IBM'S

TERMINAL STRATEGY

for

DISTRIBUTED PROCESSING

IBM'S TERMINAL STRATEGY

FOR

DISTRIBUTED PROCESSING

MAY, 1977

IBM's Terminal Strategy for Distributed Processing is published by Small Business Systems, Suite 230, 4320 Stevens Creek Boulevard, San Jose, California 95128.

TABLE OF CONTENTS

EXHIBITS

I. IBM'S TERMINAL STRATEGY 1970 - 1974

A. Terminals Accelerate System Growth

IBM had raised the problem of terminal product planning to the status of a Key Corporate Strategic Issue during 1970. Here it would receive the attention of the Management Committee. Task forces were organized to identify the size and direction of the terminal market. Key elements of IBM's marketing strategy were reviewed with respect to the role that terminal products would play in future Corporate revenue growth. A technical review of terminal product planning produced a recommendation that terminal products be developed around a series of controller and peripheral modules, and that these building blocks be interchangeable among various terminal products. The long term goal was to use LSI/FET logic elements in all terminal products.

The Data Processing Division estimated that over 3,000 IBM 360 mainframes were supporting teleprocessing applications and that by 1975 this number would grow to over 6,000 360/370 systems. Over 100,000 terminals were already attached to IBM systems and it was estimated that by 1975 this would increase to over 350,000 units. Terminal products, in turn, would continue to be used to increase both the size and the number of IBM mainframes in service. It had been noted that the addition of one or more substantial teleprocessing applications to an IBM installation tended to produce a 2X to 4X increment in main-memory requirements, and a 3X to 6X increment in rotating storage requirements. In addition, once a customer had made a substantial commitment to teleprocessing applications, there frequently followed an order for a second central processor to back up the primary teleprocessing system.

Thus, for the time being, IBM Management concluded that the relatively poor profit margins (9 - 16%) garnered by the terminals currently in the IBM product mix could be tolerated because of their dramatic impact on mainframe and peripheral sales. For the long term, however, it was anticipated that IBM's investment in new circuit technology and the development of a modular product line would also improve terminal product profit margins.

B. IBM's Marketing Assumptions

1. Competitive Vendors

Although terminals were removed from the Key Corporate Strategic Issues list in early 1971, the problem of developing a competitive - and profitable - terminal product line was brought to the attention of the Management Committee on several occasions during the years 1971 - 1972. Many of these discussions centered around the assignment of Divisional responsibilities and the enforcement of a clear direction to the product planning/development cycle.

In the meantime, IBM proceeded with the introduction of the 3270 to offset the erosion of its installed 2260 CRT product base, and the announcement of the 3705 to blunt the inroads of competitive front ends that were fast replacing older IBM 2701, 2702, and 2703 communication controllers.

IBM assumed that the announcement of NCP and the programmable features of the 3705 would cause the majority of its customers to hesitate in selecting an alternate front-end. To provide a low end capability, IBM announced a scaled down version of the 3705 called - appropriately - the 3704, and a series of integrated communication adaptors for the smaller 370 mainframes. IBM emphasized in its sales efforts that NCP would be fully interdependent with VTAM and the System 370 Virtual Operating systems. This strategy was used to stall its customers from selecting alternative terminal and front-end products until IBM's own software programs for network control could be completed.

IBM developed the basic strategy of by-passing the natural evolution of user applications from 10 or 15 CPS teleprinter terminals to newer 30, 45, 60 and 120 CPS units. Instead, IBM focused its efforts on the development of a Synchronous Data Link Control (SDLC) procedure and a network management concept called Systems Network Architecture (SNA). The emphasis was therefore on the development of terminals which would be functionally efficient in the block mode data transmission environment that is common to CRT and RJE terminals as versus terminals which have a character by character mode orientation. Hence a product like the 3767 teleprinter was introduced with 2741 emulation mode only as a means of providing initial host system support. To fully utilize the 3767's considerable features, the user would need to convert to SDLC protocol running under the network control concepts of SNA. It was assumed that this orientation toward block mode data transmission would tie nicely to IBM's plan for the centralized processing and storage of data which has been generated by a series of remote terminals. This data could then be accessed, updated, and distributed as needed.

IBM's chief problem would be the development of the software products necessary to support the concepts of SNA. First of all there was the development of the Data Base/Data Communications software necessary to support the demands these terminals would place on a centralized system. Then there was the communications software to manage the interface between the operating system/user program and the 3704 or 3705. And finally, there was the need for a line and terminal control program which would reside in the 3704 and 3705. It was assumed in this development that the user would be required to use IBM terminals in order to avoid any conflict with these software products. IBM's software response has been prolific. For upper end mainframes there has been OS/VS (Operating System/Virtual Storage) followed by OS/VS1 and OS/VS2 (later renamed MVS for Multiple Virtual Storage), and VM 370, which provides for the operation of many virtual machines within one central processor. For small and midrange machines IBM has developed DOS/VS (Disk Operating System/Virtual Storage). These operating systems are linked to the 3704 and 3705 by VTAM (Virtual Telecommunications Access Method) and the network itself is under the control of a program in the 3704 or 3705 called NCP (Network Control Program). It was assumed that competing front-end vendors would have a tough time in their attempt to achieve compatibility with with OS/VS, OS/MVS, or DOS/VS in a VTAM/NCP environment since each one would have to develop his own code and bit compatible version of NCP. In addition, it was assumed that only the larger terminal vendors would be able to afford the expense of developing link compatibility with SDLC protocol procedures and the intricate system demands of VTAM/NCP.

To further compound the problems of interfacing foreign equipment to IBM mainframes, IBM's strategy called for a fully implemented SNA to have the capability of linking multiple 3704/3705 communication controllers together in a distributed network. Dual 3705's acting as a single front-end could also be used to interconnect up to four 370 mainframes, share a common data base, provide message switching with other 3704-3705 front-ends in the network, and permit the use of remote 3704/3705 controllers as remote nodes in a network.

To this ambitious plan, IBM was to add the release of TSO (Time Sharing Option) under OS/DOS VS, and CMS (Conversational Monitor System) under VM. These last two products, however, are not primarily block mode data transmission processors, but are rather character by character processors designed to support interactive timesharing and transaction processing applications. Because of the conflict with VTAM/NCP and the batch orientation of VS operating systems, the use of TSO or CMS is laborious at best. Neither of these products are particularly compatible, therefore, with the block mode transmission concepts of SNA and are certainly alien to the use of SDLC.

IBM could not have made the assumption that all users would be satisfied by software which is oriented toward RJE and CRT block mode data transmission concepts. Indeed, the demand for TSO should have been the tip-off that interactive application program users expect their host system to operate interactively. IBM therefore has a conflict of system's software/hardware orientation wherein the block mode processing paths of VS conflict with the character mode processing needs of TSO/CMS. As a result, the <u>interactive</u> response times of TSO/CMS have suffered.

2. Users

IBM's complex and ambitious plan for the development of SNA almost proved its undoing. Not only are these software products difficult to develop, it is even more difficult to render them sufficiently "bug free" for installation at a user site. IBM's NCP/VTAM Advanced Communications Function (AFC) software is over two years late, and in the meantime, users have made a heavy investment in existing operating systems and access methods. In addition, the conversion to

NCP/VTAM has been identified as an expensive one - both in terms of the one-time conversion costs and the continuing hardware/software support costs. Small wonder, then, that the migration of users to SNA has not been going according to the original schedule.

IBM had assumed that its customer would follow a planned route of migration to larger mainframes, increased storage, and the use of VS functions. This migration, in turn, would make the move to VTAM/NCP software a natural upgrade from the network control functions provided under BTAM, QTAM, and TCAM (et al). As a further stimulus to make this move, certain features of newer IBM terminal products would be available only in an SNA environment using SDLC protocol. This, of course, would also require the user to upgrade to one of the VS operating systems and the use of VTAM/NCP.

Once this course of action had been sold to a user, IBM assumed that the effort required to make the transition to SNA - and the related interdependence of SNA software products with IBM terminals - would not only preclude most users from seriously considering alternative methods of network control, but would also make it difficult for them to choose alternative terminal vendors.

but would also make it difficult for them to choose alterna- tive terminal vendors.

By mid-1973, IBM had evolved an industry orientation to its terminal Marketing strategy. Each industry had been analyzed for the identification of special purpose terminal requirements. There had been a concurrent planning action to identify appropriate industry oriented application packages which could be tied to the VS operating systems and the installation of SNA. Where IBM had already made a significant industry penetration, such as Banking, it was assumed that there would be little trouble in selling the user on the need for interrelating host mainframe applications support

that there would be little trouble in selling the user on the need for interrelating host mainframe applications support

6

with unique terminal applications software packages. Terminal resident software could either be down line loaded from the host processor, or locally loaded at the terminal site using a diskette peripheral. Additional terminal features would be made available through a series of firmware modules which could be installed as the user found need for them. The strategy thus evolved was to provide proprietary firmware/software solutions to specific industry application problems, superior specialized terminal devices where appropriate, and a broad integration of terminal hardware with host and network support software. IBM could emphasize its role as a complete systems vendor, rather than its position as a hardware vendor, with a massive array of hardware and software products tailored to the needs of each industry. IBM's concentration was therefore on the development of centralized batch mode data processing/storage functions, versus the decentralized processing of user data, because that was the environment in which IBM felt most comfortable. It was also the environment in which IBM had the greatest confidence of continued revenue growth and profitability.

C. Terminal Product Goals

1. Objectives

IBM's basic objective was to merge its terminal strategy with its mainframe hardware/software strategy and thus encourage users to stay in the fold. This led to the organization of the task forces that would eventually recommend the SNA/SDLC concepts and the development of new Data Base/Data Communications software packages.

Until 1970, IBM had usually been a follower, rather than a leader, in the application of new technology to the terminal products it had under development. The planning cycle that occurred 1970 - 1972 changed IBM's perception of terminal product development and newer products would be developed using new "best effort" mechanical designs and the lowest cost circuit technology available. Although this strategy was reworked in 1971, 1972, and 1973, IBM's basic objective was to standardize the hardware modules from which a variety of terminal products could be derived. Required high technology programs were put in place, price/performance objectives established, and a software support plan was developed.

IBM's terminal product line had suffered from poor profitability because of relatively high manufacturing, software, and maintenance costs. IBM attempted to solve these problems with improved circuit technology, emphasis on "maintenance free" terminals, provision of diagnostic tests which the user could invoke, and the development of common hardware modules. Higher terminal prices - and hence improved profitability - would be justified by the "functions" which IBM's terminal products would provide to the user, and the software ties established under SNA between IBM terminals and IBM host mainframe software support systems.

2. Results of the 1970 - 1974 Period

New products coming on-line as the result of the product planning and development period of 1970 - 1974 include:

-3704 (1973) and 3705 (1972) Communication Controller

Although the genesis of the 370X product set has its foundations in the pre-1970 to 1974 period, IBM has used it as the basis of its NCP strategy. First introduced with 270X emulation, the software capabilities of the 370X communication controllers have made it somewhat easier for IBM to provide

RPQ features in response to user needs, and they do provide the vehicle for user systems migration to VTAM/NCP under the VS operating systems.

-3767 Communication Terminal

IBM intended to replace the vulnerable 2741 and 2740-2 terminals with the 3767. The targeted applications were inquiry/response, interactive timesharing, transaction processing, and low volume data entry. For non-VS environments, IBM offers 2741 start-stop mode emulation at 30CPS and 2740-2 emulation at 60 or 120 CPS. NCP SDLC software support for the 3767 is via the 370X under VTAM, or TCAM through VTAM, in a VS environment. The 3767 utilizes a 132 column carriage, offers an alternate character set, APL functions, and a security lock. Offline the 3767's (8008 equivalent power) microprocessor can be used to provide desk calculator functions.

-3790 Communication System

IBM attempted to respond to user programmable multistation terminal and multistation key-to-disk system competition with the 3790. It is (with the May 1977 announcements) a curious combination of old and new technology. The older 3791 controllers could be expanded to 64k bytes of storage, support 27.5 million byles of disk storage, a removeable diskette, and a 120 line per minute belt printer. These older controllers are no longer available. The newer Model 1C controller permits the attachment of 10M bytes of disk storage, 1,920 character capacity 3278 CRT displays via an attached remote 3274 controller, and/or a remote 1,920 character capacity 3276 CRT Display/Station Controller. Disk storage capacities of 20M, 30M bytes may be added with the 2A or 2B models. Internal storage for the new 3791 controller may be increased to 192K bytes. Software for the new controller may be developed using a package IBM calls DMS/3790. With it, and an IBM supplied coding form, a programmer can define I/O fields, screen field attributes, and field editing requirements.

-3770 Data Communication System

IBM's ability to reach its goal of terminal device modularity appears to have been best reached in the execution of the "Rocket" product plan. Key components include 50, 150, or 300 CPM card readers, 40, 80 or 120 CPS character printers, a 50 CPM card punch, and an adaptation of IBM's newer, 10, 20, and 30 M byte disk file devices. Other devices for the upper end of the 3770 family include a 400 CPM card reader, and two line printers (400 LPM and 1,000 LPM). IBM is scheduled to add OMR, OCR, and badge readers. The 3774, 3775, 3776, and 3777 models are all supported as RJE stations under SNA, and as 2770 or 3780 terminals under Binary Synchronous Communications support. IBM's strength in terms of price/performance appears to be in the card and disk equipment areas - long IBM strongpoints. The 377X product set is functionally competitive to anything available from the independent terminal vendors. It appears that the microprocessor base of the 3770 series thus far introduced has the compute power of an Intel 8080.

-3600 Finance Communication System

The 3600 is a good example of what IBM can accomplish when it tailors a specific set of products to a specialized application. The 3600 system is designed for the financial community - commercial banks, savings and loan associations, and finance companies. Most of the terminals in this family are small enough to be comfortably used on a countertop and each one has a specific (set of) transaction function(s). Because of IBM's competitive strength as a vendor to the financial community, this is the only product set which requires DOS/OS VS with VTAM/NCP as a prerequisite for installation.

-3650 Retail Store System

There is a sharp contrast between IBM's penetration of the banking terminal market (35 percent) and the retail point-of-sale market (7 percent and growing). IBM tried to make VTAM/NCP a requirement for the support of the 3650, but the retail store owners would have none of that action. The retailers could not (in general) justify the high cost of converting to the more expensive 370 models running under VS just to support their retail terminals. Competition offered lower cost mainframe support either by using non-IBM mainframes, or offering to interconnect their retail terminals to an IBM mainframe in a BSC environment. IBM has thus been less successful in convincing the retail chains that the 3650 special purpose terminals offer functions which are superior to those of NCR, Singer/TRW, and National Semiconductor. But IBM is gaining with the demise of Singer, and its own ability to penetrate an industry on the basis of applications expertise. Special purpose terminals are a vehicle to sell a complete mainframe, peripheral, software, and teleprocessing system package.

3. Field Inventory - Year-End 1975

a. CRT Products

By year-end 1975, the population of IBM's 2260 multistation CRT display system had declined to less than 6,400 CRT stations, and there were virtually no 2265 single station CRT display terminals in existence. IBM's replacement product, the 3270 multistation CRT display system and 3275 single station CRT display terminal were still selling reasonably well against greatly improved products from such vendors as Courier, Four Phase, Raytheon, and Sanders. GTE, Courier, and several other vendors, had embarked on a strategy of supplying a 3270 compatible terminal with superior hardware features at a lower price. Four Phase, Raytheon, and Sanders were primarily emphasizing the flexibility of a programmable controller which could support user applications and auxiliary storage devices. Nevertheless, IBM had an installed population of over 80,000 3277 CRT display stations, and 10,000 3275 single station display terminals. In addition, there were just under 5,000 3277 CRT display stations attached to IBM's 3790 controller.

In the Airline reservations system industry, IBM had been impacted by multistation display products from Raytheon and Four Phase Systems. It had no real single station capability, and hence this market had largely gone - almost by default - to Incoterm. This resulted in an erosion of IBM's leadership to an installed base of less than 23,000 2915 and 4505 units. The Brokerage industry was the second largest user of specialized CRT display terminals at year-end '75, and consequently represented a large potential market for IBM. However, IBM's attempt to penetrate this market with an industry specialized product had met with little success due to regulatory problems, political cross-fire among brokerage houses, the more complete service offered by the stock quotation service vendors, and the relatively high price of IBM's unit. It is also doubtful if IBM's management has been impressed with the profits to be gleaned from this traditionally price conscious and frequently unstable industry.

IBM's 3740-2 and 3740-4 had met with some user resistance because of the more attractive alternatives offered by Sycor, Incoterm, Datapoint, and Sanders. By year-end 1975 just under 13,000 units had been installed.

b. Banking and Retail Terminals

Since the IBM 3600 Banking System was just getting started at year-end 1975, most of IBM's installed banking industry terminals were the older 1060, 2972, and 2980 units. IBM had roughly 43,000 banking terminals installed throughout the United States. In addition, some 20,000 Credit Verification/Electronic Funds Transfer System terminals were linked to banking and retail user mainframes. IBM had not made any significant penetration into retail POS systems.

c. Teleprinters

The 2741 and 2740-2 were in deep trouble by year-end 1975. Competitive pressure from superior products based on Diablo and Qume "daisy" wheel mechanisms, competitive units from TI, ready user acceptance of the DEC LA-36, a migration of users from BCD or Correspondence code to ASCII code as a basis of their interactive software support, and the substitution of low cost CRT displays for teleprinters in interactive applications were among the factors causing the rapid demise of these two venerable products. There were less than 43,000 2741 and 2740-2 terminals in active use and the lease deck was eroding rapidly.

d. Remote Batch Terminals

IBM's 2780 was gradually being replaced by the 3780, System 3, and competitive products from Data 100, Harris, and others. System 32 was just coming on stream as a remote job entry terminal by year-end 1975. These factors had combined to push 2780 installations to below the 5,000 unit mark and no specific replacement was ready for shipment.

In the meantime, 2770 and 3735 installations had fallen to fewer than 7,500 units. Shipments of the 3770 product set had just begun and would cause a further displacement of 2770 terminals.

II. THE USER FAILS TO RESPOND

A. SNA: Complex and Expensive

1. Migration

The planned migration of IBM 370 mainframe users to the virtual storage operating systems environment has not gone as rapidly or smoothly as originally anticipated. Early users were frequently unable to identify any real processing gains for programs converted to run under one of the VS operating systems. Early VS installations were often plagued by problems of page "thrashing", and the attendant loss of total systems efficiency. The cost of the conversion was also a hurdle, particularly during the 1974-75 recession, as was the justification of the increased mainframe and peripheral hardware cost required by the virtual storage environment. Consequently the conversion of user teleprocessing systems to VTAM/NCP has also been delayed.

In the meantime competitive software vendors have been able to offer alternative data base/data communication functions which are well suited to the non-VS environment, and competitive terminal/front-end vendors have been able to offer newer hardware which frequently exceeds the advantages announced for IBM's SDLC oriented terminal/front-end products. To add to IBM's problems, there has also been a growing conviction - at least among some users - that the data base management problems associated with IBM's virtual systems environment may prove to be too unweildy to handle and that the solution to these problems lies in breaking the data base down into smaller processing/storage components i.e.; decentralized data processing.

Small wonder then, that there are currently fewer than 75 working VTAM/NCP installations throughout the world. This, despite the intense interest in the provision of NCP functions which has developed over the last six months. Consequently, while the utilization of VTAM/NCP will greatly accelerate over the next three years, it is probable that by 1980 fewer than 40 percent of IBM's 370 mainframe users will have completed the conversion.

2. A Tutorial

Currently SNA is offered in a single domain environment: i.e., one host, one network. By late 1978, however, IBM will have brought up the first multi-domain environment systems: i.e., multiple host processors, one or more networks.

In a non-VS environment, i.e., where a 360 or 370 was linked to the network via a 270X communications controller, the host CPU provided such network control functions as code translation, determination of line control procedures (SOH, STX-ETX, CRCC, etc.), insertion of device dependant information between the user program and the telecommunications line, data buffering, page swapping, polling, and terminal/line testing/error recovery (sometimes). The 270X communications controller acted as a line multiplexor (one subchannel address of the byte multiplexor channel was required for each line), established and maintained - terminal connections (under host program control) checked for data transmission errors, and provided autocall/autopoll/autoanswer hardware functions. Usually one application program was dedicated to each type of terminal (and vice versa).

The first step in conversion to the VTAM environment was to install a 370X communications controller running under PEP, wherein the 370X appeared to the host as a 270X. The host

CPU continued to provide the same functions it did when attached to a 270X, and the user retained the older telecommunications access methods (TCAM, BTAM, QTAM, GAM, etc). Experimentation with VTAM/NCP could then begin while concurrently maintaining 270X mode operations.

The second step of the conversion process was to generate VTAM in the host and NCP in the 370X. NCP took over the functions of polling, I/O initialization, I/O scheduling, error detection/correction, data stream blocking/deblocking, character/data block buffering, line/terminal testing, and some editing functions. GAM, QTAM, and BTAM program product support would then be discontinued and where the user insisted on maintaining OS/TCAM software within the host it could only access NCP through VTAM (i.e.: TCAM effectively runs under VTAM). In theory - at least - the user could now access multiple applications from any terminal (and vice-versa). Only one sub-channel address is required for (user selectable) multiple lines. In theory this off-loading of NCP functions to the 370X would free up the host processor for other tasks. In practice, however, the host CPU overhead load for handling teleprocessing related functions has been reduced by less than 10 percent.

VTAM has been developed to provide a common telecommunications access method across the DOS and OS product sets. Using a macro definition language, the user can generate both direct and queued line control interfaces for his application programs. As originally announced in 1972, VTAM did not support 370X operation in 270X emulation or NCP/SNA functions. It was, instead, offered as a BTAM/QTAM replacement with Bisynchronous and Start/Stop line control procedures. It had the distinct advantage, however, of supporting locally attached 3270 or 3290 controllers. This greatly simplified user application support for both locally and remotely attached multistation CRT terminal systems.

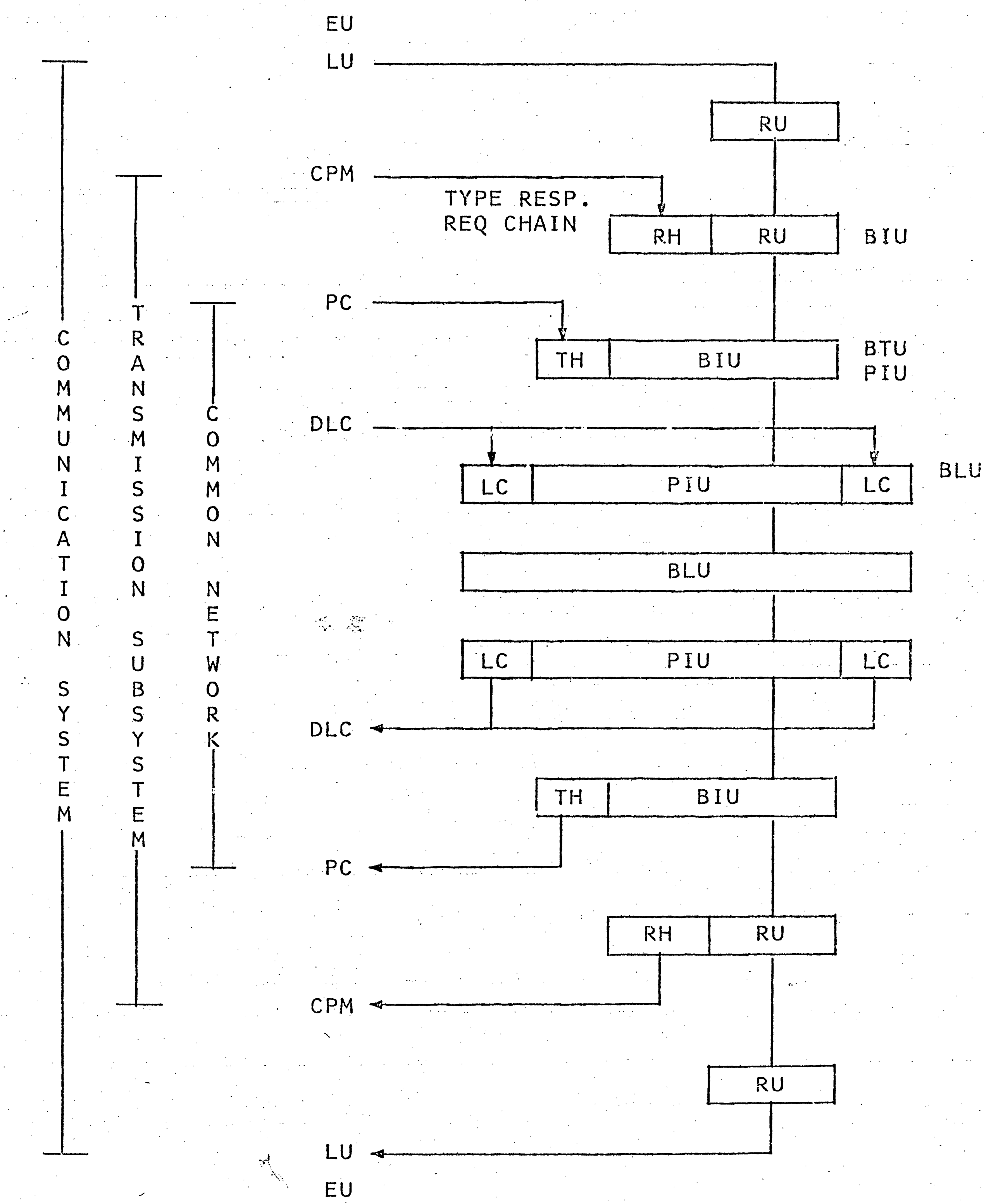
VTAM, therefore, had to be redesigned. The older terminals would be supported using current disciplines and protocols, and the newer terminals would be supported using SDLC protocol procedures. This posed something of a problem since the older protocols were character or message data stream oriented, whereas the SNA environment would require messages to be organized into multiple message sessions between two nodes. A session could not be interrupted until VTAM got a subsequent request for an alternate node.

Under SNA, message "sessions" are established between two logical units. Although these logical units (or LU's) usually consist of the user application program at one end of the line and the terminal at the other end of the line, they could just as well include two terminals talking to one another, or two cluster controllers, and so on. As shown in Exhibit 1, a Communication System is inclusive of all the events that occur in moving data from one LU to another LU. The transmission subsystem consists of all of the events required to move the actual message from LU to LU, and the Common Network includes the events which move data among various nodes within the physical network itself. SDLC is only a small portion of this overall architecture, dealing as it does with the actual Data Link Control information appended to a message as it moves through the network.

A user application program written in PLI, Cobol, Fortran - et al, is treated as a subtask to either IMS or CICS. (As an alternative, the user may supply his own control program). The control programs, in turn, interface to VTAM and a new VTAM related module called SSCP for System Service Control Point. The SSCP module actually performs the function of managing the network and maintaining a directory of network nodes (another host CPU SSCP; a remote node communication controller - 370X, Series 1, etc; a remote or local cluster controller -

EXHIBIT 1

A TUTORIAL



3600, 3790, 3650, 3660, 3770; or a specific terminal type, i.e. -3270, 3767). Note that programmable controllers are treated as cluster controllers, whereas non-programmable (or limited programmable) terminals are treated as individual units. If a terminal user initiates a session then the inbound message is called a "Log-on" to a specific application program. CICS, IMS, or the user control program provide "Log-on" management. If, on the other hand, the host application program (any node in the network can act as a host) initiates the session, then the message is called an acquire (i.e.: I want to acquire a terminal/node in the network).

The network is logically full duplex. It may (and frequently will), however, be physically half-duplex. This is appropriate since IMS and CICS are logically conversational (half duplex) software packages, trying to operate in a logically full duplex environment. CICS typically requires that the remote node only generate an exception response: i.e.; respond to a CICS message only if the received message is (for some reason) unacceptable. IMS, on the other hand, typically requires a definite response to every message, whether acceptable or not.

Since a given logical message can be sent in a series of separate physical blocks (called a multielement chain) and since it is unknown how fast or how much data can be handled by the receiving node, then the concept of Pacing must be introduced. This determines how much and how fast data can be sent to a node, and the software paces the physical blocks according to the pacing formula for each destination node. This includes, incidentally, inbound pacing to NCP, since if the NCP buffer area gets full, the 370X will simply stop accepting inbound traffic.

The basic concept of SNA is that one user program (host or node application) will talk to another user program (host or node). In other words, SNA is basically a program to program communication facility. The remote program, in turn, talks through still another program to the user - which leaves non-programmable terminals like the 3767 in something of an awkward situation. Now IBM must create exceptions to SNA in order to handle non-programmable terminals, or define what that program will be (an inelastic situation). Worse, users who desire simple interactive terminal links to a host application, are precluded from "normal" SNA sequences <u>by definition</u>.

There are three basic types of sessions:

1. VTAM SSCP to each physical unit (PU) in the network.
2. VTAM SSCP to each logical unit (LU) in the network that wants to be active - i.e.: has gone through "Log-on" in one fashion or another.
3. LU to LU

The first session can be characterized as "Hello controller, how are you, what devices do you have, are they healthy, are you ready for another transmission, do you have anything for me, and by the way - who are you?" The second session can be characterized as "Hello user/terminal or host application program, what does your user want to do?" The third session type can be characterized as "Hello, I'm application program and I want to talk to the application program at the other end of the line." Each node in the network, whether host CPU or remote terminal, is treated as an individual addressable resource or Network Addressable Unit (NAU). The software compatibility for each network node controller to manage its own physical resources is provided through a series of controller routines sometimes referred to as Physical Unit Services or PUS.

In any event, let us follow a message (correction session) from one end user logical unit to another end user logical unit.

In the user's view, data is simply being sent from one LU (application program) to another LU (application program). In the course of this transfer the data will be broken into physical blocks (if necessary) and transmitted as a series of moves from buffer to buffer. Hence outbound host CPU data is placed in an LU buffer, transferred to the control program buffer, transferred again to the NCP buffer, thence to the remote control unit buffer, and finally to the remote LU buffer.* Along the way each physical data block being transmitted picks up a remarkable amount of overhead information.

Each logical data block is broken (where necessary) into physical data blocks of up to 256 bytes in length. Each physical data block to be transmitted now constitutes an RU on Request/Response Unit. The transmission software adds 3 bytes of request/response header information (RH), and the resulting block is called a Basic Information Unit (BIU). Next the transmission central program adds from 2 to 10 bytes of network addressing and sequencing information (TH) to the BIU and the resulting block is now called a Path Information Unit (PIU).** Next the data link control information is added - NOW comes SDLC - and the block grows by 6 more bytes. The resulting block, with RU, RH, TH, and DLC information, is called a Basic Link Unit (BLU). This is what gets transferred from one physical location to another over the telephone line.

*Note this infers the presence of a buffer pool at each physical/logical location encountered.

**Also called a Basic Transmission Unit (BTU).

When this block reaches its destination, (or in some cases the next node it encounters) it will be disassembled in the reverse order from which it was assembled. Hence the data link control information is checked and stripped, the TH is analyzed and removed, the RH is then analyzed and removed, and the RU is finally given to the LU buffer. In the process of this transfer from LU to LU, flags have been set and checked, error conditions detected and corrected (usually), requests have been checked against responses and related physical blocks have been reunited as a single logical data block at the final destination.

Be it ever so cumbersome for interactive applications, IBM is emphatic about SNA and is promoting the implementation ov VTAM, NCP, and SDLC. These all tie too closely with the strategy of centralized processing and the carefully controlled account environment with which IBM feels most comfortable. These new transmission techniques are also (loosely), linked with the overall strategy for Satellite Business Systems since the essence of this service will be to provide a low cost - block mode - transmission path from remote nodes to central site hardware.

B. Migration of User Applications

This is an industry which has grown up with the belief that the preparation, editing, processing, and storage of data on a centralized basis is the most effective way to handle the corporate data processing workload. This concentration of corporate data processing functions into a minimum number of centralized sites is still - and will continue to be - a fundamental assumption which underlies the DP budgeting and planning process. As a result, although 1977 shipment of minicomputer systems will exceed $2 billion, and shipments of the infant microcomputer product sets will exceed $200 million, they are only a fractional part of the more than $10 billion in mainframe system shipments which will occur this year.

There is a growing use of both decentralized and distributed processing, however, as a supplement to large institutional data processing requirements. There is a logical sequence of events, a rational if you will, that can be used to identify the evolutionary course of data processing. That rational can be based on an examination of user applications - and their interaction with the hardware/software products available to support them.

There has been a steady migration - from the mere use of a centralized computing facility to provide a solution for the user's most critical counting chores - to the use of this data processing/storage resource as a tool for the day to day management of an organization's operations. To be sure, there were some industries where the computer played a critical role in daily operations right from the start. The airline industry with its requirement for the world's most time sensitive inventory control system (seat reservations) and the Brokerage industry with its urgent need to know the current status of financial instrument prices, are two such examples. But for most organizations the advent of data processing has initially meant the mechanization of such counting functions as billing, receivables, payroll; and non-time critical inventory control. These initial efforts to mechanize one or more repetitive counting chores were generally followed by an attempt to vertically integrate - or link if you will - several counting jobs into some kind of sequential system. Hence billing was linked to order entry, payroll with personnel accounting, parts inventory control with a bill of materials explosion, and so on. The emphasis of the DP department's efforts began to shift to an involvement with the daily workings of departmental operations, and this began - in turn - to create a time sensitivity for the flow of information which each department needed in order to meet its operational schedules.

This gradual shift of the Central site workload has therefore carried with it a similar shift in the methods of data entry and retrieval required to support the mass of data which must be entered, edited, stored, processed, and then made available for time critical information requirements. Hence, while payroll applications lent themselves nicely to batch data processing systems and the use of the keypunch as the primary data preparation device, the development of a personnel reporting system frequently involved the need to enter, update, and retrieve records in a random fashion. Terminals which had previously been justified only when the receipt or delivery of payroll data was time critical to some distant office, became an integral part of the clerical operation. In a similar fashion, the use of terminals in billing and receivables applications tended to be justified only to the extent that they could shorten the receivables cycle. The linking of a batch processing oriented receivables system with a batch processing oriented billing system, however, carried with it the same interesting side effects. The users of the new system quickly recognized that terminals could be a useful tool in processing information about such application components as credit verification, order backlog reporting, customer master file maintenance, and product code verification.

We could provide additional examples, but the key point is that as the user's sophistication grew, and a relationship began to emerge among the various applications being processed, there arose more time critical problems associated with the collection, editing, manipulation and dissemination of data. In addition, there arose the question of who should edit the data, does this infer responsibility for the content of the data base, how accessible does the information stored in the data base need to be, and if the use of the data base is distributed - why not the processing as well?

This migration of user applications is an ongoing thing, and we have only recently begun to see the results of this change. But given this migration - as summarized by Exhibit 2 - it is difficult to imagine the indefinite prolongation of centralized data processing. When, as has been the case, application planning is concentrated on counting functions, then the processing of data on a batch basis at a centralized site makes sense. This concentration of DP attention carries with it an analogous concern with using the computer as a tool to effect cost reduction, the management of applications on a job basis, and the use of a job oriented data base. As the attention of management turns to using the computer as a problem solver at the operating department level, however, the influence of the accounting department over day to day computer installation operations begins to diminish (and becomes more of an auditing function). The departmental managers are concerned with finding cost effective ways to use a function oriented data base to solve daily operational problems. The computer center is a resource, not an end in itself, and since the responsibility for the preparation and editing of data lies with the using department, then why not process it there on a decentralized basis?

The migration of user applications thus shifts the budgetary emphasis from the purchase of raw computer power to the usefulness of a hardware configuration in supporting the use of a data base by the operating department (or Division). Good, clean (heavily edited), complete data in

EXHIBIT 2

MIGRATION OF USER APPLICATIONS

COUNTING FUNCTIONS	DATA BASE FUNCTIONS
REPETITIVE PROCESSING	RANDOM/REPETITIVE PROCESSING
SEQUENTIAL/BATCH FILE ACTIVITY	RANDOM FILE ACTIVITY
CENTRALIZED	DECENTRALIZED/DISTRIBUTED
ACCOUNTING DEPARTMENT CONTROL	OPERATION DEPARTMENT CONTROL
JOB ORIENTED DATA BASE	FUNCTION ORIENTED DATA BASE
JOB STRING	TASK STRING

a readily accessible form is the essential element of these new applications - not its manipulation. The user needs a global data base which contains all the elements useful to his particular application. There must be a strict definition of these elements. Consecutive data elements must be easily linked and logically ordered using names which are familiar to the target user. The resulting data base needs to be accessible if it is to be useful.

Hardware/software product development has kept pace with these evolving needs. Indeed, in a sense it can be said that the improvements in these two technologies have stimulated the shift of user applications to localized problem solving.

Low cost data base storage at the user site is not only feasible, it is frequently cheaper to store data remotely, than to pay the communication cost associated with moving it between the center and the user, and there also exists sufficient raw compute power in mini computer hardware to process it efficiently at the remote site. The user can choose a variety of interactive CRT products with various screen sizes and editing features. There is also a wide choice of daisy, matrix, belt, band, and non-impact teleprinter mechanisms available.

Along with these improvements in hardware some significant advances in mini-micro based software products have been made. At least sixteen small business system/programmable terminal vendors how offer Cobol. Several vendors also offer some form of RPG, Basic, and Fortran language capability. In addition there is a selection of interactive format development languages such as Sycor's TAL or Datapoint's Dataform. And to pull all of these software aids togethere, there are multipartition - even multitasking - operating systems with a choice of utility and data base management software support products.

There has thus been a migration of user applications to the use of the computer as a tool in daily departmental operations. Alternative methods for processing them do exist. Most of these methods are readily available from competitive vendors. IBM must respond to this challenge with a new array of products and services. IBM has no choice.

C. Key Terminal Markets: 1975 - 1981

During 1977 domestic users will spend between $7.1 and $7.6 billion on teleprocessing equipment and services. About half of this expenditure will go toward the cost of transferring data from one point to another (lines, packet services, modems, etc.) and the other half will go for vendor supplied hardware/software front-end and terminal products. This represents about 16% of the nation's data processing bill, or 19% of all expenditures by formalized DP organizations. Key terminal product markets include:

CRT Display Terminals -

As shown by Exhibit 3, the installed base of single station terminals will grow from a population of 216,000 units at year-end 1975 to an installed population of 684,000 units by year-end 1981. The most dramatic growth is in your programmable units which will increase from 38,000 terminals installed at year-end 1975 to 255,000 units installed by year-end 1981, yielding an average annual growth rate over the six year period of 36%.

The provision of a user accessible CPU also impacts the market for Multistation Systems during the 1975 through 1981

EXHIBIT 3

SINGLE STATION DISPLAY TERMINALS

DISPLAYS INSTALLED AT YEAR END

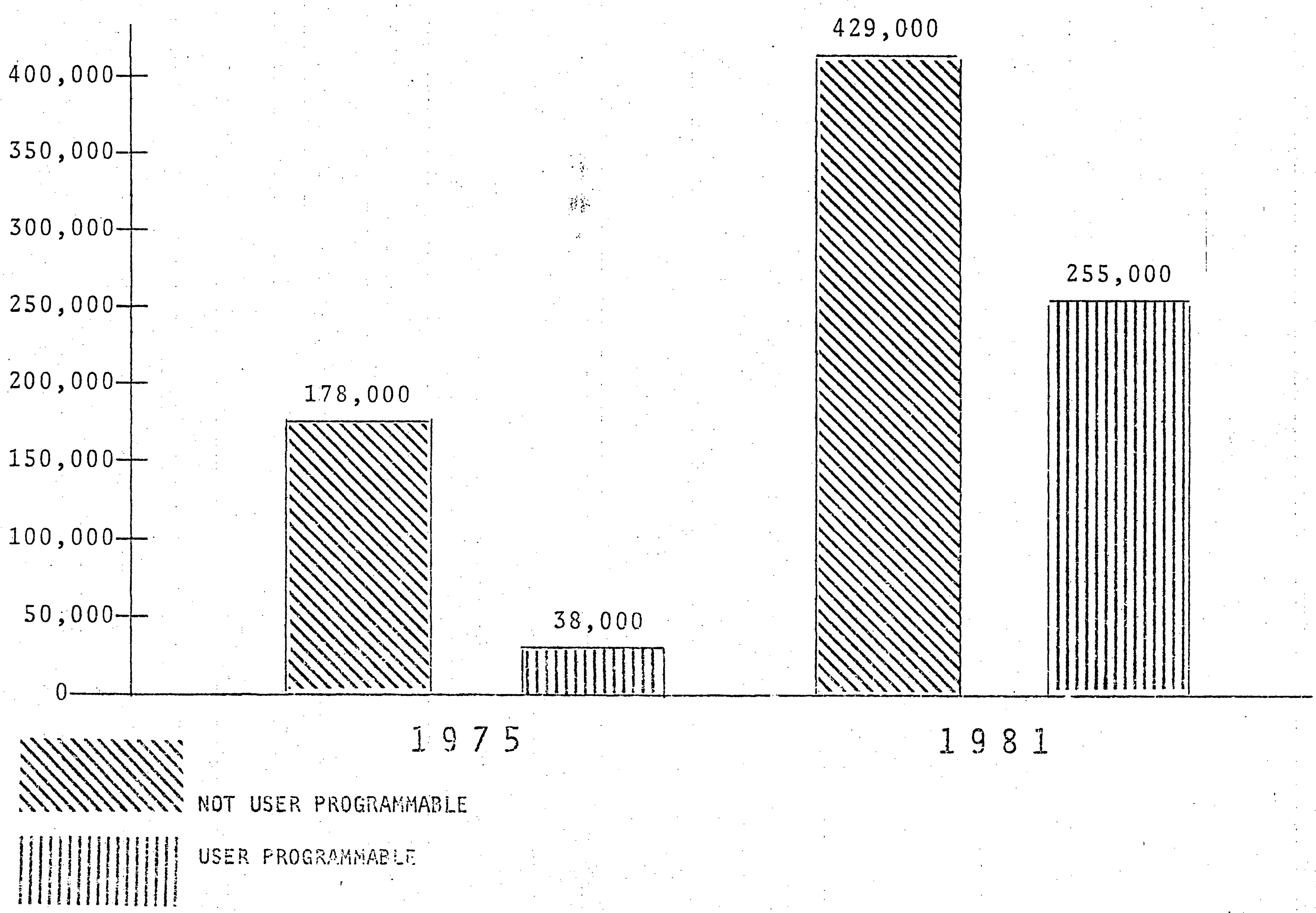
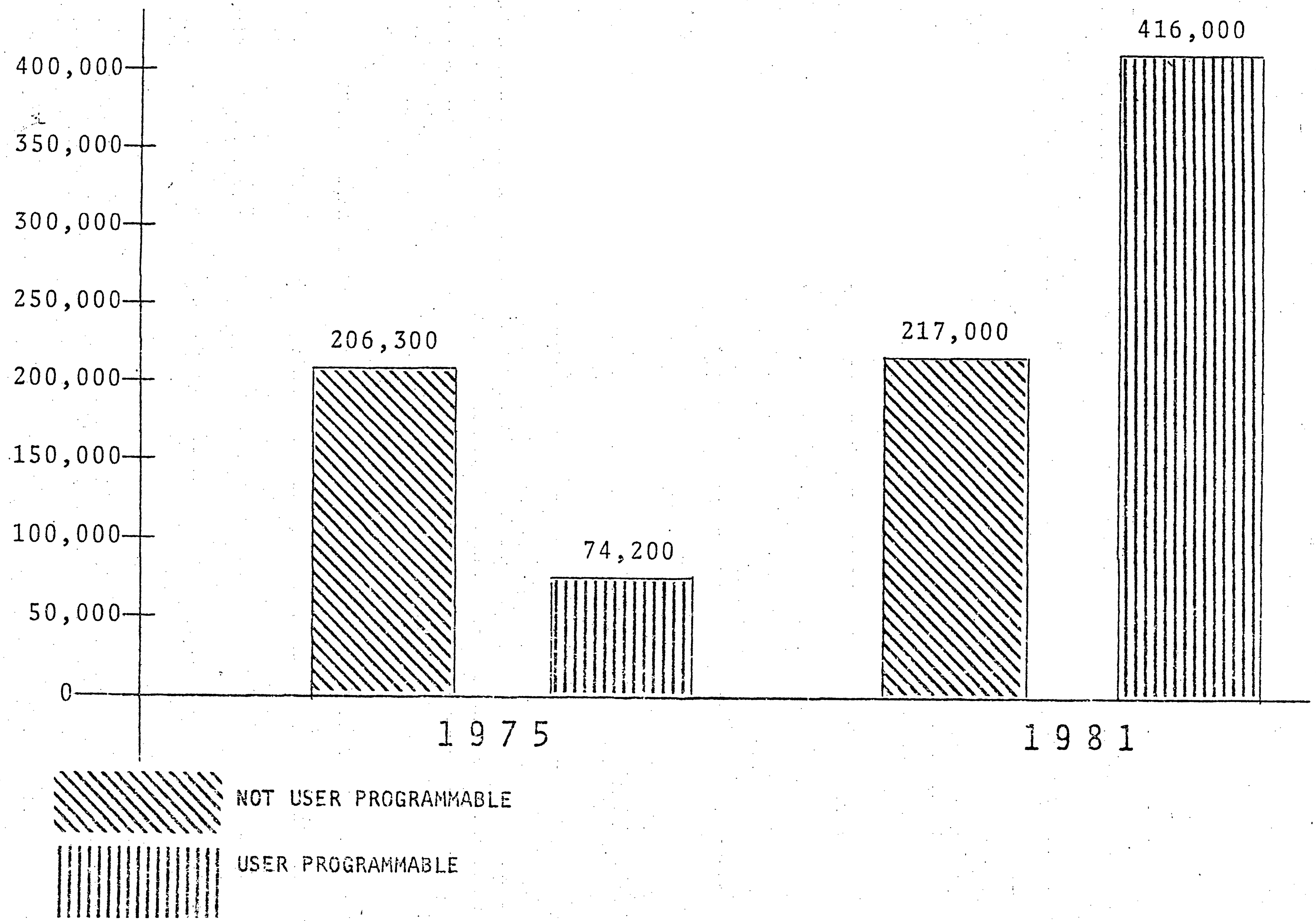


EXHIBIT 4

MULTISTATION TERMINALS

DISPLAYS INSTALLED AT YEAR END



time frame. Although there will be a great deal of churning in the market as evidenced by a relatively high rate of shipments versus only nominal growth, the installed base of non-programmable CRT displays will remain flat through the period. In contrast to this, the installed base of CRT display terminals attached to programmable controllers will climb from 74,200 units at year-end 1975 to 416,000 installed units by year-end 1981.

IBM's share of the total CRT market will drop from 30% at year-end 1975 to 19% by year-end 1981. This will occur even though IBM's installed base of CRT displays will increase from 139,000 units to 244,000 units during the 1975 - 1981 timeframe - an average annual growth rate of 10%. A partial explanation for IBM losing market share is the greater reliance IBM will place on non-CRT technology by 1981 - a factor not included in this CRT forecast.

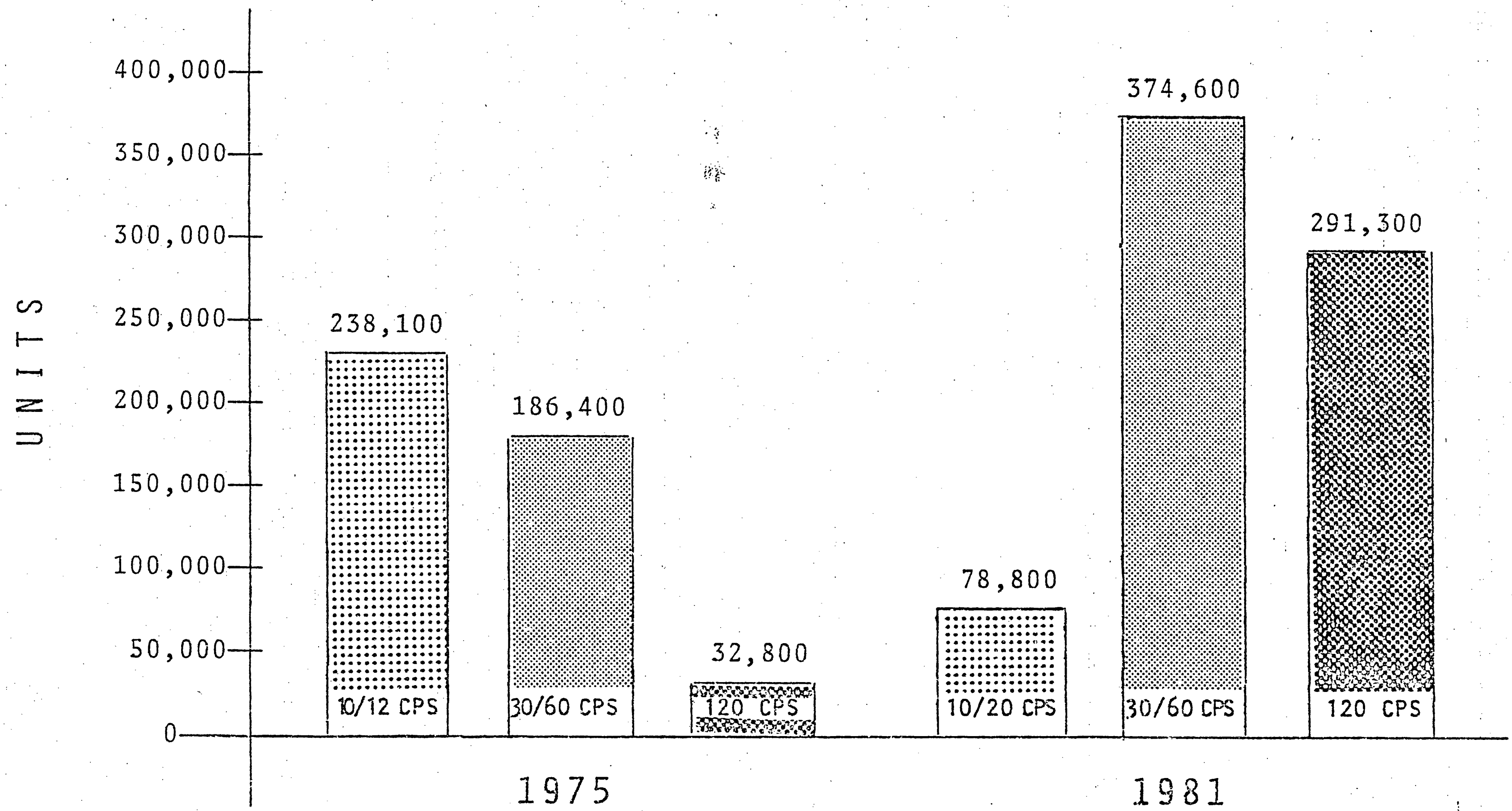
Teleprinter Terminals -

The teleprinter terminal market will grow at a much slower pace during this forecast period. Total units installed at year-end 1975 yield a base of 457,300 terminals (versus a CRT base of 496,500 units), and by year-end 1981 this base will have grown to 744,700 units. The growth in the use of 30 or 60 CPS mechanisms has been coming along as expected. The real "news" of course is the pending growth of 120 CPS line speeds. The use of higher speed lines (not necessarily related to teleprinter mechanism speeds because of the growing use of diskette, bubble memory, and RAM for temporary data storage) grows dramatically from 32,800 teleprinter terminals so connected at year-end 1975 to 291,300 units by year-end 1981. In the meantime, there will be a steady migration of users away from 10/12 CPS terminals. The use of these slower units in data processing applications will have dropped to 78,800 units by year-end 1981.

EXHIBIT 5

TELEPRINTER TERMINALS

UNITS INSTALLED AT YEAR END



IBM's share of the teleprinter market will remain an unchanged 11%, year-end 1975 versus 1981.

Remote Job Entry Terminals -

The market for Remote Job Entry terminals will increase from 27,500 installed systems at year-end 1975 to 41,200 systems by year-end 1981. The slow (6% per annum) growth of these specialized units is attributable to the use of alternate multistation systems and single station terminals for remote job entry functions. Here again we can see the influence of the ubiquitous microprocessor, and its bigger brother, the minicomputer, as users move from the use of 9,500 programmable units at year-end 1975 to 35,000 units at year-end 1981. IBM's share of this market will increase from 45% at year-end 1975 to 54% by year-end 1981. Most competitive RJE terminals will have evolved into multistation systems by the end of 1981 - hence while they will be very much in evidence, they will not greatly affect IBM's marketing of the 377X product sets.

Special Purpose Terminals -

Exhibit 7 covers three special purpose terminal product markets - Point of Sale (sometimes called Point of Transaction), Credit Verification, and Bank Teller application terminals. At year-end 1975, IBM could claim 40% of the Bank Teller Terminal Market, and virtually none of the POS or CV markets. By year-end 1981, IBM will garner 46% of the installed teller terminals and 24% of the retail POS terminals. IBM will start to make a significant penetration of the credit terminal verification market with the 3608.

EXHIBIT 6

REMOTE JOB ENTRY TERMINALS

SYSTEMS INSTALLED AT YEAR END

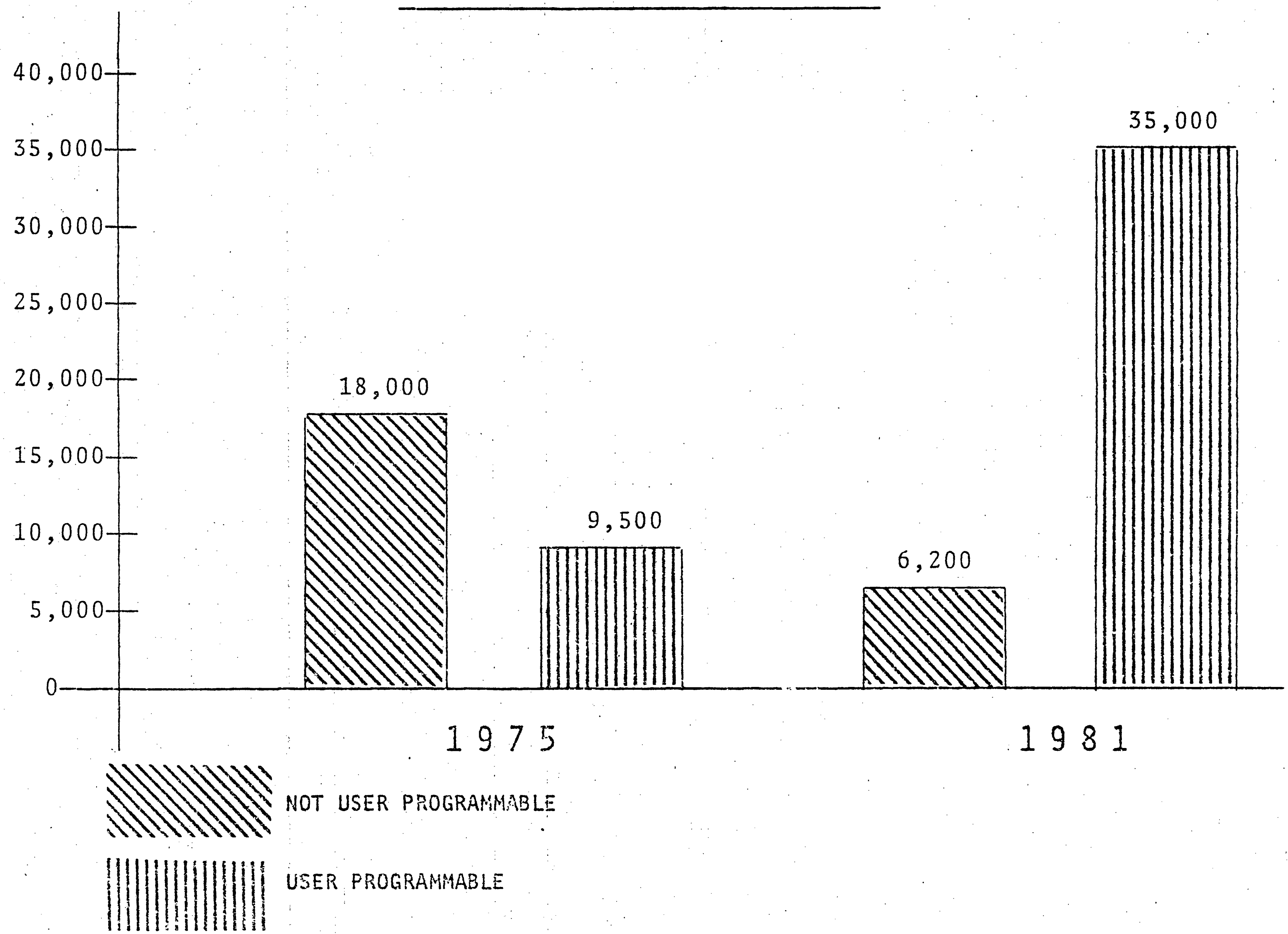
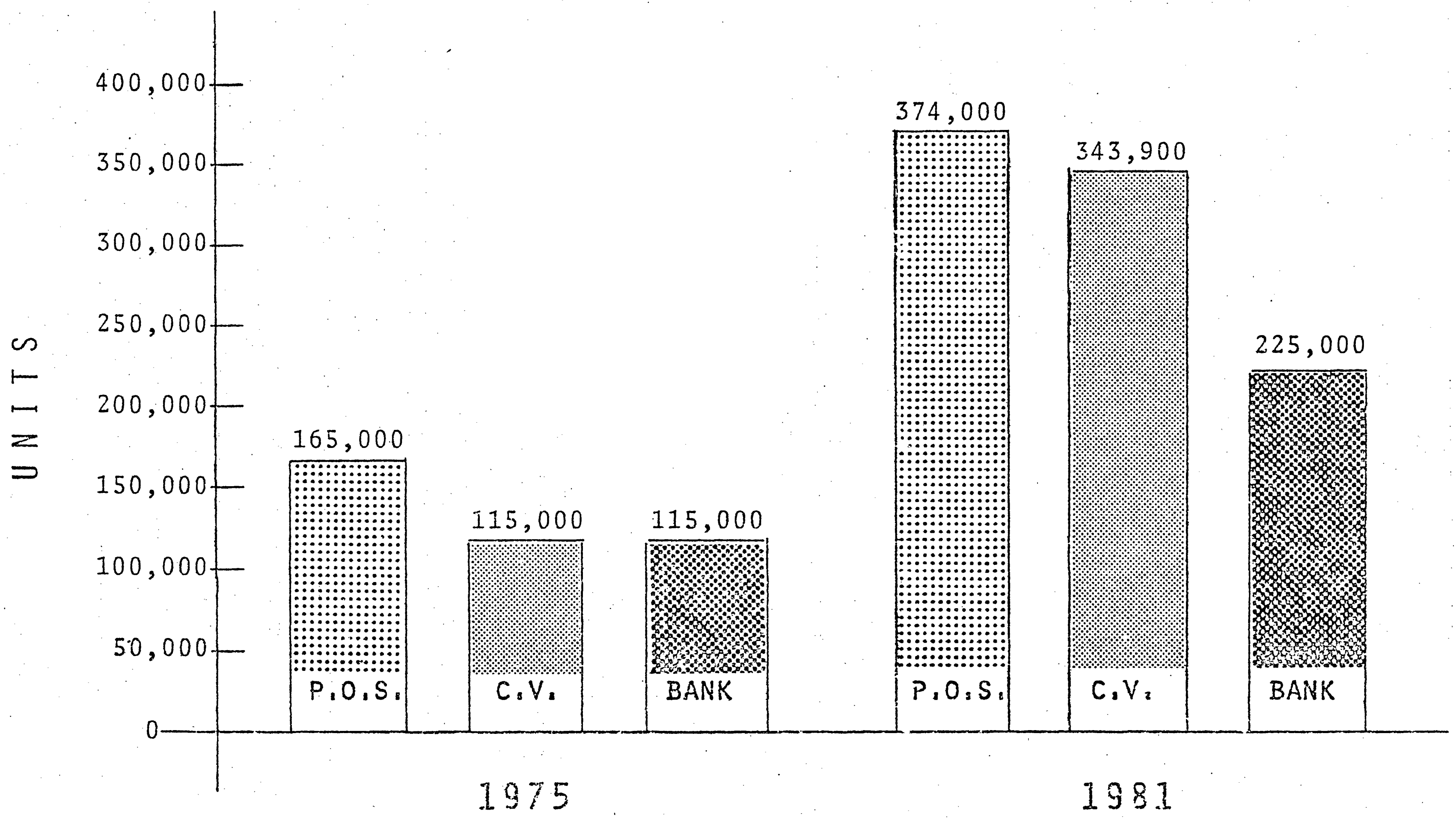


EXHIBIT 7

SPECIAL PURPOSE TERMINALS

UNITS INSTALLED AT YEAR END



D. IBM Loses Control - Temporarily

1. Do it yourself!

IBM does not appear to have reacted fast enough to the shift of user applications and the resultant impact this change would have on the selection of compute - power. This has to be described as something of an ironic situation, since IBM is in large measure responsible for guiding the user to ever more sophisticated and integrated applications. IBM's product planning of the early '70's seems to have stalled somewhere between consideration for the need of user access to, and interaction with, centralized data base/data processing functions and the distributed alternatives that would be presented to the user by competitive vendors. The emphasis has been on larger and more complex mainframe structures, programming languages primarily useful in a large mainframe environment, and the use of the data communications network as a support tool for the origination/dissemination of centrally processed data.

But not only must IBM contend with the growing sophistication of the user in the application of compute power, it must also contend with an entirely new (for IBM) phenomenon - the emerging growth of the "do it yourself" attitude. Working on large mainframes can become 1. dull, 2. laborious, and 3. unrewarding. This is, in some measure, due to the requirement for a high degree of specialization among those employed in the day to day tasks of running a large installation. But in large measure, this dissatisfaction also stems from the ungodly amount of time it seems to take in order to get anything done. Hence, there is a lack of personal involvement, pride, or satisfaction on the part of many professionals. On the other hand, this need for satisfactory involvement can be fulfilled when working with smaller "chunks" of the system.

Here the personal contribution is more recognizable and hence more potentially rewarding. Smaller "chunks can be equated to the development of a minicomputer based application, the creation of a new terminal system, the development of a micro-programmed controller to support a larger application, or - for some - the building of a complete micro-computer based system.

It is a study in contrasts. Some 100 corporations accounted for 44% of the 1976 domestic Gross National Product. By and large, these are also the super computer users and should be the source of IBM's continuing revenue and profit growth. These are the users who can best afford and benefit from SNA (and all it means). These users, along with 400 other large governmental and industrial customers, probably account for over 55% of IBM's business. It is with them that IBM's terminal strategy should feel most comfortable. It is ironic, however, that within these very accounts is a growing cadre of programmers, analysts, operators, and managers who are best equipped to take advantage of the alternatives to large mainframe solutions for what are basically localized application problems. Perhaps, at the moment, this is a rather smallish group of individuals. But they, along with the majority of small and medium installation users, could find an alternative solution to IBM within a micro or minicomputer based framework. For the largest installations this translates into the much discussed concepts of distributed processing and the growing interest in increasing the capital intensity of white collar applications - such as message and word processing. In these applications the user has more control over the outcome, and IBM thus faces the irony of competing against some of the very same analysts and programmers who were IBM's best sales tool only a few short years ago.

The hardware is certainly available. What remains are problems of software development/integration and the configuring of suitable hardware elements to support the intended application. Every programmer/analyst thus has the opportunity of becoming a product designer, and the independent terminal vendors are only too happy to respond!

2. Decentralized or Distributed

User experience has already shown that a minicomputer based processing solution can be far more cost effective than a large mainframe based system solution. Minicomputers can support large amounts of mainframe memory (256, 512, or 1,024K bytes), do run perfectly acceptable higher level languages (Cobol, Fortran, Basic, etc.), will handle entire applications on a dedicated basis, and save the user money in terms of implementation and ongoing maintenance costs. They are thus an economical way to get the job done, and it has also been proven that new projects are usually easier to implement on a "mini" computer than in a large, complex operating system environment. The key element is that the large centralized processing approach which has, in the past at least, proven suitable for the counting functions, does not necessarily lend itself to the operations environment of manufacturing, shipping, engineering, or distribution. It is rapidly becoming more important to have the computer fit the required information processing/storage situation, than to lay claim to improved central site cost efficiency. The goal of these "heads up" installations is therefore not to minimize data processing costs, but rather to reduce the total cost of the information system being used by the operating department. Here the cost savings are apt to be defined in terms of labor, document processing time, and information accuracy/availability.

The distributed systems environment may not necessarily meet the needs of these operations oriented applications. The term "distributed" infers the splitting of a large centralized workload into component parts. Typically what is envisioned is that the using department will have sufficient CPU horsepower to correctly enter and store data which can then be economically used by the large host center. But where is the actual using department in all this? Perhaps the entire DP function should be provided at the using department site! If that is so, the processing workload is more properly done on a decentralized basis, rather than on a centralized basis. This is the issue which must now be faced by DP managers and they will need to come to a solution which is both plausible and economical - not necessarily IBM.

3. And Other Problems

Given the complexity of the SNA/SDLC environment and the tardy availability of the VS software support elements, it is small wonder that competitive Transmission Control Unit vendors have been able to erode IBM's position of leadership in the provision of front-ends for its own mainframes. It was originally projected within IBM product management that the field inventory of 3705 equipment would remain relatively flat after 1976 and that the 3704 would lose its forward momentum by year-end 1977. Such appears to be the case.

IBM's teleprinter and data entry product strategy has also proven deficient. The 3767 has been judged overly expensive, complicated to operate, and so lacking in good human factors design that it is not a good replacement for the aging 2741 and 2740-2 products. Indeed, these last two units gave (somewhat) satisfactory service as typewriter units, interactive terminals, and data entry devices - three functions not well filled by the 3767. In the meantime the

3740 has also been judged deficient versus competitive products from several independent vendors.

One can couple these problems with a basic error of strategic planning. IBM has apparently decided to ignore 300 baud asynchronous full duplex data transmission, and renders only poor support to 1200 baud devices of like transmission compatibility. Even 1200 baud half duplex transmission receives only token support over dial lines, forcing 3767 users to rely on asynchronous half or full duplex mode over private or leased lines. IBM's product planners apparently chose a basic strategy that ignored the low and medium speed interactive applications in deference to SDLC based block mode systems at 1200, 2400, 4800, and 7200 (now 9600) BPS. But the users have found too many attractive product alternatives in the newer 300 baud teleprinter terminals and will find equally fine alternatives at 1200 baud in either half or full duplex mode by year-end 1977. The big independent names are DEC, G.E. and TI. There will be a migration of users, with or without IBM, to teleprinters which can support interactive and/or typing applications at speeds of 300, 600, or 1200 BPS, and these terminals will be supported with considerable optional diskette and programmability features.

4. It's Only Temporary

IBM didn't get to be the leader by being afraid to innovate. And innovative thinking is what we can expect from the debates within IBM during the 1974-1976 period. IBM must respond to the decentralization and do-it-yourself phenomenon. It must satisfy the interactive user requirement. IBM must - in short - net net - regain the total direction of its accounts if it is to realize the maximum revenue growth from each existing (and potential) IBM equipment user.

III. IBM REVISES ITS STRATEGY

A. Preparing for Distributed Processing

By year-end 1975 the domestic population of 2741 and 2740-2 teleprinter terminals had fallen to 42,000 units. During 1976 this installed base eroded by 10,000 terminals as users replaced their aging "golf ball" units with low cost interactive CRT display terminals and the newer teleprinter terminals based on daisy and dot matrix mechanism technology. The popular interactive CRT vendors were Lear Siegler, ADDS, Datapoint, Hazeltine, and Infoton. Daisy wheel mechanisms were supplied by Diablo, and a new company called Qume, to terminal vendors such as Anderson Jacobson, Data Measurements, DTC, Diablo Systems, Terminal Communications, and Trendata. Dot matrix impact mechanism technology was being spearheaded by DEC and Extel. Non-impact mechanism technology was expanding rapidly under CTSI, Computer Devices, NCR and Texas Instruments. General Electric had supplied over 35,000 band printers and was bringing its 30CPS dot matrix impart mechanism "on stream".

IBM's 3270 and 3790 were under strong competitive pressure from Courier, Datapoint, Four Phase, GTE, and Raytheon. The 3275 would soon be out of new production and the 3277 station was already being phased out of production.

The 3770 RJE/Teleprinter product set appeared to be doing reasonably well against competitive products. In particular, the price/performance characteristics of IBM's new slow speed card equipment gave this terminal family a strong place in the product lineup. The 3775 and 3776 RJE terminals were not yet in production, however, and the 3773 appeared to be a misplaced - superflous - product.

The decision to alter the distributed processing product strategy had been made by the third quarter of 1976. All during the Fall of 1975 and Spring of 1976 there had been a lively debate between the proponents of continuing the centralization/distributed terminal strategy and the champions of a radical departure from this course. The new strategy, these managers felt, should include consideration for the growth of decentralized data processing and the use of distributed networks as a bridge from centralized computing to multiple installations of smaller mainframes which then - in turn - could be grown into larger installations. In addition, IBM would need to accommodate the growing do-it-yourself restlessness among its users and this would require a radical change in marketing techniques for the proposed Series 1 minicomputer system. Typical of IBM management, the resulting series of discussions over centralization versus decentralization resulted in a compromise. IBM would do both.

IBM's user base had a large psychological, political, and financial interest in the continuation of a centralized computing philosophy. IBM had a similar interest - with its stress on the financial aspects of continued centralization. Large mainframes, and IBM's virtual control over the majority of larger users, were sources of continued revenue stability and growth. The profits from these systems (27 - 35%) were typically better than those secured from smaller systems and terminal products (11 - 21%). IBM could not, and would not, abandon the centralization strategy. Such a move was never in serious consideration.

What IBM would do, however, would be to work out a marketing strategy that gave vent and license to those interested in expanding the role of decentralized or decentralized/distributed systems. Hence the distributed processing concepts announced under SNA would be continued. The product line, where deficient, would have to be patched. The migration of users to the virtual systems environment would be continued for the near term. As a consequence, IBM would go ahead with the announcement of a new 8 port CRT controller (3276), a new cluster engine (3274), and a family of new CRT displays (3278). Software enhancements would be added, as planned, to the 3790 and 3770 product sets. Series 1 would be used as a cluster/node controller for attached 3276, 3274, and 3770 products. Directly attached 3278 CRT's and a new line of dot matrix impact printers would be added as a Series 1 product enhancement. Because of its superior performance and lower cost, Series 1 would replace the 3704 as the targeted remote node concentrator. IBM would continue with its plan for the introduction of SDLC procedures, the distribution of the remote processing workload among the cluster controllers and their attached intelligent terminals, and local data base hardware/software products (primarily in the form of new lower cost/higher performance disk media, and a multitasking RTOS for the node controllers).

B. New Products for the User

The driving force in hardware technology over the next decade will be the growing use of microprocessors and minicomputers. The use of these processors will be enhanced by improvements in RAM, bubble, and disk storage memory systems. Micro/mini processor based systems will continue to be the basis for the development of a greatly improved small system software technology. The leading serial printer technologies will be based on the continued development of dot matrix and daisy impact mechanisms. The leading low cost line printers will use either dot matrix or band technology. The CRT will continue to dominate the market for visual displays through 1981 even though both IBM and Xerox are preparing electro chemical panel technology for introduction by 1980.

IBM will not only emphasize the development of special purpose terminal hardware, but will place an even greater emphasis on the development of specialized applications software. This emphasis on software products which are heavily dependent on IBM host and terminal hardware characteristics is fundamental to IBM's long range planning. This application program strategy is driven by the need to pose as an applications expert to each industry in a fashion similar to that used in marketing System 32.

As shown by Exhibit 8, IBM stands to benefit from this approach. Transportation, retail and wholesale distribution, finance, and discrete manufacturing have already been identified for special purpose hardware and software products. These industries will utilize 62% of the terminals installed by year-end 1981.

C. Impact of Series 1

November, 1976 - IBM ships the first commercial Series 1 processor. Things will never be the same.

With this product family IBM will; penetrate a domestic market worth over $2.8 billion in 1977 and over $9 billion in 1981, replace the aging System 7 for sensor based applications, pave the way for replacing the 3704 as a network node concentrator and both the 3704 and the 3705 as a transmission control unit, create a new cluster controller to which interactive operator stations will be added by year-end 1977 (and not necessarily by IBM), and provide an IBM oriented outlet for "do-it-yourself" installations.

Series 1, with the raw compute power of a 370/135 will have sufficient configuration flexibility to cover the entire spectrum of distributed cluster node controller and decentralized processor requirements. Series 1 enhancements and

EXHIBIT 8

TERMINAL DISTRIBUTION BY INDUSTRY

1981

INDUSTRY	% OF TOTAL TERMINALS*	% COMPUTER SITES
MANUFACTURING		
DISCRETE	15%	22%
PROCESS	5	12
TRANSPORTATION	10	2
DISTRIBUTION	15	10
FINANCE	22	8
INSURANCE	7	4
EDUCATION	4	4
UTILITIES	4	2
GOVERNMENT	9	12
OTHER	9	22
TOTAL	100%	100%

* *Includes terminals used within an industry to access a service bureau.*

follow-on products will be introduced to provide timely upgrades for increased user processing requirements. The Series 1 peripheral family will include card, printer, display, and storage devices used for other IBM products - thus giving IBM even greater economics of scale in the production of these peripheral devices.

IBM prefers to refer to Series 1 as a family of general purpose processors which can currently be supported by four distinct groups of peripheral components; I/O media units, sensor I/O units, communication devices, and accessories. Interactive CRT and teleprinter stations will be added to supplement the operator CRT console. The 16 bit processor is capable of addressing up to 128K bytes of main memory and 256 I/O devices. The average instruction execution rate of the 4953 processor is 11.8 microseconds, and the instruction execution rate of the 4955 processor is 3.9 microseconds. Memory cycle times are 800 nanoseconds and 660 nanoseconds respectively, and the corresponding data transfer rates are 1.2 megabytes/second and 1.6 megabytes/second. Standard processor features include hardware byte manipulation, multiply/divide, parity check, eight general purpose registors, and four levels of priority interrupt. The Series 1 channels can be configured to support asynchronous, bisynchronous, and SDLC devices/lines. IBM has appealed to the instincts of the "do-it-yourself" installation by providing adaptors (with sufficient documentation) which are specifically designed to accommodate the attachment of competitive hardware devices.

IBM's marketing strategy for Series 1 is both innovative and radical. It provides a migration path for loyal IBM mainframe users into the distributed, and if they choose - decentralized, processing environment. But it does so in a manner which is wholly unique for IBM. For the first time in this decade, IBM is actively helping users and competitive vendors to attach non-IBM hardware to an IBM mainframe. In one swift move, IBM has defused much of the rancor that has surrounded the use of non-IBM devices, and has done it in a way that will be profitable to IBM. In addition, IBM can now be on the competitive bid list when larger users send out an RFP covering new minicomputer based applications. Losses, such as the ones to DEC at AT&T, General Automation at Ford, and Computer Automation at Fireman's Fund, can be reduced.

Users will be encouraged to define their own application and operating system requirements. Consequently, users and vendors alike are busily preparing RTOS, TOTAL, Cobol, Fortran, APL, ALGOL, and VM software facilities for Series 1. Hardware vendors will supply disk storage units, tape units, printers, memory attachments, multiplexors, and terminals. One gets a sense of working with IBM rather than against or despite IBM. To the system's designers delight and the senior programmers wonderment, one can now achieve the feeling "We are helping IBM to bring up their new system". What an ego trip! And guess who will cash in!

Small wonder then that IBM will have achieved over $3 billion in hardware revenues, $125M in software revenues, and $500M in service revenues from over 40,000 domestically installed Series 1 systems by year-end 1981. But watch out. Once IBM's product managers have separated the wheat from the chaff, once they know what the user needs (or can be sold), once they have identified the profitable hardware/software product opportunities, - one can expect a steady flow of competitive products with an IBM label that will outperform those so laboriously and lovingly developed by competitive vendors and erstwhile users. IBM may again shut the door. In addition, there is a real and present danger that the cost of supporting non-IBM hardware/software products on Series 1 may cause IBM to withdraw its current friendly attitude. Multiple installations of Series 1 processors for individual large system customers would tend to be profitable for IBM - even with the pressure of foreign gear. Single installations for individual customers would tend to be unprofitable, unless a third party undertook the support effort. This, in no small measure, explains why IBM currently does not have a lease plan for Series 1.

D. The New Revenue Strategy

The litigation of IBM versus U.S. could easily drag on into the 1980's. Will IBM be paralyzed in the intervening years? Of course not. IBM plans a growth rate of 12% to 15% per year and expects to reach $40 billion in revenues by the mid-1980's. IBM has had 25 consecutive years of rising earnings per share, and IBM now ranks sixth among all U.S. corporations in terms of assets. IBM is currently the third most profitable company in the world - in dollars - ranking third to AT&T and Exxon. The company is sitting on some $5 billion in cash and marketable securities.

IBM is well aware of the tremendous growth of teleprocessing. More than 250 users now have more than 2,000 terminals - each - within their individual teleprocessing networks. By year-end 1981, 85% of all terminals will be located remotely from the central site. In these large networks, it will be IBM's aim to reduce communications costs (through such ploys as Sattelite Business Systems), while at the same time increasing user costs for those teleprocessing system elements which IBM sells - processors, peripherals, terminals, node controllers, software, and maintenance service. IBM will continue to reduce terminal operator labor costs -

where possible - by providing local terminals with software which can encode/decode and edit data, permit the accumulation of application related data at the operator site, enhance the resulting data base structure with local processing capability, offer data security, and improve terminal reliability/availability.

IBM's revenue objectives include; the migration of users to the higher overhead/storage costs of VS functions, increas- the conversion of the 370 lease deck to cash, introduction of even more powerful 3XXX central processors in order to continue the stability and growth of central site revenues, heading off the alternative use of competitive minicomputers through the introduction of Series 1, and recapturing the technological (revenue) direction of "do-it-yourself" installations by offering Series 1 as an acceptable channel for these creative energies.

IBM will migrate its user base from "dumb" terminals to programmable terminals and cluster controllers. Once hooked, users will want to increase their terminal memory and disk storage capacity as the processing load increases. Next comes the introduction of a decentralized computer to offset the processing/data base deficiencies of the programmable terminal or cluster controller. This will then lead to the inevitable free standing computer installation, loosely connected to a host mainframe through a distributed data processing network.

The primary purpose of IBM's new terminal strategy and the introduction of Series 1 is to recapture the direction of its accounts - and their contribution to IBM revenues.

E. IBM Terminal Forecast: 1975 - 1981

In order to protect its position in the terminal market, IBM has moved forward with its "second generation" of 3000 series products.*

Transmission Control Units

Peachtree became Series 1 in November of 1976. Either this processor, or one similar to it, will become the basis for a 370X product set replacement by year-end 1979. IBM needs to provide the user with better front-end message switching, store/forward, and off-line storage capabilities. There is also a need to reduce the host systems software overhead required to run a TP network, provide better implementation flexibility, and permit the use of redundant front-end processors. Series 1 will be used by some installations to fulfill this role. But in order to achieve its long range goals, IBM will need to announce a replacement for the 370X by year-end 1978. CP1 (due for FCS in 1979) will be configured to support from 1 to 32 lines, and CP2 (FCS in 1980) will be aimed at supporting 16 to 256 lines. Series 1 and its successor, Series X (FCS 1981), will provide the user with the node controller capability required in order to support SNA defined distributed networks. Both units will inherit the card, diskette, disk, CRT, and teleprinter capability of Series 1. It will be possible to interlink two CP1 units for the purposes of providing redundant processor capability, and two to four CP2 units will be configured for sharing the load and redundancy of a multiprocessor host system. It is possible that both CP1 and CP2 will be integral to the 3000 Series processors, and hence difficult to separate from the IBM software/hardware support structure built into these systems.

CRT Terminals

As originally written, this report projected that IBM must announce a replacement for the 3275/3270 product sets by

*Reference Exhibit 9

EXHIBIT 9

IBM'S NEW PRODUCT SCHEDULE

FIRST CUSTOMER SHIPMENT - USA

	1965	1970	1975	1980
TRANSMISSION CONTROL UNITS	2701, 2702, 2703, 2265	3705, 3204	Series 1, CP1	CP2, Series X
CRT TERMINALS	2260	3270, 3275, 3740-2, 3740-4	3790, 37XX, 37XY	
TELEPRINTER TERMINALS	2740, 2741, MTST	2770, 3735, 3774, 3775	3771, 3773, 3767, Daisy, Inkjet, Impact	Impact
BATCH/RJE TERMINALS	2780	3780, 2922	Sys 32, 3776, 3777	
SPECIAL PURPOSE TERMINALS	2790, 2730, 2250, 5275	3650, 3660	3600, DC, Graphics	

year-end 1977. IBM has announced new multistation capability, but the replacement for the 3275 is still lacking.

The 3276 control unit/CRT station and the 3278 CRT display terminal will reduce the cost of multistation systems where only 8 CRT devices are required. The 3276 controller uses fast-field effect transistor (FET) technology, supports an integral CRT, up to 7 additional CRT stations, and a 328X printer. (The user will be able to choose either the 3287 80/120 CPS dot matrix printer or the 80-400 LPM 3289 printer). The 3276 and 3278 CRT displays can be configured with 960/ 1920/2,560/ or 3,440 character formats. The first three models use an improved 7 x 14 dot matrix character cell, while the 3,440 character unit continues to use a 7 x 9 dot matrix character cell. To us, the 960 character capacity screen appears to be the most useful.

IBM also announced a 32 station controller labeled the 3274 for multistation systems requirements. The 3274 can handle a mix of 3278 CRT, 3287/3289 printers, and up to 16 of the earlier 3270 devices. To lower field service call costs, IBM has provided this controller with self test diagnostics and user accessible panels for attaching cables, keyboards, and power cards.

The 3790 also received an upgraded processor, increased disk storage file capability, remotely connected 3274 and 3276 CRT controllers, and upgraded software support.

Another feature of these announcements was the revelation that IBM has finally increased its standard data transmission line speed from 7200 BPS to (industry standard) 9600 BPS.

All that is lacking, aside from the announcement of peripheral enhancements for the 3274 multistation controller, is the provision of a new single station CRT product. IBM really needs two. It needs a "dumb" CRT single station display terminal to go with the 3276 and 3274 (or remotely to the expanded 3790). IBM also needs to announce a user programmable single station unit with diskette/disk and teleprinter support to replace the 3740-2, and 3740-4.

Teleprinter Terminals

IBM has thus far failed to announce a suitable replacement for the 2741 and 2740-2 teleprinter terminals. The 3767 does not have the necessary print quality, cost/performance features, or human engineering to fulfill this role. Users will be looking for a "typewriter" like terminal that can be used with diskette support for message, data, interactive, and word processing applications. The software/firmware features of this terminal could also be used by a companion terminal which uses a dot matrix impact mechanism.

Thus we can expect to see IBM announce the use of a Qume mechanism in its word processing terminal for System 6 by year-end 1977. The Qume mechanism, or an IBM version of the Qume mechanism, will show up in a free standing IBM teleprinter terminal by year-end 1979. In the meantime, IBM will announce a replacement for the 3767 and ship its first unit by year-end 1980.

When IBM announces its new products, it will - for the first time - be head to head with TI, and this is terminal competition unlike anything IBM has ever met before. TI intends to be the leader in daisy, impact dot matrix, and non-impact dot matrix technology.

Batch/RJE Terminals

IBM will continue to upgrade the software and peripheral capability of the 3776/3777 terminals. The RJE function will continue to migrate to intelligent terminal products such as those offered by Four Phase, Sycor, Harris, and - of course - IBM through its own 3790 and Series 1 controllers.

Special Purpose Terminals

By year-end 1978, IBM will have effectively replaced the Data Collection and sensor terminal functions performed by System 7 with new hardware/software products attached to Series 1.

Although IBM has not met with an overwhelming success in selling its concepts of POS, it will - for the near term - continue in its attempt to overtake the industry leader - NCR. Most of the action is still in the department store area, because the supermarket chains are still having conceptual and customer problems with POS automation. IBM is willing to spend the necessary additional funds, however, to develop ticket and package scanning equipment for OCR-A and bar code tags. And IBM has also presumably learned from its earlier marketing and sales mistakes which annoyed potential customers. For example, users are now allowed to link their IBM POS terminals to a non-IBM/non-VS mainframe. IBM is losing money on POS. Its long term strategy is thus unclear.

IBM has a much stronger competitive position in the banking industry. Here IBM has successfully insisted that users implement SNA/SDLC procedures in a VS environment in order to enjoy the benefits of the new 3600 teller terminal product family. We can see additional enhancements to this product line by year-end 1978, including improved MICR equipment, and updated transaction terminal capability for credit/check verification. IBM will attempt to combine EFTS functions with POS capabilities in a hybrid system.

IBM must announce a replacement for the 2250 by year-end 1978 or it will effectively have gone out of the graphics terminal business.

IV. THE NEW SCENARIO

A. IBM Will Recover

IBM will patch its terminal problems, provide a migration path to distributed processing for its users, and give vent to the "do-it-yourself" installation using IBM controlled products. The public presentation of Series 1 has to be regarded as the most innovative strategy of this decade. It solves two problems - one for the user (who wanted to chart an independent but "safe" course into the use of minicomputers) and one for IBM (how to regain market control over these wandering accounts). IBM will next provide an alternative teleprinter terminal capability for interactive applications, and a single station CRT product set to offset the gains of the independent vendors. But the real ace up IBM's sleeve is a complete change to the display market. IBM will introduce electro-chemical display technology in the form of a slim line data entry/retrieval terminal.

In the meantime, IBM's terminal revenues will continue to grow. As shown by Exhibit 10, the domestic installed base of CRT display terminal stations will steadily increase throughout the forecast period from 138,800 units at year-end 1975 to over 240,000 units by year-end 1981. Coming events include the replacement of the 4505/2915 PARS products and 3740-1/3740-4 data entry products with newer display technology based on the 3278 CRT in a minicomputer based system.

Exhibit 11 details a like pattern of growth for IBM teleprinter terminal products. Although IBM's growth will be sluggish through 1978, the introduction of new technology by year-end 1979 will cause a rapid recovery of IBM's leadership in the delivery of teleprinter products to its own mainframe users. Gone are the days, however, when IBM teleprinter products will be popular with non-IBM mainframe users.

EXHIBIT 10

IBM DISPLAY TERMINAL FORECAST

INSTALLED BASE - USA

		1975	1976	1977	1978	1979	1980	1981
2260	Remove	8200	4,500	2,100	500	100	50	-
	Reinstall	2,050	700	200	-	-	-	-
	Net	6,350	2,550	650	150	50	-	-
2265	Remove	100	50	-	-	-	-	-
	Reinstall	-	-	-	-	-	-	-
	Net	50	-	-	-	-	-	-
3277	Remove	12,500	21,000	26,000	27,000	24,000	18,000	16,000
	Reinstall	12,000	19,000	23,000	20,000	15,000	9,000	7,000
	New	24,000	18,000	6,000	-	-	-	-
	Net	82,000	98,000	101,000	94,000	85,000	76,000	67,000
3275	Remove	1,100	1,900	2,800	3,400	3,600	4,100	3,700
	Reinstall	1,000	1,750	2,000	2,200	1,800	1,200	800
	New	1,900	1,450	750	-	-	-	-
	Net	10,700	12,000	11,950	10,750	8,950	6,050	3,150
3790*	Remove	-	400	1,260	3,800	6,000	8,900	11,500
	Reinstall	-	350	1,200	3,600	5,400	4,000	3,200
	New**	4,500	12,000	4,850	6,200	-	-	-
	Net	4,500	16,450	21,240	27,240	26,640	21,740	13,440
3915 4505	Remove	3,600	4,950	5,300	5,100	4,300	3,600	2,900
	Reinstall	2,200	2,150	1,750	1,250	490	210	100
	New	-	-	-	-	-	-	-
	Net	22,700	19,900	16,350	12,500	8,690	5,300	2,500
3740-2 3740-4	Remove	500	850	1,500	3,850	6,150	8,500	12,000
	Reinstall	450	800	1,400	3,600	4,300	3,700	4,000
	New	4,350	6,250	8,900	6,950	-	-	-
	Net	12,500	18,700	27,500	34,200	32,350	27,550	19,550
37XX 37XX	Remove				-	2,200	8,100	14,200
	Reinstall				-	2,000	7,600	12,900
	New***				18,000	36,000	42,000	44,000
	Net				18,000	53,800	95,300	138,000
TOTAL		138,800	167,600	178,690	196,840	215,480	231,940	243,640

* *3277 Displays on 3791 Controller.*
Includes use of Refurbished 3277 units from 3271/3272 removals.
Excludes shipments of new Plasma Display panels attached to 37XX controllers.

EXHIBIT 11

IBM TELEPRINTER TERMINAL FORECAST

INSTALLED BASE - USA

		1975	1976	1977	1978	1979	1980	1981
2740	Remove	8,000	14,000	12,000	9,000	8,000	6,000	2,000
2741	Reinstall	4,560	4,300	4,000	1,900	1,200	600	-
	Net	42,000	32,300	23,300	16,200	9,400	4,000	2,000
2770	Remove	1,500	2,700	2,500	2,300	1,800	600	300
3735	Reinstall	1,100	1,600	900	400	-	-	-
	Net	7,500	6,400	4,800	2,900	1,100	500	200
3770	Remove	-	240	1,000	2,300	4,500	6,900	9,000
	Reinstall	-	200	950	2,200	4,250	6,600	8,500
	New	2,400	9,600	14,400	10,800	9,000	7,800	6,000
	Net	2,400	11,960	26,310	37,010	45,760	53,260	58,760
3767	Remove	-	1,050	3,700	6,300	8,900	11,500	14,000
	Reinstall	-	1,000	3,600	6,000	8,300	10,700	12,900
	New	7,000	14,400	12,000	9,000	8,000	5,000	-
	Net	7,000	21,350	33,250	42,550	49,950	54,150	53,050
New	Remove						600	2,700
Tech -	Reinstall						550	2,500
nology	New					6,000	18,000	22,000
	Net					6,000	23,950	45,750
TOTAL		58,900	72,010	87,660	98,660	112,210	135,860	159,760

It would be an understatement to say that competitive vendors have done a better job than IBM has in the development of RJE terminals, and the weakness of IBM's products shows up in Exhibit 12. IBM will recover, however, with its continuing enhancement of the 3770 product family. Although the 3773 appears to be displaced, IBM has satisfied the high speed batch terminal requirement of IBM mainframe users with the 3776 and 3777. These new products appear to be competitive on a price/performance basis versus older IBM batch offerings and will also take a greater share of this market from competitive vendors. Therefore, even though many Batch/RJE functions will be migrated to IBM's new cluster controllers, the installed base of 3776/3777 terminals will exceed 22,000 units by year-end 1981.

IBM's failure to do anything really dramatic with the POS market is illustrated by Exhibit 13. This is NCR stomping ground, and NCR won't yield gracefully. In addition, IBM has made some horrendous mistakes in dealing with the retailers. But, IBM is learning and if IBM management should decide to stay in the business, the installed base should exceed 80,000 units by year-end 1981. In the meantime, IBM will continue to increase its share of the Bank Teller special purpose terminal market. By year-end 1981 IBM installations will have passed the 100,000 unit mark.

B. The User Will Benefit

User attitudes may well hold the key to IBM's success with its SNA approach to data communications. Users are concerned when vendors are unable to provide a working demonstration of the proposed terminal hardware/software product in the environment of the planned network. They are concerned with the availability of service and the

EXHIBIT 12

IBM BATCH/RJE TERMINALS

INSTALLED BASE - USA

		1975	1976	1977	1978	1979	1980	1981
2780	Remove	1,500	2,700	4,300	6,500	4,200	1,800	1,100
3780	Reinstall	1,200	2,100	2,800	2,100	1,200	400	-
2922	New	-	-	-	-	-	-	-
Sys 32	Net	12,500	11,900	10,400	6,000	3,000	1,600	500
3775	Remove				400	1,100	1,500	1,700
3777	Reinstall				375	1,000	1,400	1,550
	New			2,100	5,400	6,200	4,800	3,600
	Net			2,100	7,475	13,575	18,275	21,725
Total		12,500	11,900	12,500	13,475	16,575	19,875	22,225

EXHIBIT 13

IBM SPECIAL PURPOSE TERMINALS*

INSTALLED BASE - USA

		1975	1976	1977	1978	1979	1980	1981
Bank	Remove	3,750	6,200	8,900	9,250	9,000	7,300	4,500
	Reinstall	2,900	2,790	2,900	2,300	1,450	900	350
	New	-	-	-	-	-	-	-
	Net	43,700	40,290	34,290	27,340	19,790	13,390	9,240
3600	Remove	-	275	720	2,500	5,500	8,400	10,750
Bank	Reinstall	-	220	645	1,460	3,550	5,060	5,900
	New	2,500	9,500	16,400	23,000	22,000	19,000	14,000
	Net	2,500	11,945	28,270	50,230	70,280	85,940	95,090
3650	Remove	300	450	1,050	1,400	2,950	6,100	11,400
3660	Reinstall	150	300	750	1,000	2,200	4,000	7,400
Retail	New	1,700	3,900	6,200	12,200	21,000	32,000	17,900
	Net	2,500	6,250	12,150	23,950	44,200	74,100	88,000
Total		48,700	58,485	74,710	101,520	134,270	173,430	192,330
			20%	28%	36%	32%	29%	11%

* *Excludes factory, sensor, electronic funds transfer, graphics, or credit verification terminals.*

proposed maintenance arrangements. They will ask about terminal RAS (Reliability, Availability, and Serviceability). Users will want to work with a vendor from the inception of a project plan. They expect a vendor to demonstrate an adequate knowledge of the intended applications and the hardware/software support required to make them work. In short, users want all of the things which IBM can potentially do best.

From the viewpoint of the Data Processing manager, the introduction of distributed processing increases the number and scope of the responses which can be chosen to fulfill user department requirements. It is easier to segregate the prospective workload into central site versus remote site components, and where a decentralized data base is a desirable alternative it can be provided within the framework of a centrally controlled system. The decentralized approach has even more flexibility. It is easier to accommodate changes in user application requirements and the user is more emotionally/politically involved in the success of the resulting system. The status of the data processing managers who preside over this environment will be increased because they will become involved with Corporate policy decisions affecting the flow and use of information among the individual departments.

In the coming two years the competitive environment will be restated. The user will be presented with an increased selection of terminal hardware/software product alternatives, and a real choice as to how they will be distributed among the nodes in the network. The choice will be based on IBM's new strategy, and competitive reaction.

C. Impact on Competitive Vendors

The cost of a successful entry to this business has steadily risen since 1969. By now, only the well heeled can try. Only a few will succeed. We are in a phase of vendor consolidation. Familiar names will be lost or merged into other firms. Money for lease base development will be harder to find. Money for the development of field service support programs will virtually dry up.

It is not necessarily the growth of the IBM spectre which causes these conditions. It can also be attributed to the lack of public investment incentive, and the high cost of new technology.

But this is a growing industry. This year's $7.5 billion expenditures on terminal hardware/software products, services, and communication costs will climb to over $20 billion by 1981. Who will benefit? Perhaps this question can best be answered by examining the recent record of those in our business who are still around. Exhibit 14 shows the revenues and net profits of vendors for two consecutive reporting periods, and the calculated growth (decrease) of each from the first to the second period. By 1981, this author estimates that 40% of the current primary printer terminal, and 26% of the current primary CRT terminal vendors will have either been merged into other operations, or placed in Chapter 11.

Every company has its personality. Anderson Jacobson with 6 consecutive years of steady, conservative, revenue and earnings growth. Surviving in a tough segment of the terminal business - teleprinter terminals. ADDS, flamboyant growth and suddenly with $30M to spend after one of the neatest poker plays of all time. Beehive, smallish - but finally moving ahead after all these years on the explosive

EXHIBIT 14

FISCAL YEAR RESULTS

SELECTED VENDORS

MILLIONS (ROUNDED)

COMPANY	PREVIOUS YEAR REVENUE	PREVIOUS YEAR PROFIT	%	RECENT YEAR REVENUE	RECENT YEAR PROFIT	%	GROWTH REVENUE	GROWTH PROFIT
Anderson Jacobson	17.3	.864	5	20.9	1.0	5	21	16
Beehive	9.6	.570	6	12.5	.770	6	30	35
Centronics	41.5	7.2	17	52.1	9.7	19	26	35
Codex	26.2	4.4	17	27.2	3.3	12	4	-25
Comten	18.5	1.0	5	27.0	1.4	5	46	40
Data General	108.2	13.0	12	161.1	18.0	11	49	39
Data 100	95.9	5.7	6	121.9	4.7	4	27	-18
Datapoint	46.9	4.6	10	72.1	6.0	8.3	54	33
Four Phase	50.1	2.8	5	63.2	8.1	13	26	184
Incoterm	32.7	2.5	8	39.8	2.5	6	22	-
Milgo	40.4	4.2	10	40.9	2.3	6	1	-45
Sanders Data	25.3	(9.2)	-	27.9	(6.1)	-	10	-
Sycor	54.8	5.1	9	67.2	5.2	8	23	1

growth of the CRT market, showing impressive earnings and revenue growth. Centronics, riding the crest of the wave on a technology none were sure of, but now everyone needs. Codex, high technology in telecommunications, but the market wasn't there when Codex was ready. Comten, hanging on - now rapidly growing as users seek alternatives to SNA. Data General, fast growth, high potential, and trying to mature. Data 100, fantastic growth on the basis of IBM's weakness, but now going through an evolution into a systems Company - and its tougher to make a profit. Datapoint - living proof that the market for "dispersed" data processing is growing fast. DEC, what can you say with that record, and what client loyalty! Incoterm, a company in search of a lasting market identity. Milgo - a rapid growth based on technical innovation, then faltering on the need for additional diversification. Sanders Data Systems (now Harris) never making it out of the military marketing environment to survive profitably in the commercial market. Sycor, proving one big customer can be a problem when he packs up and leaves, but recovering on the basis of new-found marketing strength. And finally, Texas Instruments - selecting its markets for domination on the basis of volume.

One naturally assumes IBM to be more profitable in the terminal market because of its size, financial reputation, and marketing skills. In theory, this is true. But the differential is not as great as one might expect when comparing an established vendor with sufficient critical mass - given the segment of the terminal market being worked - to have established a "normal" relationship of marketing, service, and product costs to product revenues. A "typical" company in the $20 - 50 million range might show a cost/profit structure similar to the one shown in Exhibit 15. This analysis shows what happens to a company which can consistently sell 25 to 35% of

EXHIBIT 15

PROFIT SUMMARY *

	IBM	INDEPENDENT VENDOR
DEVELOPMENT COST	3 %	4 %
PRODUCT COST	20	26
GENERAL ADMINISTRATION	14	7
MARKETING	21	19
INTEREST	4	5
MAINTENANCE	16	24
TOTAL EXPENSE	78	85
PRE TAX PROFIT	22%	15%

* *Costs expressed as a % of Revenue.*

its production and place the remaining production on lease. Note the independent vendors development costs as a percent of total product revenues are going to be somewhat larger versus IBM's development costs which (although substantially higher in terms of dollars) will be allocated against a larger volume of revenues. IBM's volume manufacturing strength will give it a significant manufacturing cost advantage, but this tends to be offset by IBM's higher G/A overhead and marketing costs. IBM is also a bank. Each product is charged an interest cost based on the depreciation period of lease revenue units and non-revenue units which must be capitalized. Purchased units are not charged with interest costs, and hence total program interest costs are less than one might first suspect. IBM also has an advantage in terms of critical mass when it comes to field service labor and allocated parts cost per unit serviced. The net net - IBM would make a pre-tax profit of 22% versus the well managed independent's profit of 15%. But then, IBM may pay higher taxes on the result.

D. Competitive Strategies

One key factor in distributed/decentralized processing must not be overlooked. While a vendor may offer changes in processing power and the cost of data storage, the user will recognize that while the form of the system may be changed, the content of the data base cannot be altered. Thus, not only is the user seeking program compatibility, but particular attention must be paid to the compatibility of the data base from one system to another. This means that designers of hardware and software will have to concentrate on the provision of systems which generate, protect, transport, display, and occasionally manipulate (as versus update) data elements in an efficient manner. Compatibility, therefore, becomes an issue of file structure and communications protocol. In this, IBM will have an advantage. It will be able to exclude competitive hardware/software vendors from linking/using IBM hardware/software products on the basis of the complexity of SNA's bit oriented protocol and system elements. The key element for the user will be the interaction of transactions with data elements.

If it becomes cheaper (and it will/is) to store data base elements at distributed sites than to transfer it across land lines, then IBM's economic argument for large, centralized systems begins to disappear. IBM needs to be in the satellite business in order to assure a low cost means of transferring large amounts of data from distributed sites to the central host CPU. IBM's target is 400 - 450 companies. One half to one third of the traffic on these links will be voice, rather than data, transmission. Even if IBM does capture these users, this leaves everybody else.

The strategy, therefore, revolves around the provision of a low cost, easily manipulated, data base for each distributed processing site. Although for many organizations the politics of the distribution of compute power will be more important than the economic considerations, user costs can benefit from the distributed/decentralized approach to Data Processing. The Citibank experience shows a budget headed toward $400M that could be trimmed to $240M, a clerical staff reduction from 10,500 to 6,250, after tax cost savings of $80 million, and a real gain in new project productivity.

In addition users will eventually realize that the single large centralized installation is too vulnerable to unfriendly penetration.

The user must also evaluate the conversion cost, increased capital costs, personnel costs, and equipment resources demanded by a conversion to the SNA environment. The user must have a particular set of circumstances (high ratios of RJE/block mode data transmissions to interactive/transaction processing transmissions) in order to "enjoy" the benefits of SNA. The user must be exposed to alternative methods of data transmission/distributed/decentralized processing.

If IBM can not, or will not, define response times under SNA, or other equally important things such as system resource requirements and channel utilization, then does it not follow that users will respond to a vendor who can? If the performance and cost of a distributed network under SNA is uncertain, can these facts be exploited by a competitive vendor? The answer is yes, if that vendor has an alternative answer (Exhibit 16).

EXHIBIT 16

COMPETITIVE STRATEGIES

POOR	SDLC EMULATION PRICE REDUCTION, EQUAL PERFORMANCE
BETTER	PRICE REDUCTION, BETTER PERFORMANCE SDLC EMULATION/ASYACHRONOUS 1200 BAUD SWITCHED NETWORK FDX OPERATION GOOD INTERACTIVE CAPABILITIES
BEST	ALTERNATIVE TELEPROCESSING SYSTEM ARCHITECTURE PRICE REDUCTION (CONCEPTUAL OR ACTUAL) AND BETTER PERFORMANCE IMPROVED INTERACTIVE CAPABILITY LOWER HOST CPU OVERHEAD ALTERNATIVE 1200 BAUD FDX SWITCHED NETWORK OPERATION ALTERNATIVE 9600 BAUD FDX PRIVATE/LEASED LINE OPERATION SUPERIOR DATA BASE COST/PERFORMANCE FOR STORAGE AND MANAGEMENT

The alternative offering must:

1. Provide a means of simplified terminal software application development.
2. Eliminate or minimize terminal device dependency on application software elements.
3. Ensure that changes to the network are transparent to the programmer.
4. Determine that application programs are not terminal dependent and vice versa. Or to put it differently, any terminal (application) must be able to access any other terminal (application).
5. Allow different types of terminals to be attached to the same communications line.
6. Permit transmission flow to be full duplex in nature, thus permitting fast turn around of message traffic.
7. Handle interactive requests, transaction requests, and RJE blocks, equally well.
8. Show a reduction of CPU overhead versus a VTAM/NCP environment, and
9. Make the generation, maintenance, and use of a localized data base economically competitive.

There is no magic in SNA. It is a highly vulnerable concept because it is costly to implement. The hardware/software products of competitive vendors must simply keep on doing what they have always done - offer a better, more cost effective solution. The more sophisticated users will respond. It is becoming a common practice for large users to issue an RFP for a new terminal product. Hence, competitive opportunities will continue to exist for the vendor who influences the content of that RFP, and insures that the buyer knows the score.

One can also pursue the high volume, low price strategy - ne: DEC and TI in teleprinters or Lear Siegler in CRT's. Or, take the opposite approach. Seek those market/product areas where the volume is so low, IBM is glad to have someone else handle the problem (Graphics? Special Purpose Terminals?), and take a cooperative attitude. Attachment to Series 1 lends itself nicely to this approach. Another idea is to stay with a product/industry market where a specialized application knowledge will be appreciated by the customer.

Or then again - you can always be acquired.