Informatics to continue its diversified growth strategy through more acquisitions of vertical turnkey vendors (a new area that Informatics might consider is the UNIX-based

TABLE 4-12
INFORMATICS SOFTWARE REVENUES BREAKDOWN
1982 ESTIMATES

Life Insurance Applications (for IBM Mainframes)	$15M
Legal Applications (turnkey systems for Wang VS)	$7M
CPA AND Property Management (turnkey applications for IBM minis and micros)	9M
Applications Development Tools (MARK IV and V)	$25M
Other Facilities (INQUIRY/IV, TAPS, SHRINK)	$2M
End-User Facilities (ANSWER/DB)	$10M
TOTAL	$68M

Source: the Yankee Group

systems). IG sold off $32 million in stock in May 1983; the Yankee Group believes that these liquid assets will be used for further acquisitions.

C. MARK IV and V

MARK V, which was first shipped in 1982, is an interactive applications development system, designed to generate applications for both IMS/DC and CICS environments (MARK IV, which was first shipped in 1976, is MARK V's batch companion). The Yankee Group estimates that there are 2,200 installations overall, with 200 of these MARK V-based. Although the great bulk of installations are MARK IV-based, the Yankee Group believes that MARK IV will be phased out as users convert their systems to interactive environments.

MARK V, which ranges in price from $50,000-$100,000, is an applications development system using fourth-generation techniques for IMS environments. MARK IV and V is one of the most successful third-party software products; it has aggregate revenues of about $125 million. But the Yankee Group believes that MARK V has limited potential: its future is bounded by IMS (it is limited to IMS environments), and the Yankee Group believes that, as IBM improves IMS facilities, users will either stay with IBM's software, or opt for third parties which offer options to IMS. Thus, MARK V loses its market attraction over time.

D. Informatic General's Micro-to-Mainframe Link — ANSWER/DB

ANSWER/DB is a software package that forms the mainframe portion of Informatic General's micro-to-mainframe product. ANSWER/DB is a general purpose report writer for end users and programmers. It was introduced in 1980 and has about 275 installations. It runs under MVS and DOS operating systems, and a VM/CMS version is due in 1984 (this could offer some good

potential for a XT/370 version). ANSWER/DB costs $50,000-to-$60,000, with large discounts for MARK V users.

ANSWER/DB interfaces with a range of products including: IMS, IDMS, TOTAL, ADABASE, VSAM, IFPS, and ISSCO.

E. VisiAnswer

Informatics also developed (with VisiCorp) Visi-ANSWER, which provides a link between ANSWER/DB and VisiCorp's PC applications (VisiCalc, VisiPlot, etc.). VisiOn Answer is also due late in 1984 for microcomputers running VisiCorp's environmental software package, VisiOn.

Informatics estimates that as much as 25% of its 1983 revenues came from micro-to-mainframe products. This translates into $50 million, this figure is interesting because the Yankee Group estimates that the total sales for the 1983 micro-to-mainframe market were only $250 million. Thus, Informatics has a 20% market share in this area. Informatics has built these sales by offering simple and easy-to-use packages that use both menus and prompts to help the user understand the complex process of accessing mainframe data. Informatics also appeals to DP managers by restricting the size of queries and offering extensive security features. DP managers also like the fact that VisiAnswer only has "read" privileges, files cannot be uploaded to the mainframe. In financial environments, VisiAnswer has found favor, since it provides a higher-level of error checking than is normally available with ASCII asynchronous communications protocols.

F. Conclusion

While the Yankee Group thinks that Informatics offers the rudiments for an Information Center, the Yankee Group believes it faces very stiff competition from other third parties (those discussed in above chapters) which offer a substantially

broader product line. Therefore, ANSWER/DB and Visi-ANSWER are more likely to enhance MARK V's market potential (which is, itself, limited), as opposed to opening substantial new market opportunities.

One real advantage Informatics might have over vendors like Cullinet, which is competing head-on with IBM, is its potential to develop closer marketing ties with hardware vendors. By supplying vertical applications software, Informatics becomes an asset to IBM and Wang, rather than a competitor. Should IBM, for example, "sanction" Informatics as one of its chosen third-party suppliers, Informatics will have a substantial competitive advantage. Furthermore, Informatics has the potential to become an integrator between IBM and Wang systems.

VIII. Management Science of America (MSA) and Peachtree Software

A. Introduction

MSA announced the first micro-to-mainframe link that went beyond simple communications. Introduced late in 1982, MSA's Peachlink was enhanced before it was even shipped. Several announcements updated the product last year. Interestingly enough, actual shipments of this product occurred only in the last few months. Nevertheless, MSA's micro-to-mainframe product has been delivered and it actually works -- a situation that many micro-to-mainframe vendors can only hope for. MSA is also different from some of its competitors in that it offers a wide variety of good products in both the microcomputer and mainframe areas.

As for size, MSA is the largest independent software vendor; its 1982 revenues were more than $100 million. (It was the first independent software vendor to surpass $100 million.) MSA has experienced compounded annual growth rates

TABLE 4-13
MANAGEMENT SCIENCE OF AMERICA AND PEACHTREE SOFTWARE

Vendor	Management Science of America (MSA) and Peachtree Software of Atlanta GA
Vendor's Software Prices	
Mainframe Software	Several applications packages in Financial, Cash Mgmt., Human Resources, Mfg.
Host Communications Link	MSA offers several ASCII TTY and 3270-type communications packages
Microcomputer Software	Executive PeachPak -- $6,000 Graphics PeachPak -- $3,000; Administrative PeachPak -- $1,500
Software Cost for 50 Users	$180,000 (includes 40% discount for purchases over $50,000, but does not include price of mainframe packages)
Vendor's Mainframe Software	MSA offers variety of Financial, Cash Mgmt., Human Res., & Mfg. software pkgs.
Vendor's Micro Software	Executive PeachPak contains the following applications: word processing, spreadsheet, mailing list manager, graphics, spelling checker, dictionary, and communications.
Hardware Required Mainframe	IBM mainframes (4300 series and 30XX) running the following OSs: MVS, DOS, VM/CMS, and SSX.
Minicomputer	None
Microcomputer	IBM PC, PC XT, PC compatibles, Zenith Z-100, and Epson QX-10
Compatible Mainframe Software	IBM's IMS and Cullinet's IDMS.
Compatible Micro Software Features	Lotus 1-2-3 and interfaces to DIF files.
Terminal Emulation	IBM 3270 emulation with IRMA board
File Downloading	Supported on both micros and mainframes
File Uploading	Supported on both micros and mainframes
Menu-driven Query Languages	Executive PeachPak only

NOTE: This table is only a guide. This table is not intended as a comprehensive product outline since pricing and specifications may have changed since this information was compiled.

Source: the Yankee Group

exceeding 40% since it reorganized in 1971 to sell packaged applications software based on IBM mainframes.

MSA's 1982 revenues (fiscal year ends with calendar year) were $101.2 million, and its 1983 revenues were $145 million -- a 45% increase over 1982 revenues. Earnings continue to increase by 40%+ (they increased by 51% for 1982 and 58% for 1983). MSA's excellent growth (which slightly exceeds the 40% average growth rate for packaged applications software) is a result of its:

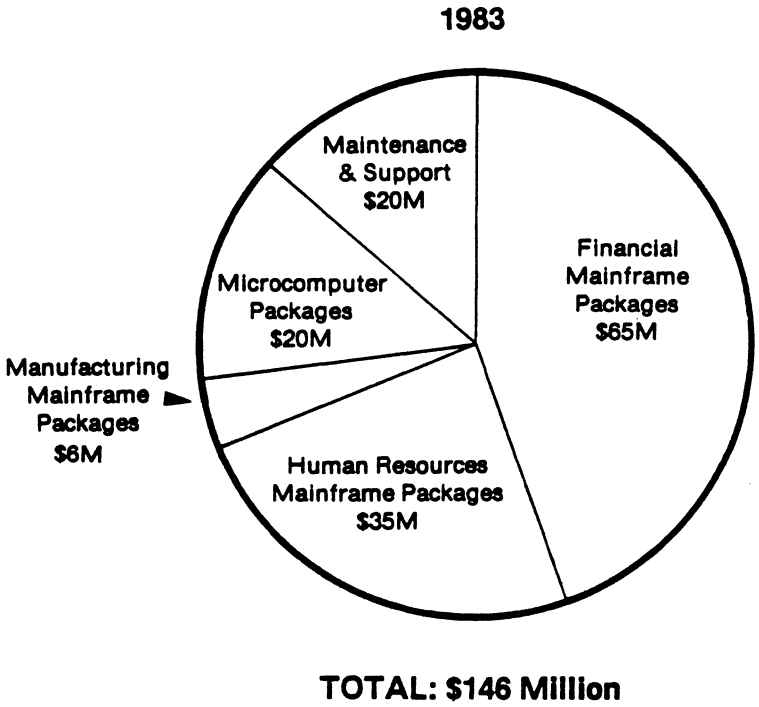
- marketing and support expertise (with a sales force over 100-strong and very aggressive advertising);
- growing international sales (80%-85% growth rates in international markets);
- continued excellent choice of acquisitions to broaden its product line in both mainframe and microcomputer software market areas (over the past two years, it has acquired Peachtree, ARISTA, and Computeristics).
- continued commitment to R&D (at over $20 million, MSA's annual R&D expenditures exceed most third-party software vendors' total revenues).

B. Competition

In both the mainframe and microcomputer software markets MSA faces strong competition. In the mainframe area, it competes against database vendors (such as Cullinet and Cincom) and applications vendors (e.g. McCormack & Dodge/Dun & Bradstreet, and Walker Interactive).

In the microcomputer area, every MSA/Peachtree product has a host of competitors. For example, Peachtree's word processing package, PeachText, competes against MicroPro's WordStar, Softword System's Multimate, and Satelite Software's WordPerfect to name just a few. Peachtree's PeachCalc also suffers

FIGURE 4-4
MSA'S REVENUES BREAKDOWN, 1983 & 1987



Source: the Yankee Group

TABLE 4-14
MSA/PEACHTREE PRODUCT LINE

Mainframe	Microcomputer
General Ledger	Accounting Packages
Personnel Management and Reporting	PeachCalc
Accounts Payable	Business Graphics
Accounts Receivable	Communications
Order Processing	PeachText
Forecasting and Modeling	Spelling Checker
Fixed Assetts Accounting	Dictionary
Capital Expenditure Tracking	Thesaurus
Inventory and Purchasing	List Manager
Foreign Exchange	PeachLink
Manufacturing Systems (MRP III)	
PeachLink	

Source: the Yankee Group

from competition with VisiCorp's VisiCalc, Sorcim's SuperCalc, and Lotus' Development Corp.'s 1-2-3. (Interestingly enough, MSA is a value-added reseller of Lotus Development Corp's extremely successful integrated spreadsheet package, 1-2-3.)

Still, the Yankee Group believes that MSA, which is overhauling, as well as broadening, its entire product line, will continue to be a leader throughout the 1980s, with growth rates exceeding the industry's average.

C. Products

MSA and Peachtree is basically in the applications software business. Table 4-14 indicates the broad range of software products that MSA/Peachtree sells to both the microcomputer and mainframe users.

On the mainframe side, MSA's applications packages run under MVS, DOS, VM, and SSX, with most major databases and on-line monitors, including CICS, IMS, Cullinet's IDMS, TSO, ICCF, and CMS (a VM facility). The Yankee Group estimates that a growing portion of MSA's installed base is MVS-based (about 50% of its installed base is currently MVS-based). The Yankee Group also expects a fast growth in VM/CMS-based applications when MSA introduces applications for the XT/370 (as discussed below).

On the microcomputer side, Peachtree applications run under both the MS-DOS and CP/M operating systems. Peachtree's software runs on the IBM PC, PC XT, PC-compatibles, Zenith Z-100, and the Epson QX-10. Peachtree has placed heavy emphasis on the MS-DOS operating system, but it may support the Apple Macintosh and UNIX systems if these products develop large installed bases.

TABLE 4-15
MSA'S 1983 REVENUE BREAKDOWN

Financial Mainframe Packages	$65M
Human Resources Mainframe Packages	$35M
Microcomputer Packages	$20M
Manufacturing Mainframe Packages	$ 6M
Maintenance and Support	$20M
TOTAL	**$146M**

Source: the Yankee Group

D. Mainframe and Minicomputer (e.g., 4300) Applications Market Areas

MSA's IBM applications software addresses three basic areas:

1. financial and cash management (including general ledger, accounts receivable, accounts payable, fixed assets, foreign currency-exchange management, forecasting and modeling);
2. human resources (payroll, personnel);
3. manufacturing (the numerous applications that fit into a closed-loop system).

The Yankee Group estimates that MSA has installed over 5,000 IBM applications packages. These include (as of October 1983):

- 1,700 payroll installations;
- 1,400 general ledger;
- 800 accounts payable;
- 400 accounts receivable (all recently written with MSA's fourth-generation facilities);
- 50 foreign exchange (also written with MSA's new facilities);
- 30 personnel.

The Yankee Group believes that MSA is the leading supplier of third-party financial and human resources packages. The market is far from saturated, and vendors with a broad product line with integrated interactive applications should have substantial market opportunities for the remainder of the decade.

E. Peachtree Software International

In June 1981, MSA acquired Peachtree Software -- a major "coup." At the time, Peachtree's revenues were around $5

million, and Peachtree was sanctioned by IBM as a third-party supplier of software for the PC. Moreover, Peachtree's applications for the PC (including general ledger, accounts payable, and accounts receivable) complement MSA's mainframe applications. Peachtree's retail distribution channels give MSA additional exposure. Although Peachtree's 1983 revenues were $21.7 million, MSA states that Peachtree is only mariginally profitable.

1. New Directions

"In the past we've concentrated on the adminstrative worker," according to Dennis Vohs, president of Peachtree. Peachtree now plans to go after the office productivity market and the estimated 35 million "knowledge workers" in the U.S. While MSA is well-known for its accounting packages, over 50% of its sales actually come from productivity software packages such as Peachtext 5000.

Peachtree products are often criticized as dated since it licenses many of its software packages. (For example, Peachtext is based on the venerable Magic Wand word processing package from Small Business Applications of Houston, TX.)

2. New Product

In April, however, Peachtree will attempt to silence these criticisms. At that time, MSA plans to release seven new software packages. One of these new packages will be a $500-to-$600 integrated package with a windowing facility. Called the Division Manager, it will include: spreadsheet, graphics, word processing, database management, windowing, and communications along with a calendar. Since this package will include communications and possibly an interface to PeachPak, Peachtree will push the fact that it is integrated horizontally (with both Peachtree and independent software vendors' products) and vertically (with MSA and other mainframe software vendors' packages).

While other vendors are still striving to release their first micro-to-mainframe packages, MSA is already planning the next generation of micro-to-mainframe links. Moreover, MSA's present micro-to-mainframe product, PeachPak II is also selling well.

F. MSA/Peachtree's Micro-to-Mainframe Link — Peachpak II

MSA was one of the first software suppliers to offer a micro-to-mainframe link. MSA claims to have accrued $3.4 million (as of September 1982) in mainframe revenues associated with micro-to-mainframe sales. MSA actually offers three micro-to-mainframe links:

- Administrative PeachPak which costs $1,500 and contains a communications link along with with word procesing for building reports;
- Graphics PeackPak which costs $3,000 and contains a communications link along with a graphics capability for handling mainframe-based data;
- Executive PeachPak II which costs $6,000 and is MSA's leading micro-to-mainframe product.

Announced in September 1983 and delivered this January, the $6,000 Executive Peachpak II offers:

1. PeachLink -- A facility that links an IBM PC with any data communications monitor or DBMS. PC users can download data into Peachtree applications, and upload to the mainframe application;
2. Interfaces that support other third-party software, such as Lotus 1-2-3 or VisiCalc;
3. 3270 facility that gives PC users access to the Easy Screen facility used for MSA's mainframe applications;
4. Peachtree Applications for PC users, including word processing, spreadsheet,

mailing list manager, graphics, spelling-checker, and dictionary.

Executive Peachpak enables PC users with Peachtree applications like spreadsheet, word processing, graphics, and list manager, to interface directly with MSA's mainframe applications (see Exhibits 4-3 and 4-4 for the broad range of micro-to-mainframe applications that Executive Peachpak offers). Executive Peachpak pre-defines the applications so PC users do not need to know where the data is, or how to access it. Also, there is no need for a database administrator (as there is with Cullinet's Information Data Base).

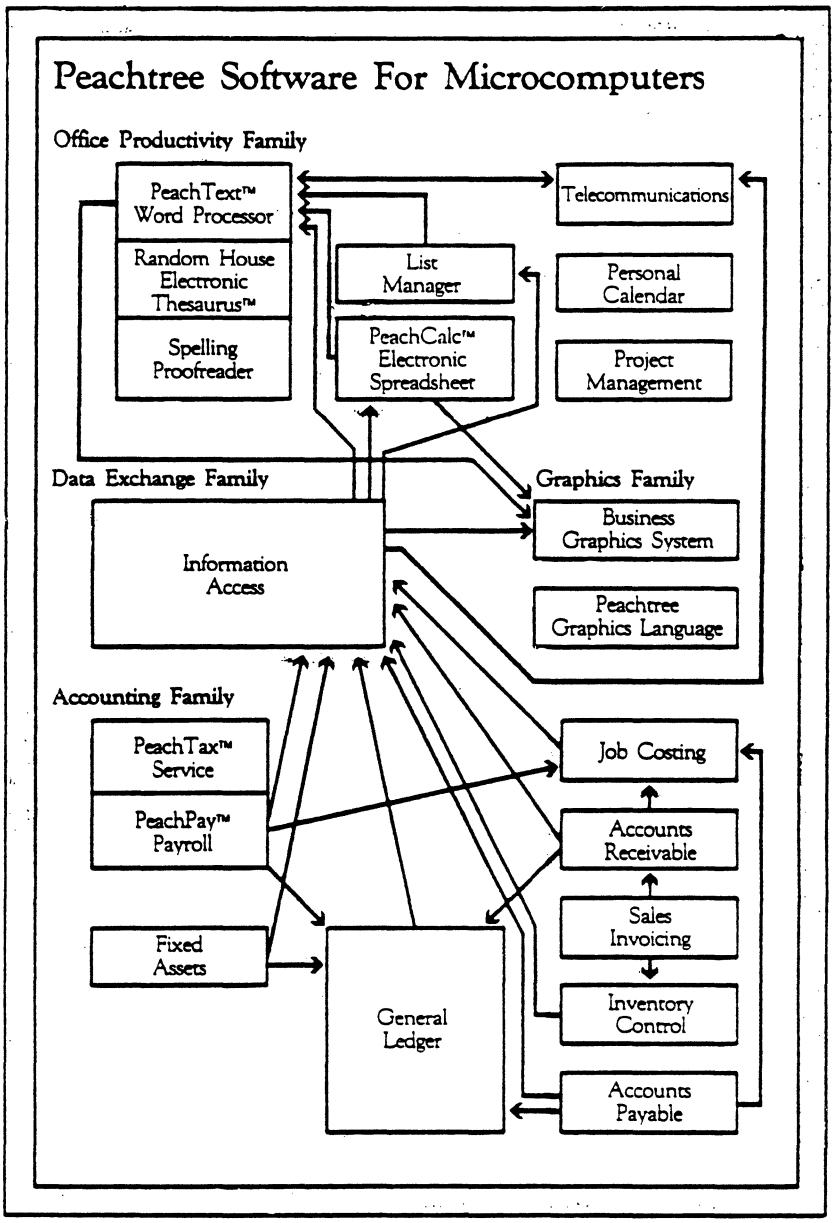
Executive Peachpak is sold to MSA's mainframe customers only. It costs $6,000 per PC unit, but MSA offers a 10% discount for volume purchases over $20,000 and a 40% discount for sales over $50,000. The price is competitive (competitors typically offer a mainframe package for $25,000, and a PC-link for $500-$1,000 per workstation, plus additional charges for PC applications).

The Yankee Group expects MSA to offer a further extension of Executive Peachpak for very high-volume applications. For example, a PC user might need 25,000 names and addresses from accounts receivable for a mailing list. A high-volume facility would enable the PC user to bypass the 3270 screen facility, and dump all the data into the PC application. This Executive Peachpak version, which might cost around $6,000 per PC workstation, would be the first commercial offering of its kind.

G. Micro Distribution Division(MDD)

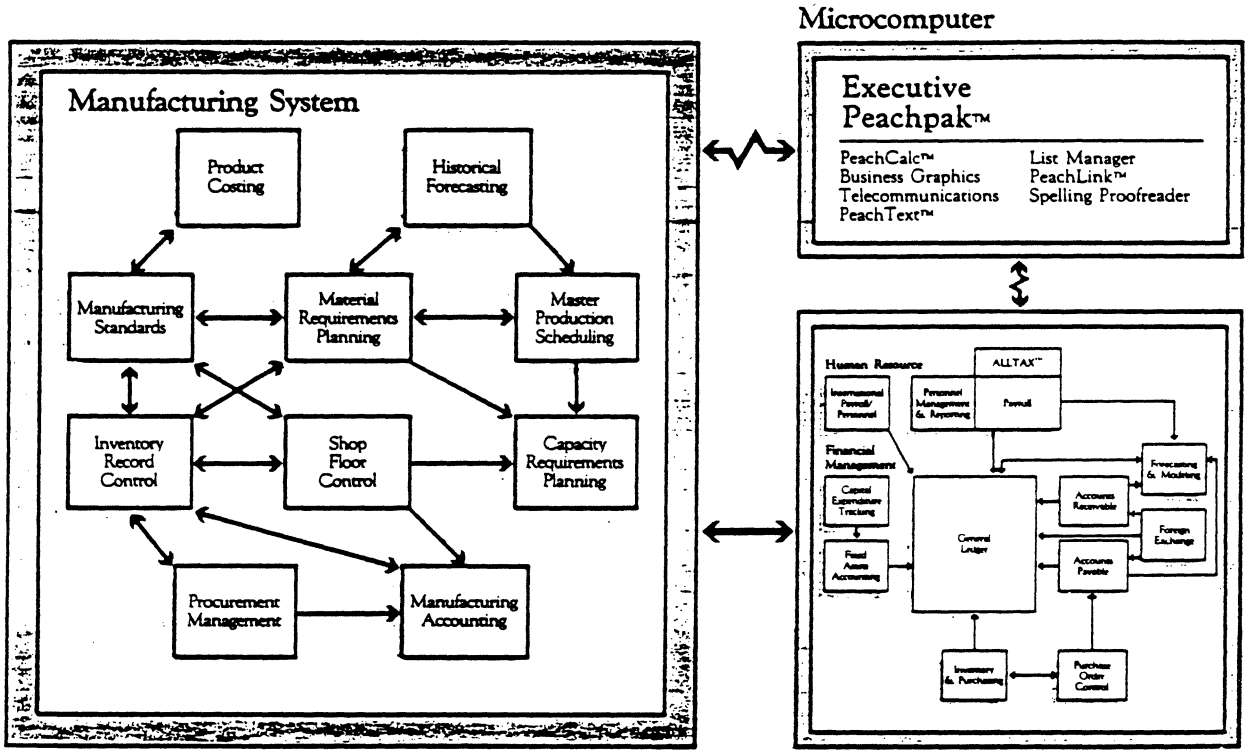
In January MSA formed Micro Distribution Division (MDD) to target its Fortune 1000 accounts. This sales force will sell both Peachtree and competing software vendors' products. MDD will provide MSA with the capability to sell all its products

EXHIBIT 4-3
PEACHTREE SOFTWARE FOR MICROCOMPUTERS



Source: MSA

EXHIBIT 4-4
EXECUTIVE PEACHPAK



Source: MSA

(with discounts of 15% to 30%) to one account at the same time; a real benefit to companies wanting a single source for all softwares.

While the Yankee Group believes that MSA/Peachtree's MDD pesents substantial advantages to both MSA/Peachtree and its customers, there are also a few potential drawbacks. First, there is a minimum order of $100,000 worth of IBM PC software each year.for PC software. Second, it is uncertain whether software "stars" will sacrifice margins for the greater exposure offered by MSA/Peachtree's sale force. (Nevertheless, Lotus has signed MSA as value-added reseller for Lotus 1-2-3.) Peachtree will also be offering competing products of its own -- a situation that could bias MSA/Peachtree's sale force towards its own products.

H. Additional Microcomputer Acquisitions

In July of 1983, MSA spent $1.5 million on the acquisition of Edu-Ware Service Inc., a small software company that makes educational software for Apple, Atari, and IBM PC computers.

In 1983, Edu-Ware's sales were equal to the acquisition price. For 1984, MSA expects Edu-Ware to hit $5 million in sales. Renamed Peachtree Educational Software, MSA hopes this division will provide MSA/Peachtree with a foothold in the educational market as well as building some brand loyalty in the home and educational market. In the long run, MSA hopes these users can be moved into buying MSA/Peachtree's business software.

MSA recently stated that it has a $90 million "war chest." It intends to use some of this money to acquire or license additional microcomputer software packages. The Yankee Group believes that MSA is positioning itself to become the leading producer and publisher of microcomputer software in addition to its leading role in the mainframe software business.

In June 1983, MSA acquired a database management system for the IBM PC from Infotecs. This system will be used for Peachtree applications development, and the Yankee Group expects MSA will also market it as a standalone package.

I. The 3270/PC and the XT/370

The Yankee Group believes that IBM's 3270/PC product will have a major impact for MSA. Executive Peachpak currently requires an IRMA board for the 3270-to-PC link. With the 3270/PC, MSA will not have to stock hardware, and the new product will complement Executive Peachpak, which is well-suited for windowing. Furthermore, the Yankee Group believes IBM will soon introduce an upgrade, which will provide a PC-to-3270 transfer window (the current product only provides for four 3270 windows, one PC window, and two "message" windows; 3270 applications cannot be dumped into the PC window, or vice versa).

The Yankee Group also believes the XT/370 should present MSA with enormous opportunities (although it is not clear how much of a conversion effort is needed for MSA to offer its applications, which run under VM and CMS, on the XT/370). MSA concurs with the Yankee Group's analysis that the XT/370 is basically a program-development workstation (MSA could decide to offer Information Manager for the XT/370), but as discussed elsewhere in this report, the Yankee Group believes the XT/370 will have a major impact on third-party applications vendors. MSA should be a major beneficiary, as future IBM PCs will undoubtedly employ the VM operating system.

J. MSA's Software Factory

In 1982, MSA bought Xerox Corp.'s Arista Manufacturing Division. Based on this acquisition, MSA built a "software factory" to reduce the manufacturing costs of its software. With the ability to publish and package its own software

products, MSA reduced its production costs on the five Peachtext 5000 products to $19 from $185.

K. Vertical Integration

Although the term "vertical integration" is often applied to hardware manufacturers (specifically Commodore, which produces everything from microprocessors to complete systems), MSA/Peachtree is one of the first software vendors to become vertically integrated. The Yankee Group believes that MSA is one of the strongest software vendors since it manufactures, publishes, and sells a complete line of software across a broad range of processors along with providing "bridges" between these disparate products.

L. Summary

The Yankee Group believes MSA will compete directly with Cullinet, ADR, and others, for the "Information Center" market. Within this concept, MSA intends to be the leading supplier of "software solutions." It fully intends to offer the Fortune 1000 "one-stop shopping" for all its software needs by providing everything from microcomputer to mainframe applications along with the software link between its products.

MSA's broad range of applications software with Executive Peachpak make MSA a strong contender. MSA's marketing strength is its installed base of corporate end users in the accounting departments of large corporations. But, with its broadening applications software product line, MSA obviously intends to compete more directly with Cullinet, Cincom, and ADR for other end user departments.

While these vendors are also entering the micrcomputer software market, these vendors have chosen to either rely on microcomputer vendors for support or they are builing their own software package. MSA/Peachtree, to its credit, has chosen

both routes. MSA/Peachtree both creates its own packages and signs distribution agreements with other vendors such as Lotus that are not willing to license their products to MSA, but are attracted by its large sales force and Fortune 1000 clientele.

Furthermore, the Yankee Group expects MSA to support a LAN standard (which will probably be 3 COM's, since MSA is currently engaged in joint development with 3 COM). Thus, MSA is positioning itself to move along with the evolution of microcomputers into networked systems.

MSA is the leading third-party software vendor, with revenues well over $100 million. The Yankee Group believes that with the Information Manager, MSA is converting its entire product line to an on-line interactive operating environment. This is no small accomplishment for a vendor which, a year ago, had its entire product line in batch mode. Nonetheless, the Yankee Group believes this is necessary to insure MSA's continued leadership role. This conversion is also needed to insure the growth of its microcomputer software line since real-time interaction is very important to fully functional micro-to-mainframe links.

The Yankee Group believes that MSA can sustain 40%-to-50% annual growth rates over the next few years because:

- the packaged applications software market is expanding at 40% annual rates;
- MSA has more proven experience in mainframe applications packages than any other vendor;
- with over 20% of its revenues invested in R&D, MSA has kept up with new technology;
- through aggressive acquisitions, MSA has broadened its product line to include mainframe manufacturing applications as well as micro-based applications;
- MSA has close ties with IBM.

This last point could determine just how fast MSA will grow. Growth rates could be phenomenal if IBM enters a joint-marketing agreement with MSA. IBM, in fact, does market MSA/Peachtree (PC) packages in IBM product centers. MSA does not compete directly with IBM (as third-party DBMS vendors do). Database management systems and facilities create an applications environment, and third-party vendors like Cullinet and Cincom are direct threats to IBM. However, applications vendors, like MSA, enhance IBM's operating environment (since MSA's applications support IMS).

Indeed, this is important, not just for selling MSA's applications software, but also because there is one weak link in MSA's strategy: to date, MSA has opted to interface with leading DBMSs, but it has not linked the development of its applications software with any particular DBMS. Any such development with Cullinet or Cincom is unfathomable anyway, since MSA is a direct competitor with these vendors. In fact, as discussed in the previous chapters, the Yankee Group believes that Cullinet and Cincom have a distinct advantage, since their applications are written to the database.

IX. McCormack & Dodge

A. Introduction

M&D offers one of the most powerful micro-to-mainframe links on the market. Called the Interactive PC Link (IPC), M&D's product is versatile since it can connect to a wide variety of both hardware and independent vendors' DBMS and applications packages. IPC offers the ability to query and download data directly into the Lotus 1-2-3 spreadsheet. IPC is also one the few micro-to-mainframe links to offer real-time upload capability. (A debatable feature since many DP direc- tors are violently against users directly updating mainframe files). (A feature that delights users, but horrifies some DP managers.)

TABLE 4-16
McCORMACK & DODGE

Vendor	McCormack & Dodge of Natick MA
Vendor's Software Prices	
Mainframe Software	Milennium
Host Communications Link	Interactive Personal Computer (IPC) Link -- $25,000
Microcomputer Software	IPC Link -- $2,500 (includes Lotus 1-2-3)
Software Cost for 50 Users	$150,000 (excluding cost of Milennium)
Vendor's Mainframe Software	Milennium
Vendor's Micro Software	IPC Link
Hardware Required	
Mainframe	IBM mainframes (OS, DOS, and CICS)
Minicomputer	None
Microcomputer	IBM PC and PC compatibles
Compatible Mainframe Software	IBM's IMS and Cullinet's IDMS
Compatible Micro Software	Lotus 1-2-3
Features	
Terminal Emulation	ASCII TTY and 3270-terminal emulation with IPC Link (DCA's Irma board needed for 3270 emulation)
File Downloading	IPC Link on an IBM PC
File Uploading	IPC Link on an IBM PC
Menu-driven Query Languages	supported at both IBM PC and mainframe levels

NOTE: This table is only a guide. This table is not intended as a comprehensive product outline since pricing and specifications may have changed since this information was compiled.

Source: the Yankee Group

All this power comes at a price, however. First, M&D's product is not as easy to use as other micro-to-mainframe links. Second, the Ineractive PC Link is expensive. Costing $25,000 per mainframe and $2,500 per PC (includes Lotus 1-2-3), the Interactive PC Link costs around $150,000 for 50 users (excluding the cost of Milenium).

Nevertheless, McCormack & Dodge has installed approximately 500 copies at 70 companies since the October 1983 release of this product. Buyers range from Pizza Hut of Witchita KS to General Electric of Schenectady, NY.

B. McCormack & Dodge and Dun & Bradstreet

McCormack & Dodge was a privately-held company until its acquisition by Dun & Bradstreet (a $1.5 billion company with a variety of specialized information services) in March 1983. The Yankee Group estimates that M&D's 1982 revenues were $39 million, up 47% from 1981's $26 million, and that Fiscal Year 1983 revenues will be up around 45%-50% (or about $57 million). D&B acquired M&D for a price of about 38 times its earnings (for an initial cash payment of $50 million plus further payments over the next three years based on M&D's profitability). This is D&B's most significant acquisition since it purchased National CSS for $169 million in 1979.

McCormack & Dodge has about 3,000 installations, most of which are IBM mainframe-based among the Fortune 1000 for accounts payable and general ledger applications. These applications run under the MVS and DOS operating environments, and support the CICS teleprocessing monitor.

While M&D is second behind MSA in installed applications software for large IBM mainframes, M&D lacks a broad product line. The Yankee Group believes that in 1984, M&D will offer additional cross-industry financial applications (such as accounts payable, fixed assets and human resources); but M&D

will still lag behind MSA in specialized financial applications software, and will not have any manufacturing software.

M&D is in the same developmental phase as MSA: it must convert exisiting applications (which run in batch mode) to an interactive real-time environment. All new applications will be developed for on-line interactive environments.

C. Millennium

Millennium is M&D's version of MSA's Information Manager. Millennium is a fourth-generation facility which includes:

- fourth-generation programming language;
- screen generator and editor;
- report writer;
- ad hoc query facility.

With applications based on Millennium, users can perform real-time maintenance and updates across applications. In other words, the applications are "borderless" (this is the same functionality that is provided by MSA's borderless report writer). Using the ad hoc query facility, users in general ledger can hit a function key, and access accounts payable.

McCormack & Dodge has taken an aggressive tactic, with a public Millennium advertising campaign (as opposed to MSA, which is not currently marketing the Information Manager). In terms of installed base, however, the two vendors are in a similar position. Neither has many new systems installed, but MSA has greater potential because of its broader product line.

M&D must also upgrade its installed base. It has chosen to offer its new Millennium-based packages as an update to its installed base under its maintenance program. The Yankee Group believes this is a costly but smart strategy. The important

question is M&D's ability to leverage its base with new packaged applications software.

M&D claims that Millennium has its own database management-like file structure, and the Yankee Group believes that M&D is even considering selling Millennium to MIS Departments. The Yankee Group believes that such a move would stretch M&D's resources, and bring it head-to-head with systems vendors like Cullinet and ADR. M&D would be better off developing more specialized applications software for Millennium, and selling Millennium at a competitive price to Development Centers, which might then acquire applications software from M&D.

Millennium currently converts VSAM files to its own file structure, which is based on an inverted list, or relational structure. The Yankee Group expects M&D to offer interfaces between Millennium and IMS and IDMS by mid-1984.

M&D might develop a niche in the minicomputer market. M&D's current applications run on DEC VAXs, and M&D could presumably do well in this market. Its biggest competition would be Cincom. The Yankee Group believes that M&D is actively considering a S/38 version of Millennium, which would be another good niche (since there are over 5,000 S/38s installed, virtually all without a fourth-generation language, but all with strong database capability).

D. PC-Link

M&D recently announced PC-Link, which is currently being beta-tested, and should be delivered by first quarter, 1984. PC-link executes a subset of Millennium's Query, enabling PC users to extract data from M&D's mainframe applications. A file is created on a floppy (or fixed) disk, and read into a Lotus 1-2-3 (or other "standard" spreadsheet). M&D is a value-added reseller of Lotus 1-2-3.

M&D has indicated that the mainframe price for PC-Link could be as low as $10,000, but the price per workstation could be as high as $2,500 (substantial reductions with volume discounts offered). PC users must also acquire IRMA boards (but this requirement will disappear with IBM's new PC 3270).

PC-Link also provides PC users with uploading capabilities. An advantage of M&D's PC-Link (over MSA's Executive Peachpak, for example) is that its query facility is built into the PC-Link. This should give PC users more intelligent access to mainframe files (whereas MSA has not built its query facility into Executive Peachpak).

The Yankee Group agrees with the strategy of supporting popular third-party PC applications (especially Lotus 1-2-3). However, this can be a dangerous strategy if the vendor has no other options (e.g., given the tumultuous PC market, Lotus 1-2-3 could soon become outmoded).

E. Summary

At this time, McCormack & Dodge does not appear to have any particular competitive advantage over Cincom, Cullinet, or MSA. Its strategies seem slightly confused and unfocused.

The Yankee Group believes that in the immediate future, M&D must acquire the rights to applications packages (converting them with Millennium) to leverage its product line, and give it the specialized software it needs to secure some vertical market niches. Applications software is M&D's expertise, and to enter the DBMS market blindly at this point would be a dangerous and superfluous move, given National CSS's NOMAD product. Selling Millennium as a standalone product, however, could open new opportunities for applications packages (even with the fourth-generation language market becoming very crowded).

The Yankee Group believes that the solution for M&D could be its new parent: Dun & Bradstreet. Although D&B has moved very slowly with National CSS, the recent name change (to "D&B Computing Services") indicates that D&B might begin to integrate more of its services with National CSS. NOMAD itself is a fourth-generation language with database capabilities (which National CSS sells as a standalone package for MVS systems for $130,000). Ironically, NOMAD is currently a potential competitor for Millennium. But there may be some synergy here, and certainly D&B's specialized databases coupled with its network services could offer some interesting possibilities with M&D's applications software. It is too early to make any predictions, however, and M&D is likely to remain a separate subsidiary for the indefinite future.

Where D&B should be a valuable resource in the immediate future is in the area of acquisitions. M&D's major weakness now is its relatively narrow product line, but this could be overcome shortly with some aggressive D&B acquisitions.

CHAPTER FIVE
FOURTH LEVEL MICRO-TO-MAINFRAME LINKS

I. Overview of Fourth Level Micro-to-Mainframe Links

Fourth level products provide a subset or full implementation of mainframe software on microcomputers. This level includes products from Information Builders Inc., Comshare, Cullinet, Execucom, and Oracle. Although AI products are not full micro-to-mainframe links, their advanced software technology has placed them in this section.

While providing the same packages at both the microcomputer and minicomputer/mainframe offers many advantages (such as less training, fewer compatibility problems, etc.), some vendors have temporarily chosen to ignore problems such as security, error checking, high level communications protocols, and poor operating performance.

Many of these enhancements are coming in the future, but potential micro-to-mainframe users should remember that software developments periods tend to slip and revisions or updates that are promised in six months may not appear until nine months or even a year later. In other words, caveat emptor.

These vendors (independent software vendors and service bureaus) are in excellent position to take advantage of the XT/370's powers. Leading products in this area are: EPS's EPS, IBI's Focus, Oracle Corp.'s Oracle, Martin Marrietta's (Mathematic's INGRES). The reader will note that many of the fourth-level products are really DSS packages. The Yankee Group does not believe that spreadsheets and DSS packages are the same thing. On the contrary, there are major differences in performance, data storage, features, price, and ease-of-use.

TABLE 5-1
MATHEMATICA PRODUCTS GROUP

Vendor	Mathematica Products Group of Princeton NJ (a Martin Marietta Data Systems Company which also owns ITSoftware)
Vendor's Software Prices	
Mainframe Software	RAMIS II -- $40,000 - $80,000
Host Communications Link	RAMLink -- $4,500 - $9,000
Microcomputer Software	RAMLink -- $185 (quant. disc. available)
Software Cost for 50 Users	$51,437 - $95,937 (without IRMA board)
Vendor's Mainframe Software	RAMIS II, ATLAS (TP monitor), English, Relate, SAS Interface, Plot, DBIS, and Screen Manager
Vendor's Micro Software	RAMLink, and RAMIS II/PC. ITSoftware series: KeepIT, CalcIT, SortIT, EditIT, $150 LinkIT (asynch. TTY), $1,495 PLEASE (LinkIT's mainframe software for LinkIT), and $250 PassIT (3270 terminal emulation with an IRMA board.
Hardware Required	
Mainframe	IBM mainframes (MVS, DOS/VSE, VM/CMS)
Minicomputer	None
Microcomputer	IBM PC, XT, PC-compatibles, and XT/370 (LinkIT and PassIT only available for IBM PC and PC compatibles)
Compatible Mainframe Software	IBM (IMS, DL/1, VSAM, ISAM) Cullinet's IDMS, Cincom's TOTAL, and Software AG's ADABAS
Compatible Micro Software	Lotus 1-2-3, VisiCalc, and other software through DIF files
Features	
Terminal Emulation	RAMLink (contains 3270-type synchronous communications), PassIT, and LinkIT
File Downloading	RAMLink, PassIT, and LinkIT
File Uploading	RAMLink, PassIT, and LinkIT
Menu-driven Query Languages	None

NOTE: This table is only a guide. This table is not intended as a comprehensive product outline since pricing and specifications may have changed since this information was compiled.

Source: the Yankee Group

II. Martin Marietta Corporation

A. Introduction — Mathematica and ITSoftware

Martin Marietta participates in the micro-to-mainframe with two different products. The Mathematica Products Group offers both mainframe and microcomputer versions of its relational DBMS, RAMIS II. Martin Marietta also owns ITSoftware, which offers a line of communications software (along with assorted applications packages) for asynchronous and synchronous communications with an IBM host. While Mathematica has its own micro-to-mainframe link called RAMLink, ITSoftware packages can also work in conjunction with RAMIS II/PC (the microcomputer version of RAMIS II).

B. Martin Marietta

Martin Marietta Corporation is a multi-faceted conglomerate (in aerospace, chemicals, aluminum, cement, and data systems), which had $3.5 billion in 1982 revenues.

Martin Marietta Data Systems is a Division of Martin Marietta which provides Remote Computer Services (based on a large IBM data center) for financial and manufacturing applications software on both a timesharing and a packaged basis. Martin Marietta also acquired Mathematica in early-1983 for $30.8 million -- more than 20 times Mathematica's earnings. Nonetheless, the Yankee Group believes this was a strategic acquisition that will pay long-range dividends.

C. Data Systems Division

Mathematica offers RAMIS, a leading fourth-generation language and applications development system. The Yankee Group believes that with RAMIS and its remote services, Martin Marietta (unlike most other data service companies) has the

potential to be a major player in third-party software markets. Furthermore, Martin Marietta (through a separate division of Mathematica) is beginning to market a variety of PC-based applications.

Martin Marietta Data Systems had $122 million in 1982 commercial revenues. Despite the recession, Data Systems has steadily increased at 25% annual rates, and its 1983 revenues should exceed $150 million. The Yankee Group estimates that 30% of Data Systems' revenues come from packaged applications software. This amounts to $36.6 million in 1982, and about $45 million in 1983. Mathematica had about $36 million in 1982 revenues, about 50% of which (or $18 million) came from RAMIS. RAMIS is growing at a 50% annual rate, and the Yankee Group estimates that in 1983, RAMIS will accrue $27 million in total revenues. In other words, in 1983, the Yankee Group estimates that Martin Marietta had $72 million in revenues for third-party software packages, mostly for IBM mainframes. This is a far better mix than most service bureaus, and it gives MM a solid base to build a super service bureau.

Assuming MM will continue its commitment to further acquisitions and its ability to integrate its applications with new generation technology (e.g., with RAMIS), the Yankee Group believes that MM must be considered a major competitor (although MM faces very stiff competition from Cincom, Cullinet, and MSA).

D. Mainframe/Minicomputer Applications Packages

The Yankee Group estimates that Martin Marietta has installed over 1,000 applications packages, about 80% of which are installed on IBM mainframes. At least 750 installations are for manufacturing applications. In addition, MM offers its applications on a 4300 subscription basis from its Remote Computer Services (as described below).

The applications MM offers include the following modular areas:

- manufacturing (a closed-loop system);
- payroll (recently introduced);
- personnel (recently introduced);
- decision support; and
- project management (just introduced).

These packages run for all IBM 4300 and 30XX computers under MVS, SSX, DOS/VSE, and VS/1. They also run under DEC VAXs and HP 3000s. MM is also a value-added reseller of IBM 4300s, and following IBM's new 4300 announcement, MM announced that most of its applications are fully operational on the 4361, Groups 4 and 5.

Each modular area offers a range of packages priced from $20,000-$100,000, depending on the hardware configuration.

E. Strategic Architecture

In 1983, Martin Marietta designed its modules under what it calls its "Strategic Architecture." Each application has a kernal, which is the same regardless of the operating environment under which it is running (the basic application is transportable across operating systems; only the interfaces need be rewritten and/or converted).

Under the Strategic Architecture, the screen manager and teleprocessing manager are the same; only the database manager is different. Manufacturing and Project Management are designed under the Strategic Architecture now, and Payroll, Personnel, and Decision Support will all be under Strategic Architecture in 1984. Through the Strategic Architecture, MM's applications will interface with IBM's IMS and DL/1, Cullinet's

IDMS, and HP's IMAGE 3000. The Yankee Group expects a RAMIS interface to follow in 1984. The notion of applications portability is extremely important for future service bureaus, because load-leveling (between hardware, software, and services) will demand it.

The Strategic Architecture approach should enable MM to support other operating systems. MM has UNIX capability now, and supporting UNIX will become a key factor in the near future, especially for smaller manufacturers.

However, there is one obvious problem regarding MM's thrust: the actual kernals, which are written in COBOL, must be written using RAMIS. This is essential for programmer productivity, maintenance, ease-of-use, etc. The fact that MM owns RAMIS is a very positive sign for MM, but it is still lagging behind primary competitors in actually converting and offering new generation applications. Assuming MM is able to make this conversion, and deliver new products by late 1984-1985, MM could, in fact, emerge with a competitive and broad product line including not only a wide spectrum of applications, but also RAMIS-based applications transportable across a broad spectrum of IBM, DEC, and HP systems. Furthermore, the Remote Services should enable MM to branch out into a variety of smaller manufacturers.

F. RAMIS

As mentioned above, RAMIS II is growing at 50% annual rates. It represents about $27 million in 1983 revenues, and has approximately 1,150 IBM mainframe installations. About 40% of these are MVS-based, with the remainder running under DOS/VSE and VM/CMS. In other words, RAMIS is an established leading product, with as many installations as FOCUS and MANTIS, and more installations than ADS-On Line.

RAMIS is a fourth generation language/application development facility with database capabilities. It includes a DBMS (supporting small- to medium-sized production environments), and RAMMASTER, an active data dictionary. RAMIS II ranges in price from $40,000 to over $80,000 depending on the size of the IBM mainframe (see Table 5-2). It supports MVS, but is also the only fourth-generation language that currently runs under DOS/VSE. It also runs under VM/CMS, with a significant VM/CMS installed base, and should, therefore, run on the new IBM XT/370 (see below). Mathematica recently introduced a teleprocessing monitor called ATLAS (for $28,000), but RAMIS interfaces with IBM's CICS, ICCF, IMS/DC, TSO, and VM/CMS, and with ADR's ROSCOE. But given that most IBM users employ CICS as their teleprocessing monitor, ATLAS is a superfluous product.

RAMIS also offers extensive reporting capabilities. Its report writer can access VSAM, TSAM, and ISAM (IBM disk access methods), as well as IMS, IDMS, ADABAS, and TOTAL.

Mathematica recently announced an Artificial Intelligence component (called ENGLISH, for $12,000-to-$24,000). The Yankee Group expects Mathematica to announce a monitoring facility for database administrators (called DBIS) by yearend.

RAMIS is based on a single path hierarchical structure, but the component RELATE (listed in Table 5-3) gives RAMIS relational capabilities. This is similar to Cullinet's attempt to make IDMS relational, and Cincom's layering of TIS over TOTAL. A more direct comparison is with FOCUS, a fourth-generation application development facility/language with a relational file structure. With all the new fourth-generation languages being introduced, RAMIS may have difficulty sustaining market-share leadership.

As discussed above, the integration of MMDS's applications is crucial. There is also the question of developing a marketing presence. Martin Marietta has a reputation for being

TABLE 5-2
RAMIS II COMPONENTS AND PRICING

Ramis II*	$40K - $80K
English	12K - 24K
Screen Manager	6K - 12K
Relate	7K - 14K
SAS Interface	1K - 2K
DBIS	6K - 12K
Atlas	28K
Plot**	4K - 8K
Mainframe-PC Link	4K - 8K
ITS Software***	(per workstation) 1K-1.5K
Ramis/370/XT	(per workstation) $1,395

* Prices range according to cpu site
** for high resolution graphics
*** Depending on pc-applications chosen

Source: the Yankee Group

a slumbering giant. It has never shown an aggressive marketing face, as Cullinet has. If Martin Marietta is serious about competing with Cullinet, Cincom, and others, the Yankee Group believes it must not only rewrite its applications, but must reorganize its marketing and sales force -- combining the expertise of both MMDS and Mathematica, and hiring from the outside.

G. RAMLink

In March, Mathematica announced RAMLink, a micro-to-mainframe link designed to work with RAMIS II. Available for the IBM PC, XT, and compatibles, this link sells for $185 per microcomputer and $4,500-to-$9,000 per mainframe host. RAMLink is designed to work specifically with RAMIS II on the mainframe side, but on the microcomputer end it offers interface to programs with DIF file formats, Lotus 1-2-3, VisiCalc, and Martin Marietta's own ITSoftware line.

RAMLink permits bi-directional data transfer between mainframe and microcomputers. As a result, RAMLink permits users to download data into a spreadsheet as well as transfer data directly to the mainframe. RAMLink also provides the facility to automatically reformat data for several types of popular software packages. As for communications, RAMLink supports full 3270 terminal emulation when connected to DCA's IRMA board. RAMLink also provides the protocol conversion to allow PC to act as 3270 terminals. Mathematica has chosen the simple route with RAMLink and priced it accordingly. Moreover, Martin Marietta is pulling both Mathematica and ITSoftware into one cohesive unit by integrating the two companies' diverse product lines.

H. RAMIS II/PC and the XT/370

Since the IBM PC lacks the processing power and main memory capacity to run RAMIS II, the Mathematica seems well suited for

the XT/370. RAMIS II runs under VM/CMS, as does the XT/370, and Mathematica has already announced that will it deliver an XT/370 version of RAMIS, called RAMIS II/PC, on the XT/370 as soon as IBM starts delivering the XT/370 in 1984. The price per workstation will be $1,395. Furthermore, the Yankee Group believes that Mathematica has been experimenting with RAMIS on 68000-based processors. The Yankee Group expects Mathematica to introduce micro-RAMIS to run under a variety of 68000-based systems besides the XT/370, in particular, 68000-based systems that may be introduced by DEC and HP.

I. ITSoftware

ITSoftware is a wholly-owned subsidiary of Martin Marietta. It was formerly a division of Mathematica. ITSoftware is sold through retail, but it is also marketed by the RAMIS and MMDS sales forces.

ITSoftware -- a good product for network service bureau load-leveling applications -- has developed a PC-Link with RAMIS that will:

- employ the PC like a full-screen RAMIS II through dial-up, using ASCII emulation; this full screen ASCII emulation makes the PC function as an intelligent terminal, and it can be used with any VT-100 and most ASCII terminals. Called LINK-IT, this ASCII software link provides block-mode error checking;
- enable PC (and terminal) users to use the RAMIS commands to access RAMIS mainframe files; the PC user merely states which PC application is desired (ITSoftware applications, Lotus 1-2-3, dBASE-II, and any application that supports the DIF format is supported), and the files/data are downloaded to the KEEP-IT database on the PC. The file must be re-read to the KEEP-IT (KEEP-IT is a fully relational, menu-driven data management program) format, and once in KEEP-IT, the files are transferred to the PC application chosen by the

PC user. The Yankee Group believes that ITSoftware is developing a "cleaner" RAMIS interface with KEEP-IT. Similarly, data can be uploaded to the mainframe by using the RAMIS commands;

- enable PC users to connect the PC to a 3274/76 controller. This will be announced and delivered in 1984 (but IBM's new 3270/PC will also solve this problem).

Mathematica's strategy is price-driven. The PC-Link product is the most cost-effective currently available, costing only $4,000-$8,000 per mainframe, and around $1,000-$1,500 per workstation (depending on the number of PC applications the user needs; the PC user must, at least, have KEEP-IT ($450), LINK-IT ($150), and CALC-IT ($450), or another third-party spreadsheet package). This pricing is extremely aggressive, since most other PC-links cost at least twice as much. As mentioned above, the XT/370 micro-RAMIS version will cost $1,395 (for users who already have the RAMIS mainframe package).

ITSoftware offers the "standard" array of PC applications, including:

- spreadsheet;
- word processing;
- graphics;
- statistics.

The Yankee Group believes that this is just the initial step in a long-range strategy to provide a range of micro-to-mainframe software. Once Martin Marietta Data Systems applications software modules are rewritten with RAMIS, they will share the RAMIS II user interface with KEEP-IT. This a crucial step for Martin Marietta to compete with the likes of Cullinet and MSA. Furthermore, the Yankee Group believes that MMDS's applications (based on RAMIS) should run on HP 3000s and DEC VAXs, and a KEEP-IT interface (which currently supports VT-100 terminals) with these applications for the DEC Rainbow and HP

150 PC would give Martin Marietta some potential competitive advantages (if, in fact, RAMIS can be converted to run on VAXs and HP 3000s).

J. Summary

The Yankee Group believes that Martin Marietta could be a sleeping giant. The Mathematica acquisition is the key to MM's potential to emerge as a major competitor. With RAMIS II and ITSoftware, MM has the potential to branch out into new directions, including the development (using RAMIS II) of new applications for vertical markets, as well as launching into the Information Center market (with RAMIS II, MM could develop applications like Electronic Mail, Calendaring, etc.). The RAMIS installed base makes it a proven leader, and with the RAMIS enhancements expected by early-1984, Mathematica clearly intends to compete in the large production environment. With its network, MMDS has the potential to become a super service bureau, providing a range of hardware/software/network services to small-to-large businesses.

For MMDS to offer a broad product line, it is essential that its applications become RAMIS-based. The Yankee Group believes this will happen (in the 1984-1985 timeframe) for its IBM-based applications, and RAMIS should extend to VAXs and H-P 3000s. This should give MMDS a competitve advantage. However, the Yankee Group expects MMDS to become more IBM-based in the future. First, because MMDS is a 4300 VAR. Second, RAMIS is a proven product for IBM systems, but it is not certain that RAMIS would run efficiently on DEC VAXs or H-P 3000s. And, finally, the new XT/370 should push MMDS further towards IBM.

MMDS has one real and definite current advantage over other software vendors: its data center. With the data center, MMDS can offer users timesharing and load-leveling options, which is a cost-effective way of branching out into smaller business market opportunities. The Yankee Group believes that MMDS

should build its network (it currently has only eight nodes with limited capabilities).

The Yankee Group believes that Martin Marietta must become an aggressive marketer of its full product line. Few users have even heard of ITSoftware, and few are aware of the RAMIS-Martin Marietta connection. Marketing is a current weakness at Martin Marietta Data Systems, just as it is a key strength of Cullinet

III. Information Builders, Inc. (IBI)

A. Introduction

Information Builders, Inc. (IBI) was founded in 1975 by Gerry Cohen, the author of RAMIS. FOCUS, IBI's major product, competes directly with Mathematica's RAMIS in the database, end user query, and application development markets. Both products offer what the Yankee Group considers to be fourth-generation development systems. FOCUS has approximately the same installed base as RAMIS (about 1,100 installed on IBM mainframes, and over 70% of these installations are Fortune 500 corporations), but the Yankee Group believes it is growing much faster. IBI is still privately held, with revenues increasing at 55%-to-60% annually. In 1981, revenues were $10 million; they were $19.2 million in 1982, and the Yankee Group estimates revenues will be $30 million in 1983. While FOCUS should continue to exhibit excellent growth, the Yankee Group believes IBI will encounter stiff competition from the many new fourth-generation languages being introduced from established systems and DBMSs. There is some good synergy between IBI and applications vendors and/or service bureaus, and FOCUS must be considered a good acquisitions candidate.

In fact, IBI is really a unique vendor at this time. Since Mathematica was acquired by Martin Marietta and National CSS

TABLE 5-4
INFORMATION BUILDERS INC.

Vendor	Information Builders Inc. of New York NY
Vendor's Software Prices	
Mainframe Software	FOCUS -- $66,000 - $120,000 (without report generator, FOCUS costs $23,000)
Host Communications Link	None
Microcomputer Software	PC/FOCUS--$1,595 (quant. disc. available-drops to $950 for quant. of 75 & up)
Software Cost for 50 Users	$145,700 - $199,750
Vendor's Mainframe Software	FOCUS contains: relational DBMS, graphics, statistics, financial modeling, full screen editor, report writer, and transaction processing langauge. A report generator is also available
Vendor's Micro Software	PC/FOCUS contains the same features as mainframe FOCUS
Hardware Required	
Mainframe	IBM mainframes (MVS and VM/CMS)
Minicomputer	None; may offer Wang VS and Digital Equipment VAX versions by mid-1984
Microcomputer	IBM PC, XT, PC compatibles, Texas Instruments PC, XT/370 (summer or fall of 1984), and Digital Equipment's Micro-VAX (late-1984 or early-1985)
Compatible Mainframe Software	DBMS (IBM's IMS, Cullinet's IDMS, Software AG's ADABAS, and Cincom's TOTAL) and Execucom System's IFPS
Compatible Micro Software	Software reading DIF files
Features	
Terminal Emulation	Asynchronous TTY with PC/FOCUS; PC/FOCUS DIAL offers IBM 3270 terminal emulation with IRMA board
File Downloading	yes
File Uploading	yes
Menu-driven Query Languages	available on both FOCUS and PC/FOCUS

NOTE: This table is only a guide. This table is not intended as a comprehensive product outline, since pricing and specifications may have changed since this information was compiled.

Source: the Yankee Group

(with another non-procedural fourth-generation language called NOMAD) was acquired by Dun & Bradstreet (which also acquired McCormack & Dodge), IBI is the only surviving company whose product line is solely focused on database query/fourth-generation language (IBI is neither in the packaged applications software business, nor in the systems software business per se).

The competition for FOCUS includes not only RAMIS and NOMAD, but also products like IBM's Applications Development Facility and SQL, Pansophic's Easytrieve, Cullinet's ADS-On Line, and ADR's IDEAL.

B. FOCUS

FOCUS is a fully relational, fourth-generation non-procedural language, as well as a powerful end user R-DBMS. It offers multi-path facilities with file inversion at any segment level (whereas RAMIS utilizes a single path hierarchy). FOCUS is a powerful applications development facility, which includes a DBMS, report writer, and query language. It offers a number of components and options, including a Transaction Processor, Data Dictionary, Modeling Language, and Graphics Subsystem. Prices are very competitive (there is only one price for FOCUS and FOCUS options, whereas RAMIS is priced according to CPU size, and is higher-priced for high-end mainframe systems; compare Table 5-3 with Table 5-2).

The Yankee Group believes that most FOCUS installations are MVS-based, but FOCUS also runs under VM/CMS. IBI offers database interfaces with IBM's IMS, Cullinet's IDMS, Cincom's TOTAL, and SWAG's ADABAS, as well as communications interfaces with IBM's IMS/DC, CICS, and CMS. FOCUS has been successful in IBM environments because it offers end users tools for accessing data from the corporate information center. IBM had been unresponsive in this area until recently.

IBI's experience and strategy with FOCUS is similar to Mathematica's experience and strategy with RAMIS. Users might typically acquire FOCUS for its non-procedural report writing capabilities, and acquire the additional facilities and options, using FOCUS for applications development primarily in professional and end-user environments. Exhibit 5-1 shows the overall FOCUS environment; the typical end user might be a manager of a corporate marketing division using FOCUS as a Decision Support System (FOCUS offers Graphics, Statistical Analysis, and Modeling Language, as well as an interface with Execucom's Interactive Finacial Planning System).

FOCUS can be used in a heavy-transaction environment with applications packages (e.g., one large user uses FOCUS for data validation and data entry to MSA's General Ledger). FOCUS has also penetrated many large corporate MIS departments, which are replacing their COBOL-based applications with FOCUS (however, this market opportunity is getting very competitive, with the availability of ADS On-Line, IDEAL, NATURAL, and MANTIS). IBM's DB 2 will offer yet another challenge.

The Yankee Group believes IBI's strategy is to leverage its position within MIS departments by providing products that enhance the Information Center. FOCUS (with options) is already used for development, end-user query, and as a Decision Support System; with PC-FOCUS (which already has 600 installed units within 250 Fortune 1000 corporations), IBI already has a jump on the competition, which will become fierce in the 1984-85 timeframe.

C. PC-FOCUS

PC-FOCUS, which was announced in May 1983, provides all the basic facilities for IBM PC users. These include:

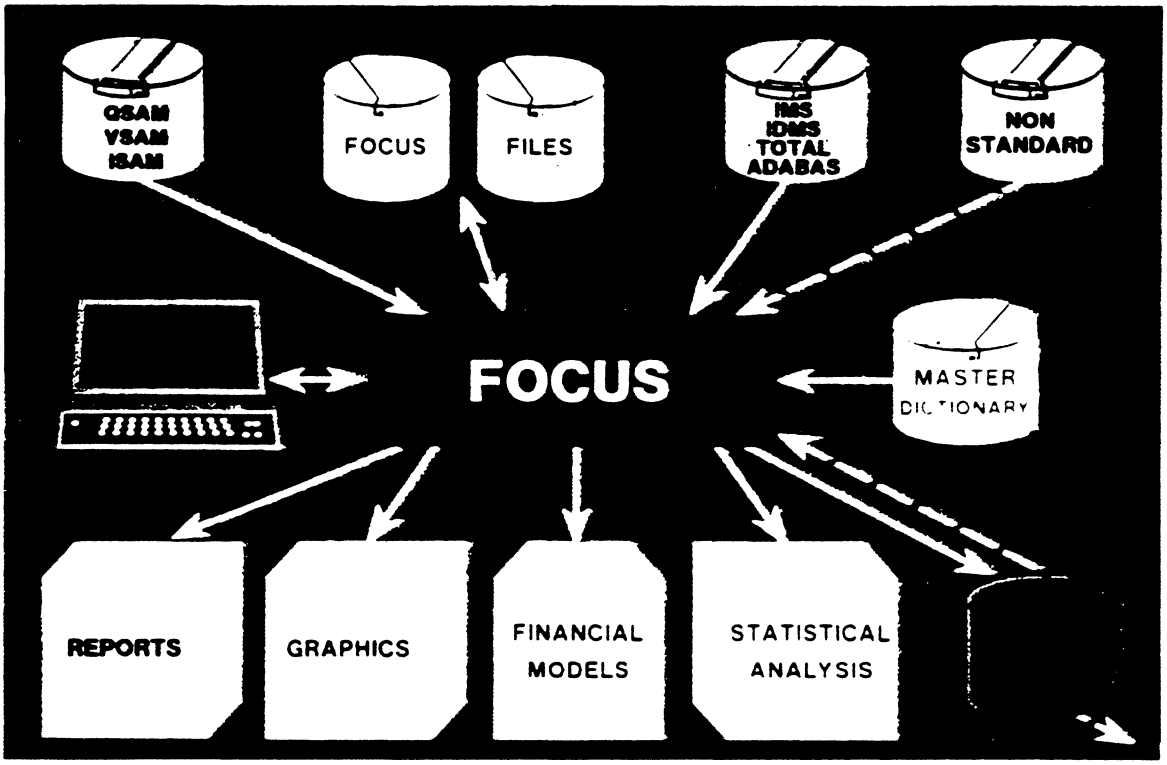
- asynchronous communication program;
- report generator (FOCUS and non FOCUS

TABLE 5-3
FOCUS FEE SCHEDULE

ITEM	Onetime License
BASIC SYSTEM	
FOCUS Report Generator and Dialogue Manager for Reporting from FOCUS and/or external files	$43,000
FOCUS Data Base Management, Transaction Processor and Interactive Data Base Editor	$23,000
OPTIONAL FEATURES	
FOCUS Graph Subsystem	$8,500
Modelling Language for Financial Reports	$8,500
FIDEL (Full-Screen Data Entry Language)	$5,500
Central Data Base Control for Simultaneous Users	$8,500
FOCUS Statistical Analysis Package	$6,500
FOCUS Host Language Interface	$8,500
FOCUS Data Dictionary	$12,000
TED for Editing from within FOCUS	$2,000
CP/Assist CMS Installation Option	$2,500
OPTIONAL PRODUCT INTERFACES	
FOCUS/APL (VS/APL use of FOCUS files)	$6,000
TELL-A-GRAF Interface (FOCUS Graph Required)	$4,500
IFPS Interface	$5,500
OPTIONAL DATA BASE INTERFACES	
IMS Interface to report from IMS files	$8,500
IDMS Interface to report from IDMS files	$8,500
TOTAL Interface to report from TOTAL files	$8,500
ADABAS Interface to report from ADABAS files	$8,500
OPTIONAL COMMUNICATIONS INTERFACES	
CICS Interface for interactive operation of FOCUS under CICS	$8,500
IMS/DC Interface for operation of FOCUS under IMS/DC	$8,500
Bridge for MVS FOCUS Files read from CMS	$2,000

Source: IBI

EXHIBIT 5-1
THE FOCUS ENVIRONMENT



Source: IBI

files);

- dialog manager;
- full screen editor;
- full screen data entry;
- data management language;
- graphics (low resolution; high resolution will be introduced in 1984);
- financial modeling.

The price is $1,595 per workstation, but volume discounts bring the price down to $950 per workstation for quantities of 75 and over. In other words (taking 75 as an average number of PCs in a typical corporate marketing department), the average FOCUS-PC cost to a FOCUS user might be $71,250 (excluding other components, like IRMA boards, which PC users might need). IBI's pricing is similar to what the Yankee Group expects other vendors will charge for the PC part of a micro-to-mainframe link.

FOCUS-PC supports both the IBM PC and the Texas Instruments Professional Computer. The Yankee Group expects IBI to announce a version for the 3270/PC. Furthermore, IBI has announced publicly that it will offer FOCUS for the XT/370 (which the Yankee Group expects IBI to deliver as IBM ships the XT/370 next June). IBI has announced that the price will be $8,400 for the first ten copies (to FOCUS licensees), which appears to be very price-aggressive.

FOCUS-PC offers downloading and uploading capabilities, and the syntax is common throughout. While this is a good strategy for ease-of-use and efficiency, the Yankee Group believes that IBI should also offer optional support of popular third-party PC applications (like spreadsheet and word processing). The Yankee Group expects the upcoming Version 1.1 of PC/FOCUS, to offer a DIF interface (offering file transfer capability with most available PC applications).

Furthermore, Electronic Mail will become an essential application for Information Centers, and the Yankee Group believes that IBI must offer an integrated EMail package.

IBI has displayed one additional capability -- FOCUS TABLE-TALK, a report-writing "front end" to FOCUS which enables PC users to access files on the mainframe through simple English-like statements. IBI will offer TABLE-TALK with Version 1.1 of FOCUS PC, and expects IBI to offer a mainframe version later in 1984 (the price should be under $20,000). This should make FOCUS more user-friendly and accessible to unskilled PC users.

D. Marketing Strategy

As indicated above, IBI's strategy is to sell FOCUS (with graphics, statistics, and financial modeling language) and FOCUS/PC to marketing, financial, and sales departments of large corporations. IBI does not intend to compete with MSA, Cullinet, Cincom and McCormack & Dodge for packaged applications software for the accounting departments and manufacturing divisions of large corporations. The Yankee Group believes this is a good niche, with little current direct competition except from RAMIS and National CSS's NOMAD. NOMAD has limited support capability (until late-1982, NOMAD was sold only on a timesharing basis, and National CSS prefers to sell it that way), and National CSS only recently introduced an MVS version of NOMAD; furthermore, NOMAD's PC version has not been shipped yet.

FOCUS' other direct competition comes from the Decision Support Software Suppliers (like Execucom's IFPS, and Management Decision Systems' EXPRESS). But these vendors' products do not offer fourth-generation applications development capability. However, the Yankee Group expects ADR (as discussed in Chapter Three), which offers EMPIRE and IDEAL, to become a

significant competitor. Other DBMS vendors will offer similar DSSs, development facilities, and query capabilities.

The Yankee Group believes that IBI could leverage FOCUS by developing end user-specific applications and selling these as a package with FOCUS. This is not a new idea, since time-sharing companies have done this for several years. Tymshare (which was recently acquired by MCAUTO/McDonnell Douglas), for example, sells FOCUS on a timesharing basis (it cannot sell FOCUS on a licensed basis) with specialized applications like RAILTRACK (which keeps track of rail freight). This kind of application is ideally suited to PCs. IBI must offer specialized packages for large corporation end user departments as a way of differentiating itself from its competition.

E. Summary

FOCUS is an established product, with an excellent reputation. Furthermore, it is well-positioned in the Fortune 500, and has already shipped FOCUS/PC. The Yankee Group believes the future of FOCUS lies in the Information Center direction (even though FOCUS can be, and is, used in production MIS environments), where the product is well-positioned along with Decision Support Software.

The IBM XT/370 is a blessing for FOCUS, which supports the VM/CMS operating system, and the expected VAX and VS FOCUS versions will give FOCUS more leverage.

The competition, however, is heating up. As stated before, Cullinet, ADR, Cincom, and IBM are taking a systems approach, layering application development (fourth-generation languages) and query facilities onto their DBMS products. The Yankee Group expects IBI to develop more specialized end-user applications with FOCUS. The possibility of an acquisition must not be ignored. In fact, there is some obvious synergy between IBI and a vendor like Tymshare, which needs to offer delivery

options (e.g., selling FOCUS as a package), as well as support. There is also some obvious synergy between IBI and applications software vendors. IBI could greatly expand its market by offering packaged software, and vendors like Comserv need to integrate their applications with a fourth-generation development/query/language product like FOCUS.

IV. EXECUCOM Systems Corporation

A. Introduction

EXECUCOM, a primary competitor with MDS, has revenues of about $23 million. EXECUCOM offers IFPS (Interactive Financial Planning System). IFPS supports 25 different operating systems environments, including DEC VAX (and PDP-11), Prime Series 50, Data General MV Systems, and Wang VS. It also has joint marketing agreements with these four vendors. However, these four vendors have not, for the most part, aggressively pushed toward the end user, decision support market. EXECUCOM has therefore concluded that its major thrust is marketing decision support software to IBM users. The Yankee Group estimates that 45% of IFPS sales in FY 1983 were IBM-based, and that IBM-based sales will dominate in 1984 (however, EXECUCOM has a unique advantage in that it supports a real multi-vendor environment).

IFPS runs under IBM's DOS, MVS, and VM/CMS operating systems. The Yankee Group estimates that IFPS has over 700 in-house installations, about 150 of which are IBM-based (it has another 2,000 users who use IFPS on a timesharing basis).

The Yankee Group believes that EXECUCOM has a significant marketing advantage over its competition. It actively developed interfaces with other leading third-party packages, including:

- IBI's FOCUS;
- Mathematica's RAMIS;

TABLE 5-5
EXECUCOM SYSTEMS

Vendor	Execucom Systems of Austin TX
Vendor's Software Prices	
Mainframe Software	IFPS -- $40,000-to-$64,000 (Interactive Financial Planning System)
Host Communications Link	IFPS/Link--$5,000 (free with quant. purchases)
Microcomputer Software	IFPS/Personal--$500-to-$2,500 (minimum order is 10 copies costing $20,000)
Software Cost for 50 Users	$65,000-to-$189,000 (quantity discounts are available)
Vendor's Mainframe Software	IFPS, IFPS/Link, IFPS/Sentry (validates data entries), IFPS/Dataspan (transfers IFPS data to external files), IFPS/ Graphics, and IFPS/Optimum (solves simultaneous equations for goal seeking)
Vendor's Micro Software	IFPS/Personal
Hardware Required	
Mainframe	IBM (DOS, OS, and VM/CMS), Control Data, Honeywell, and UNIVAC
Minicomputer	HP 3000, Digital Equipment VAX, Prime, and Wang VS
Microcomputer	IBM PC, PC compatibles, Texas Instruments' PC, Wang's PC, Digital Equipment's Rainbow
Compatible Mainframe Software	IBI's FOCUS, Mathematica's RAMIS, Cullinet's IDMS, Software International's accounting packages, SAS Institute's statistical packages, GEISCO's Mark III time sharing service, along with financial packages from McCormack & Dodge and UCC
Compatible Micro Software	only IFPS/Personal
Features	
Terminal Emulation	ASCII TTY
File Downloading	available with IFPS/Link
File Uploading	available with IFPS/Link
Menu-Driven Query Languages	available with IFPS/Link

NOTE: This table is only a guide. This table is not intended as a comprehensive product outline since pricing and specifications may have changed since this information was compiled.

Source: the Yankee Group

- Cullinet's IDMS;
- Software International's accounting applications;
- McCormack & Dodge's financial applications;
- UCC's financial applications;
- SAS Institute's statistical packages.

The strategy of providing support for a variety of successful applications packages should enable EXECUCOM to elicit user demand for IFPS, which could give IFPS significant leverage. The Yankee Group believes that EXECUCOM is focusing its R&D towards developing additional interfaces, and towards improving existing interfaces.

Finally, IFPS has announced a PC-Link for IFPS which implements the same syntax of IFPS for the PC (under MS-DOS). While this is not an implementation of IFPS (which requires at least 500KB of main memory) on the PC, EXECUCOM has implemented the modelling syntax of IFPS on the PC, giving PC users full-screen, menu-driven IFPS capabilities (this is similar to Comshare's implementation of System W on the PC, as discussed in the June 1983 C/iS report, "Network Service Bureaus"). The Yankee Group believes that, while this is a convenient and efficient micro-to-mainframe link, EXECUCOM should also support de facto standards (namely, Lotus 1-2-3).

Like Management Decisions Systems, EXECUCOM should be well-positioned to take advantage of the IBM XT/370 (since IFPS supports VM/CMS).

The Yankee Group believes that decision support systems software represents a large growth opportunity for both EXECUCOM and MDS (even if EXECUCOM currently has a more aggressive marketing strategy). The decision support software market is still in its infancy. In 1983, the Yankee Group estimates that revenues were around $75 million for third-party mainframe

and minicomputer-based DSS. However, the PC has opened the door for a significant increase in DSS packaged sales. The market could double annually over the next two-to-three years, but the competition will also increase as others like Comshare, ADR, Evaluation and Planning Services, Inc. (with FCS/EPS) offer decision support software.

V. Relational Technology, Inc.

Relational Technology, Inc. (RTI) was founded in 1980, after several years of developing INGRES at the University of California, Berkeley. INGRES, a relational DBMS for DEC VAXs, was first shipped in 1981. The Yankee Group estimates that INGRES has about 100 customers with over 250 installations (as of September 1983). FY 1983 revenues were $3 million (FY ends in June), and the Yankee Group expects FY 1984 revenues to more than double (they could be as high as $10 million).

RTI has positioned INGRES to function in portable and distributed environments. INGRES is written in the "C" language, which gives it some measure of portability. In September 1983, RTI announced the release of INGRES/VAX/UNIX Version 2.0, which makes available the whole INGRES product line under UNIX for VAX superminicomputers. Furthermore, INGRES is available on a number of MC68000-based supermicrocomputers running UNIX.

In October, RTI introduced INGRES/Net, which enables users (using DECnet) to access INGRES from remote nodes.

With the emergence of the UNIX market, the Yankee Group believes that RTI could become a major factor. It could offer versions of INGRES for virtually any 32-bit architecture, including NCR's new 32-bit systems (NCR, in fact, will market INGRES on the Tower, a 68000-based supermicro) and Data General's MV Systems. The most significant factor for RTI

would be a 4300/UNIX-based version introduced by IBM. IBM will probably introduce UNIX to run as a "guest" under its VM operating system on 4300s, to attack the scientific and engineering market.

RTI has many possibilities. It could use INGRES/UNIX as a basic office automation building block, introducing word processing, graphics, calendaring, and electronic mail. The portability and distributed processing capabilities of such a system would lend itself nicely to the confusing array of new and installed systems. RTI could take advantage of the relatively weak and confused position of the traditional minicomputer vendors, which have invested over five years of development in their own proprietary software, and are, therefore, hesitant to actively support UNIX.

VI. Software International

Software International was acquired by General Electric Information Services Company (GEISCO) in 1981 for about $35 million. The Yankee Group estimates that SI's 1983 revenues were about $25 million. SI offers cross-industry financial applications for IBM mainframes, IBM minicomputers (the S/34, S/36, S/38), DEC VAX, Wang VS, Data General MV Systems, and HP 3000s.

The Yankee Group believes the competition from vendors such as Cullinet, MSA, and McCormack & Dodge has become too much for SI in the IBM mainframe market. SI has not redesigned its applications, and it does not have any fourth-generation facilities. SI has turned to the minicomputer market as an alternative. It has developed a close joint marketing and development relationship with Wang in particular. This means that while SI's volume shipments should grow, its average sale will decline (from around $150,000 per mainframe sale to under $50,000 per minicomputer sale. Thus, SI will have to gear its sales

force to a much shorter sales cycle (under 60 days), with higher volumes.

GEISCO has maintained an arms-length posture with SI. Initially, it appeared that GEISCO would incorporate SI with its burgeoning IBM service. However, this no longer appears feasible. GEISCO recently established the GEISCO/Software Products Operation, bringing together, under one loose marketing umbrella, its software acquisitions (SI, Energy Enterprises, and MIMS). However, each of these software suppliers addresses different markets, and they will each continue with their own sales force.

VII. Artificial Intelligence (AI) and Micro-to-Mainframe Links

Although AI products do not qualify as level four products in themselves, they form the basis for very powerful level four systems when they are combined with microcomputer and mainframe applications. These products are also indicative of the trend towards integrating high-level facilities for querying and extracting date from mainframe packages. The Yankee Group expects AI products to become necessary components of micro-to-mainframe links within the next year.

A. The AI Connection

Computers process information by breaking questions into "Yes" or "No" answers. Unfortunately, people frequently tend to answer questions with "Maybe" followed by a conditional statement such as, "Maybe X will occur if Y happens in the near future." Many computer and older database software packages require users to learn complex programming languages or "natural language" query facilities that use English-like statements but require these English words and phrases to be arranged into cryptic commands. The reason most query facilities require

these cryptic commands is that the English language is not very precise, since many words have several definitions.

Recently, several companies in the AI field have brought this arcane science into the commercial market. Putting aside the science fiction aspect of AI, these companies sell products that have one simple goal -- to make a computer understand and retrieve information when asked a question using standard English sentences. While these software packages will translate English sentences into commands understood by other computer programs (such as DBMS, general ledger, personnel, inventory, and accounting packages), their vocabulary is presently limited.

B. AIC's INTELLECT and INTELLECT MICRO-TO-MAINFRAME LINK

Artificial Intelligence Corporation (AIC) of Waltham MA is the current leader in selling an AI product to the commercial market, principally because it is the only company currently offering a fully-tested product to the business market. (Frey Associates' THEMIS, INTELLECT's only real competition, is still in beta test at this writing.) Furthermore, INTELLECT is presently installed at over 200 sites.

AIC is also the leader in the distribution of AI products. INTELLECT is sold by both IBM and AIC's direct sales forces, and it is licensed by Cullinet Software of Westwood MA (Online English) and Information Sciences of Montville NJ (GRS Executive). In addition, INTELLECT works with a variety of popular mainframe software packages such as:

- AIC's DFAM (Derived File Access Method),
- Software AG's ADABAS,

- o Cullinet Software's IDMS,
- o IBM's DB 2,

C. AIC's INTELLECT MICRO-TO-MAINFRAME LINK

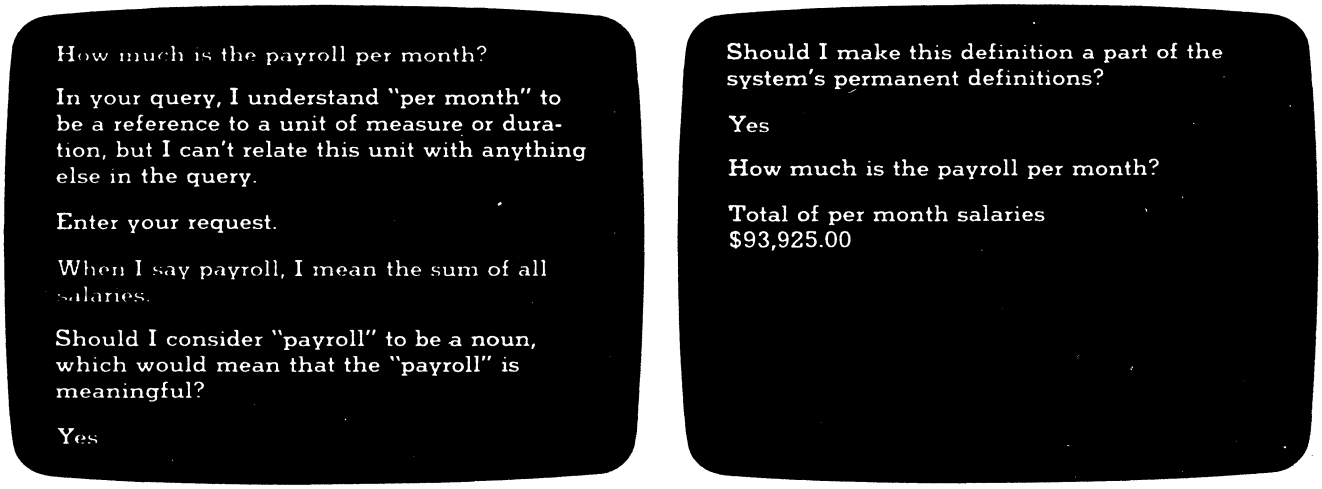
In February 1984, AIC announced its newest product, INTELLECT MICRO-TO-MAINFRAME LINK. Designed to allow IBM PC users (or compatibles with 256K of RAM) to access information on IBM mainframes with straightforward English sentences, this package will also act as a "front-end supervisor" to popular IBM PC applications such as spreadsheets, graphics, and statistical analysis packages when it becomes available in third quarter 1984.

All this power comes at a high prices, however. MICRO-TO-MAINFRAME LINK requires the following:

- Mainframe INTELLECT ($69,500) running under VM/CMS or TSO on IBM mainframe;
- AIC's Host Mainframe-to-Micro Link ($17,500);
- AIC's PC Micro-to-Mainframe Option (minimum order of 10 copies for a total of $2500)
- IBM PC (or compatible) with 256K of RAM, Concurrent CP/M-86 or PC-DOS, RS-232 port or a coaxial cable connection to an IBM 3274 controller, and microcomputer software (Digital Research's GKS kernel required for graphics);

Still, AIC's INTELLECT MICRO-TO-MAINFRAME LINK offers an excellent selection of features. It offers with the same variety of IBM, Cullinet, and Software AG DBMSs. This link allows mainframe data to be downloaded into microcomputer applications such as spreadsheets. Mainframe data can be automatically downloaded into a graphics package by simply asking for a graph of the data. AIC's PC Micro-to-Mainframe

EXHIBIT 5-2
THEMIS' ADDITIONS TO VOCABULARY

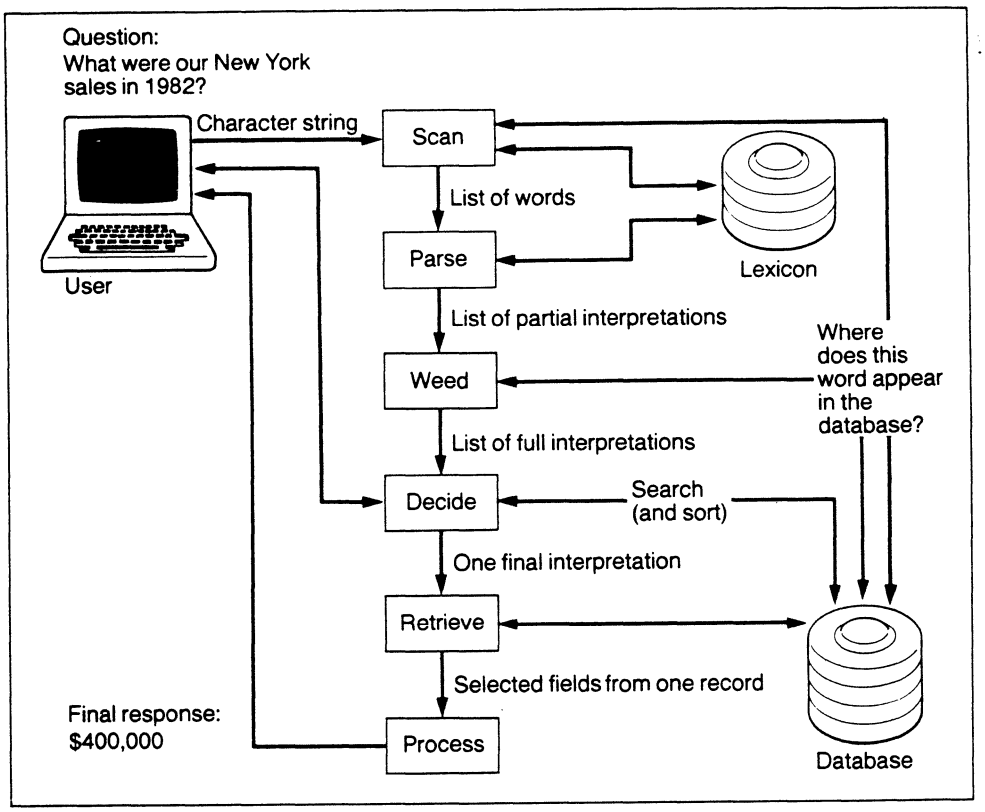


Frey Associates' Themis permits users to add words and definitions easily to its vocabulary. In the above example, where the system doesn't recognize the word "payroll," the user defines the word's meaning and part of speech and then makes it a permanent definition. Word definitions can be designated temporary if the user wants to experiment with the results. Because the system depends upon the user to correctly identify a word's part of speech, problems can develop if an improper designation is made. Yet, because the user generally has very few options to choose from, this isn't expected to prove troublesome.

Source: High Technology

EXHIBIT 5-3

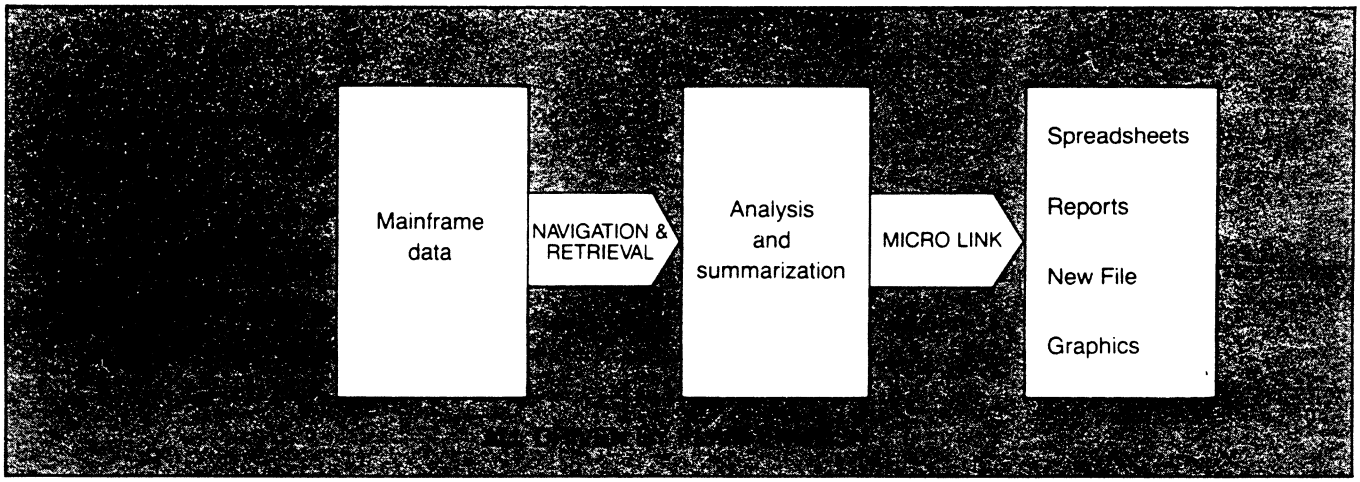
INTELLECT'S STEPS TO INTERPRETATION



The Intellect natural-language processing system progresses through several steps to interpret and respond to a user's request for information. First, the scan function breaks the request "What were our New York Sales in 1982?" into appropriate word entities, using information from both the computer's database and the system's lexicon (vocabulary). The scanner can't just assume that breaks occur at every space; for instance, "New York" should be classified as one, not two, word entities. Next, the parser grammatically diagrams the sentence in as many ways as possible and passes a list of partial interpretations to the weed function. Weed attempts to "fill in the holes" in the partial interpretations, using the database for guidance. Any complete interpretations that result pass to the decide process. Decide, in part, uses the relative difficulty with which each full interpretation was produced to assign preference values to each. If the system can't clearly choose one final interpretation based on its preference rating and from additional searching of the database, it may query the user for additional information. For example, it might ask if "New York" refers to the city or the state, a decision it couldn't reach alone if its database contained sales figures for each. Once the final interpretation is chosen, the system retrieves the requested information, processes and organizes it as necessary, and displays it to the user.

Source: High Technology

EXHIBIT 5-4
INTELLECT'S ENGLISH ENVIRONMENT



Source: Artificial Intelligence Corporation

option offers both asynchronous and synchronous terminal emulation, with either modems or coaxial cable attachments. This product will support multitasking via windows. Security is available at the file, record, and field level for mainframe data.

D. INTELLECT's Shortcomings

While INTELLECT is the leading package in this area and delivers on its promise of providing users access to data without any programming knowledge, INTELLECT does suffer from a few shortcomings. First, it's expensive. The one-time license fee for an INTELLECT system can cost from $49,500 to $69,500, depending on computer configuration. (The link is $17,500 but offers connections to 10 PCs.) Second, users cannot directly add to INTELLECT's Lexicon -- an application specific dictionary that is customized to a particular business' needs.

Finally, the last deficiency can be considered either a disadvantage or an advantage. On the negative side, INTELLECT's ability to work with older, less efficient database systems degrades its performance. On the other hand, it is just this feature that makes INTELLECT commercially attractive to many businesses that want to upgrade their software without replacing it.

For all AIC's success, the question still remains, "Is INTELLECT MICRO-TO-MAINFRAME LINK a "true" link? The answer is no. AIC must still rely on other vendors to supply the mainframe and microcomputer applications. Nevertheless, AIC does not really need to sell a "full" micro-to-mainframe link. Why? AIC is pioneering the market for true English query langauges. As such, it is basically exploiting a niche market that major software vendors consider too small a market in which to invest R&D funds.

E. Frey Associates' THEMIS

In addition to AIC, one other company, Frey Associates of Amherst NH, is viewed as a potential competitor in the AI marketplace for English-like query systems. Called THEMIS, this product is still in beta test (at this writing) but shows promise.

Introduced in October 1983, THEMIS costs $24,500 and runs on Digital Equipment Corp.'s VAX-11 minicomputer. (INTELLECT runs on the IBM 4300 series and other IBM mainframes.) THEMIS has interfaces to Digital's DATATRIEVE and Oracle Corp.'s ORACLE database management software.

Even though THEMIS does not really compete with INTELLECT (since they run on completely different hardware and software), THEMIS does offer some advantages over INTELLECT. First, THEMIS is less expensive than INTELLECT's price of $69,500. It also runs on substabtially less expensive hardware.

Second, THEMIS allows users to directly update the lexicon with words and definitions. (INTELLECT requires a trained administrator to update the lexicon as a batch file.) While this feature seems advantageous and AIC plans to add this capability to INTELLECT in the near future, allowing users to update the lexicon without restraint could also create processing problems if the size of the lexicon was substantially increased with new entries without deleting redundant definitions. Third, THEMIS is more understanding when it comes to misspellings, typographical mistakes, and grammatical errors.

All in all, THEMIS is an interesting product with enhanced features at a lower price than INTELLECT. Still, INTELLECT has three advantages -- graphics, an installed base, and IBM. In the graphics area, THEMIS lacks the ability to automatically download mainframe data into a microcomputer graphics package.

As for installed base, INTELLECT is installed at over 200 sites, whereas THEMIS is still in beta test. Finally, IBM sells INTELLECT. (THEMIS will be sold directly to end users and OEMs, and offered to Digital distributors as well.) IBM's blessing of any product can be emphemeral, but this endorsement certainly gives INTELLECT some momentum in the mainframe software market.

There are several other AI programs but these packages are the only real packages in the commercial market. It should be notted that these products are only part of a micro-mainframe link. They do not provide communications or applications at either end. They merely serve as translation device for information. At present, both INTELLECT and THEMIS are used mainly in conjunction with large systems, but the Yankee Group believes that INTELLECT MICRO-MAINFRAME LINK represents an important step in that direction.

AI has a long history of producing outright failures and ineffectual, intellectual "toys" for use in applications generators and DBMS, but the Yankee Group firmly believes that AI vendors are finally offering a viable commercial product that satifies a demand, not creates one.

F. What Does AI Mean for Micro-to-Mainframe Links?

AI will be increasingly necessary for entry-level access to mainframe DBMSs. Query languages will cover a broad range of products, but they will be interconnected. For example, users can learn basic SQL commands from Intellect's "echo" feature. With the advantages of easy access to mainframe databases, will also come the danger of users' access to confidential information. At present, security precautions are inadequate on most systems as numerous teen-aged "hackers" have proven in the past year. micro-to-mainframe links with AI interfaces represent a real threat to the integrity of mainframe databases, and password protection constitutes virtually no protection.

At another level, microcomputer software vendors will find VAR (value-added reseller) agreements with mainframe and minicomputer software vendors an utter necessity to compete in the Fortune 500 market. Second, cost of sales and marketing may soon outstrip the resources and expertise of microcomputer software vendors as well. Finally, just as Fortune 500 companies are increasingly looking for a systems approach in purchasing hardware, these customers will increasingly demand that one software vendor supply the family of software that is compatible across microcomputers, minicomputers, and mainframes.

CHAPTER SIX
MARKET FOR MICRO-TO-MAINFRAME LINKS

I. Introduction: Why are Micro-to-Mainrame Links Needed?

Prior to 1982, most data processing was handled by minicomputers and mainframes. Dumb, smart and intelligent terminals were used for communicating with these large systems. But many users of these systems were becoming increasingly unhappy with slow response times, system failures and applications backlogs. As a result, many professionals saw DTCs offering them a new level of freedom from cumbersome and unresponsive data MIS departments.

As DTCs infiltrated Fortune 1000 companies, many DTC users realized that the standalone solutions were simply not enough in some cases. First, DTCs simply lacked the power to run complex models, large accounting systems, and big databases. Second, DTC users disliked re-keying data from minicomputers and mainframe files into their microcomputers. As a result, many DTC users are looking for way access minicomputer- and mainframe-based information, move that information into their microcomputer applications, process selective data, and move the updated information back to the minicomputers and mainframes larger storage space where it can be accesse by other users as well.

II. Projections

In spite of a slow start in 1983 and some reluctance by users to become "pioneers," the Yankee Group believes that the explosion of PCs and these users' increasing thirst for data will fuel the micro-to-mainframe market. As Table 6-1 indicates, the Yankee Group expects this market to hit $2 billion by 1988.

TABLE 6-1
MICRO-TO-MAINFRAME LINK MARKET

	Total Micro-to-Mainframe Links*	Link Software Only**
1983	$250 million	$10 million
1984	$400 million	$50 million
1988	$2,000 million	$400 million

* Includes associated microcomputer and mainframe software.
** Includes revenues from link software only.

Please note that these projections inlude microcomputer, minicomputer, and mainframe software. Projections do not include the cost of associated hardware devices (such as modems, Irma boards, cluster controllers, etc.).

The large disparity in growth rates between Total Micro-to-Mainframe Links and Link Software Only can be explained in two different ways. First, Link Software will grow at a much faster rate, since the number of DTCs equipped with communications is expected to increase dramatically from 1983-to-1988 (see Table 6-2, Communicating DTCs, for more information.)

Second, the lower growth rate for Total Micro-to-Mainframe Links is due to the fact that many installations already have the microcomputer and mainframe applications that are used with the Link Software. As a result, many vendors will be selling Link Software to their installed base initially. Over the next two or three years, however, new sites in smaller companies will start investigating Total Micro-to-Mainframe Links.

Source: the Yankee Group

TABLE 6-2
COMMUNICATING DTCS*
(in millions of units)

Year	DTCs Installed	DTCs with Communications	Percentage of DTCs with Communications
1983	5.1	0.5	10%
1984	9.4	1.9	20%
1985	14.5	6.5	50%
1986	19.6	11.7	60%
1987	25.9	18.1	70%
1988	33.3	26.6	80%
CAGR	45.5%	121.4%	

* With both asynchronous and synchronous communications.

Source: the Yankee Group

TABLE 6-3
COMMUNICATIONS AND
IBM'S PERSONAL COMPUTER PRODUCTS

	Percentage of All Installed PCs	Number of Installed PCs*
Total IBM PCs Installed (YE 1983)	100.0%	811,000
PCs Installed in Fortune 2500 with IBM Mainframe**	43.0%	349,000
Total PCs with any communications capability	34.0%	276,000
PCs with asynchronous communications***	19.0%	154,000
PCs communicating with IBM mainframe in 3270 BSC or SDLC	5.0%	41,000
PCs communicating with IBM mainframe locally	1.0%	8,000
PCs communicating with IBM mainframe at a remote site	4.0%	32,000
PCs with SDLC communications	3.5%	28,000
PCs with 3270 BSC communications	1.5%	12,000

* All figures rounded to the nearest thousand.

** Percentage reflects 25% of NAD sales and 18% of non-NAD sales. The Fortune 2500 contains companies with revenues in excess of $75 million including financial and service companies.

*** Includes PCs communicating with other PCs, outside databases, and non-IBM synchronous communications devices.

Source: the Yankee Group

III. Micro-to-Mainframe Dilemmas

For all the optimistic projection, there are still major problems facing micro-to-mainframe that could dampen users' enthusiasm for these products. While some of these problems are minor, many of these dilemmas are political footballs within user organizations.

IV. Caveat Emptor — Microcomputer Software is Still a Mess

Caution: there now are over 40 companies offering "integrated" packages, approximately 15 vendors offering "Windowing" systems of one sort or another, 20 or more micro-to-mainframe vendors, and a legion of micro-to-mainframe suppliers. Choosing the wrong product could be disastrous to both the micro-to-mainframe vendor and its customers. As a result, there will be a tendency to go with "safe" and established vendors such as Lotus and VisiCorp (if it does not lose VisiCalc to Software Arts).

On the other hand, new vendors may offer better features and better deals. Basically, its a trade-off between established integrated software products that are used by numerous other vendors and have a large installed base, and new vendors whose new integrated products differentiate a micro-to-mainframe system by offering superior features, performance, and price.

TABLE 6-4
MICRO-TO-MAINFRAME DILEMMAS

1) Which users have the right to view the data?

2) Which users have the right to download data? (While users can steal small amounts of data by simply copying the data from a terminal's screen, taking large amounts of data (personnel records, customer lists, etc.) is not practical unless the user has the right to download this information to his/her microcomputer.)

3) Which users have the right to change the data?

4) Which users have access to the tools and knowledge necesssary to use the data?

Source: the Yankee Group