IBM SYSTEMS
NETWORK ARCHITECTURE

A Study Prepared for the Exclusive Use

of EDP Industry Corporate Planning Service Sponsors

International Data Corporation
214 Third Avenue
Waltham, Massachusetts 02154

IDC #1745

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What is Systems Network Architecture?

In terms of the definitional aspect, IBM discussed its new teleprocessing structure in a press release of September, 1974. The following is an excerpt from that release and gives a broad overview of SNA, its components, and supposed advantages.

> *SNA permits communications functions -- such as control of transmission lines -- to be distributed throughout the system, freeing computer facilities to process applications. The architecture also allows a variety of IBM terminals to operate over a single line, which can help reduce communications costs. Moreover, users can install additional terminals at remote locations with little or no modification to existing application programming -- increasing programmer productivity since more time can be devoted to developing new applications.*
>
> *Each component in an advanced function system provides special features, but users gain additional benefits when the components are integrated into a teleprocessing system through SNA. For example, the connections among controllers, lines and terminals are simplified. This provides a uniform communications structure compared to systems that include a variety of uncoordinated approaches -- such as different line control methods, line speeds, and access methods.*
>
> *SNA -- the blueprint for Advanced Function for Communications -- defines how various communications functions are distributed among the components. Virtual Telecommunications Access Method, for instance, provides a link to the central processor, while the transmission control technique handles duplex (simultaneous, two-way) communications and data error recovery.*
>
> *The distribution of functions allows many network control operations to be removed from an IBM System/370 and allocated to terminals where they can be performed more effectively.*
>
> *The ability to distribute functions is made possible, in part, by large scale integration (LSI) technology -- used in producing miniature electronic circuits that are installed in terminals and controllers to handle a variety*

of communications tasks.

The major components in an advanced teleprocessing network and their key tasks are:

-- *A virtual storage IBM System/370 running under Disk Operating System/Virtual Storage, Operating System/Virtual Storage 1, Operating System/Virtual Storage 2, or Virtual Machine Facility/370 in conjunction with other virtual storage programming. This provides the facilities and services required by teleprocessing applications. For data base/data communications applications, users can add IBM's Customer Information Control System/Virtual Storage or Information Management System/Virtual Storage.*

-- *Virtual Telecommunications Access Method (VTAM), residing in a System/370, is the access method -- or link -- that gives users at remote terminals access to application programs. It also provides resource sharing, a technique for efficiently using a network to reduce transmission costs. For example, VTAM permits one terminal to "share" many application programs, eliminating the need to install a separate terminal and communications line for each application.*

   TCAM, another access method widely used today, can operate under the facilities of the newer VTAM -- eliminating the need for TCAM users to make a full systems conversion.

-- *An IBM 3704 or 3705 communications controller and Network Control Program/Virtual Storage that work in conjunction with VTAM to manage the communications network. The two programs provide a variety of administrative functions -- such as scheduling the operation of lines, collecting error statistics, polling terminals for messages and handling some error recovery. Moving these functions from the computer into the network helps free the computer to process more applications.*

   When equipped with another program, Partitioned Emulation Program Extension, a 3704 or 3705 also permits currently installed terminals and application programs to operate over existing start-stop or binary synchronous transmission lines, while VTAM uses the communications controller to access SDLC lines.

A 3704 or 3705 also can be used as a remote concentrator collecting messages from low-speed lines and transmitting them over high-speed lines to the computer -- helping reduce transmission costs.

-- *Synchronous Data Link Control (SDLC), IBM's newest line discipline, that initiates, controls, checks and terminates information exchanges over communications lines. Designed for duplex operation -- simultaneously sending and receiving data over the same line -- SDLC permits as many as seven messages to be sent before a response is required from the receiving device, further enhancing communications efficiency.*

SDLC can provide automatic self-recovery from most communications errors, allowing processing to continue without interruption.

-- *Terminals with integrated control units, or linked to programmable controllers, permit some communications functions to be handled at the terminal location -- further reducing demands on the central processor.*

The IBM 3767 communication terminal and IBM 3770 data communication system, announced at the same time, are designed with integrated control units and provide advanced features that make them a key element in this advanced teleprocessing systems architecture.

Other IBM terminal-oriented systems that offer Advanced Function for Communications are: the 3600 finance communication system, for transaction processing in banks; the 3650 retail store system, designed to streamline retail operations up to the point of sale; the 3660 supermarket system, which helps speed normal checkout operations; the 3790 communication system, designed to improve the accuracy and efficiency of data entry, inquiry and document preparation; and the 3270 information display system, which has been enhanced to operate over SDLC lines.

Figure 1 illustrates the interrelationship of the elements of SNA while Figure 2 illustrates the concept of distributed functions made possible through implementation of SNA.

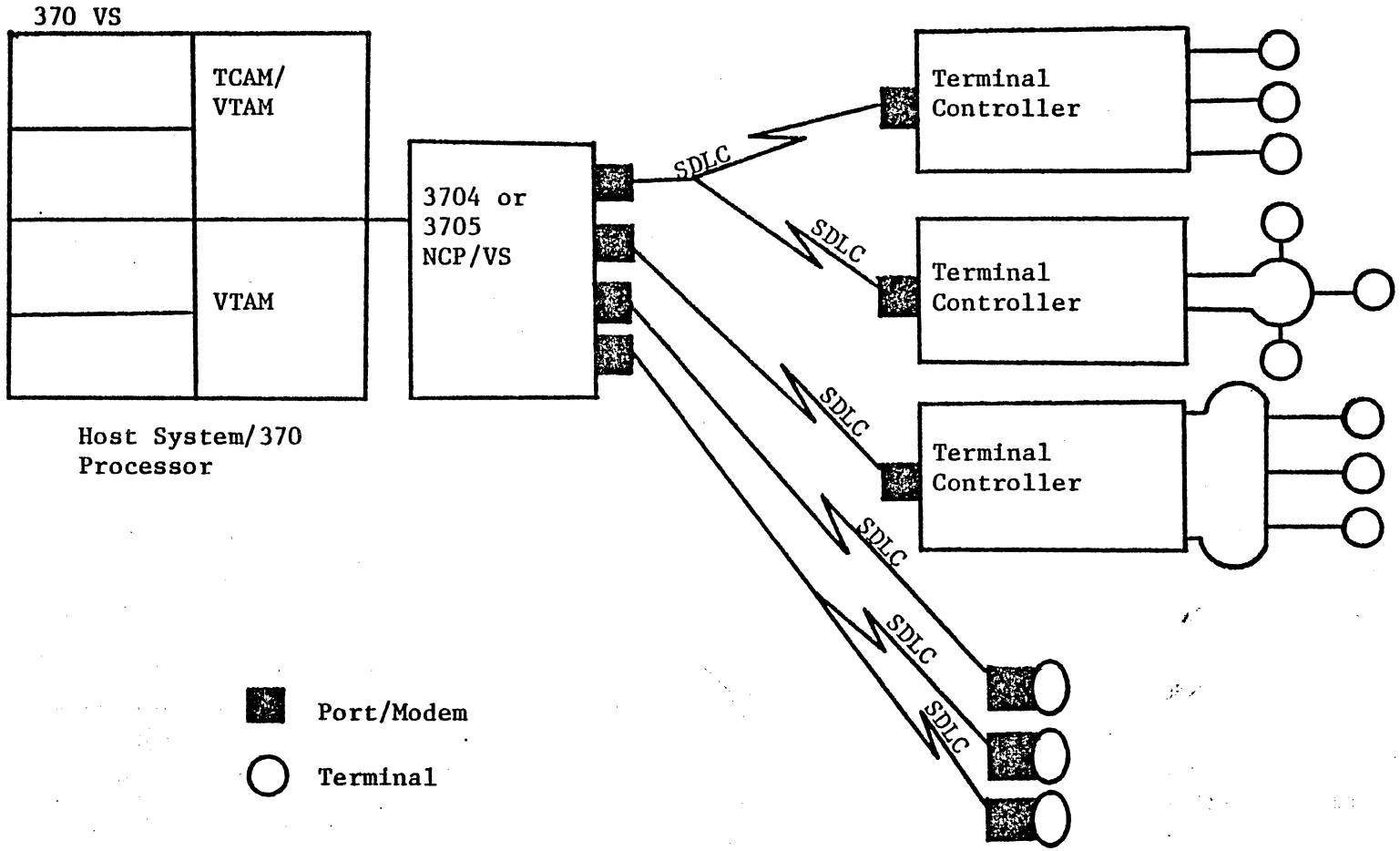

FIGURE 1
ELEMENTS OF SYSTEM NETWORK ARCHITECTURE

Illustrates the inter-relationship of the elements of SNA.

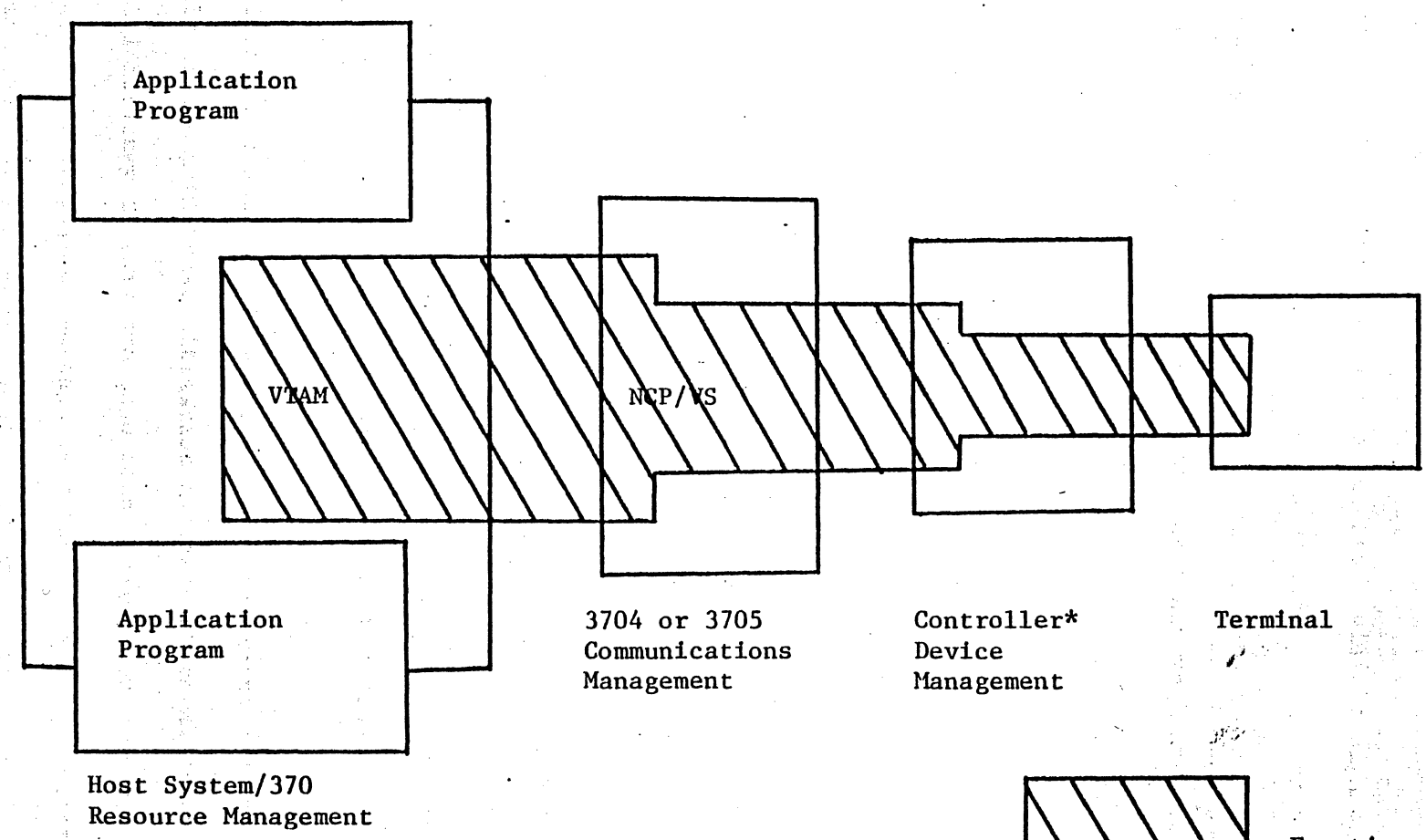

FIGURE 2
CONCEPT OF FUNCTION DISTRIBUTION
Illustrates concept of distributed functions made possible through implementation of SNA.

IBM's Strategy in Telecommunications

System Network Architecture represents a visible sign of IBM's Advanced Function for Communications which undoubtedly has been in the planning stages for several years and reflects the considerable emphasis IBM has placed on one of its previously weak areas - telecommunications.

Its implications can be observed from several possible vantage points:

- A competitive reaction to thwart the plug-compatible terminal and communication control suppliers.
- A "unified approach to teleprocessing" for its valued leading-edge users.
- An indirect means of selling larger computer systems and more memory.
- A part of an even larger scheme to compete with AT&T.

Historically, data communications has not been one of IBM's strong points. Other mainframe companies typically were more communications-oriented and the "independent" peripheral suppliers more often than not were the ones to introduce more advanced data communications equipment. IBM is therefore observed as "coming from behind" in many respects to offer "state of the art", competitively priced data communications products. Internal planning documents made public as a result of the anti-trust litigation against IBM reveal that indeed a unified strategy in this area had been lacking for many years and much of IBM's planning for advance functions on its 370 series and FS revolved around data communications. Its importance in IBM's overall corporate organization became apparent when it re-organized in May, 1975

with the creation of the System Communication Division.

An analysis of the product mix of U.S. computer shipments over the last ten years as well indicates that the portion contributed by CPU and memory has accounted for an ever decreasing portion of that mix as technology and learning curves reduce costs and the typical system configuration over time become larger and encompasses more peripherals and terminals. In 1966, for example, terminals accounted for some 3% of all computer shipments by value. By 1975, that portion of the product mix accounted for an estimated 12% of shipments by value. For IBM, in particular, communications products, at yearend 1975, accounted for 4% of the installed value of 360s but some 9% of the installed value of 370s.

One over-simplified interpretation of IBM's strategy with its SNA concept relates to a competitive reaction to the inroads being made by the plug-compatible equipment suppliers. In the general purpose data communications market, independents have garnered a market share of close to 40% in some cases. In the communications controller market, independents have captured some 30% of the number of devices in use. The introduction of SDLC line protocol could be interpreted as a direct means of temporarily postponing possible plug-compatible interfaces. Sanders Data Systems, however, has already announced SDLC compatibility for its IBM 3270 replacement product and other such offerings should follow.

In a broader context, System Network Architecture can be thought of as providing a unified approach to teleprocessing previously not existing. In essence, it does for the proliferation of terminals,

controllers, and software aids of the early 1970s what System/360 did for the hodge-podge of systems, machines, and programming languages of the early 1960s - it brings order out of chaos. System 360 introduced organization (architecture) so that customers could grow flexibly without major conversion or change. In the same manner, SNA, allows organized growth (terminal addition/substitution and applications expansion) without conversion problems, re-programming or integration problems. IBM seemed to be saying with its announcement that if users wanted to keep up with what's happening as teleprocessing becomes a way of life to many users in the seventies - look to IBM because it now has everything needed to smooth the way for teleprocessing development.

A perhaps more cynical view of the implications of SNA would suggest that it's an indirect means of selling more i.e. larger computers and memory. Certainly the connection is there - SNA requires Virtual Storage, more sophisticated access methods, a new proliferation of terminals, etc., - all requiring, incidently, more memory and large computers for effective operation. As System/370 nears the expected end of its product cycle and the great bulk of system migration has already taken place, one might agree that a new stimulus is needed to keep revenues flowing at an acceptable level.

Another interpretation depicts SNA as one element in IBM's more global strategy to compete with AT&T and includes the role played by Satellite Business Systems - IBM's proposed joint venture into satellite communications. The theory is that presently there is a lot

of money being spent by users today that goes into AT&T's pocket that IBM would like to divert into its own pocket.

- During 1976, an estimated $1.6 billion dollars will be spent on communications line costs - the bulk of that going to AT&T. Such expenditures have been growing 20-25% per year to the point where they are estimated to account for some 8% of all users' outside spending on EDP in 1976.

Through implementation of SNA, the user, supposedly, can operate more efficiently by sharing different terminals on the same network and among various applications. Utilizing SDLC supposedly allows for more efficient actual transmission in a full-duplex mode. Such improved efficiencies theoretically should lower the users' communications line costs. With the then additional expenditures in IBM terminal equipment and host computer overhead, IBM can possibly divert user expenditures from AT&T to itself.

In addition, as a means to capture some of the communications expenditures itself, IBM submits application for Satellite Business Systems - a company that will develop, build, and market a proposed new domestic satellite communications system. Such a system was termed an "advanced digital communications system that will allow each customer with geographically disperse locations to combine voice, data, and image communications into a single, integrated, private-line switched network." Users of the system - perhaps also users of IBM computers - will have no need to tie into the Bell System for intra-company communications. For intra-company communications, it's conceivable that the IBM system could be used for long haul calls, tieing into the Bell loop only at the local level. Obviously, independent common carriers would be impacted as well.

Survey Synopsis

It is worthwhile noting certain characteristics of the System 370 users with regard to the individual SNA components as indicated by our survey responses and how they fit into the profit-making lifestyle of the corporation. All data communications users are cognizant of their ever increasing need for faster and more reliable ways to send and receive the data necessary for order entry, transaction reporting, and inventory control, etc. SNA can be seen as a method of structuring the architecture of their corporation's information flow to meet this need.

Among our sample of System 370 users who were data communications users, the acceptance of virtual storage operating systems will be an accomplished fact by yearend 1977. A prerequisite for SNA, VS is also a prerequisite for some of IBM's other new equipment that is not directly related to SNA such as the 3850 Mass Storage System, 3800 Printer, and the 3350 Disk Drive. At the same time, usage of the SNA access method, VTAM, will be doubling by 12/77. Our research indicates that the decision to add VS and VTAM appear to be catalysts for an upward migration of mainframe at the same time. And users comments on justification for making the switch to VS and VTAM indicate concern that IBM might withdraw support for some non-VS devices. At the same time that they were indicating it was a requirement for vendor support, they also indicated that it was required for support of the new terminal devices of interest to their specific industries.

Statistics indicate that three quarters of the programmable communication controllers now in use and projected to be in use by yearend 1977 are of the IBM 370x variety. However, COMTEN will be battling with

MEMOREX's new 1380 programmable for the remaining one quarter, as the 270x variety of IBM fades away.

In relating SDLC usage to the major industries found in our sample to be the major implementators of SNA, certain implications can be observed. To date, the only significant usage of specific industry purpose terminals is within the banking industry with the 3600 Finance Communication System. However, by yearend 1977, significant implementation of the 3600 and the 3790 Communication System, the 3650 Retail Store System, and the 3660 Supermarket System will be accomplished by the banking, insurance, manufacturing, retail, and service industries. Industries are undoubtedly looking for the better and faster transmission methods offered by SDLC. These newer IBM systems offer significant improvements in the way transactions, inventory, and policy checks can be done. Both improved transmission capability and better hardware are equal motivators for the implementation of SNA. However, users of the "tried and true" 3270s indicate continued demand for this product as well as intentions of converting present and future 3270s to SDLC for current applications. At the same time, the implementation of new applications can be related to the newer terminals that allow the organization to view his system in a different light.

IDC views SNA as having implications in all the previously mentioned areas but essentially as IBM itself has made reference - as the "blueprint for teleprocessing" development and conversion for its 370 user base. A composite of hardware and software elements, it can be construed as IBM's statement of how to do things in the '70s. As such, it is still a considerable departure from previous modes of operation and requires

considerable evaluation on the part of the users. While the advantages of such an approach have been touted by IBM, the true costs associated with such implementation are still not fully understood. While it has been two years since SNA was announced, user understanding is still too limited in many respects to allow proper evaluation of the concept. Many users are taking a "wait and see" attitude and do not want to be pioneers in this regard.

Objectives and Methodology

In an attempt to evaluate the acceptance of IBM's System Network Architecture, IDC, conducted a broad-based user survey of known System/370 users. A mail questionnaire was designed with two major objectives in mind:

- To document, by IBM 370 model, the degree of present and planned usage of each of the major components of SNA (VTAM, SDLC, 370X communications controllers, etc.), and
- To assess in a general way, user's feelings about the advantages and disadvantages of the SNA approach for their network.

The use of a quantitative and qualitative approach was deemed to be the best way to obtain overall evaluations. (Sample questionnaire included at end of report.)

Users were selected from IDC's U.S. Computer Installation Data File of June, 1976. Recognizing that it was primarily the larger installations which would be the only true candidates for SNA, sample selection was made accordingly:

- All 370/15X and 16X sites were selected.
- About one-half of the 370/135 and 145 were selected.
- Only some 15% of the smaller 370/115 and 125 sites were selected.

A total of 226 questionnaires were returned and judged usable for analysis from a total of over 2,200 originally mailed. Users were classified according to the senior system at that site and the resulting distribution was as follows:

RESPONSE DISTRIBUTION BY SENIOR SYSTEM AT SITE

IBM Computer Model	No. In Sample
370/115	6
125	8
135	18
145	62
155	25
158	78
165	7
168	22
Total	226

Acceptance of Virtual Storage Operating Systems

A System 370 model equipped with a virtual storage operating system is a basic requirement for a company desiring to operate in an SNA environment. Virtual storage can best be described as a disk extension of main memory. IDC wished to guage respondents current usage of virtual storage and/or future plans for doing so. Referring to Table 1, it can be noted that overall, 81% of those sites responding are currently utilizing some form of virtual storage. This overall percentage is weighted down by inclusion of the 370/155 and 165 which are non-V.S. machines. Considering only those with V.S. capability, the degree of usage ranges from a low 85% of 158 users to a high 96% of the 145 base.

When asked about their future plans, some 77% indicated no plans to change either CPU or operating system. Of those users, indicating some change:

- 18% would go to a larger CPU with virtual storage.
- 4% would keep the same CPU and change to VS.
- 1% would migrate to a larger CPU but still not adopt VS.

It was the 370/135/145 user base which indicated the most plans to upgrade to a larger CPU with virtual storage although these very same users currently registered the highest incidence of virtual storage usage. The newly announced 370/138/148 systems should take care of such users, very nicely offering the additional memory required at very attractive prices. The 370/158 and 168 users expressed the most stable plans with little CPU migration indicated but further adoption

TABLE 1

CPU MIGRATION AND USAGE OF VS OPERATING SYSTEM

Senior CPU Model at Site	Number Sites In Sample	% Now Have VS	% No Change	% Same CPU Change To VS	% Larger CPU Change To VS	% Larger CPU No VS	Total
370/115	6	-	100%	-	-	-	100%
370/125	8	-	75	-	25%	-	100
370/135	18	94	44	-	56	-	100
370/145	44	96	57	2	41	-	100
370/155	23	30	69	9	13	9%	100
370/158	78	85	91	4	4	1	100
370/165	7	57	86	-	14	-	100
370/168	18	89	89	11	-	-	100
TOTAL	202	81%	77%	4%	18%	1%	100%

of VS operating systems expected.

Such statistics are felt to be representative of 370 users involved in data communications but may somewhat overstate VS usage for all 370 systems.

Comments that follow were typical of users in stating their justification for making the conversion to VS.

- "Growth and support of peripheral devices"
- "Require for continued vendor support"
- "Improving system software for security and reliability"
- "Control of multi-user, multi applications"
- "Ability to run TSO on-line and batch without large storage requirements"

The comment on "growth and support of peripheral devices" indicates that IBM has announced new peripherals such as the 3850 Mass Storage System, 3800 Printer, and 3350 Disk Drive which require a VS operating system for usage.

Usage of VTAM

IDC also asked respondents to note their current and planned access method. The objective was to gauge current and planned usage of another SNA component, VTAM(Virtual Telecommunications Access Method). VTAM is, as previously noted, the common access method and network manager for SNA. It establishes the link between the terminals and the application programs. Once this link is made, VTAM assumes overall control of the communication between the application program and the terminal. Originally a prerequisite for SNA, it is not now necessary that all companies wishing to support terminals that operate under SNA convert to VTAM. For example, a TCAM user on an OS system can interface directly with the NCP in the communications controller and some SDLC devices - 3270 CRT, 3600, 3614, 3767, 3770 or the equivalent. Excluded from operation under a TCAM interface are the SDLC compatible "only", 3790, 3650 retail store system, and the 3660 supermarket system.

The survey indicated only a small 8% current utilization of VTAM overall. Table 2 shows:

- Virtually none of the 370/115, 125, and 135 user base in our sample presently utilized VTAM.
- Usage on the larger 370/158's and 168's was considerable (13-14%)

As was observed with VS operating system usage, a large percentage of users had no plans to change CPUs, or Access Method by 12/77.

- Close to 70% of all users had no such plans.
- 13% would retain the same CPU but change to VTAM.

TABLE 2

CPU MIGRATION AND USAGE OF VTAM

Senior CPU Model	Number Sites In Sample	% Now Have VTAM	% No Change	% Same CPU Change To VTAM	% Larger CPU Change To VTAM	% Larger CPU No VTAM	Total
370/115	3	-	100%	-	-	-	100%
370/125	6	-	83	-	-	17%	100
370/135	16	-	56	6%	13%	25	100
370/145	46	4%	59	9	4	28	100
370/155	18	5	67	11	11	11	100
370/158	64	14	81	14	-	5	100
370/165	7	-	72	14	-	14	100
370/168	15	13	53	40	-	7	100
TOTAL	175	8%	69%	13%	4%	14%	100%

- Another 4% would migrate to a larger CPU with VTAM.
- The balance of 14% would plan to migrate to a larger CPU without incorporation of VTAM.

Although there was an observable higher incidence of usage of VS currently than VTAM, plans were relatively greater to incorporate VTAM over the near term.

- Overall planned usage (17%) is twice as large as current usage (8%).
- A full 40% of 370/168 users expressed plans to implement VTAM.

Individual respondents' most prevalent reasons for making the switch were:

- "Ability to switch terminals between applications dynamically"
- "To support the 3600 network"
- "3790 terminals require it"
- "To take full advantage of SNA"
- "Required for vendor support"

Present and Planned Usage of Data Communications

Since it is only those users either presently involved in or planning to implement data communications who are possible candidates for SNA, users were asked about such involvement. The results as indicated in Table 3 indicate considerably greater data communications usage than previously estimated for general-purpose computers users.

- Overall 92% of all system 370 sites in the survey were presently involved in data communications.
- Usage increased proportionately, as would be expected, from 50% of the 370/115 users up to 100% of the 370/158 and 168 users.

Previous research indicated overall usage of data communications at 60% of all sites with an installed value of computer equipment of at least $300,000 which is the equivalent of a 370/115. While the current research effort was more limited in scope, the degree of difference is considerable. One explanation suggests that the subject of current research was SNA and that was clear to the users surveyed. Since those with no involvement with data communications logically had nothing to contribute in the way of responses, the questionnaire was probably not returned allowing for a considerably larger incidence of data communications usage among respondents. Therefore we feel Table 3 is not representative of the entire U.S. marketplace.

The balance of this report is based on responses from users who are presently involved in or planning to implement data communications.

TABLE 3

PRESENT AND PLANNED USAGE OF DATA COMMUNICATIONS

Senior CPU Model at Site	Number Sites In Sample	% Now Use	% Plan To Use	% Not Using & Not Planning To	Total
370/115	6	50%	-	50%	100%
370/125	8	63	25%	12	100
370/135	17	82	12	6	100
370/145	61	93	2	5	100
370/155	23	79	17	4	100
370/158	78	100	-	-	100
370/165	7	100	-	-	100
370/168	20	100	-	-	100
TOTAL	220	92%	4%	4%	100%

Acceptance of SDLC

IBM defines SDLC as a "line discipline for management of information transfer over a data communications channel."

Current and future usage of IBM's SDLC line protocol was gauged in two different ways. First, users were asked to list the terminals currently in use and expected to be in use by yearend 1977. Line disciplines associated with such terminal usage were also requested to assess the SDLC impact. As indicated in Table 4, the impact of SDLC has been neglible to date. In fact, the only measurable usage was observed in conjunction with terminals associated with a 370/145.

Other findings which help to profile the 370 user base in regard to terminal usage:

- The average number of terminals in use per CPU is slightly in excess of ninety currently. This average is high due to the inclusion of all devices specified and many of the larger sites reporting networks of over 100 terminals - in some cases, figures of over 1,000. This average is expected to increase some 20% by 12/77.

- IBM's current market share of terminals reported to be in use on its 370 mainframes was 63% and expected to drop slightly over the next year as inroads are made by independent suppliers with SDLC compatible terminals.

Current usage of SDLC terminals in the survey was as follows:

	# Terminals	%
3650 Retail Store System	78	70%
3600 Banking System	18	16%
3270 Information Display System	10	9%
3790 Data Communication System	6	5%
TOTAL	112	100%

TABLE 4

SDLC USAGE ON TERMINALS

	Current			Future		
Senior CPU Model at Site	Average Number Terminals Per CPU	% Terminals IBM	% Terminals SDLC	Average Number Terminals Per CPU	% Terminals IBM	% Terminals SDLC
370/115	7	40%	-	7	45%	-
370/125	10	100	-	17	89	-
370/135	32	41	-	35	70	-
370/145	40	54	4%	48	54	25
370/155	59	68	-	77	68	12
370/158	112	70	-	134	62	12
370/165	97	74	-	98	76	-
370/168	228	54	-	268	51	23
TOTAL	91	63%	-	108	59%	17%

Analysis of survey respondents' terminal usage at yearend 1977 and associated line discipline reveals an overall expected SDLC impact of 17% on the terminal base.

- Heaviest future usage of SDLC is observed in the 370/145 and 168 user base which is consistent with the major commitment these same groups indicated to VS and VTAM.

A distribution of terminals expected to be utilizing SDLC by 12/77 according to survey results:

	# Terminals	%
3270 Information Display System	2,382	75%
3767 Communication Terminal	349	11%
3600 Banking System	168	5%
3650 Retail Store System	128	4%
Other (377X, 3790, etc.)	162	5%
TOTAL	3,189	100%

It is quite apparent that the demand for 3270s continues strong and that users are expecting to convert their present 3270s to SDLC operation as well as ordering SDLC versions. Our figures suggest that the 3790 is not making any large inroads.

Of those users indicating they will be utilizing SDLC in the future, an analysis of existing terminals revealed the types of networks seemingly most apt to make the conversion. Such users were classified as to major generic types of terminals in use currently. Table 5 presents such a classification:

Table 5

Types of Terminal Networks
Converting to SDLC

Type of Network	# Users
"3270"-type only	29
"3270"-type and Remote Batch	12
"3270"-type, and Conversational Printer Terminals	11
"3270"-type, Remote Batch and Conversational Printer Terminals	9
"3270"-type and Industry-Specific	4
Remote Batch only	6
Other (3740, 3790, etc.)	7
TOTAL	78

As seemed clear from the previous analysis of SDLC terminals expected to be in use at 12/77, most networks planning the conversion involved either IBM 3270s or plug-compatible equivalents represented as "3270 type" above.

- The largest number of users employed "3270" type networks only.
- The second seemingly most likely networks to convert to SDLC involved combinations of "3270-types" and remote batch or conversational printer terminals.

In a more direct way, users were asked specifically if they currently utilized or planned to utilize SDLC. Their justifications for doing so were also requested. Table 6 summarizes the results of this query.

- A small percentage of respondents, (7%), indicated current usage of SDLC. It should be noted that such a statistic measures the percent of users as opposed to percent of terminals incorporating SDLC that was previously discussed. While there is some ambiguity here, it is nevertheless apparent that SDLC's impact to date has been minimal.

- Future usage among sites responding was expected to increase dramatically to 50%. It should be noted here that there was no specific time frames associated with this specific question as there were for terminal usage.

The smallest percentage of planned future use came from the smaller System 370 model users (370/115, 125, 135). These systems are perhaps running minimal communication applications so a change would not be worth the effort involved. In addition, IBM has stated that they will continue to support start/stop and bisynchronous communications for those user classes. When asked to state their reasons for not making the switch, such a hypothesis was supported by reasons such as these:

- "Bisynchronous meets our needs"
- "Conversions costs too high"
- "Not ready to expand terminal network yet"
- "Too small a network"

TABLE 6

PRESENT AND PLANNED USAGE OF SDLC

Senior CPU Model at Site	Number Sites In Sample	% Utilize Now	Plan to Utilize % Yes	% No	% Don't Know	Total
370/115	3	-	-	100%	-	100%
370/125	6	-	33%	67	-	100
370/135	16	6%	25	50	25%	100
370/145	58	9	44	49	7	100
370/155	22	-	41	42	17	100
370/158	72	7	64	28	8	100
370/165	7	14	29	57	14	100
370/168	20	15	55	40	5	100
TOTAL	204	7%	50%	41%	10%	100%

Reasons for switching to SDLC have been touted in IBM literature. IDC listed the major arguments IBM gives for making the switch and asked users to indicate any and all reasons important to them in switching or in deciding to switch protocols. Most sites overwhelmingly indicated that "flexibility of network configuration" was the major reason.

SDLC is concerned only with transferring data not processing. Link control (SDLC) is separate from network control (NCP) and peripheral device control (VTAM). This means that SDLC is not an instrinsic part of any device nor does SDLC demand that a particular file accessing technique be followed. This allows the network to be arranged to suit the network's purpose not a predetermined course that could be unsatisfactory for the organization.

"Comprehensive detection and recovery procedures" and "Increases communication commands" were two next - most often - mentioned reasons. Previous data link controls only checked the text of the message; the new protocol tests a complete frame - address control information, and error redundancy sequence. Additionally, up to seven messages can be sent before a response is required improving system availability. The bit rather than character orientation of SDLC allows the user to increase the number of commands without having to add new control characters increasing overhead.

Respondents also indicated other specific reasons for making the switch such as:

- "Only way to support new devices - 3790, 3653"
- "Common usage of network by applications"
- "More efficient programming"
- "It's the state of the art"

The Data Link Protocol Standard Issue

Currently, there are three candidates for a data link protocol standard which could either be conflicting or complementary depending upon the outcome of meetings of various organizations. Such a standard will have an effect on competition among the data communications terminal, controller, and mainframe vendors and will have an effect on the systems' decisions/dilemma of users.

A data link protocol is basically the method through which the terminal talks to the network over its physical circuit. The data link protocol is only one quarter of the entire communications pie however, the other three-quarters are made up of: physical circuit protocol, which tells how the devices are to be connected for the particular configuration; packet level protocol, which is the method of identification for messages routing and control; and the application level protocol which decides how the terminals and programs talk to one another. Our discussion will concern itself with data link protocol and touch briefly on packet level where applicable.

The primary purpose of the data link level is to facilitate the exchange of information over a data communications channel. For a small network user, it would simply handle the transfer of data between terminals and network. For a larger user, it would mean interfacing with a packet-switching network.

The three data link protocols under consideration for a standard are:

- The ADCCP (Advanced Data Communications Control Protocol) is

sponsored by the ANSI (American National Standards Institute) and is considered to have an excellent shot at being approved by yearend 1976.

- ISO (International Standards Organization) has HDLC (Higher Level Data Link Control) as its entry in the world race.

- The final protocol of concern is the data link protocol level of the CCITT's X.25 recommendation. CCITT (Consultative Committee on International Telephone and Telegraph) is backing X.25 as the most likely candidate for the role of standard host interface to public packet-switched networks.

The ADCCP is closer to the data link control portion of X.25 than HDLC. Most likely, those users who buy ADCCP compatible terminals, concentrators, and processors will have no problem interfacing with a packet-switched network. The provisions that differ among all three are relatively minor and involve frame structure and command set, but could be serious enough to preclude compatibility from vendor's point of view. Burroughs, DEC, and UNIVAC all have their own data link protocols that are part of their system architecture. Burroughs is one of the closest to conformance with ADCCP. Honeywell is rumored to be introducing a new link protocol soon which probably will be in accordance with ISO standards as they participated in the conference discussions.

From the standpoint of data terminal equipment manufacturers, ADCCP-compatibility seems to be of importance. Control Data, Univac, and Burroughs are rumored to be ready to introduce ADCCP compatible terminals. Still others are waiting until ADCCP has been formally approved and is in final form. Carriers of packet-switched networks are reluctant to give up control of some or any of the control functions and vendors are equally determined to tie customers into their equipment. What the outcome of this tug of war will be is a moot

question until X.25 gets final approval from the full board of CCITT and until ADCCP receives final approval from ANSI.

How operable SDLC terminals would be under an ADCCP net is a question mark at this point; it is generally felt that ADCCP terminals will be of higher capability than SDLC terminals but ADCCP terminals will be able to operate successfully within an SDLC environment.

Resolving all the conflicts among the different protocols affecting the transfer of information over data communication lines could simplify life for users. It would give them the ability to mix and match terminals of different vendors and interface with data networks in this country and abroad. The ability to change or add to their networks without throwing out installed equipment or having to rewrite programs and procedures would be a plus.

User Opinions On SDLC As An Industry Standard

While there currently is no specific standard line discipline, IBM has sufficient ability to create "De Facto" standards by virtue of its large role in the industry. IBM System/370 users were asked for their opinion on whether SDLC should become an industry standard. Table 7 presents such analysis.

- Overall 45% of the sites surveyed felt SDLC should be the industry standard.
- The balance of users were evenly split between those opposed to SDLC as a standard and those who were undecided or had no opinion.

Reasons for yes answers went the gamut from "Why not?" to "IBM has the clout to make it happen."

The no's cited the possibility of retricting non-IBM vendors and also the capricousness of vendors i.e. "Vendors sets a standard, he can change a standard." The undecided gave as their reasons either an "Insufficient knowledge to intelligently comment" to those who felt it was not superior to bisynchronous mode and furthermore had been outmoded by packet switching. However, it should be noted that throughout all the answers regardless of category, there ran a resigned tone verbalized by one who said "This is what I think...but what difference does it make...it will be anyway." (De Facto)

While establishing a data link control standard certainly would allow easier interfaces for users and vendors alike - usage of a particular protocol certainly does not preclude others equipment from such an interface. As particular devices incorporate more intelligence, particularly with microprocessors, interface with most any protocol

TABLE 7

OPINIONS ON SDLC AS INDUSTRY STANDARDS

Senior CPU Model at Site	Number Sites In Sample	% Yes	% No	% Don't Know	Total
370/115	6	33%	67%	-	100%
370/125	8	25	50	25%	100
370/135	16	25	31	44	100
370/145	57	38	32	30	100
370/155	22	50	29	22	100
370/158	78	60	17	23	100
370/165	7	43	43	14	100
370/168	20	20	50	30	100
TOTAL	214	45%	28%	27%	100%

will undoubtedly be possible. However, the amount of effort and cost may not offset the expected usefulness unless large networks are employed.

Usage of Communications Controllers

Another component of SNA is the 370x group of communication controllers which are needed as programable front-ends to the host computer. Residing within the controller is a system software package named NCP/VS (Network Control Program). The purpose of NCP is to act as traffic manager, controlling communications between VTAM and remotely attached devices. After NCP has recognized a condition and specified appropriate action, actual commands are issued by VTAM however.

Current usage of communication controllers in the survey shows strong acceptance of IBM's 370x family which continues in future plans (Table 8).

- Close to 75% of all communications controllers in use with IBM 370 mainframes were found to be of the IBM 370x's.
- The combined market share of independents is just over 20% with Memorex presently outranking COMTEN by a 2-1 margin.

IBM's 370x series is expected to capture a slightly larger share according to the future plans of users, notably in the 370/145 base which has been observed as a strong current and/or planned user of VS, VTAM, and SDLC in previous analyses shown. While the overall share held by independents is expected to remain about the same, COMTEN appears to be making stronger inroads and survey statistics indicate its share will be greater than MEMOREX by 12/77. COMTEN's impact appears greatest at the very large sites (15X and 16X). It should be noted that it was MEMOREX's older 1270 products which account for loss of market share in the survey. However, their market share should

TABLE 8

USAGE OF COMMUNICATIONS CONTROLLERS

	Now						Future					
CPU Model	Average Number Controllers Per CPU	% 270X	% 370X	% MRX	% Comten	Total	Average Number Controllers Per CPU	% 270X	% 370X	% MRX	% Comten	Total
370/115	-	-	-	-	-	-	-	-	-	-	-	100%
370/125	-	-	-	-	-	-	1.0	-	100%	-	-	100
370/135	1.3	-	100%	-	-	100%	1.3	-	100	-	-	100
370/145	1.0	13%	76	11%	-	100	1.2	5%	89	6%	-	100
370/155	0.9	-	83	13	4%	100	0.9	-	92	4	4%	100
370/158	1.0	3	77	10	10	100	1.0	3	74	5	18	100
370/165	1.0	-	50	25	25	100	1.0	-	50	25	25	100
370/168	1.0	8	58	27	7	100	1.0	7	56	22	15	100
TOTAL	1.0	6%	73%	14%	7%	100%	1.0	4%	76%	8%	12%	100%

stabilize as their newer 1380 programmable controller finds user acceptance.

User Consideration of SNA

As a preliminary means of documenting the acceptance of the SNA concept, users were asked to indicate their company's current position by checking which of the following was the best description of its current stage of consideration of SNA: "not aware", "considering", "under study", "planning to implement", "implementing", or "considered and rejected". Table 9 presents the survey results.

Overall, only a small percentage of 370 users surveyed claimed to be not aware of SNA (6%). It was surprising that it was the 370/145 user base which registered the largest percentage on unawareness in the sample. Previous indications throughout the survey were that it was this segment of users which exhibited inclination to adopt elements of SNA.

Those indicating "aware" as the best description of their stage of consideration accounted for the largest single group of responses (33%). It was predominantly the smaller CPU sites registering such a response - other larger sites have gone farther in their consideration.

Recognizing that there perhaps are subtle differences separating some categories it may be more meaningful to consider responses to "Considering" and "Under Study" as one stage, although the intent was that "Under Study" indicating one step further along the consideration scale. In fact it did appear that, for those not yet having made specific plans to implement SNA, a larger percentage had gone to the "Study" stage than those merely considering (18% vs. 14%).

TABLE 9

USER CONSIDERATION OF SNA

CPU Model	No. In Sample	% Not Aware	% Aware	% Considering	% Under Study	% Planning To Implement	% Implement-ing	% Considered & Rejected	Total
370/115	3	-	100%	-	-	-	-	-	100%
370/125	6	-	50	17%	-	-	-	33%	100
370/135	15	-	60	7	-	13%	7%	13	100
370/145	55	13%	22	16	18%	11	11	9	100
370/155	22	5	45	18	9	18	-	5	100
370/158	68	3	18	13	26	21	13	6	100
370/165	7	-	57	-	29	-	14	-	100
370/168	18	6	31	13	25	19	6	-	100
TOTAL	194	6%	33%	14%	18%	16%	7%	7%	100%

While only 7% of all respondents indicated that SNA was currently under implementation, another 16% expressed plans to implement in the near future. As might be expected, it was the larger 370/15X and 16X who indicated most plans in this regard while none of the smaller 370/115 and 125 sites expressed such intentions.

Only 7% of all sites had considered SNA and rejected it to date. None of the very large 168 sites were in this category while a full third of the 125 sites, for example, felt SNA was not for them.

Pro's and Con's of SNA

As was previously stated, IBM has been touting the benefits of SNA since 1974. Respondents were asked to rank the following advantages from one to nine. (1 being highest rank, 2 being second highest, etc). Summary results are presented in Table 10.

- Improve terminal availability over current data communications facilities.
- Operate on both dial and leased line facilities.
- Gain the security posture you desire for your communications system.
- Employ all VS operating systems.
- Simplify communications system application development.
- Accommodate a variety of application types.
- Share lines and terminals, even with many mixtures of terminals.
- Utilize uniform structure for programming.
- Obtain the advantages of the built-in error recovery and maintenance characteristics provided in each system element.

The "sharing of line and terminals" was the top choice for first and second place with 55 and 38 votes respectively. Previously, batch and interactive applications required separate terminals and lines. SNA provides for a telecommunications environment that supports many different kinds of telecommunication devices. By eliminating costly duplication of resources, SNA provides for a more economical sharing of resources. It supplies a base for tying intelligent terminals and programmable controllers into a consistent telecommuni-

TABLE 10

USER RANKING OF SNA ADVANTAGES

ADVANTAGES	RANKING								
	1	2	3	4	5	6	7	8	9
Term. Avail	29	28	22	15	13	13	15	10	7
Dial & Leased	4	5	3	10	16	19	20	34	22
Security	3	6	9	9	21	20	34	27	13
VS Op. Sys.	5	4	5	9	10	13	13	29	52
Simplify C. Sys.	42	21	26	23	17	14	7	2	2
Acc. Variety Types	22	25	19	29	18	22	9	5	4
Sharing Lines & Terminals	55	38	21	17	13	7	5	6	2
Utilize Uniform Structure	10	18	25	26	17	19	15	9	16
Built-in Error Recovery	11	27	34	19	25	16	15	6	7

cation design. Such a design allows more flexibility in developing new applications, as it addresses all market segments, instead of being closed-ended i.e. for one specific application.

"Built-in error recovery and maintenance" took third place with 34 votes. The components of SNA can recover from many communication link errors without operator intervention, decreasing downtime.

Description of Company Position on SNA; the User Speaks

After asking respondents specific questions about components of SNA and probing for justification for their feelings on each, IDC wanted to attempt to capsulize their position on SNA. Our question asked for a fair description of their companies position on SNA and yielded the following representative remarks:

Those "Aware"

"When our communications network is more mature and host processing upgrade is indicated we will likely take advantage of SNA."

"We are in a wait and see mode. Not sure what it really means to our environment."

"We recognize the potential but are waiting for software shakedown and hardware cost reductions."

Those with SNA "Under Study"

"Worthwhile looking at. Must consider all cost angles before going ahead with SNA. No hurry, since we're satisfied with bisynch."

"As the on-line systems are developed, consideration will be given to the use of SNA as primary mode of teleprocessing environment. Will probably go to SNA in two to three years depending on industry acceptance and cost justification."

Those "Implementing" or "Planning to Implement"

"The way to go."

"We're an IBM shop, as IBM goes, we go."

"If industry goes, we go."

"Implement at a leisurely pace, and as the demand requires it."

"Going to SNA to gain flexibility and stay in the mainstream."

"The architecture is sound we will implement as fully as possible."

Although many enthusiastic responses appeared as replies to our query, a substantial number of people from all categories indicated that they were not really sure what SNA meant to their organization even if they were in the process of implementing. This indicates that there is still a great deal of public education needed on SNA to move people from the "I'm aware" stage to the ACTION stage, be the forthcoming action one of rejection or acceptance. Our feelings are that there are a great many more sites who could have benefited from a structure such as SNA's than those who indicated they were acting on SNA; lack of education seem to be the stumbling block. People need more information to be able to intelligently evaluate the meaning of SNA to their organization.

Application Conversion Timetable

Those users indicating present or planned implementation of SNA were asked to describe the application conversion timetable expected. Would whole networks convert to SNA, or just new applications? Would this happen quickly or gradually?

In the following discussion, a site could fall into the converting "old applications" as well as "all new" or "some new" category within the same year. Furthermore, the 1977 and 1978 groups take into account the upgrade of the senior CPU.

Very few users were found to be converting all their applications to SNA this year.

- Only one 370/145 user and one 370/155 user were converting all current applications in 1976. The remainder of the sites seem to be running dual environments with the conversion of old applications leading the way with fourteen sites indicating changeover to SNA. Highest conversion of old applications was found in the 370/158 (seven sites). The number of sites indicating all implementation of "new applications" and "some new applications" were six and eight sites respectively.

During 1977, thirteen sites indicated total conversion to SNA (10 were 370/158). Dramatic increases were also found in the conversion of old applications (23 sites) and the implementation of new applications (15) and some new applications (12 sites); in both cases, 370/158 sites were found to be leading the way.

In 1978, ten more sites were found to be totally converting to SNA with the largest number of conversions coming from within the 370/158 group (six sites). Consistently, the 370/158 group were found to be the leaders in all categories; in total, twenty-seven of this group were experiencing total or partial conversion to SNA during 1978.

In summary, there were more companies "testing the water" by either implementing "some new" or "all new" applications under SNA and/or converting "old" applications than there were undergoing total conversion. Conversion of old applications can be correlated with the high degree of conversion of their present 3270 terminals to SDLC indicated in our discussion of the Acceptance of SDLC. Furthermore, it would also appear that there is a logical connection between deciding on an application requiring new lines plus multi-application access and the decision to use SNA, or more specifically, a terminal that can only be run under SNA.

Disadvantages of SNA

The expressions of cautious implementation of SNA is further underlined by comments made by respondents when asked what they felt were the disadvantages of SNA for their organization. Those most often mentioned:

- "Increased hardware and software costs".
- "Lack of experience and support on vendors part".
- "Money, manpower, time".
- "Will force a larger system".

The true "costs" associated with SNA implementation are not fully known at this time although several indirect costs are probably "inevitable":

- The requirements of VS, VTAM, etc., require larger memory. Also, conversion to such elements was observed earlier as often coincident with migration to a larger CPU.
- The SDLC terminals cost more money.
- Need to retrain personnel such as system programmers.

Profile of SNA Users

To gain another perspective of the those sites "implementing" or "planning to implement" SNA, IDC decided to categorize them according to their standard industrial classification (SIC). Table 11 indicates that the top three industry sectors involved in SNA are insurance, banking, and manufacturing. All of the industries profiled had to be able to rapidly and reliably access information. Since communication is a key to profitability, they all need terminals designed for order entry, data retrieval, and data inquiry/response types of applications. IBM had designed industry-oriented terminals and cross-industry terminals to allow them to mix and match according to their needs and also supplied the SNA architecture to put the network together. In that regard, further analysis of the CPUs and terminals at leading SNA sites provided a profile of a site planning on implementing SNA. Those sites that had indicated they would not be implementing until 1978 were dropped from this part of the analysis as we had no data on their terminal network.

TABLE 11

INDUSTRY DISTRIBUTION OF SNA USERS

	# Within Category	Total #	%
1. Finance, Insurance, and Real Estate		18	31%
Insurance	9		
Banking	6		
Credit Agencies	1		
Ins. Agents, Brokers, Service	1		
Holding & Other Invest Offices	1		
2. Manufacturing		17	29%
Textile Mill Products	4		
Machinery, Except Electrical	3		
Primary Metal Industries	2		
Food & Kindred Products	2		
Tobacco Products	1		
Apparel & Other Finished Products	1		
Printing, Publishing	1		
Chemicals & Allied Products	1		
Rubber & Miscellaneous Products	1		
Measuring, Analyzing & Controlling Instruments	1		
3. Public Administration		8	14%
Public Finance, Taxation, and monetary policy	8		
4. Services		6	10%
1. Miscellaneous	3		
2. Business	3		
5. Retail		4	7%
General Merchandise	3		
Food	1		
6. Wholesale		3	5%
Durable	2		
Non-Durable	1		
7. Transportation - motor freight		2	4%
		58	100%

Table 12 demonstrates again that the largest usage of SNA is associated with the larger host mainframes.

- Twenty-seven of the forty sites in the sample were 16X or 15X senior hosts (68%).

During 1975, few of the industries demonstrated any extensive usage of SDLC on their terminals. However, in 1977, usage of the SDLC version of the 3270 terminal jumped dramatically in all cases. The banking, government, and services industries had all indicated substantial usage of SDLC. The manufacturing industry which had one site utilizing SDLC in 1975 had nine of their ten sites with SDLC compatible 3270 by yearend 1977.

All of the banks in our sample by yearend 1977 would have installed the 3600 Finance Communication system. The 3650 Retail Store system and the 3660 Supermarket system accounted for the 36XX usage shown by the retail industry in 1977 and 1975. Two of the government sector sites showed usage of the 3767 along with the 3780. The 37XX usage shown by the manufacturing consisted of all 3770 data communication terminals. Usage of the 3790 Communication System was strongest among the insurance, manufacturing, and service industries.

TABLE 12

EQUIPMENT PROFILE OF SNA USERS

	CPU Usage at 12/77					% Sites With Devices Under SDLC Currently				% Sites With Devices Under SDLC at 12/77			
Sites by SIC	16X	15X	14X	13X	TOTAL	327X	36XX	37XX	3790	327X	36XX	37XX	3790
Insurance	3	2	2	-	7	14%	-	-	14%	14%	14%	[1]56%	42%
Banking	-	3	1	-	4	-	*50%	-	-	50%	*100%	-	-
Manufacturing	3	3	2	2	10	10%	-	-	10%	90%	-	[1]40%	70%
Government	1	4	1	-	6	-	-	-	-	83%	-	[1]49%	17%
Services	2	2	1		5	-	-	-	20%	80%	10%	20%	40%
Retail	-	-	3	1	4	-	+25%	-	-	50%	+ 50%	-	-
Wholesale	-	2	-	-	2	-	-	-	-	100%	-	-	-
Transportation	-	2	-	-	2	-	-	-	-	-	-	[1]50%	-
TOTAL	9	18	10	3	40								

*Represents 3600 Usage
+Represents 3650 Usage
[1]Represents 3767 Usage

INTERNATIONAL DATA CORPORATION
214 THIRD AVENUE
WALTHAM, MASS. 02154
(617) 890-3700 ☐ TELEX 92-3401

August 1, 1976

Dear Data Processing Executive:

What are your thoughts on these challenging questions?

- Will SDLC become an industry standard?
- Will SNA become a way of life for network enthusiasts?
- Is SNA cost-effective?
- Will whole networks convert to SNA, or just particular applications?

International Data Corporation, Publisher of "Computerworld" and The Data Communications User seeks your valued input in attempting to put such issues into perspective and would be glad to share other users' thoughts and plans with you.

As a thank you for filling out the enclosed questionnaire, we will send you a summary of our findings. All replies will be held confidential and used for statistical purposes only. A self-addressed, postage paid envelope is enclosed for your convenience

Thank you for your cooperation.

Sincerely,

Sandi Steere

Sandi Steere
Market Research Analyst

SS:d
Enclosure

Circle Area

Data Processing Management
Data Communications Management
Information Systems Management
Other_____

1. Please identify the IBM 360/370 computer system now in use and indicate the operating system and access method currently employed. Also, please indicate the same information for systems in use at 12/77.

Current			12/77		
Mfr./Model	Oper. System	Access Method	Mfr./Model	Oper. System	Access Method

1a. If planning to convert to Virtual Storage, please indicate reasons.

_____

_____

_____

1b. If converting to VTAM, please indicate reasons. _____

_____

_____

2. Does your organization use or plan to use data communications?

[ ] Now use [ ] Plan to use
[ ] Not using [ ] Not using and not planning to

If you indicated that you are NOT USING AND NOT PLANNING TO USE data communications, please return the questionnaire in the envelope provided.

Otherwise please continue . . .

3. Please identify as completely as possible the terminals now in use in the entire network of your organization by manufacturer/model, quantity, and line discipline. Also indicate the same information for 12/77.

Current			12/77		
Mfr./Model	Qty.	Discipline (BISYNC, SDLC, etc.)	Mfr./Model	Qty.	Discipline (BISYNC, SDLC, etc.)

4. Please indicate the communications controllers now in use in your organization by manufacturer/model and quantity. Also, indicate the controllers that will be in use in 1977.

Current		1977	
Mfr./Model	Qty.	Mfr./Model	Qty.
_____	____	_____	____
_____	____	_____	____
_____	____	_____	____

5. Are you now or are you planning to utilize SDLC-synchronous data link control?

Utilize Now: [ ] Yes [ ] No Plan to Utilize: [ ] Yes [ ] No

a. If YES, please indicate your primary reasons:

[ ] increases communications commands
[ ] common format gives flexibility of information length
[ ] flexibility of network configuration (point-to-point or multipoint)
[ ] comprehensive detection and recovery procedures
[ ] other -- please describe _____

_____

b. If NO, please state reasons: _____

_____

6. Do you feel that SDLC should be the industry standard line discipline?

[ ] Yes [ ] No Why or why not? Please describe. _____

_____

_____

7. In October, 1974, IBM announced SYSTEM NETWORK ARCHITECTURE, also hailed as its "blueprint for teleprocessing." Please check the phrase that is the best description of your current stage of consideration of SNA.

[ ] not aware
[ ] aware
[ ] considering
[ ] under study
[ ] planning to implement
[ ] implementing
[ ] considered and rejected

7a. If you indicated that you are PLANNING TO IMPLEMENT or IMPLEMENTING, which applications will be involved and in what time frame?

1976	1977
[ ] will convert all applications	[ ] will convert all applications
[ ] will convert some applications	[ ] will convert some applications
[ ] all new applications	[ ] all new applications
[ ] some new applications	[ ] some new applications
[ ] Other _____	[ ] Other _____

1978

[ ] will convert all applications
[ ] will convert some applications
[ ] all new applications
[ ] some new applications
[ ] other _____

7b. Are there any specific types of applications that are better suited for SNA implementation than others? Please describe. _____

8. According to IBM, the following factors are major advantages of SNA. Please indicate, in rank order, each factor's importance to your organization (1 is highest rank, 2 is second highest rank, etc.).

[ ] Improve terminal availability over current data communications facilities.
[ ] Operate on both dial and leased line facilities.
[ ] Gain the security posture you desire for your communications system.
[ ] Employ all VS operating systems.
[ ] Simplify communications system application development.
[ ] Accommodate a variety of application types.
[ ] Share lines and terminals, even with many mixtures of terminals.
[ ] Utilize uniform structure for programming.
[ ] Obtain the advantages of the built-in error recovery and maintenance characteristics provided in each system element.

8a. What disadvantages do you feel SNA has for your organization? _____

9. Considering the advantages and disadvantages you have indicated, what would you say is a fair description of your company's position on SNA? Please describe. _____