Startup Expected by April

Trading System to Link Five Stock Exchanges

By Tim Scannell
CW Staff

WASHINGTON, D.C. — A computer-based market-connecting system that will link five major stock exchanges across the country is scheduled to become operational by April.

Developed by the New York Stock Exchange (NYSE) in accordance with guidelines mandated by Congress in The Securities Acts Amendments of 1975, the Intermarket Trading System (ITS) will connect the New York bureau with those of the American, Boston, Philadelphia and Pacific stock exchanges, an NYSE spokesman said.

Although ITS hasn't been hailed as "the" national market system or even a major improvement, the exchanges are cooperating with one another in an effort to ease Congressional pressure and deflect Washington charges of footdragging on the issue.

Basically, the intermarket system would work this way: If a broker on the NYSE receives an order to sell 50 shares of a particular stock, he will first check the current price offered on the New York exchange to see if it meets or exceeds the price at which he is willing to sell. If the broker is not satisfied with the New York price, he can then check the quote display of the ITS terminal and see if some other market is able to match his price, the spokesman explained.

If New York is unwilling to equal the better price, the broker can then send a message to the other exchange, via ITS, stating his interest in selling at its price. If no intervening trade has occurred, changing the selling figures, the trade is executed and confirmed in as little as 30 seconds, the spokesman said.

Communications Control

Communications between the exchanges will be handled by a centrally located T/16 dual processor manufactured by Tandem Computers, Inc., a spokesman explained. Participants will initially access other stock exchanges via AT&T Dataspeed 40 terminals linked to the computer, probably located in New York. Bureaus will have as many terminals as they think are needed in order to receive and transmit the various price quotes.

Implementation of ITS is being coordinated by the Securities Industry Automation Corp. (Siac), a firm owned by both the New York and American stock exchanges. With such a system, "orders have a greater chance of achieving the best price for customers, no matter where they are," Lee Amaya, president of Siac, said. "I think it's absolutely the best way the market centers can 'break the ice' with regard to a national market system," he observed.

Not only will ITS "provide a basis for free competition among all the exchanges" but it will also allow brokers on participating exchanges free access to all trading floors without having to buy a membership, Amaya stated. A typical membership on the NYSE, for example, currently costs approximately $50,000.

One potential problem that might occur would involve establishing brokers' commissions.

For instance, if a number of stocks are bought or sold on the Pacific exchange by a broker on the Boston exchange, to whom should the commission be given and on what market rate should that commission be based?

"That's a policy sort of thing," Amaya noted. "It is my opinion that every market place will have its own policies and negotiate its commission structure with whomever the customer is."

"They [presently] have a so-called operations committee and will eventually, no doubt, have a policy committee" governing the conduct of the participants, he observed.

Although Amaya would not elaborate on the total cost of the intermarket system, he did say that individual expenses would be based on the number of trades within each exchange. Since the NYSE handles about 86% of the trades, "you can see who's going to pay the lion's share of the cost," Amaya said.

Honeywell Adds Data Dictionary

PHOENIX — Honeywell has added a data dictionary to its Integrated Data Store/1 data management system which is claimed to enhance the use of data bases by application programs.

The new software consists of routines that analyze Cobol, Index Sequential Processing (ISP) and other source programs to determine what data elements a program uses and how each data element is used within the program.

The package requires 48K words of memory for implementation and will be available during the fourth quarter of 1978 for a license fee of $14,500. The fee includes system and program documentation, but does not include training or support, Honeywell said.

The data dictionary is the first Honeywell has introduced for the IDS/I system, but the firm would not comment when asked if a data dictionary were planned for the more recently introduced IDS/2.

The new package, Honeywell claimed, features exception processing and privilege deletions via pass-word protection.

Interactive Data Names President

WALTHAM, Mass. — Interactive Data Corp. has named John J. McElroy as president, replacing Jack A. Arnow who resigned to pursue academic interests.

Mr. McElroy has served for the last 5 years as a director and vice-president of the firm, which specializes in computer-based financial and economic services. He was also a vice-president of the Information Services group at Chase Manhattan Bank, which owns Interactive Data, a spokesman said.

At Chase Manhattan, Mr. McElroy was responsible for marketing and international expansion of several information services subsidiaries including Interactive, Chase Econometric Associates and Chase World Information Corp.

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Comshare to Hike Interest in Europe, Canada Affiliates

ANN ARBOR, Mich. — Comshare, Inc., here, said it has entered agreements to increase its ownership to 100 per cent of its European affiliate and to 27 per cent of its Canadian affiliate.

The moves follow an early-October denial by the Canadian government of a move to increase ownership of the Canadian firm, Comshare Ltd., to 79 per cent.

Under the first agreement, Comshare here said it would issue 407,156 shares of common stock to Comshare Ltd. in exchange for the Canadian firm's holding in Comshare CIBV, the European affiliate.

Under the other agreement, Comshare will purchase from Polysar Ltd., Sarnia, Canada, 16 per cent of the outstanding stock of Comshare Ltd. in exchange for 45,244 Comshare common shares and an option to purchase up to 60,000 more shares at $16.50 a share. As a result of that transaction, Polysar's remaining holdings in Comshare Ltd. will be 52 per cent, a spokesman said.

The first agreement, covering the takeover of the European affiliate, has been approved by the boards of directors of both companies and will be submitted for approval by the shareholders of Comshare Ltd., the spokesman said.

Comshare last month said the Canadian Cabinet had rejected the company's application to increase ownership in the Canadian affiliate from 11 to 79 per cent (EN, Oct. 9). The government's reasoning was that the application failed to show sufficient benefit to the country to be acceptable, Comshare claimed then.

At that time, however, the firm said it was exploring alternative methods of increasing its ownership in Comshare Ltd.

Richard L. Crandall, Comshare president, said the firm will report consolidated U.S. and European results beginning in the second fiscal quarter ended Dec. 31, 1978. Revenue for the past fiscal year ended June 30, 1978, if consolidated, would have been $38.9 million. Consolidated revenue for the most recent quarter ending Sept. 30, 1978, would have been $11.9 million, up 54 per cent from the like period a year ago.

Mr. Crandall also noted that, on completion of the Canadian shares purchase, Comshare will report 27 per cent of Comshare Ltd. earnings, using the equity method of accounting.

He added "Although consolidation of results will only apply to part of the current fiscal year, we are aiming at approaching the $50 million level while achieving at least 30 per cent growth in earnings per share."

The company said it would still be able to increase its ownership in the Canadian affiliate, despite the denial last month by the Canadian cabinet of a previous plan. In addition, the previous plan would have limited ownership in the European Comshare to 80 per cent, as compared with the 100 per cent currently expected.

GSA Awards Xerox $2M For System 1200 Printers

EL SEGUNDO, Calif. — Xerox Corp. was awarded a negotiated contract valued at $2,040,000 to supply 17 of its Model 1200 computer printing systems to the U.S. General Services Administration.

The printers, which produce computer output from magnetic tape at up to 4,000 lines a minute, will be used in general business applications, such as accounting, inventory control and payroll at 10 GSA regional centers. The printers are scheduled to be installed by Dec. 1.

A GSA spokeswoman declined to disclose names of competing bidders.

BOWNE GROWN: Microcomputer (left), designed to interface CRT terminal with Bowne Time Sharing's mainframe, is part of the firm's new correspondence management system. The new offering is claimed to help users create and print letters using software-prompted instructions. The microcomputer, designed and built in-house by Bowne with a Motorola chip, performs prompting, dial-up and screen handling functions. Bowne claims the system is aimed at large firms requiring stockholder communications, trade notification or publication distribution.

CompuServe Gets $4.6M ICC Pact

COLUMBUS, O. — CompuServe, here, said it has been awarded a $4.6 million, 5-year contract to provide computer services to the Interstate Commerce Commission.

The firm said it would provide the commission with services to handle a case history system designed to track the transportation industry. Backing CompuServe up will be CallData Systems, Inc., Woodbury, N.Y., which will act as a secondary contractor, a spokesman said.

The ICC services contract was formerly held by Automatic Data Processing, the CompuServe spokesman said, noting that contract expired this month.

Comp. Sciences Let Navy Pact

EL SEGUNDO, Calif. — Computer Sciences Corp., here, said it has won a follow-on contract which, with four 1-year renewals, would be worth approximately $12.2 million over the 5 years to provide the Navy with data processing services at the Naval Ocean Systems Center in San Diego.

The 1-year contract contains four annual renewal options worth $2.4 million each, the firm said. It continues support the company has provided the naval center under contracts since 1969, including mathematical analysis, data reduction, program development and computer operations.

The contract was awarded by the Naval Regional Procurement Office in Long Beach, Calif.

Optimum Systems Books BLS Pact

SANTA CLARA, Calif. — Optimum Systems, Inc., here, has been awarded a contract to perform production processing of statistics for the Department of Labor, Bureau of Labor Statistics..

The contract, which Optimum claims will give it revenue exceeding $2 million per year over its 5-year term, covers all processing the bureau cannot support on its own facilities. The bureau currently has an annual data processing budget of $7 million of which approximately three quarters is expended for outside services.

The contract will provide services from Optimum's Washington Data center which recently installed an IBM 3033 processor, the firm said. Other time-sharing clients will use a 3031, it was said.

Tandem Offers Operating System For NonStop Unit

NEW YORK — Tandem Computers has added a new operating system to its NonStop computer which permits linkage from single sites into networks.

The new operating system, called Expand, can link a single system with up to 255 geographically dispersed locations, via full-duplex telephone lines or virtual circuits of an X.25 network. Cost of the new operating system is $1,500 per processor for microcoding and a $10,000 licensing fee.

Sam Weigand, the Cupertino, Calif., company's vice-president of marketing, said the most important feature of the Expand network was the dynamic routing and re-routing feature that prevents breakdowns in the system by automatically moving data over alternate lines should there be a breakdown in a communications link.

The company said customers are free to choose which lines they will use to link the various Tandem computer sites once Expand has been added to the computer.

Up to 16 Tandem-16 computers containing a maximum of two megabytes per processor can be connected at a single site, the company said, giving the user the capability to attach to as many as 4,080 processors with the Expand network.

Mr. Weigand said the market size for the failsafe redundant dual-processor small computer market would be about $700 million in 1979.

With the network system capabilities added to Tandem's 16, however the company would be able to tap the distributed data processing market, which he predicted would grow from about $7.5 billion in 1979 to nearly $30 billion worldwide in 1983.

Another software option added to the Tandem computers last week was a non-procedural language called Enform which allows users without previous programming experience to make ad hoc queries with simple requests in English statements.

Enform will be available in March, 1979, and sells for a $7,000 license fee plus a $1,500 microcode fee per processor.

Names Marketing Chief

SANTA CLARA, Calif. — Optimum Systems, Inc., here, said it has named James Zahoudanis national director of marketing. He replaces Anthony Chacharone who left to take a sales management position in Europe with Control Data, a spokesman said.

Mr. Zahoudanis, who will report to William R. Roach, executive vice-president, was most recently district manager for northern California, the spokesman said. Computer Utility branch offices will report to him.

Sci. Time Sharing to Offer 370 Compatible System

By JOHN VERITY

BETHESDA, Md. — Scientific Time Sharing Corp., here, plans to market next year a 370-compatible computer with its APL/Plus time-sharing software for in-house use by existing customers, it was learned last week.

The company is evaluating several plug-compatible systems in the "mini" class, including those offered by Two Pi and Magnuson Systems, and plans to deliver its first system "early next year," a spokesman said. The firm's APL/Plus software and enhancements to IBM's standard VS/APL package also will be offered for in-house use by customers currently using its time-sharing services, the spokesman added.

Scientific expects to choose its hardware within 2 months and until then pricing information would not be available, said Robert Cook, vice-president of planning.

The firm joins Automatic Data Processing and National CSS as traditional remote computing services firms offering computers for user-site installation. ADP and NCSS, which disclosed their hardware plans earlier this year, expect their proprietary software to be primary marketing factors, as does Scientific.

Mr. Cook said the three APL products will be offered under the name Triad and will be aimed at users desiring in-house APL time-sharing in one form or another.

Cites Factors

Asked why current time-sharing users would choose to bring APL in-house, Mr. Cook said factors such as cost and hardware control appeared forefront in users' minds. However, he said his calculations show that in-house systems may cost more than time-shared mainframes in the long run.

Many of the firm's customers, he said, have said they want to bring APL in-house and the firm is responding to those wishes. Some users claim they want to maintain a single corporate data base, he noted, adding that much of their desire is a *"mind set."*

Although the marketing of in-house software and hardware is expected to take away revenues from the APL/Plus time-sharing services currently offered, the overall impact of the new marketing venture is expected to be positive.

Scientific went public several weeks ago (EN, Sept. 11) with an offering of 500,000 shares of common stock.

The company's APL/Plus software, which is designed for commercial and scientific users, would be offered for use as a virtual machine on in-house 370s or their equivalents, Mr. Cook said. The software would not be run as in native mode nor would it run under VM/370's CMS interactive monitor.

Outgrowth

The software, he noted, is an outgrowth of an APL system IBM released some 9 years ago as an experimental version. Scientific, which has specialized in APL services, runs the software with many enhancements and additional features on an Amdahl 470V/6 and an IBM 148, here.

The firm's plans for VS/APL, which runs under VM/370 and is one of the most popular versions of the language offered by IBM, would include adding new formatting routines, file handling features and system utilities, many of which have been developed for APL/Plus.

Customers would be required to order VS/APL from IBM and then install Scientific's enhancements, it was explained.

Several universities and government agencies, which Mr. Cook declined to name, are currently using APL/Plus on their own computers.

Comp.Sci. to Offer Personnel Pack

EL SEGUNDO, Calif. — Computer Sciences Corp., here, said it has obtained exclusive worldwide marketing rights to provide the InSci Human Resource System on its Infonet time-sharing network.

The personnel management software was developed by Information Science, Inc., a New Jersey consulting firm, and is said to help users comply with government employment regulations. Information Science claims to have installed the package at some 400 companies.

In another development, Computer Sciences said it has named Daniel Toth vice-president for communications industry marketing for the Infonet division.

Mr. Toth, who takes over from Erwin L. Allen, who left the firm, will be responsible for marketing time-sharing services to units of AT&T and independent telephone companies. He was most recently district manager for Infonet and was responsible for nine offices in western states.

The district manager post has not been filled, the firm said.

Xerox Comp. Adds Inventory System

LOS ANGELES — Xerox Computer Services, here, has added an inventory management system to its on-line offerings for distributors.

The new system is designed for large distributors maintaining extensive inventories and enables users to set customer service levels and meet them with minimal inventory investment.

The system is offered nationwide for Xerox' standard package charges, a spokesman said. Included is a requirements planning program that provides planning aids, such as cash-flow projections and replenishment planning for product introduction or special product promotions.

Data 100 System For Terminals

MINNEAPOLIS — Data 100 Corp. has introduced a new operating software package for its Model 76 and 78 terminal systems that reportedly allows them to emulate the IBM 3776 remote batch terminal with binary synchronous line protocol.

The software package is available immediately at no charge, Data 100 said.

It can be used with a basic Data 100 remote-batch terminal system — which includes a keyboard-CRT unit, 4,800-bps binary synchronous communications protocol, a systems diskette and a data diskette — or with systems having additional peripherals, the firm said.

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BUSINESS

DDS/Wespercorp Merger Off

By Bob Citelli

ANAHEIM, CALIF.—Wespercorp has terminated merger negotiations with Diversified Data Systems, Inc., a business applications software company located in Tuscon, Ariz.

According to statements made last month by Wespercorp president Randy Knapp and DDS president Don Wyatt, the two firms were to have merged, with DDS retaining its name as a semi-autonomous division of the Anaheim-based peripherals manufacturer. Consideration was given to relocating the Tuscon company to Orange County, Calif., as well.

With the failure of the talks, Knapp asserted, "there's nothing negative about this announcement. Both companies left the negotiations on good terms." He explained, "DDS is a profit-oriented entity. It is successful at what it does. It has been a profitable entity over the last seven years, and it is strongly managed. We felt it was our kind of business." Knapp suggested that one reason for the talks' failure was that "the two companies weren't matched in terms of management." He added, somewhat cryptically, that "gasoline is good and fire is good, but if you mix them they sometimes blow up."

He noted that Wespercorp "is always interested in expanding its business," but has made no plans to merge with any other firm.

DDS' Wyatt agreed with Knapp's assessment of the situation, claiming, "there were some potential advantages to the merger, but there were also some potential dangers. There are always dangers when two companies that are similar but not the same get together."

Wyatt noted, "We were not actively looking for a merger partner when we began talking with Wespercorp, and we're not actively seeking a merger partner now. If someone is interested in us, we'll listen to them, but it's important that we get the right bid."

Knapp indicated earlier (CSN, Oct. 10) that merger interest originated when Wespercorp evaluated and then installed a DDS business management system. That system, an on-line data base-oriented manufacturing control system called Summit, will be DDS' primary product in 1979.

Micor Ponders Sale

(Continued from Page 1)

quit in September Castleberry's objective, Munyan said, was to sell all of Micor, thinking that both he and the six-year-old company would be better off under a computer firm than under a hotel chain. Micor had tered lines of business far out- the hotel industry that Ram- never envisioned and that en't all profitable," accord- o the acting president.

Micor's parent company however, apparently never thought of selling the subsidiary or any part of it. Castleberry's resignation, which seemingly stemmed from the acquisition attempt, was followed by a statement from the president of Ramada Inns. William Isbell, disavowing corporate interest in completing any sale. A number of companies had been negotiating and all but two—the two still bidding—disappeared from the scene, Munyan said.

Despite the fact that the impetus for the sale has come from the outside, Munyan, who added the temporary presidency to his own job as Ramada's vice president/Information Systems, said that the stress of endless meetings and constant rumors is so great after one month's time that Micor's management "literally can't stand it anymore." And although he said he was not going to predict anymore, he ventured that by this week the company would either have an agreement in principle worked out or would have walked out of the talks altogether. He figured either way had a 50 percent chance of happening.

He thought Ramada would be foolish to sell certain parts of Micor. Ramada has reportedly said that its computer-based product line had "substantial" operating losses throughout the year, although it would not specify the size of the loss. The ventures that were losing money, Munyan claimed, were not involved with its computer operations but rather entities like its music synthesizer, which "burned up cash" and is being sold to its inventor, and Condominiums In America, a Hawaiian subsidiary that brokered real estate for travel agencies and has also been sold.

Bell Labs Eyes $8.8M Cray-1

BLOOMINGTON, MINN.—Cray Research, Inc., said it is reserving a Cray-1 computing system valued at about $8.8 million for Bell Laboratories.

The sale is subject to completion of contract negotiations by February 1979. The system would then be installed by the end of 1979.

According to a spokesman for Bell Labs, the system was reserved through a letter of intent and will be used in the company's Murray Hill, N.J., research and development plant for numerical calculation.

Centronics: Lower Qtr. Sales, Net

HUDSON, N.H.—Centronics Data Computer Corp. announced that earnings for its fiscal quarter ended Sept. 30, 1978 were expected to be lower than the 53¢ per share reported for the first fiscal quarter of the previous year, due to production delays which have now been resol

The delays resulted in a sl rtfall of almost $2.5 million in sales that were scheduled for delivery in the first quarter. The company stated that production was adversely affected by a shutdown.

MSL Absorbed By Microdata

IRVINE, CALIF.—In an attempt to recoup a $1.7 million debt owed it by MSL Software Microdata, Inc., a computer hardware manufacturer, took over the operations of its number one dealer last month.

According to informed sources, MSL, a Microdata dealer for the past four years, went into debt to the hardware manufacturer because Microdata cut down its equipment delivery between September 1977 and January 1978. Previously, MSL had received a monthly order of eight machines, but during this period it received only three.

The New Jersey software house, whose 1977 revenues stood at $6.7 million, then found it did not have enough machines to sell to break even at the end of each month. Since MSL had to meet its payroll, it fell behind in payments to Microdata. Microdata senior vice president Al Cosentino denies that there was a slowdown in deliveries, and pinned MSL's financial problems on its inability to adequately raise capital.

Several dealers CSN spoke with agreed that Microdata was slow on shipments during these months and that many other dealers were also hurt. However, other dealers contacted supported Microdata's view and contended that certain dealers were hurt because of their own poor business practices.

Meanwhile, Pick & Associates, of Irvine, Calif., a software development and systems engineering firm, filed a $90 million countersuit against Microdata.

Microdata's suit, filed in August, charged Pick with misappropriation of trade secrets and asked for $10 million in damages.

Pick now alleges that the Microdata complaint was made in an attempt to force Pick out of competition. Both companies sell computer systems based on the Reality software which Pick says it developed.

Business Briefs

Sperry Univac

NEW YORK—Sperry Univac expects its overall computer profits to double during the next five years, with its commercial revenues showing a 75 percent increase, according to Richard L. Gehring, president of Sperry Univac computer operations and an executive vice president of the parent company, Sperry Rand Corp.

Gehring told a group of security analysts here that profits for the current fiscal year, ending next March 31, should show a 20 percent jump in overall revenues and a 15 percent gain in commercial bookings over last year, and that the same rates of increase are expected to be shown annually over the next five years. Gehring added that profit margins are also likely to improve.

"Our growth should be spread across all major markets," the executive said, "with large-scale systems particularly strong."

Another company spokesman commented, "Our strength has always been in our large-scale systems, but our optimism is now based on the broad spectrum of Sperry products.

"We intend to emphasize our image as the alternative to IBM...no other competitor offers the soup-to-nuts product range that we do."

Measurex Corp.

CUPERTINO, CALIF.—Measurex Corp., manufacturers of computer-based process control systems, announced plans to open a manufacturing plant in Japan. Measurex Japan Ltd., one of its wholly owned subsidiaries, has purchased a 74,000-square-foot factory and office facility near Tokyo.

David Wilkinson, president of Measurex Japan Ltd., said, "This will enable us to improve our capability in serving the growing Japanese market for process controls." He further pointed out, "Once the plant is operational, Measurex will be in a good position to serve the Far East market, including Taiwan, Korea and the Philippines."

Measurex has sold about 50 process control systems in Japan, many in the pulp and paper industry. Japan is the world's second largest paper producer. Measurex is engaged in the design, development, manufacture and worldwide marketing of its systems for use in the pulp and paper industry.

The Japanese facility is expected to open next April.

Varian Associates

PALO ALTO, CALIF.—Varian Associates, Inc., has reached a preliminary agreement with Benson S.A. of France to combine the activities of its graphics division with those of Benson.

The financial details of the transaction were not disclosed, and Varian does not expect the agreement to be finalized until January. Varian said the agreement calls for it to exchange its assets in the graphics unit for a minority interest in Benson. The agreement is subject to the approval of both companies' boards, as well as the government's.

Benson S.A. is a privately held company that was once part of an American firm since dissolved. According to Varian, Benson's products are said to be similar to CalComp's product line.

Allegheny Ludlum

PITTSBURGH—An Altadena, Calif., computer peripherals manufacturer will be purchased early next year by Allegheny Ludlum Industries for an undisclosed amount.

An agreement in principle has been reached between Kennedy Co., which may reach $25 million in peripheral sales in 1978, and Allegheny Ludlum. Reportedly, Kennedy will retain its identity and leadership. It is expected to become part of the General Industries Group of Arnold Engineering, an Allegheny Ludlum division, which produces magnetic and electronic products.

Martin Marietta

BETHESDA, MD.—Martin Marietta Corp. said it and U.S. Filter Corp. terminated their previously announced agreement whereby Martin Marietta intended to sell its 20.7 percent equity interest in Bunker-Ramo Corp. to U.S. Filter for about $27.4 million. Bunker-Ramo, Oak Brook, Ill., is involved in electronic parts and information systems and services.

Martin Marietta reported that the decision to terminate the agreement occurred after the companies decided that completion of the transaction wouldn't necessarily be in their "longer-term best interests."

Tandem Computers

CUPERTINO, CALIF.—Tandem Computers, Inc., will put about 600,000 common shares on the block Nov. 10 in an effort "to finance growth in inventory and accounts receivable."

According to company spokesperson Jean Wohlers, "Approximately 400,000 shares will be sold from the company account. The company, which has 3.9 million shares outstanding, may also offer another 200,000 shares. Tandem's financial vice president Jack Loustaunou explained that the additional shares would be offered by "investors in Tandem who hold piggyback rights with their stocks. We will know by Nov. 10" exactly how many shares are for sale.

Loustaunou claimed the revenues generated from the sale (which could total more than $18.5 million) would be used to purchase computer peripherals and semiconductors.

Japan's Computer, Peripheral Exports Rocket

TOKYO—The Japanese are continuing to export computers and related equipment to the United States at a rocketing rate, according to figures recently released by the Japan Tariff Association.

Many Japanese companies have entered into agreements with American OEMs to market a broad range of computer components and equipment. Several of these firms have also established sales subsidiaries in the United States.

Industry analysts believe that Japan's strategy is to do business with OEMs in order to prepare the way for selling full systems.

Commenting on the situation, IBM's Chairman Frank T. Cary remarked, "We'll see them [the Japanese] everywhere in the world." James Riley of Dataquest Inc., a market research firm, said, "The Japanese are dead serious. If anyone questions whether their conquest of the color TV and motorcycle markets can be duplicated in the computer market, the answer is yes."

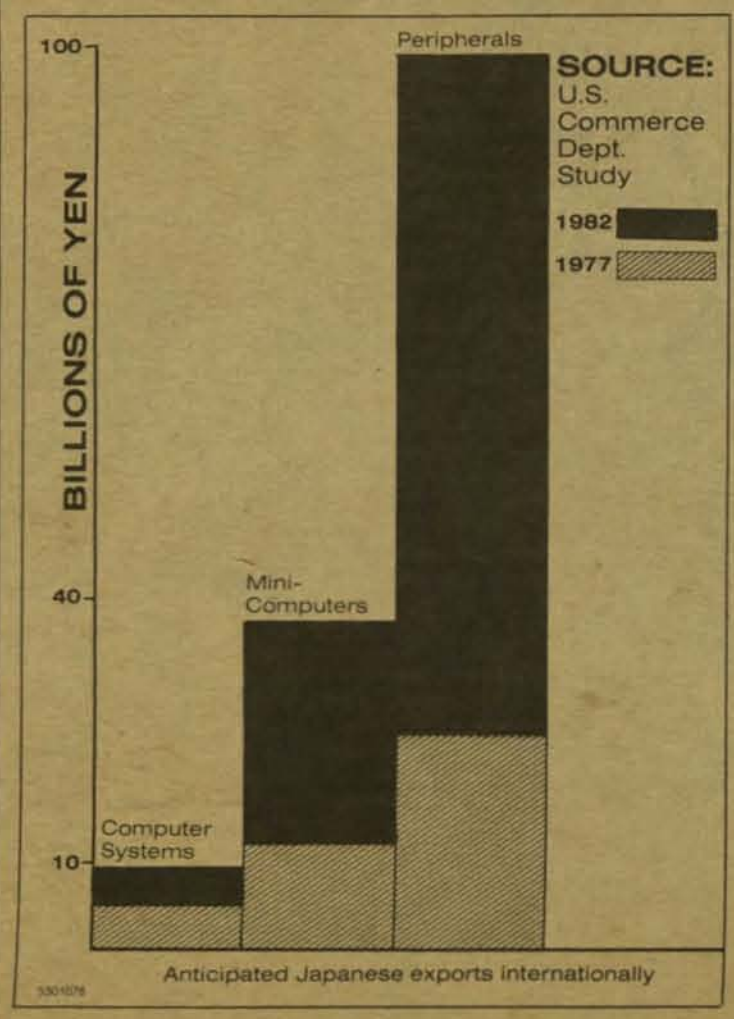
The *International Economic Report of the President* states that the Japanese "are expected to become the chief and possibly only foreign competitor of the U.S. in all varieties of computers and related equipment products by the mid-1980s."

The Japanese government offers further support for Japan's export strategy. The Ministry of International Trade and Industry (MITI), the government office that plots Japan's economic future, has declared that the information industry is the important industry of the future and has openly set its goal of increasing computer exports at the fantastic rate of 30.4 percent a year through 1985. By then, the ministry hopes, Japan will be exporting 16 percent of its production, worth $2 billion a year.

Japanese firms have been a prime stimulant to the growth of U.S. computer imports since 1976. After capturing over 55 percent of their own domestic market, Japanese computer firms have felt confident enough to embark on an ambitious program to increase their exports. As a result, U.S. imports from Japan rose from near obscurity in 1970 to 25 percent of total imports in 1977. This placed Japan on a par with Canada, traditionally the principal source of U.S. computer imports.

Japan made its greatest jump in production of computer equipment in 1976. It rose to almost $2.1 billion, a 14 percent increase. Of special note was a 39.5 percent increase in production of peripheral and related equipment. Exports, which amounted to 7 percent of total production, increased 68 percent to $148 million, and peripheral and related equipment rose 230 percent to $107 million.

In 1976-77, Japanese companies made major strides in overseas markets by establishing sales subsidiaries, often in cooperation with U.S. computer companies, and by obtaining contracts from U.S. OEMs to supply U.S. companies with Japanese-made equipment.

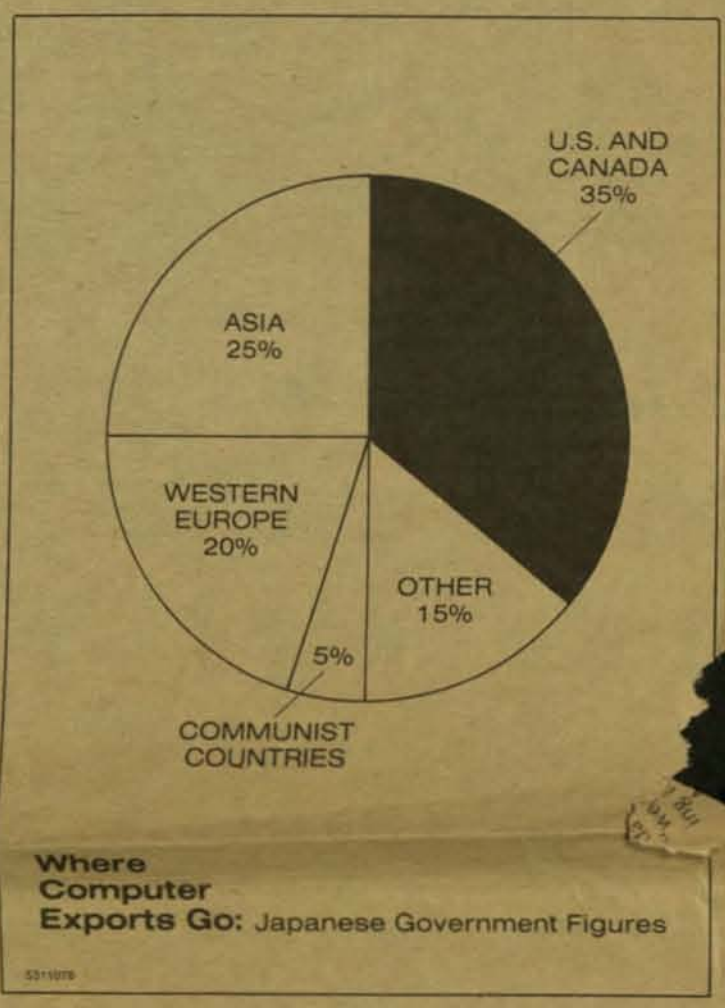


Japan's efforts to develop a competitive computer industry and its high protective tariff on imported peripheral equipment have made it nearly self-sufficient in peripheral equipment. This follows Japan's previous strategy of self-sufficiency prior to extending itself into international markets.

Over the years, the Japanese have moved from shipping mainframes to shipping relatively simple products such as low-speed printers and standard memory devices. Their aim, many industry analysts believe, is to gain an understanding of consumer needs and build up slowly, even if they have to sell at a loss. Once they have secured a foothold, they hope to capture more lucrative market segments.

It's this kind of thinking that scares many U.S. industry observers. The Japanese plan calls for building up tremendous volume in just a few segments of overseas markets, such as memory products. In time, their experience in those specialties can be transferred to other products.

Fujitsu, Japan's leading computer company (1977 DP sales $1.4 billion), has continued its relationship with Amdahl Corp., of which it owns 28.5 percent, with the formation of Amdahl International. The charter of the corporation calls for the marketing of Fujitsu equipment in all countries of the world except Canada, the U.S., Japan and Spain. Fujitsu plans to sell over $20 million worth of peripherals to U.S. firms.



Where Computer Exports Go: Japanese Government Figures

JAPANESE — EXPORT OF COMPUTERS AND RELATED PRODUCTS TO THE UNITED STATES

	1976	1977	½ 1978
Category (1) Central processing units for electronic automatic data-processing machines with self-contained input and output unit.	$4,266,869	$4,781,369	$14,764,771
Category (2) Central processing units for electronic digital automatic data processing machines.	$629,255	$269,701	$4,080,554
Category (3) Processors consisting of arithmetical logical and control elements.	$19,479,342	$29,859,358	$23,832,657
Category (4) Separately consigned digital central (main) storage units.	$16,574,815	$2,552,706	$460,010
Category (5) Other storage units.	$11,333,407	$7,949,831	$5,786,010
Category (6) TOTAL	$52,303,688	$45,412,965	$48,924,970

SOURCE: JAPAN BY EXPORTS, Commodity by Country, published by Japan Tariff Association, Tokyo, Japan.

Fujitsu established a joint venture company with Hitachi, Nippon Peripherals Ltd., to develop IBM-compatible magnetic disk devices. Nippon Peripherals also concluded an OEM agreement with Memorex of the U.S. to supply it with magnetic and storage systems compatible with the IBM 3340.

Fujitsu also signed its own OEM contract with Memorex in April 1977 to market Memorex magnetic tape drive systems compatible with the IBM 3420 in the U.S.

In the fall of 1976, Hitachi established a wholly owned subsidiary in California. The company then concluded a deal with NCR to supply that company with mini-disk storage systems on an OEM basis. Hitachi also has a technical cooperative relationship with Control Data Corp.

Nippon Electric Company (NEC) has been a recipient of computer technology from Honeywell Information Systems since 1962.

Half of OS Shops Use Independent's Sort: IDC

WALTHAM, Mass. — Based on a study of 133 installations with 197 "IBM 360/370-type computers" running under OS or OS/VS, International Data Corp. (IDC) has determined that Syncsort from Whitlow Computer Systems, Inc. is used by 54% of the systems while sorts from IBM are used by 42% of the sample.

The researchers apparently felt confident enough of those percentages to apply them to the 3,400 OS or OS/VS systems installed in the U.S. and estimated that there were 1,836 users of Syncsort and 1,427 users of the IBM sorts as of July 1.

An additional part of the study, which was commissioned by Whitlow, analyzed the migration of users of sorting products between July 1, 1977 and July 1, 1978. According to IDC's report, "it was established that 96 out of 300 new OS and OS/VS systems became Syncsort users during the study period."

At the same time, it was also determined that 204 of the new OS or OS/VS systems entering the market during the study period were users of IBM's SM1-5740 sort package, IDC reported.

The statisticians also did some calculations to determine how many users of IBM's SM1-5734 or SM023 migrated to SM1-5740 in that year-long period. This number was derived "by subtracting the number of new computers using SM1-5740 (204) from the number of SM1-5740 users who converted to Syncsort (313) and adding the difference to the net increase of SM1-5740 users during the study period," according to IDC.

The fact that Release 3 of SM1-5740 could execute in OS/MFT, MVT and OS/VS enabled OS users to convert to SM1-5740 prior to converting their operating systems to OS/VS. This resulted in more than 50% of the combined SM1-5734 and SM023 systems converting to SM1-5740 during the study period, the researchers commented near the end of their report.

The results also showed that the majority of new Syncsort users were previous users of SM1-5740. Thus, the summary concluded, although both SM1-5740 and Syncsort acquired over 500 new users, the SM1-5740 base increased by only 232, due to 313 users switching to Syncsort IV-and-a-half after having used Release 3 of SM1-5740.

Packages Aid Tandem Users

(Continued from Page 24)

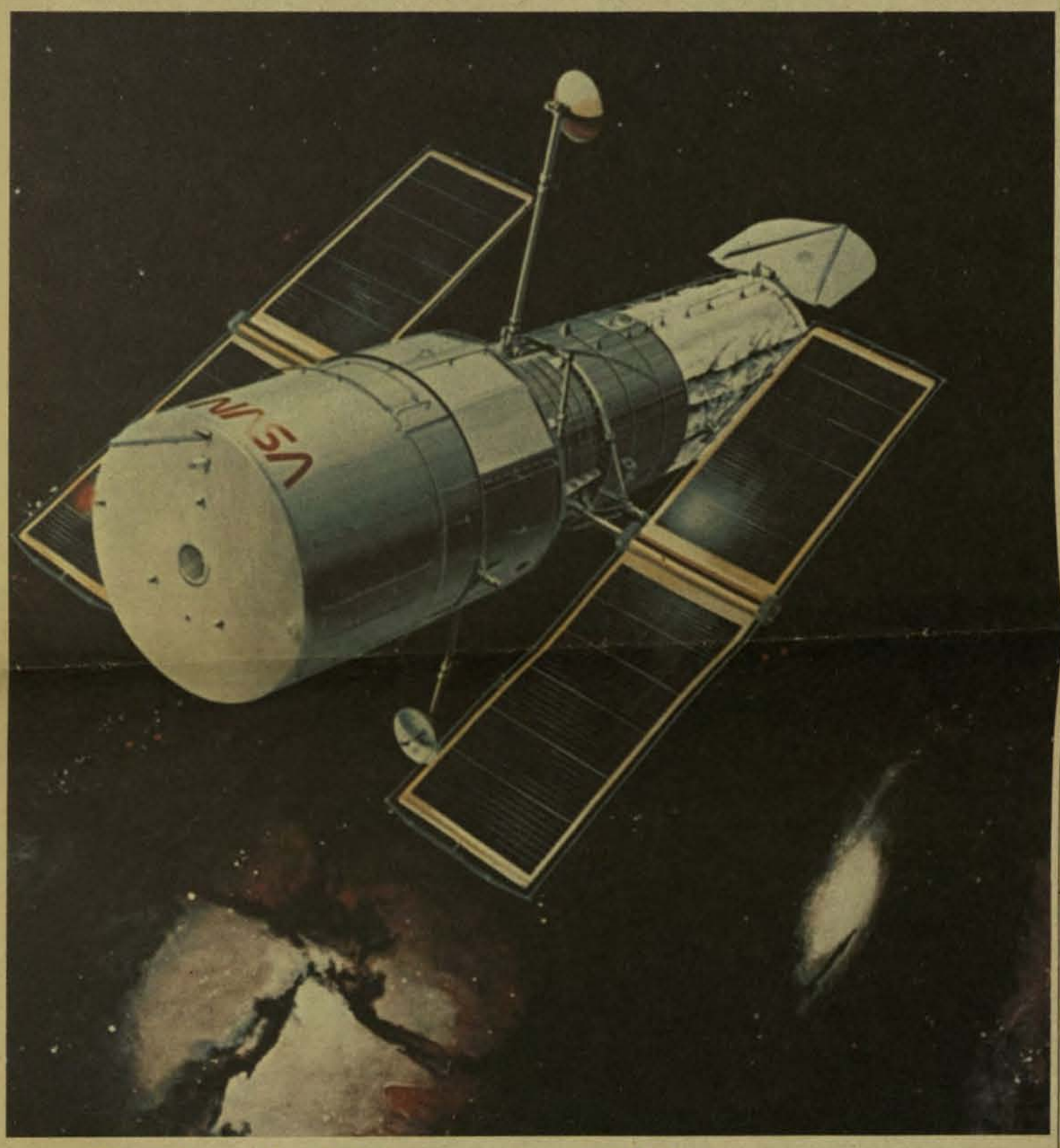
cipated during data base design, the company indicated.

Enform reportedly produces reports in less time than conventional languages such as Cobol, and its reporting options allow sorting and summarizing of retrieved data as well as evaluation of built-in or user-defined functions.

Described as a "nonprocedural language," Enform allows users to make queries with simple requests in English statements.

Expand will be released in *March 1979 with a one-time license fee of $10,000 plus a microcode charge of $1,500 per processor in the network. Enform will be available at the same time and will cost $7,000* for the license fee and $1,500 for the microcode fee for each processor.

Tandem Computers, Inc. is at 19333 Vallco Parkway, Cupertino, Calif. 95014.



The interactive database system that helps a space-minded company hold costs down to earth.

Lockheed Missiles & Space Company, Inc., was looking for a way to move a variety of data management systems onto their own computer—instead of using expensive outside services.

The in-house system they chose was CCA's Model 204—the only DBMS designed from the start to be interactive.

Lockheed's first Model 204 project involved the transfer of a system that controls large volumes of cost-estimating statistics. Model 204 not only handled the data, but also put it within easy reach of all types of people—from computer experts to clerks.

If you need a DBMS for your IBM 370/138 or larger computer, find out why thousands of users nationwide are satisfied with Model 204. Clip your business card to this ad and send to Computer Corporation of America, 575 Technology Square, Cambridge, MA 02139. 617-491-3670.

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TI 765 KSR Prtble. Mry.	2,895	270
TI 810 Printer 150 CPS	1,795	170
TI 820 Printer KSR	2,395	223
TI 733 ASR	2,995	278
TI 770/1 Int. Terminal	4,475	418
TI 770/2 Int. Terminal	5,485	510
Qume LTR Qual KSR	3,095	290
Qume LTR Qual RO	2,695	255
Hazeltine 1400 CRT	825	78
Hazeltine 1500 CRT	1,145	107
Data General 6052 - CRT	1,595	150
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Ex-DP Professional Wonders

Tribulations of DBMS: Is It Really Worth It?

By Jake Kirchner
CW Washington Bureau

So you're a DP manager and folks upstairs get the idea that developing a comprehensive data base would be a great thing for the organization. Just thinking of all that good information a few short programs away is making them dizzy with anticipation.

Just hope it isn't Monday when you get the call.

Of course, they say, they'll do the coding and hire the extra keypunchers. Of course they'll cover all the expenses out of the executive budget. All they want, they say, is the use of a programmer now and then, and probably only after the data base is complete, and they only need an occasional, simple, straightforward run, whatever that means.

So of course you give in; what else can you do?

Well, what can you do — and what you had better do if you're to have any future in that shop — is to disabuse the folks upstairs of some of those fanciful notions about the simplicity of compiling and using that data base, let alone *updating* it.

Because, after all, that's the key. The really big headache is keeping the data base updated. Who is going to do it? Is there going to be a continual line in the budget for this task? (When you read "continual," think "forever," because a good data base is like a good marriage.)

The basic considerations in putting together your own data base are the same as in every other DP project. It has to be planned carefully, and it *must* have the backing of upper management. It does not matter whether the senior accounting staffers are eager to put together a computerized costing system if the comptroller has no interest in it, won't support it and won't let his staff spend time updating the darn thing.

Sure, it's flush now that there is a lot of big talk and even bigger money floating around, possibly including government grants if your organization qualifies for that kind of help. But what happens when that grant money runs out (it always does sooner or later, no matter what you've heard about government spending) or when the economy slows down?

The painful truth of the matter is that your fancy new data base might very well be the first thing to go. The reason is simple: The people who make the final budget decisions almost never understand data processing, let alone the importance of updating the data base for which they pushed.

They have a mental picture of a completed system. Once it's set up, they think, it will last forever. And when the budget is tight, their thinking on updating data bases is, "Why can't it go for another six months without really getting out of date? We'll get to it then."

So ask how important this thing is. How high up is it backed? How often will it be used? Is there a real commitment to this project, or is it just a whim of some middle management "genius" who thinks he knows "all about computers"?

Management clout — that's the thing. It's especially crucial when the data base is to encompass information from several or many or even every (talk about ambitious) department in your organization ("Think of the interface possibilities!" they say).

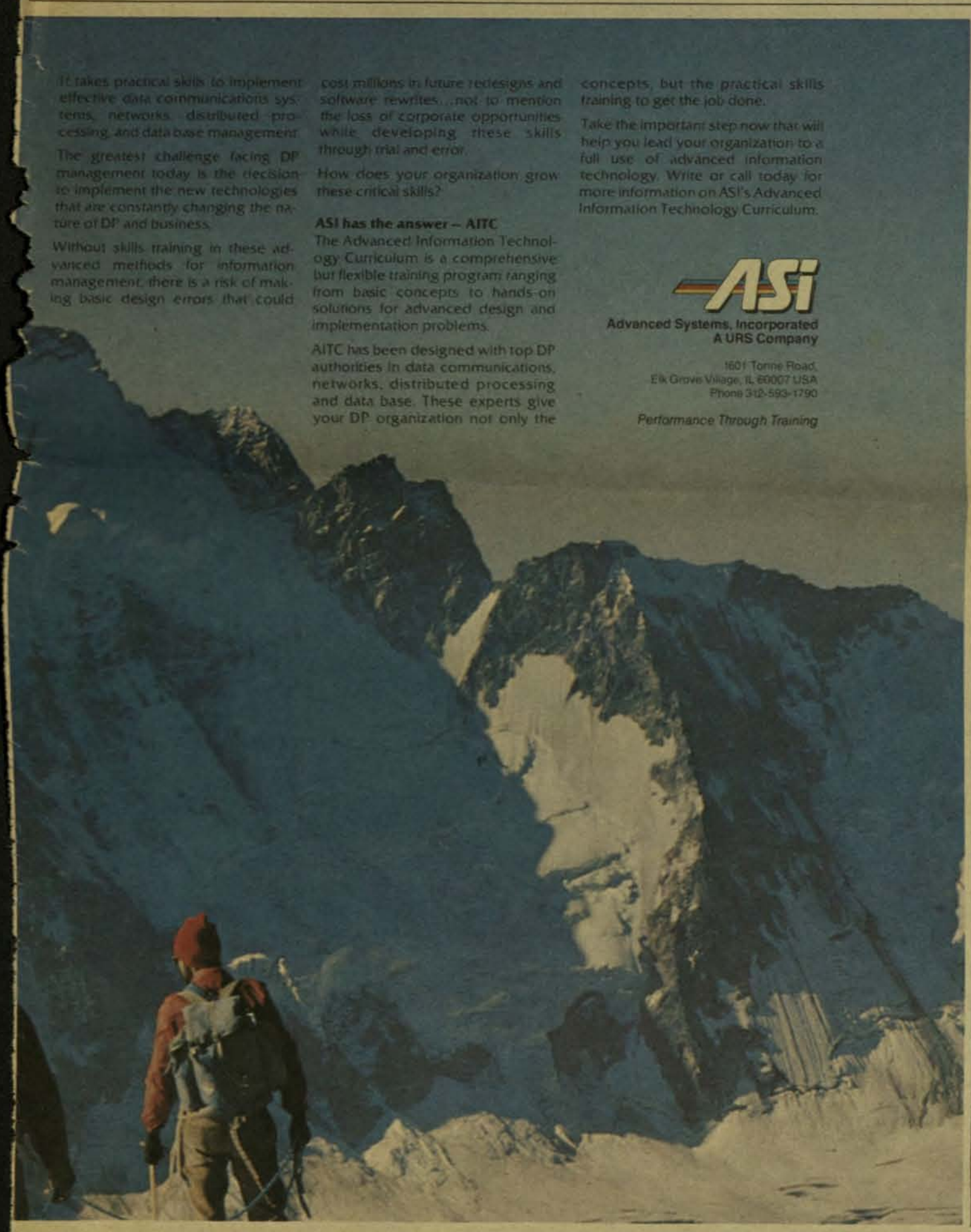
What will happen when one or more of those departments gets strapped for manpower, has its budget cut or gets a new manager who really doesn't like DP or DP people — or if the department already has a manager who hates DP or has no understanding of how the DP department works or how much work the project will take?

Then what? A lot of times a manager will go along with a multidepartmental project only because those above him want it, order it or request it nicely enough. Often it is just a matter of departmental comity.

But all that cooperation sure can break down in a hurry. And then what do you do? Send some of your DP people up to the recalcitrant department to beg to see their manual records so you can update the data base? Will they even let you in?

And what about the weekly routine — you know, that inventory report you're supposed to have out by Friday but the machine is down and the programmers are arguing among themselves about the football lottery and

(Continued on Page 32)



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Gets Everyone Involved

Prototype Seen Easing Use of DBMS

By Don Leavitt
CW Staff

MUNICH, W. Germany — Many installations begin to work with data base management systems (DBMS) by using the technology with one particular application, but that may not be the best way to do the job, according to two researchers who recently outlined a different approach.

Frank F. Kowalkowski of A. T. Kearney, Inc. and Ellen C. Rundquist told the Sixth International Adabas Users Conference, held here in mid-September, about a company that used a prototype approach to introducing the potential of Adabas, the DBMS from Software AG.

This approach exposed company personnel at all levels — from top management to DP technicians and data entry clerks — to the system, including give-and-take discussions of the way the prototype was developed and how it worked, the researchers said.

The company involved in the case study was "a member of the services industry" that was getting away from a batch-oriented "IBM 360 generation" environment. The prototype was envisioned as a means of cycling through, on a small scale, the entire DBMS procedure for developing an on-line system.

Offering facilities to people throughout the organization, rather than the limited audience that might utilize a specific application, the prototype operation involved defining a limited data base, the relationships between the elements, how it can be used and how well the system performs.

In particular, Kowalkowski and Rundquist noted, the approach provided management with proof of the concept's credibility, confirmed the choice of Adabas as the DBMS and showed users and project staff how to work with the on-line facilities.

But it also allowed the implementors to accumulate performance data on such things as runtimes and the scale of programming effort required.

In addition, it gave management the opportunity to try specific terminals and see for itself what applications would be most appropriate for the production implementation.

Initially the project was oriented toward technical performances with high-volume, in-depth testing but was reshaped, after management review, to place emphasis on testing in breadth to evaluate the data base concept and its adaptability to the business environment of this particular company.

Project business analysts developed six prototype scenarios or mini-samples of the kind of work done by the user areas in the course of normal service operations. A list of data elements needed to perform the scenarios and to allow users to experiment with inquiries or to browse through the data base were compiled.

The proposed prototype data base was to consist of 200 elements and 10 files generated within four weeks of software AG training. In reality, the data base had 180 elements and 15 files and it took six weeks to complete, partly because of the

(Continued on Page 25)

VAX at Heart of Workbench

SANTA MONICA, Calif. — A system incorporating Digital Equipment Corp. VAX-11/780 hardware with Bell Laboratories' Programmers' Workbench (PWB) and Unix operating system software has been introduced by Interactive Systems Corp.

Designated the VAX Workbench, the turnkey system supports large-scale software development and documentation projects. But when not being used for that, the hardware can be used as any other VAX CPU, a spokesman said.

In addition to the software available in the basic Unix package, the VAX Workbench can include a screen-oriented text editor, compilers, comprehensive text editing facilities and a source code control system. An integrated electronic mail system further eases development by supporting interoffice communications, the spokesman noted.

Basic Hardware

Basic hardware for the workbench includes a 256K-byte VAX-11/780 with a 67M-byte disk drive, a tape drive and an 8-line multiplexer for use with Interactive's Intext, an intelligent 9,600 bit/sec video terminal specifically designed for text editing.

Software includes DEC's VAX/VMS virtual memory operating system, which is said to give multiple users direct addressing to 4G bytes of memory. DEC's standard Fortran IV Plus, VAX-11 Macro, Basic-Plus-2 and PDP-11 Cobol are also available as no-cost options.

The VAX Workbench software package integrates the tools of Unix and PWB/Unix into the VAX/VMS environment. These tools include the Unix Shell command-language interpreter; "C," a block-structured programming language; and YACC — *Yet Another Compiler-Compilet — a general-purpose language specification tool.*

The turnkey operation can support as many as 48 programmers concurrently and users can both create and document large programs for execution on large-scale target machines accessed through remote job entry facilities, the spokesman asserted.

The hardware in the Interactive package typically costs about $250,000, while the software starts at $75,000 for a basic Unix subsystem and climbs to $90,000 for a typical installation, he added from 1526 Cloverdale Blvd., Santa Monica, Calif. 90404.

DG Enhances Software on Eclipse

WESTBORO, Mass. — Data General Corp. has enhanced the software capabilities of the Eclipse data system family.

An automatic segmentation facility for the firm's Cobol permits the operation of extremely large programs, while enhancements to Infos file management software broadens its use to applications written in the PL/I, Fortran 5 and DG/L languages, a spokesman said.

Running under DG's Advanced Operating System (AOS), the Cobol compiler complies with the Ansi 1974 standard, with all implemented modules at the highest level. The segmentation facility allows the execution of very large programs, whose memory requirements exceed the normal memory addressing capacity of Eclipse systems, the spokesman explained.

AOS Infos is a data base-oriented file management system that provides multiple-keyed access to information in a multiple terminal, batch or communications environment. The current extensions permit access to these data bases for applications written in PL/I, Fortran 5 and DG/L.

"With these facilities, our users may choose from an extremely broad range of high-level languages, to select the one that best matches each application's requirement," the spokesman continued.

Support for access to the data bases through Cobol, RPG-II, Assembler and DG's Interactive Data Entry Access System (Ideas) was already in place and continues in addition to the support being introduced at this time, he explained.

AOS PL/I is based on the Ansi 1976 PL/I standard.

AOS Fortran 5 produces highly optimized code for fast runtime execution. Unlike many other compilers, which optimize only within single statements, Fortran 5's compiler optimizes globally across the entire program as well as locally within statements, DG said.

DG/L is an Algol-derivative structured programming language designed for a wide range of applications. DG/L is an ideal development tool for systems-level software such as compilers, assemblers, sort/merge and other utilities, the company claimed.

AOS Cobol carries a one-time fee of $4,000, while AOS Infos costs $2,000, DG said from its headquarters on Rt. 9, Westboro, Mass. 01581.

'UCC-42' Models IMS Data Bases

DALLAS — The UCC-42 data base modeling system package, now available from University Computing Co. (UCC), was designed to operate as a utility under all versions of IBM's IMS/VS data base management system, according to a spokesman.

The package is a facility to provide applications and data base administration personnel with practical answers to theoretical questions about the design of their IMS data bases, he said.

Because it functions without modifications to existing systems, UCC-42 provides a capability by which users can investigate alternatives that might otherwise be ignored, the spokesman asserted. It can be used to design a new structure or to ascertain the impact on other applications if a structure has to be changed, he said.

The utility runs in batch mode, extracting data from production data bases according to user-specified criteria and inserting the data in a predefined model.

Thus, UCC-42 allows for the restructuring of data bases, the manipulation of segment types within a structure, the breakdown of large structures into smaller ones and the modification of segment lengths, he said. The package can handle physical and logical data bases, he added.

Initial users have commented on UCC-42's ease of use and the "dramatic" reduction in manual effort required to create and maintain accurate model data bases, according to the spokesman.

Written in Assembler, the package reportedly requires no changes in the user's software. It takes 10K bytes of memory plus the space needed for DL/1 and buffers, and it costs $4,200.

UCC is at 8303 Elmbrook, P.O. Box 47911, Dallas, Texas 75247.

For Networks, Queries

'Expand,' 'Enform' Enhance Tandem Facilities

CUPERTINO, Calif. — Tandem Computers, Inc. has added software and networking capabilities to its multiple-processor systems to allow users to link as many as 255 "geographically dispersed systems."

The added capabilities, called Expand and Enform, allow sites with Tandem CPUs and data bases to be linked together into four-wire private-line or X.25 packet facilities. Traffic on these nets is handled with the aid of data base directory information that is stored at each system site in the network, the company said.

Expand allows inquiries to be routed automatically to data that resides at remote sites using the best path available, but this capability relies on previously programmed data in the system which defines the location of application programs, a Tandem spokesman noted.

Other Features

As part of the Expand capability, the Network Control Process feature allows network links to be reconfigured in the event of malfunctions in specific network connections.

Computing resources and data bases in an Expand network are said to be location transparent to operators and programmers. In addition, a program resident in any system in a Tandem network can access data resident in any other system. But these features depend on directory data available at each multiple-processor system site.

Tandem also introduced its Enform software, which allows retrieval of data from multiple files in ways not anti-

(Continued on Page 30)

'Tiger' Enhances ICL 1500

E. BRUNSWICK, N.J. — ICL, Inc. has introduced an entire range of modular accounting application packages in support of broader use of the company's Series 1500 "Little Tiger" small business computers.

The systems were originally introduced early in the 1970s and despite the availability of Cobol, Basic and Business Transaction Language (BTL) support and communications software, have been used primarily as data entry systems, a spokesman explained.

With the introduction of Total Information Gathering and Execution Reporting (Tiger) software, more users should become aware of the systems' true processing capabilities, he said.

Tiger software currently includes modules for accounts receivable, accounts payable (including sales analysis), invoicing, general ledger, inventory control, order entry, client accounting and professional time accounting, the spokesman recounted.

The 1500 Little Tiger hardware — consisting of a CPU, keyboard, CRT, disk subsystem and printer — costs less than $20,000, and additional or remote data entry stations are available for $5,000 each, he noted.

The Tiger software is available at $1,000 per module, or all seven modules may be purchased as a package for $5,000, ICL said from Turnpike Plaza, 197 Highway 18, E. Brunswick, N.J. 08816.

XCS Program Controls Distributor Inventory

LOS ANGELES — A Planned Inventory Management (PIM) service now available on the remote computing network supported by Xerox Computer Services (XCS) should allow distributors to set customer service levels and meet them with minimal inventory investment, according to an XCS spokesman.

Described as especially useful to large distributors maintaining extensive inventories, PIM produces monthly reports including a forecast of demand for each item, a list of order points, economical order quantities and a tally of items below order points.

The system also simulates cost effects of possible inventory policy decisions before they are made, the spokesman said.

A requirements planning program is also included to provide aids for such things as cash flow projections and replenishment planning for product introductions or special promotions, he added.

PIM and other distributor-oriented services are available nationwide on the XCS network.

Costs are related to use of the networks resources, the company said from 701 S. Aviation Blvd., El Segundo, Calif. 90245.

NCR Cobol Validated

DAYTON, Ohio — The Cobol compiler supplied by NCR Corp. with the Virtual Resource Executive (VRX) operating system for the company's V-8400 and V-8500 systems has recently been exercised by the Federal Cobol Compiler Testing Service.

The validation disclosed only a "few discrepancies" in the "several thousand" features tested, indicating an "exceptionally high" degree of conformance with the Federal Information Processing Standard, according to NCR.

The validation program was developed several years ago in order to confirm that compilers being brought into the federal inventory did, in fact, comply with the American National Standards Institute specifications for the language — or to show where they failed to meet those "specs," an observer added.

NCR's Cobol compiler was built to the 1974 Ansi specifications and intended to operate under VRX, which the company said is capable of handling 35 programs at the same time.

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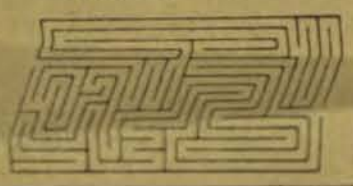

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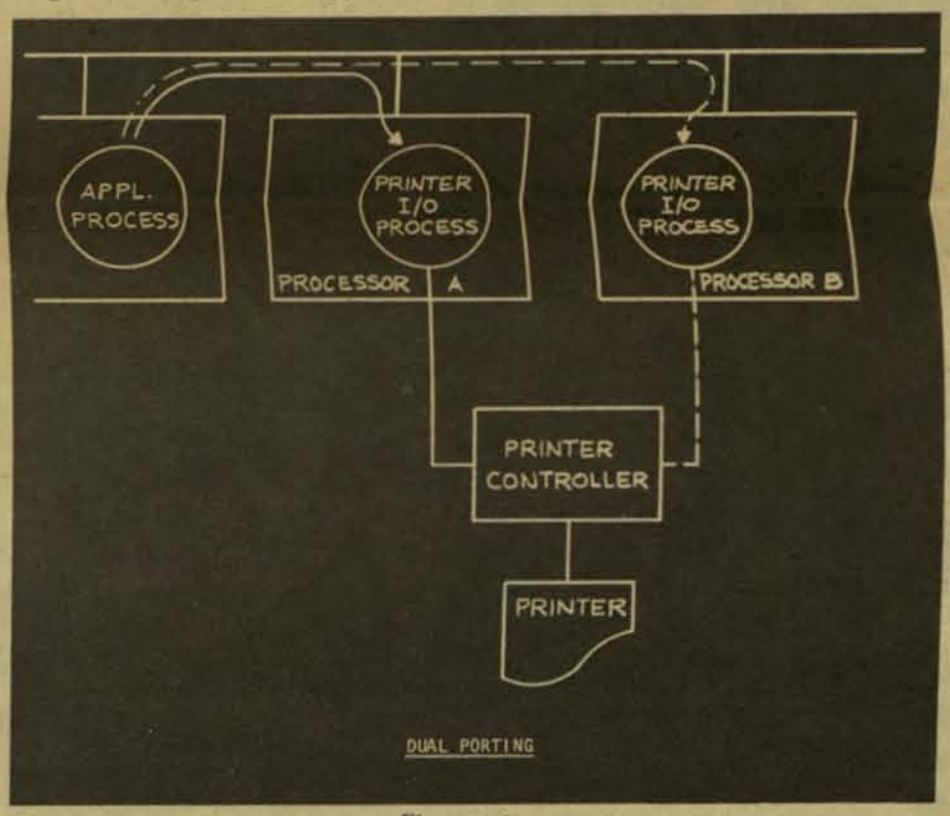


Figure 4-1

The multiprocessor aspect allows us a further extension of these capabilities. Since the system now has at least two processors, and since we have the option of adding two of anything else that might be critical, we have the opportunity to make the system highly fault-tolerant. We can create a system that will survive any single failure and many cases of multiple failures in that it will continue to perform functionally the same in the face of these failures. The user may notice a loss of capacity or responsiveness, but will not lose any of his capabilities. We will see that the structure and management of processes plays a big role in achieving this goal.

Hardware Duality

The first step in achieving survivability is hardware duality. If a critical hardware component fails, there must be another one that can be used immediately. Equally important are the paths to all components; if one path fails, there must be an alternate path to that component. For instance, if the processor to which a user's terminal is connected fails and he has no means to be connected to another processor, then so far as he is concerned the system has failed.

This leads to the concept of dual-ported devices in which each device controller has two ports, each of which can be connected to a separate processor. At any one time, one of the ports is being actively used and the other is dormant, playing a backup role. The processor connected to the active port is said to "own" the device.

As an example, Figure 4-1 shows a dual-ported printer. The printer (a normal, everyday, single-ported printer) is connected to a controller that can be driven either by Processor A or B via two independent ports. Each of these processors runs an I/O process which controls the printer via its connected port (remember that an I/O process must reside in the same processor to which the device is connected). Processor A currently owns the printer, and the operating system knows this. Therefore, interprocess messages containing data to be printed on the printer are routed to the printer I/O process in Processor A.

There are several failures that could cause this path to the printer to fail. Specifically, Processor A could fail, or logic in the printer controller port connected to Processor A could fail. In the former case, the operating system would realize the failure of Processor A and transfer ownership of the printer to Processor B; in the latter case, the printer I/O process would detect the fault in the controller and transfer ownership to Processor B.

In either event, subsequent interprocess printer messages are sent to the printer I/O process in Processor B. Therefore, providing the application process is written to reissue an I/O message in the event of an error, the failure of a processor or a device port is indeed transparent to the user insofar as his access to that device is concerned.

This is the fourth installment in a five-part series.

Unfortunately, in all devices there are simplex points of failure that will totally remove that device from service. For instance, the failure of a printer motor, or even common logic such as a line driver in the printer controller, will disable the printer. This can only be overcome by totally duplicating the device and its controller and making provision in the system for rerouting work away from the failed device to an alternate device. In the case of a printer, for instance, a sophisticated spooler would queue work for all printers on the system. If a printer failed, it would simply become unavailable to the spooler, which would continue to despool all work to the remaining printers. In many cases, the duplication of a device is not economically justifiable, and work for a failed device is simply held until the device once again becomes available.

There are two cases in which the continued operation of the device is every bit as important as the proces-

(Continued on In Depth/10)

By Wilbur H. Highleyman

IN DEPTH

(Continued from In Depth/9)

sors themselves. One of these devices is the interprocessor bus; without it, all paths but local paths within a processor are lost. Therefore, this bus must be duplexed.

The other case is disk files containing critical data bases and system files (program and process images). If a disk containing one of these files goes down and there is no alternate, the system does down. Totally. Furthermore, just having a backup disk is not satisfactory. It must contain completely updated files; that is, it must be a mirror image of its partner. As data comes in that updates one disk of a "mirrored pair," it must also update the other disk.

Figure 4-2 shows the configuration for a mirrored disk pair. Three levels of mirroring may be used:

- One controller and two disks (Figure 4-2a). However, if logic common to both disks fails, then access to both disks is lost.
- One controller per disk (Figure 4-2b). No single failure will prevent access to the data.
- Dual-ported disk devices connected to dual-ported controllers (Figure 4-2c). This adds an additional level of redundancy to the mirrored pair.

There is an important utility that must be available to support mirrored files if they are to be truly effective — an on-line disk copy utility to be used when a disk that is part of a mirrored pair is to be returned to service. When a disk unit fails, the files are now being handled by a simplex disk. When the disk is repaired or replaced with a spare and is to be put back in the system, it must be brought back to its mirrored condition — that is, contain an exact copy of the other disk — even while further modifications are being received for that data. That is the job of the on-line disk copy utility — to copy one disk to another while at the same time ensuring that file updates are kept current.

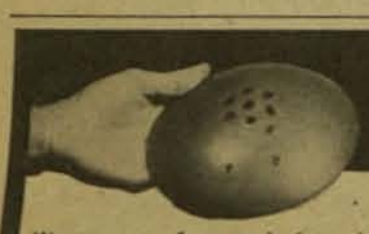
To summarize hardware duality, Figure 4-3 (on In Depth/11) shows a simple system with a terminal, printer and mirrored disk pair. Figure 4-3a shows how these peripherals might be configured physically. Figure 4-3b shows the logical process configuration as it would interact with an application process. Primary paths are shown as solid lines, backup paths as dashed.

One final point should be made about hardware duality in a survivable system. Duality is fruitless if a failed device cannot be repaired and returned to service while the system is running (this led to the need of an on-line disk copy utility for mirrored files). Therefore, any piece of hardware — including processor, buses, device controllers, power supplies, even fans — must be capable of being removed, repaired or replaced and plugged back in while power is still on the system and without inducing "glitches" in the system operation.

Software Duality

Just as each hardware unit must have a backup, so must each software unit, or process. Should the processor in which a process is running fail, then that process will cease to exist (and the capabilities it provides will be lost to the user) unless a spare process can be "switched in."

(Continued on In Depth/11)



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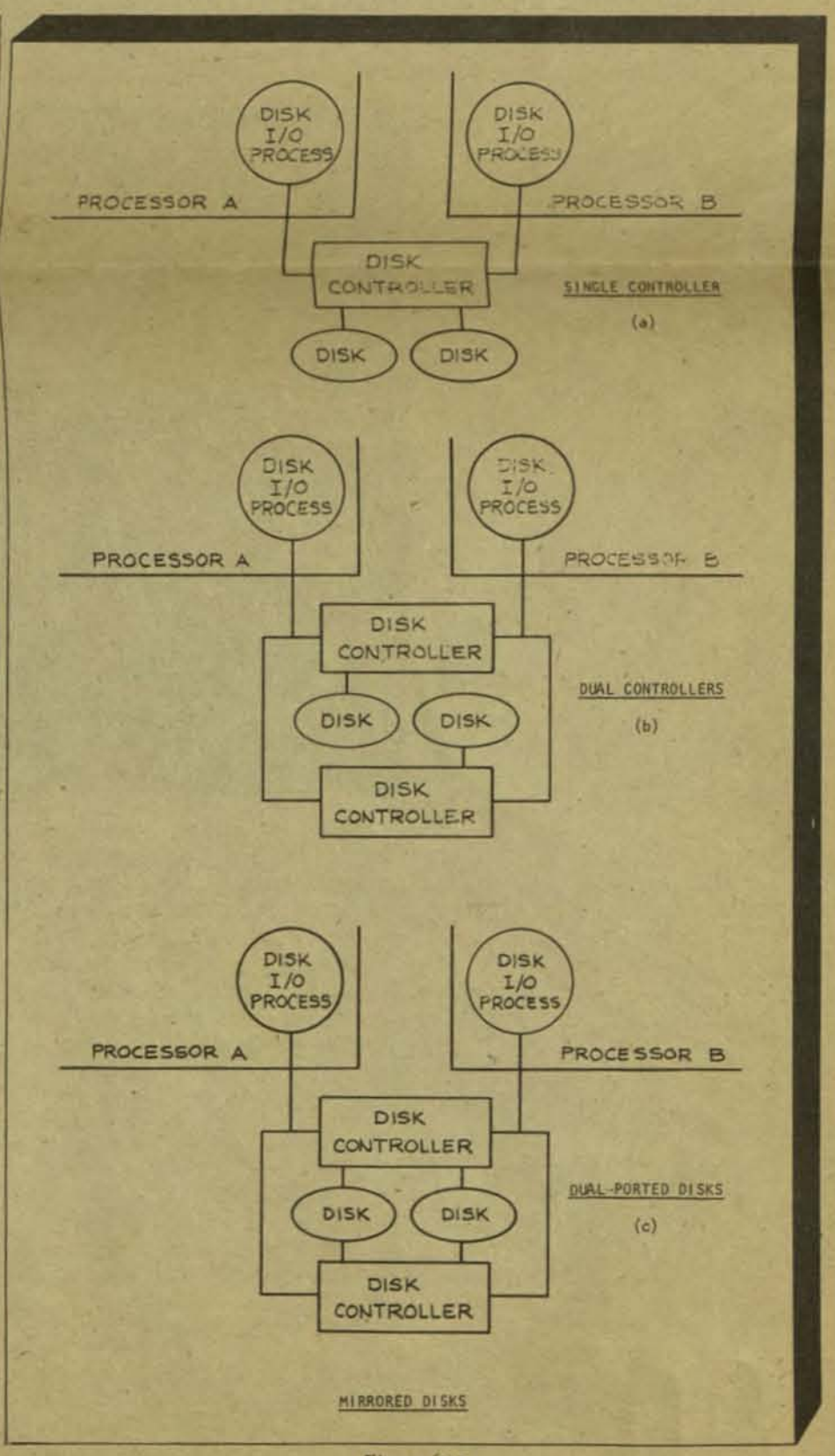

Figure 4-2

SURVIVABLE SYSTEMS

IN DEPTH

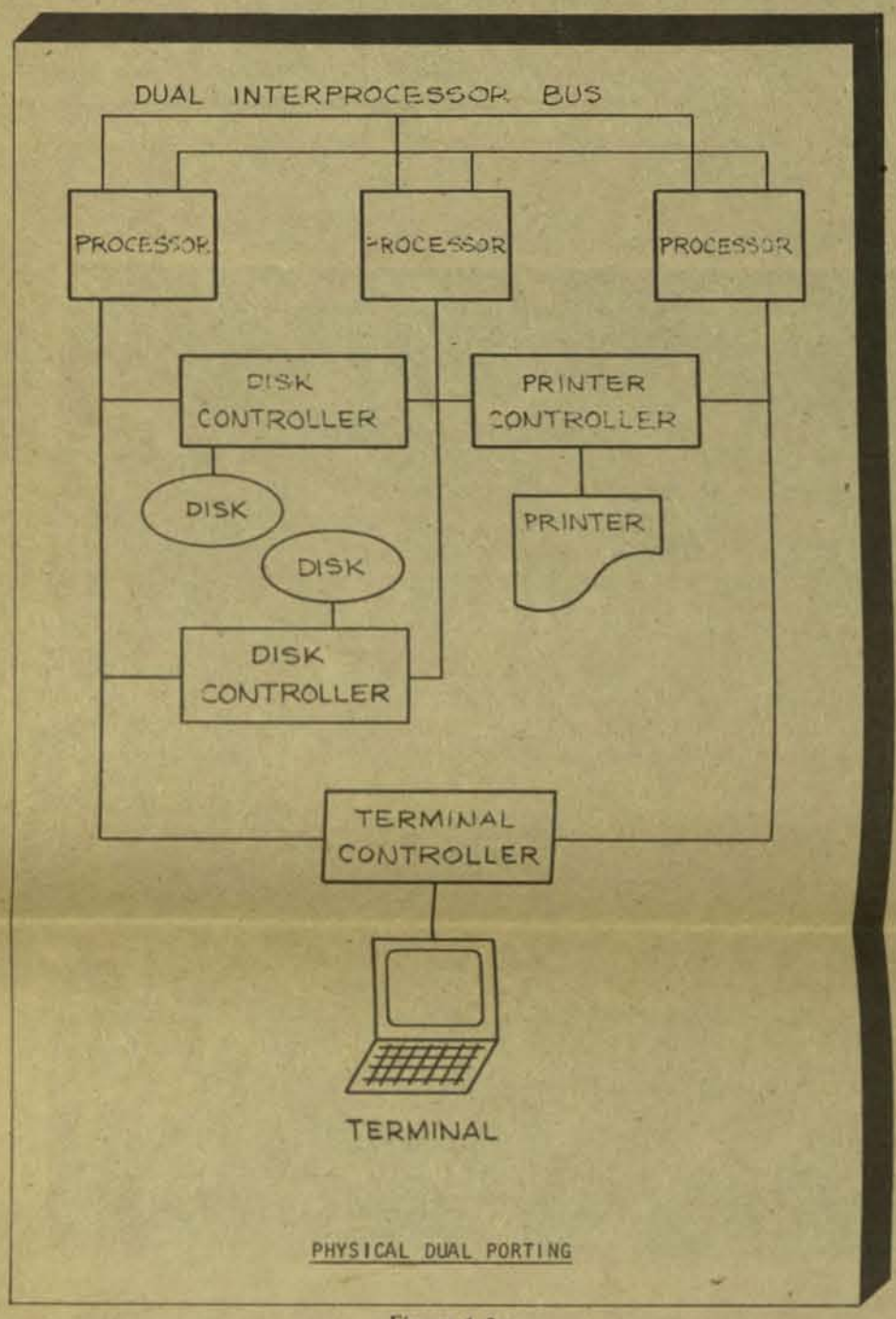

Figure 4-3a

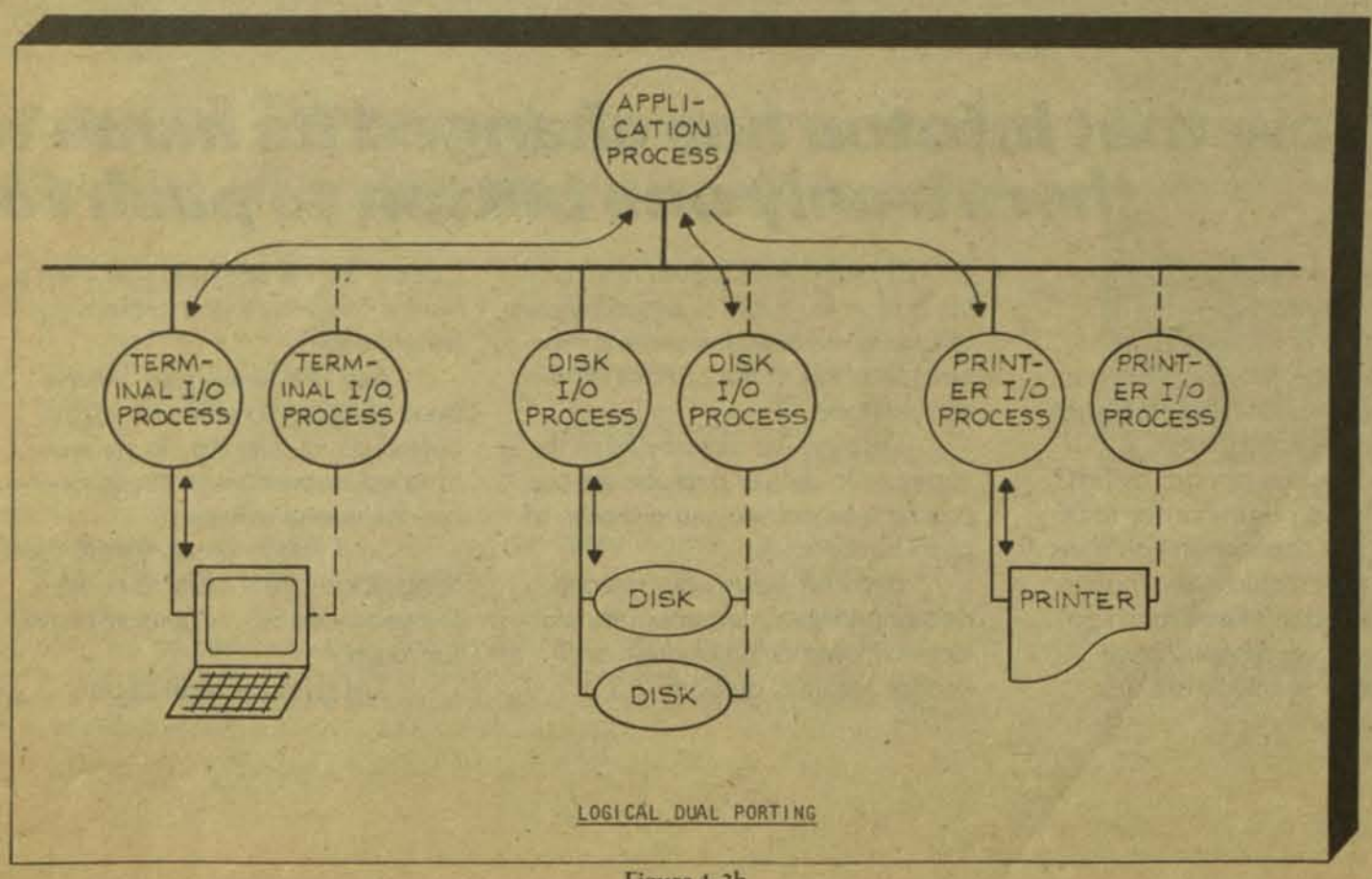

Figure 4-3b

PROCESS NAME	PRIMARY PROCESSOR	BACKUP PROCESSOR
INQUIRE	3	2
MAINT	2	
REPORTA	4	1
•		
•		
•		

Figure 4-4

(Continued from In Depth/10)

This requires two capabilities of the process:

- It must be able to create a backup copy of itself in another processor whenever it is created or has taken over from a failed process.
- It must be able to keep its backup informed of what it is currently doing (for instance, what transaction it is currently working on) so that the backup can continue its work uninterrupted should the primary process fail.

Backup Process Creation

Let us First consider the creation and management of the backup process. Assume that Process A has been created. One of the first things Process A does is to request the operating system to create a backup copy of itself in another processor; we will call this backup Process A'. It has the same name as Process A, but is created and runs in a different processor. A' detects that it is the backup (because it can sense that its brother already exists) and immediately calls a monitor procedure (Checkmonitor in the Tandem Computers, Inc. system) that is responsible for monitoring the primary process and taking over in the event of primary failure. The monitor procedure is provided by the operating system.

Just as the operating system must know of Process A so that it can route interprocess messages to it, so must it know about Process A'. As we discussed earlier, it knows about Process A and all other processes in the system via the process directory, a copy of which is maintained in each physical processor. Let us now extend the concept of the process directory to the process pair directory (PPD). The PPD contains the name of each process, the processor in which the primary is running and the processor in which the backup, if any, is running. Figure 4-4 shows a part of a typical PPD.

As Process A is performing its duties, the operating system routes all interprocess messages destined for Process A to it. However, should Process A fail (most likely because of a processor failure, but possibly because of a software fault that causes the operating system to abort it), the operating system will look in the PDP and find that Process A in fact had a backup. It will send Process A' what appears to be an interprocess message indicating the Process A has failed and the reason for its failure (processor failure, abort or whatever). This causes the operating system in the Process A' processor to

(Continued on In Depth/14)

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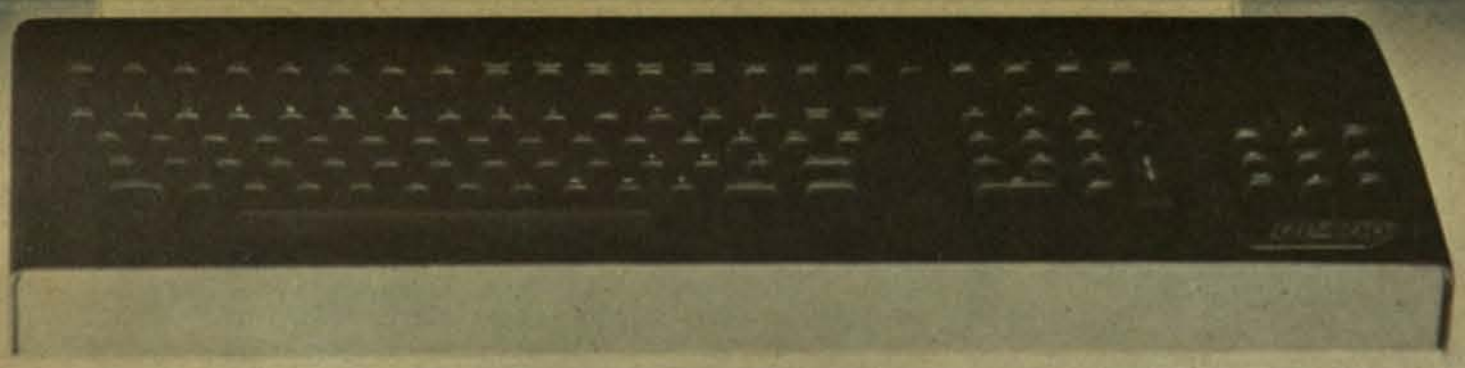

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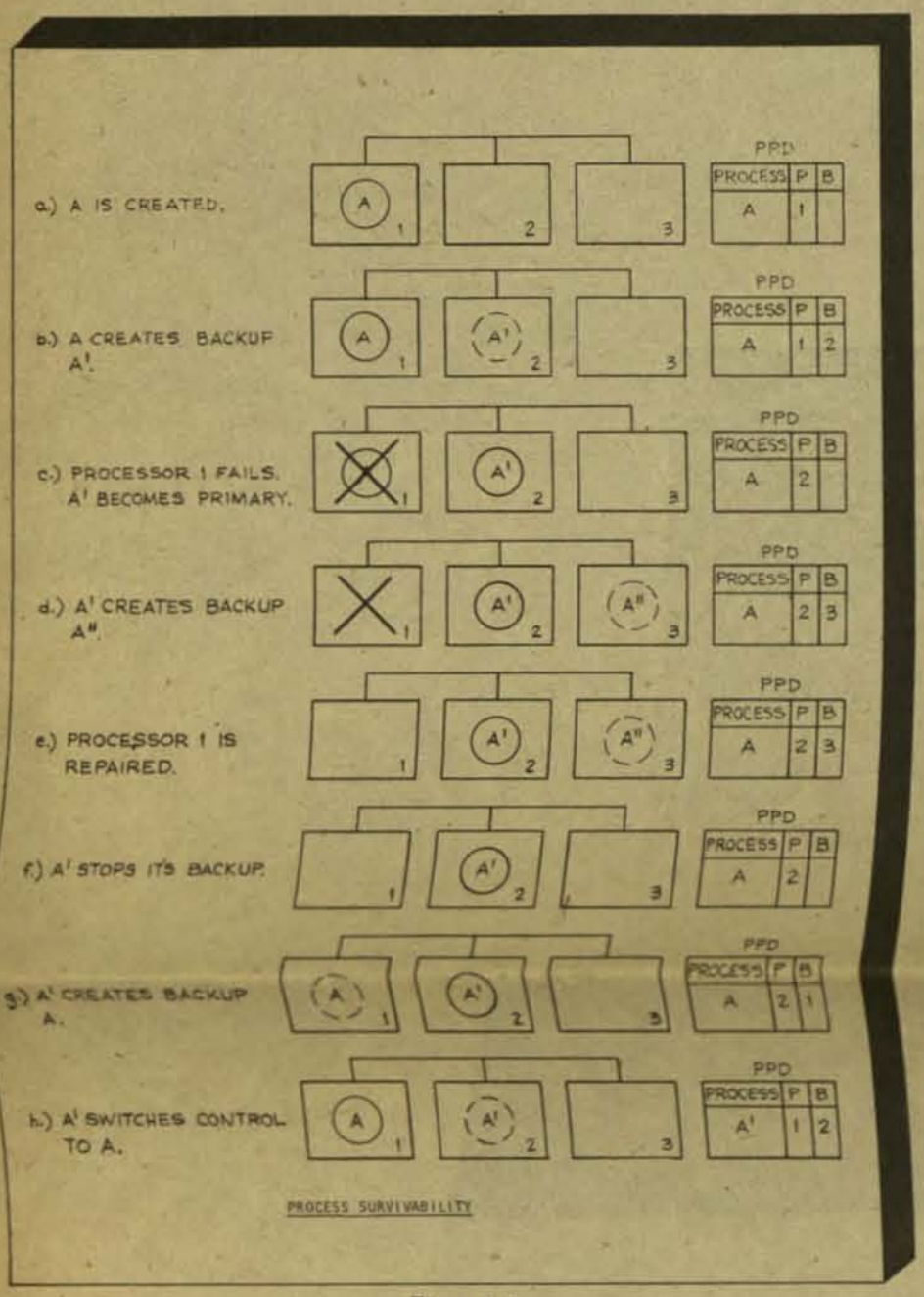

Figure 4-5

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(Continued from In Depth/11)

schedule Process A' that is, put it on the ready list). Further interprocess messages for Process A are now routed to Process A' for processing, and the system survives. At this point, Process A' may create its backup to protect itself from further failure.

Figure 4-5 shows a typical life of a process in the presence of a processor failure. A three-CPU system is shown in which Process A is created in Processor 1, it creates its backup A' in Processor 2. Later, Processor 1 fails and Process A' takes over, creating its backup A" in Processor 3. Subsequently, Processor 1 is repaired. The system could be left as is. However, in this case it is desired to restablish load balancing. Therefore, Process A'+ stops its backup A" and recreates a backup A in Processor 1. It then switches control to Process A, resetting the system to its initial configuration.

As can be seen, a variety of strategies can be employed to ensure system survival in a degrading system. Load sharing should be an important consideration in the strategy. The illustration has shown how a process can move itself from one processor to another by creating a backup in the new processor and then switching primary/backup roles. This capability could be used to dynamically balance the load in a multiprocessor system, either under operator control or under the influence of some monitoring process.

Checkpoint Messages

Having a backup process to switch to in case of a process failure is essential to surviving. However, if the system is to perform functionally the same in the event of a failure, the backup process must take over where the primary left off; this means it must know what the primary is doing.

Going back to our discussion of process structure, this is done quite simply as the result of one of the characteristics of the structure of a process. A process contains a code area and a data area. The data area comprises global data and a stack that is used to nest procedures, pass parameters between procedures and hold temporary data needed locally by a procedure. The state of a process is determined by the state of its data area; that is, give two like processes (two processes with the same code area) the same data area (and environment), and they will perform identical functions.

Therefore, if we could somehow maintain the data area of the backup process so that it is identical to the data area of the primary process, then if it started up following a primary process failure, it would behave exactly the same as if it were the primary process.

Unfortunately, the system load that would be imposed by constantly updating the backup's data area precludes such an approach. However, it is necessary only that the data areas be identical at certain critical points in the process's execution. For instance, if the data areas were made identical immediately following the receipt of a transaction to process, then if the primary failed after partially processing the transaction, the backup would start at the point at which the transaction was received and would reprocess it. In many applications, this would be acceptable.

The backup's data area is updated via a mechanism called "checkpointing." This is simply an interprocess message sent by the primary process to its backup, the contents of which are the current contents of the data area. Like other interprocess messages, the receipt of this checkpoint message by the backup process causes it to be scheduled to run. As described previously, the backup process is executing the monitor procedure; this procedure will receive the checkpoint message and store it in its data area, thus updating the data area as desired. Updating the data area includes overwriting the stack.

But the monitor procedure is also using the stack, so doesn't this destroy that procedure? It would if the monitor procedure used the normal process stack. Therefore the monitor procedure must create a pseudo-stack outside the range of the process's data area, where it won't get overwritten. Since the monitor procedure is really part of the operating system, it can play this kind of game.

If Primary Fails

Should the primary process subsequently fail, the receipt of a system-generated message describing that failure (as described previously) will cause the monitor procedure to return to the main flow of the process at the last received checkpoint. That is to say, the backup process takes over and starts executing according to the last checkpoint.

But how does the monitor know specifically which instruction it is to start executing? The program counter is not part of the data area and is therefore not sent over as part of the checkpoint message. This is handled via the last stack marked in the stack in the data area. Each stack marked indicates the place at which the current procedure was called and causes the current procedure to return to the instruction following its call when it has completed. The stack marker also contains the processor environment to restore upon the procedure's return.

When a process wants to send a checkpoint message, it does so by calling an operating system procedure that takes care of actually issuing the interprocessor message. Therefore, the last stack marker on the checkpointed stack was placed there as a result of the call to the checkpoint procedure, and it points to the instruction in the application program following the checkpoint call. When the monitor procedure wants to turn on the backup process, it simply executes a procedure return according to the last stack marker; that is, the backup process will turn on at the instruction following the checkpointed call, as if it were exiting the

(Continued on In Depth/16)

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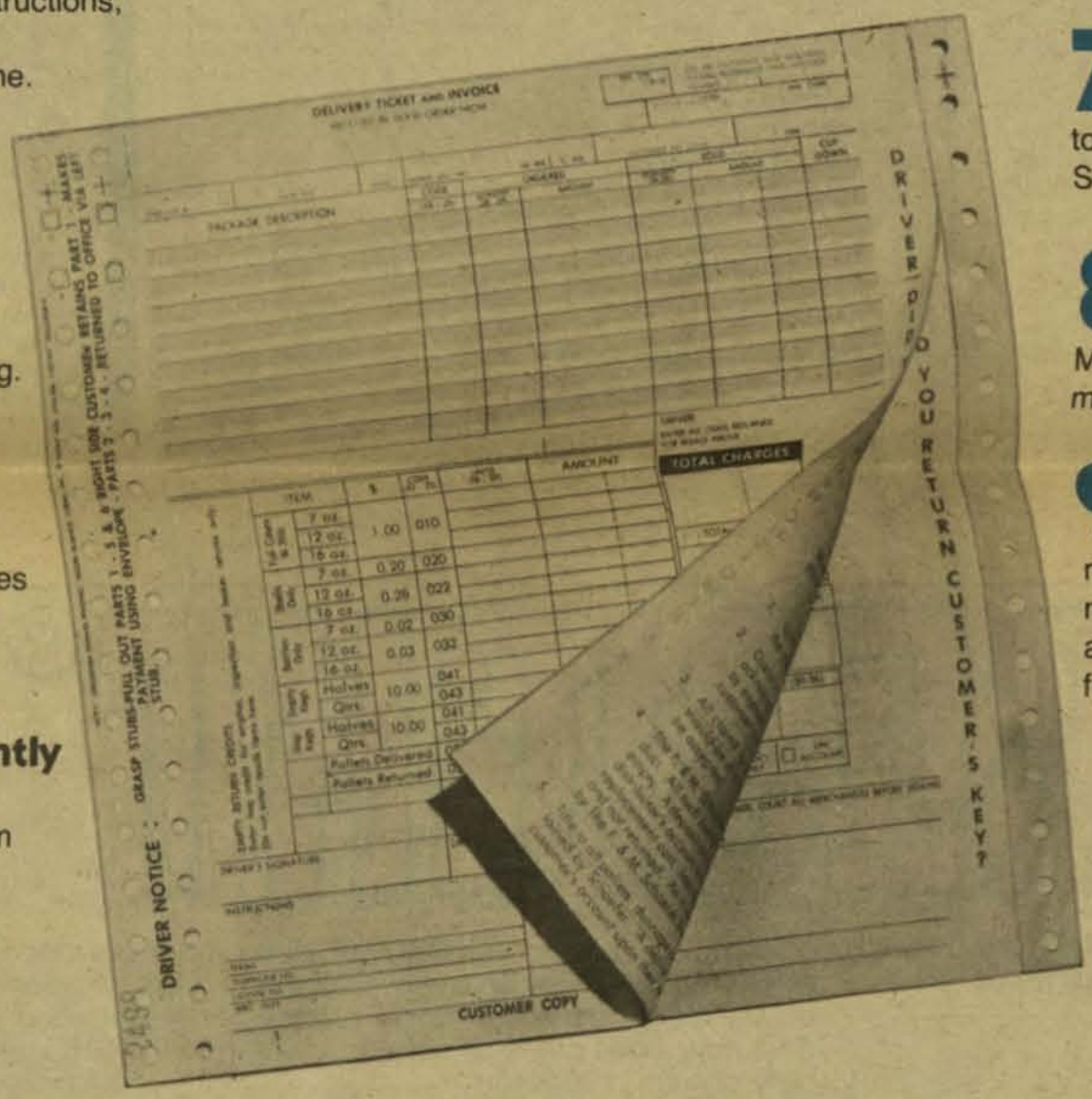

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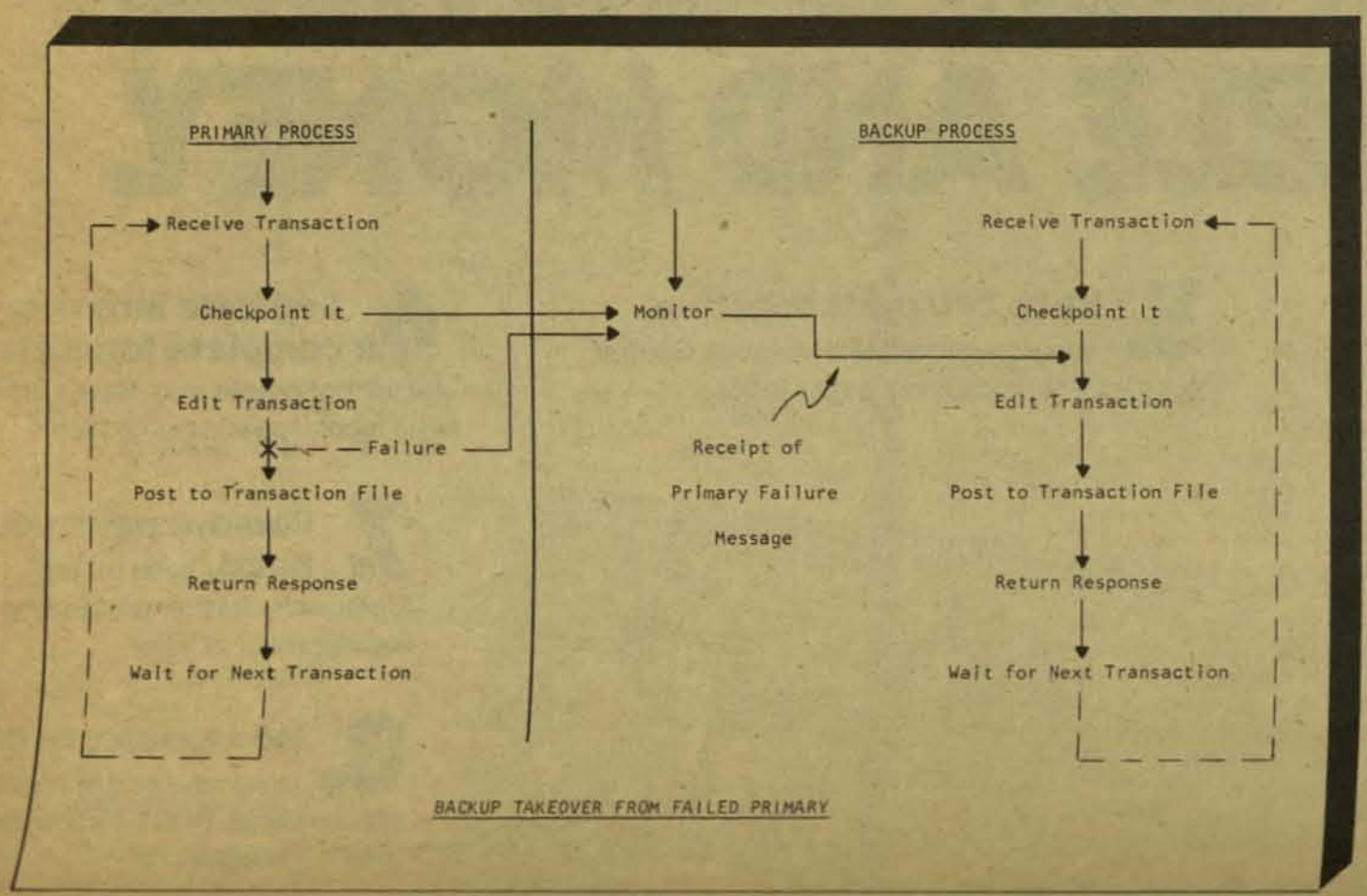

Figure 4-6

(Continued from In Depth/14)

checkpoint procedure. This is illustrated in Figure 4-6.

The checkpoint procedure also returns with a status condition. This status condition normally indicates success when the primary process is running. However, if the backup process is turned on, the monitor procedure forces an error status that indicates that the primary failed and why. This allows the backup process to perform special takeover logic, should any be required.

In actual practice, it is usually not necessary to checkpoint the entire data area. The global data often contains a large data base, whereas the stack is typically small. Since large (multi-K-word) checkpoint messages would represent a large bus and processor load, it is advantageous to send over just that part of the data area that has changed since the last checkpoint. This often is simply certain elements of the global data plus the stack.

In some cases, it may not even be necessary to checkpoint the stack. If certain messages simply update internal parameters, it is necessary only to process the message, update those parameters and then checkpoint the changed data. In this case, the stack is

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not checkpointed, so backup processing would resume at the last point at which the stack was checkpointed, rather than at noncritical checkpoints.

Checkpoint Strategies

The basic concepts of survivable processes are quite straightforward — create backup processes and keep them informed at critical processing points via checkpoint messages. Checkpointing does represent a significant system load and should not be used casually. Checkpointing strategies should be carefully thought out in terms of minimizing the number of checkpoint messages and checkpoint lengths, while achieving the degree of fault transparency desired in the system.

More important, these strategies must be established as part of the design of the process. It is not sufficient to implement simplex processes initially without giving thought to survivability and then worry about where to put the checkpoints later. This can lead to a process organization in which the checkpointing task burden is so large it cannot realistically be carried.

Let us explore various levels of checkpointing. As we have said, the level of checkpointing should be commensurate with the level of fault transparency desired. Consider an inquiry application in which the operator enters an inquiry, a file is searched and data is returned to him. In many situations, it may be quite reasonable to ask the operator to reenter the inquiry in the rare occurrence of a system fault that has interrupted the inquiry process. No checkpointing need be done at all; should the backup process find it has taken over, it might simply send a repeat request to all operators, not knowing which ones had active inquiries.

An even better situation is the above, but one in which the terminals buffer the inquiry and pass it to the system in response to a poll. In this case, the new primary process need only poll all terminals; those with unanswered inquiries would retransmit those inquiries for reprocessing. Full fault transparency has been achieved without checkpointing.

However, if it is not desirable to request the transaction again from the operator once it has been received, the process can checkpoint it as soon as it receives it and then process the inquiry. In this case, it the process fails, the backup has the transaction and will reprocess it without having to request it again. The operator will receive a response without ever knowing there was a fault.

In this case, if a failure occurred after the system had responded to the last inquiry and before it had obtained the next one, the response to the last inquiry would be retransmitted to the operator since the transaction is being totally reprocessed. If this is undesirable, a second checkpoint is required following the return of the inquiry response.

File Updates

Unfortunately, applications usually aren't this simple. Typically, a transaction is used to update a file. The simplest case of this is when the transaction is simply logged to a transaction file for later processing. In this case, all of the aforementioned strategies hold. If the operator or terminal can be requested to resubmit the transaction, no checkpointing is required. Otherwise, the transaction should be checkpointed when it is received.

In all of these cases, a failure could cause the transaction to be logged twice. Often, the processing programs can handle the case of duplicate transactions (transactions may carry serial numbers, for instance). If this is not tolerable, then (as above) the process should checkpoint following the logging of the transaction to cause the backup to pick up at this point.

Often, however, the transaction is used to perform an on-line update of a file. In this case, a record must be read, modified according to the transaction and then rewritten. Whether or not the transaction was checkpointed when it was received, it is imperative that it and the record be checkpointed when the read of the record has been completed. Otherwise a double update could occur (unless this is allowed).

Consider a transaction that contains a count which is to be added to a field in a record. If the transaction is simply reprocessed following a failure, it would be added again to the field if the first transaction had completed. However, by checkpointing the read record and assuming a failure after the transaction had been completed, the backup process would continue from the point at which the read had completed. It would add the transaction count to the original field and return the record, overwriting identical data left behind by the primary process.

So far as transaction processing is concerned, this is the case of most general interest and is shown in Figure 4-

(Continued on In Depth/18)

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(Continued from In Depth/17)

7. The first checkpoint is needed only if the transaction cannot be requested again from the user. The middle checkpoint is needed only if a double update is not allowed. The last checkpoint is needed only if a repeat response cannot be tolerated.

Most processes, whether they deal with transaction processing, external event control, communication switching or whatever, can be framed as subsets of Figure 4-7. Therefore, we can see that the usual worst case for a transaction is three checkpoints.

It is important to minimize the number of checkpoints because of the system overhead they create. Sometimes no checkpoints are required. It is very often possible, and should be a general design goal, to design the system so that no more than one checkpoint per transaction is required. However, considerations to allow this often range throughout the system, from operating procedures (reentering a transaction) to terminals (block transmit, ignoring unexpected responses) to processing functions (detecting and ignoring duplicate transactions). Therefore, the determination of checkpoint strategies belongs in the very early stages of design and is not a candidate for afterthought.

Checkpointing Pitfalls

While the basic concepts of checkpointing are fairly straightforward, there are certain traps into which one can fall. We will mention a few here.

One obvious problem can occur if multiple processes are updating a single file in a checkpointed application. Keep in mind that a checkpoint follows the read of a record; assume that the checkpoint following the rewrite of the record is deemed unnecessary. Process A updates a given record. Shortly thereafter, Process B successfully adds other data to that record. Then, before it is asked to do anything else, Process A fails. Its backup resumes at the last checkpoint, reupdates the record (a copy of which was passed in the checkpoint message) and rewrites the record. This overwrites the record last written by Process B; Process B's update is lost. This occurs even though the file was properly locked during each update.

Checkpointing after the write can avoid this, but adds overhead. Therefore, it is often desirable to have a given file updated by a single process — the data base manager for that file.

Another problem is "windows." A window is a brief interval during which, if a fault should occur, data is lost or operation is indeterminate. One example of a window is a failure during operator entry from a nonbuffered terminal. Unless this data is being read by both processors connected to the terminal controller, this data will be lost. (Dual reading is a problem, since without read interprocess requests being received by the backup I/O process, it does not know when the last read became satisfied, thus establishing which data is currently active.)

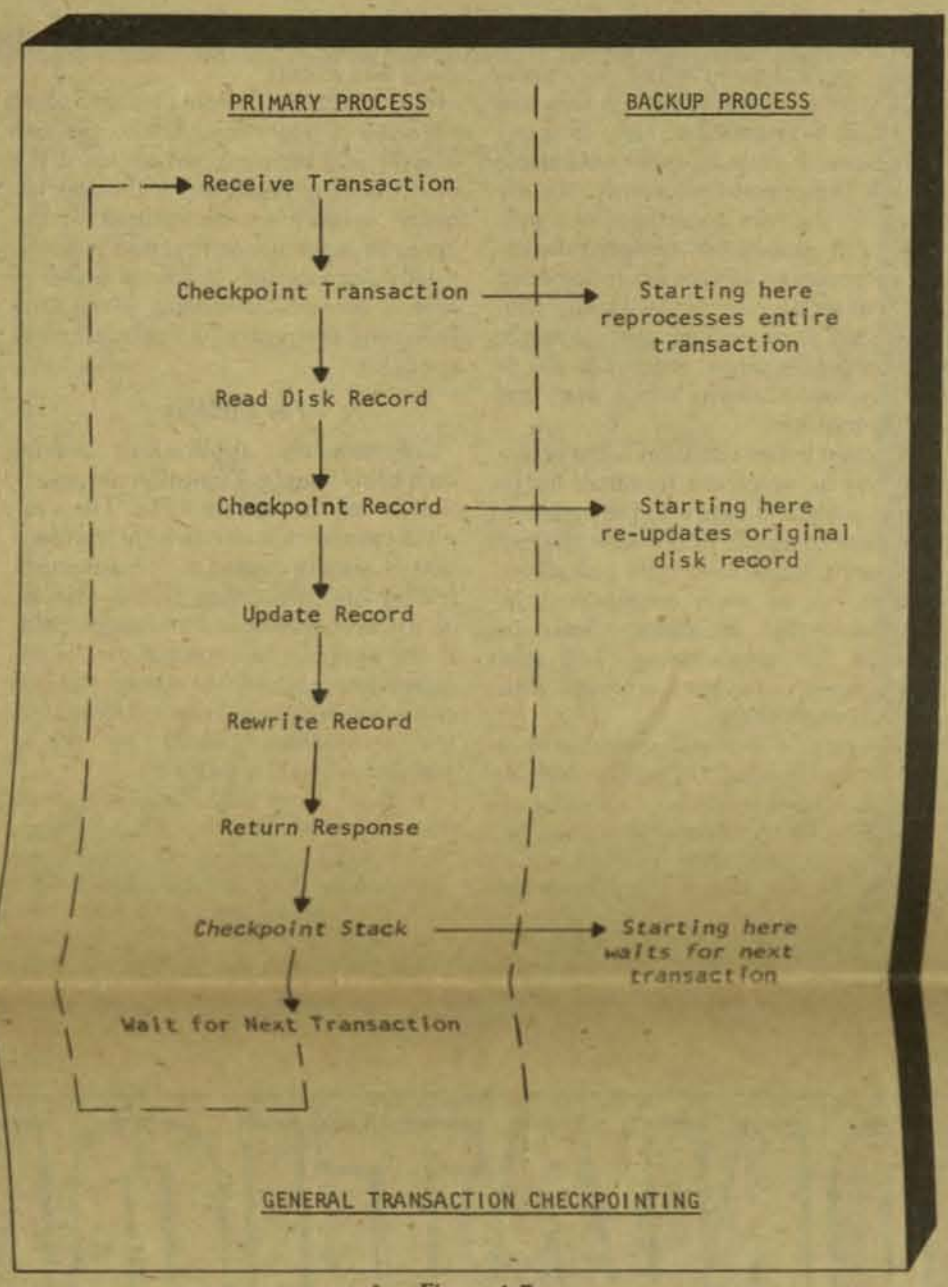

Figure 4-7

Lost operator data simply results in a degree of fault nontransparency. A more severe problem is a failure of a process during a disk write. When the backup takes over, it does not know if the disk write had not yet been initiated or had completed but the primary process had not yet checkpointed. If this operation were writing a record to the end of file, for instance, and the backup reissued the write, the record might be duplicated.

This problem can only be solved at the system level. Tandem solves it by carring a synchronization count with each critical disk operation for each process.

Other critical situations that can exist at proces failure time involve pending interprocess messages. There are several cases to consider. Let us define the "source process" as the originator of the message and the "destination process" as the recipient of the message. Consider the following cases:

- The source process sends a message and awaits a reply. It then notifies its backup via a checkpoint message that it has received a reply. What if the source process fails while it is waiting for the reply? Is the reply rerouted to the backup source process? If not, the backup source process will reissue the message, thus causing the destination process to receive a duplicate message, which it must then recognize as such if duplicate processing is not to be allowed. (The protection against duplicate critical disk operations described above is such a case solved within Tandem's Guardian.)
- The source process sends a message and awaits a reply. The destination process receives the message, checkpoints it to its backup and then fails. The backup takes over, processes the message and returns the reply. Has the return path been reestablished to the source process? If not, the source process must be able to detect the failure of the destination process and reissue the message. The destination process must be able to recognize this as a duplicate message and respond to it, but otherwise do no,other processing.
- Several source processes have sent messages to a destination process. These messages have not yet been read by the destination process (they are still queued to it) when the destination process fails. Are they rerouted to the backup process? If not, this is a variation of the above case. The source processes must detect the failure of the destination process and reissue the messages.

The extension of a process to include the capability of creating its own backup and keeping its backup informed via checkpoint messages provides the capability for the programmer to easily build survivable processes in a multiprocessor environment. The system is made truly survivable by ensuring that there are dual paths to all peripheral devices and that all critical files are mirrored. Primary/-backup role switching also allows load balancing to be accomplished dynamically in the system.

The proper strategy for checkpointing can be a difficult design task ranging across many considerations outside the realm of program design, including operational procedures and peripheral specifications. Once these are established, however, the implementation of the checkpointing strategy is little more than trivial. Particular care must be paid to lost and duplicate messages. Potentially, lost messages must be repeated, leading to the certainty of duplicate messages which must be detected and handled properly.

Next week: Throughput.

Dr. Wilbur H. Highleyman is president of Sombers Associates, Inc., Mountain Lakes, N.J., a firm specializing in minicomputer and microprocessor turnkey software. He is also chairman of MiniData Services, Inc., a service company.

Previously, Highleyman was responsible for Data Phone development at Bell Telephone Laboratories and was a cofounder of Data Trends, Inc. He has been instrumental in the design and implementation of survivable systems for the graphic arts, communications, financial and wagering industries.

Highleyman holds a B.E.E. degree from Rensselaer Polytechnic Institute, an S.M.E.E. degree from Massachusetts Polytechnic Institute and a D.E.E. degree from the Polytechnic Institute of Brooklyn. He holds four patents and has published extensively on pattern recognition, communications and business minicomputers.

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ANALYTICAL

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UPDATE

DUNS: 06-910-1152
TANDEM COMPUTERS (INC)

19333 VALCO PARKWAY
AND BRANCH(ES) OR DIVISION(S)
CUPERTINO CA 95014
TEL 408 996-6000

SEP 28 1978

DEVELOP & MFR
COMPUTER SYSTEMS

SIC NOS.
35 73

CHIEF EXECUTIVE: JAMES G TREYBIG, PRES

SUMMARY

RATING	3A2
STARTED	1974
PAYMENTS	SEE BELOW
SALES	$7,691,506
WORTH F	$2,735,284
EMPLOYS	140(130 HERE)
HISTORY	CLEAR
FINANCING	SECURED
CONDITION	GOOD
TREND	UP

PAYMENTS (Amounts may be rounded to nearest figure in prescribed ranges)

REPORTED	PAYING RECORD	HIGH CREDIT	NOW OWES	PAST DUE	SELLING TERMS	LAST SALE WITHIN
8/78	Slow 80	50	50	50	1 10 N30	
7/78	Ppt	50	50	-0-	N30	1 Mo
	Ppt-Slow 15	100000	100000	100000	N30	1 Mo
	(4)	2500	-0-	-0-	N30	
6/78	Ppt	200000	90000	15000	N30	1 Mo
	Ppt	7500	5000	50	N30	1 Mo
	Ppt	7500	5000	-0-		
	Ppt	5000	5000	-0-	N30	1 Mo
	Ppt	5000			N30	
	Ppt	1000	-0-	-0-	N30	2-3 Mos
	Ppt	100			N30	
	Ppt	50	50	-0-		1 Mo
	Ppt		-0-	-0-	N30	
	Ppt-Slow 45	500	-0-	-0-		4-5 Mos
	Ppt-Slow 110	15000	15000	7500		1 Mo
	Slow 45-90		50	50		
5/78	Ppt	5000	-0-	-0-		2-3 Mos
	Ppt	2500	1000	1000	N30	
	Ppt	250	250	-0-		1 Mo
	Ppt	50	-0-	-0-		6-12 Mos
	Ppt	50	50	-0-	N7	1 Mo
	Ppt		-0-	-0-	N30	6-12 Mos
/78	Slow 5	500	100	-0-	Regular terms	
2/77	Ppt-Slow	250	-0-	-0-		
1/77	Slow 30	20000			N30	
3/77	Ppt-Slow 15	100000	100000	20000	N30	1 Mo
	Slow 15	30000	30000	50	N30	1 Mo

On 09/27/78 Jack Loustaunou said any trade slowness reported would generally be the result of disputes.

NKING Bank reports deposit balances averaging in high seven figures, account opened in 1974. A low seven figure line of credit is available secured by accounts receivable and inventories. This line

(CONTINUED)

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BANKING is not presently in use. Relations satisfactory.

(Cont'd)
HIGHLIGHTS

	Fiscal Consolidated Sep 30 1975	Fiscal Consolidated Sep 30 1976	Fiscal Consolidated Sep 30 1977
Working Capital	365,834	2,220,316	2,346,696
Tangible Worth	394,580	2,356,263	2,735,264
Current Assets	453,685	2,607,870	4,665,490
Current Liabilities	88,051	387,554	2,318,794
Long Term Liab	184,474	312,549	316,420
Sales	---	580,969	7,691,506
Net Profit (Loss)	(656,675)	(2,168,770)	324,944

This company started in 1974, and during May 1976 its first system was shipped. During fiscal 1976, the company shipped six systems and during fical 1977 31 systems were shipped. Due to heavy expenditures losses were sustained for fiscal 1975 and 1976, for the quarter ended Jun 30 1977, the company reported its first profitable operations.

A major equity financing was closed in Jul 1976 for a total of $12,1 million. This equity capital was in the form of preferred sstock. The results of this equity capitalization greatly improved the financial position of Tandem. In Sep 1977 an additional public offering was made for $700,000 shares common stock. Net proceeds from the sale is $7,2 million.

CURRENT

Comparative operating results:

3 mos. ended Dec 31 1977		3 mos. ended Dec 31 1976
Sales	$ 3,909,000	$ 789,000
Net Income (Loss)	$ 638,000	(301,000)

On Sep 27 1978 Jack Loustaunou, vice president-finance deferred financial statement.

The following is interim unaudited results of Dec 31 1977: Current assets $12,980,000; current liabilities $1,369,000; long-term debt $351,000; net worth $12,302,000.

Notice of financing statement filed May 18 1978; File #78-078953, Secured Party: B A Leasing Corp, P O Box 37130, San Francisco, CA, Collateral: Equipment, products.

10-04(190 /15)2093/03 40101 022 H
Bank of America, 384 San Antonio Ave, Mountain View

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ANALYTICAL

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FINANCIAL STATEMENT

TANDEM COMPUTERS (INC)
CUPERTINO CA

MAR 3 1978

DUNS: 06-910-1152

FINANCIAL STATEMENT

	Consol Sep 30 1977
Cash	108,810
Accounts Receivable	2,601,622
Inventory	1,863,052
Prepaid	92,006
Total Current Assets	4,665,490
Fixed Assets	705,008
Total	5,370,498
Due Bank	800,000
Accounts Payable	1,114,715
Accruals	313,210
Long Term Liab (curr)	90,869
Total Current Liab	2,318,794
Long Term Liab	316,420
PREFERRED STOCK	207,370
COMMON STOCK	31,273
ADDIT. PD.-IN CAP	4,486,617
RETAINED EARNINGS	(2,489,976)
Total	5,370,498
Net Working Capital	2,346,696
Current Ratio	2,01
Tangible Net Worth	2,735,284

(CONTINUED)

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INCOME STATEMENTS AND SURPLUS OR NET WORTH RECONCILIATIONS

	Consol Sep 30 1977
Net Sales	$ 7,691,506
Cost of Gds Sold Exp	7,362,562
Net Income on Sales	328,944
Federal Income Taxes	171,000
Extraordinary Credit	167,000
Final Net Income	324,944
Surplus-Net Worth Start	2,814,920
Add: Net Income	324,944
Surplus-Net Worth End	(2,489,976)

SOURCE & BASIS OF FIGURES
Figures of Sep 30 1977 represent the consolidated financial condition of subject and 1 subsidiary(s).

Figures of Sep 30 1977 were prepared from a balance sheet received by mail.

Accountant(s): Arthur Andersen & Co.

ACCOUNTANT(S) OPINION: "We have examined the consolidated balance sheet of Tandem Computers Incorporated (a California corporation) and subsidiaries as of September 30, 1977, and the related consolidated statements of operations, shareholders' investment and changes in financial position for the period from Nov 29, 1974 (date of incorporation), to Sep 30 1975, and the years ended Sep 30 1976 and 1977. Our examination was made in accordance with generally accepted auditing procedures as we considered necessary in the circumstances.",

"In our opinion, the consolidated financial statements referred to above present fairly the financial position of Tandem Computers Incorporated and subsidiaries as of September 30, 1977, and the results of their operations and the changes intheir financial position for the period from November 29, 1974, to Sep 30 1975, and the years ended Sep 30 1976 and 1977, in conformity with generally accepted accounting principles consistently applied during the periods.",

Inventories valued at lower of cost or market using FIFO method. Accounts receivable shown net less undisclosed allowance for doubtful accounts . Fixed assets shown net less $230,546 accumulated depreciation.

SUPPLEMENTAL DATA
Notes Payable Bank: In Feb 1977 the Company entered into a credit agreement with a bank providing for working capital borrowings up to

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SUP-DATA (Cont'd) $1,000,000, secured by receivables and inventory. On Oct 5 1977, this credit agreement was replaced with a revolving line of credit agreement providing for borrowings up to $2,000,000, secured by receivables, inventory and all other assets. The new agreement, which expires Dec 31 1978, provides for borrowings, based on a revolving formula and evidenced by demand notes, at .75% above the bank's prime lending rate.

The average interest rate on borrowings during fical 1977 was approximatey 7 1/2%. During 1977 the average month-end borriwng was $625,000 and the maximum borrowing at any month end was $950,000. The balance outstanding at Sep 30 1977 ($800,000) was repaid shortly after year end from proceeds of the sale of preferred stock.

LONG TERM DEBT
Consists capital lease obligations.
As of Sep 30 1977, the Company had leased from a bank $454,000 of equipment for a period of 5 years with an option to purchase the equipment
The Company makes monthly payments of $9,205.
The following summarizes the future minimum lease payments together with the present value

1978	110,465
1979	110,465
1980	110,465
1981	110,465
1982	53,187
Total minimum lease payments	495,047
Less: Amount representing interest 8%	87,758
Present value of net minimum lease paymens	407,289

IN THE INTEREST OF SPEED, FINANCIAL STATEMENTS ARE ISSUED AS RECEIVED WITHOUT REVIEW. THE FIGURES WILL BE REVIEWED AGAINST THE RATING AT A SUBSEQUENT DATE.
03-23(190 /3)4004/04 10101 47 022 048

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SPECIAL NOTICE

DUNS: 06-910-1152
TANDEM COMPUTERS (INC)

20605 VALLEY GREEN DR
AND BRANCH(ES) OR DIVISION(S)
CUPERTINO CA 95014
TEL 408 255-4800

JAN 20 1978

DEVELOP & MFR
COMPUTER SYSTEMS

SIC NOS.
35 73

RATING 3A2

STARTED 1974

SPECIAL EVENTS

Subject has added a branch located at P O Box 514 Newton, PA 18940. This is a post office box for the areas sales representative.

01-23(201 /14)0311/01 47 022 H

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BASE REPORT

TANDEM COMPUTERS (INC)
CUPERTINO CA

SEP 14 1977

DUNS: 06-910-1152

FINANCIAL STATEMENT

	Consolidated Sep 30 1975	Consolidated Sep 30 1976
Cash	$ 1,761	$ 31,394
Accounts Receivable		460,774
Inventory		585,591
Cash Investments	445,000	1,485,447
Prepaid	7,124	44,614
Total Current Assets	453,885	2,607,870
Fixed Assets	154,825	345,659
Systems Spares		43,577
Other Assets	58,395	59,260
Total	667,105	3,056,366
Accounts Payable	59,226	267,650
Accruals	28,825	73,906
Long Term Liab (curr)		45,998
Total Current Liab	88,051	387,554
Long Term Liab	184,474	312,549
PREFERRED STOCK	1,016,250	5,144,706
COMMON STOCK	24,480	26,477
RETAINED EARNINGS	(646,150)	(2,814,920)
Total	667,105	3,056,366
Net Working Capital	365,834	2,220,316
Current Ratio	5.15	6.72
Tangible Net Worth	394,580	2,356,263

(CONTINUED)

THIS REPORT, FURNISHED PURSUANT TO CONTRACT FOR THE EXCLUSIVE USE OF THE SUBSCRIBER AS ONE FACTOR TO CONSIDER IN CONNECTION WITH CREDIT, INSURANCE, MARKETING OR OTHER BUSINESS DECISIONS, CONTAINS INFORMATION COMPILED FROM SOURCES WHICH DUN & BRADSTREET, INC. DOES NOT CONTROL AND WHOSE INFORMATION, UNLESS OTHERWISE INDICATED IN THE REPORT, HAS NOT BEEN VERIFIED. IN FURNISHING THIS REPORT, DUN & BRADSTREET, INC. IN NO WAY ASSUMES ANY PART OF THE USER'S BUSINESS RISK, DOES NOT GUARANTEE THE ACCURACY, COMPLETENESS, OR TIMELINESS OF THE INFORMATION PROVIDED, AND SHALL NOT BE LIABLE FOR ANY LOSS OR INJURY WHATEVER RESULTING FROM CONTINGENCIES BEYOND ITS CONTROL OR FROM NEGLIGENCE. 9 R2-3(741212)

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INCOME STATEMENTS AND SURPLUS OR NET WORTH RECONCILIATIONS

	Consolidated Sep 30 1975	Consolidated Sep 30 1976
Net Sales	$ ---	$ 580,969
Cost of Goods Sold	---	481,721
Gross Profit	---	99,248
Expenses	646,150	2,268,018
Final Net Income	(646,150)	(2,168,770)
Surplus-Net Worth Start	---	(646,150)
Add: Net Income		(2,168,770)
Surplus-Net Worth End	(646,150)	(2,814,920)

SOURCE & BASIS OF FIGURES
Figures of Sep 30 1976 represent the consolidated financial condition of subject and 1 subsidiary(s).

Figures of Sep 30 1976 were prepared from a balance sheet received by mail.

Accountant(s): Arthur Andersen & Co.

ACCOUNTANT(S) OPINION: "We have examined the consolidated balance sheets of Tandem Computers Incorporated (a CA corporation) and subsidiary as of Sep 30 1976 and 1975, and the related consolidated statements of operations, shareholders' investment and changes in financial position for the year ended Sep 30 1976, and for the period from inception (Nov 29 1974) through Sep 30 1975. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances".

"In our opinion, the accompanying consolidated financial statements present fairly the financial position of Tandem Computers Incorporated and subsidiary as of Sep 30 1976 and 1975, and the results of their operations and the changes in their financial position for the periods then ended, in conformity with generally accepted accounting principles consistently applied during the periods".

Inventories valued at lower of cost or market using FIFO method. Accounts receivable shown net less undisclosed allowance for doubtful accounts . Fixed assets shown net less $70,047 accumulated depreciation.

SUPPLEMENTAL DATA
Consolidation: The consolidated financial statements include the accounts of Tandem Computers Incorporated and its German subsidiary

(CONTINUED)

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SUP-DATA (Cont'd) after elimination of intercompany accounts and transactions. The accounts of the foreign subsidiary (which are not significant in relation to the consolidated financial statements) hve been translated into US dollars at current or historical rates of exchange, as appropriate.

Long Term Debt: As of Sep 30 1976, the Company has leased from a bank $358,547 of property and equipment for a period of five years with an option to purchase the equipment at the fair market value at the end of the lease period. These leases have been capitalized since the lease period approximates the estimated useful life of the equipment. Although the Company and the bank have not yet agreed upon a date for the Company to begin lease payments, the Company expectsto made the first of 60 monthly principal and interest payments of $7,273 in Jan 1977. Until that time, the Company will be charged interest at the rate of 12% on the outstanding principal balance; however, the effective interest rate on the lease will be 8%.

HISTORY

+JIM TREYBIG, PR & CX
SAMUEL J WIEGAND, VP-MKTG
JAMES A KATZMAN, VP-ENG
+JACK LOUSTAUNOU, VP, SC, & TR
MICHAEL D GREEN, VP-SOFTWARE
ROBERT C MARSHALL, VP-MFG

DIRECTORS: The officers identified by (+) and Thomas J Perkins, Eugene Kleiner, Franklin P Johnson, and Morton Collins.

Incorporated CA on Nov 29 1974. Authorized capital stock 4,000,000 shares common at $.05 par, 1,900,000 shares preferred at $.10 par. Charter amended Nov 17 1975 changing authorized capital 2,200,000 common shares at $.05 and 1,700,000 preferred shares at $.10.

Business started 1974.

50% of the outstanding capital stock is owned by Kleiner & Perkins, a venture capital limited partnership located in San Francisco, CA (previously of Menlo Park, CA). Balance is owned by 9 other preferred shareholders including the Mayfield Fund, Menlo Park; Wilmington Securities, Wilmington DE; DSV Associates, Princeton NJ; and E M W Associates, New York City. In addition, there are 30 employee-shareholders.

The company started in 1974 with a starting capital of $1 million from Asset Management Capital Co Inc., and Kleiner & Perkins. Additional equity capital was obtained on Nov 18 1975 in the amount of $2,021,000 preferred stock. As of Sep 30 1976, Leiner & Perkins, owned all of the outstanding Series A preferred stock (200,000 shares), 720,000 shares of the outstanding Series B preferred stock and 166,667 sharesof the outstanding Series C preferred stock.

MANAGEMENT BACKGROUND

TREYBIG born 1940 married. Leiner & Perkins, Menlo Park, as limited partners, 1972-74. At Hewlett Packard, as marketing manager 1968-72. MBA Stanford 1968. T I, Dayton, OH, field salesman from 1964-66.

(CONTINUED)

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HISTORY (Cont'd) Rico University 1959-64, electrical engineering.

LOUSTAUNOU born in 1938 married, 1972-74 at Kleiner & Perkins, Menlo Park as a limited partner, 1966-72 at Hewlett Packard as Finance Manager for data products group, MBA from Harvard 1964-66; gained AB in mathematics from University of Southern CA 1960. From 1960-64 served in the United States Navy.

WIEGAND born 1929 married, Graduated U S Naval Academy, 1952, Joined subject Aug 1975, 1973-75 Pres of Ball Computer Products, Berkeley, 1969-1972 founder and Vice Pres-Mktg of Diablo Systems, Hayward, 1967-69 Vice Pres Mktg Information Handling Services Inc. Approxiately 1954-67 with Honeywell Information Systems.

GREEN born 1943 married, Co-founder of subject in 1974, 1966-74, Hewlett Packard Co., as software development manager, 1966 MS Computer Science at Stanford, 1964 BS Math, Columbia University.

KATZMAN born 1946 married, Co-founder in 1974, 1972-74 with Amdahl as development and engineering manager, 1968-71 with Hewlett Packard in engineering, 1970 MSEE Stanford University, 1968 BSEE Purdue.

MARSHALL born 1931 married, Joined subject Oct 1975, 1969-75 Vice President and General Manager Diablo Systems in Hayward, CA, 1964-69 E.A.I, 1956-64 Lawrence Radiation Laboratories in Livermore, 1956 BSEE Heald Engineering College.

PERKINS, Partner in Kleiner & Perkins, San Francisco, a venture capital limited partnership.

KLEINER, Partner in Kleiner & Perkins, San Francisco, a venture capital limited partnership.

JOHNSON, With Asset Management Inc.

COLLINS, General Partner at Data Science Venturs Princeton, NJ.

OPERATION Manufacturer of multiprocessing computer systems, used by financial institutions, banks and insurance companies.
DISTRIBUTION: Sells through direct salesmen.
TERRITORY: International.
ACCOUNTS: Approximately 20.
EMPLOYEES: 140, including officers, 30 here.
FACILITIES: Leases 20,000 sq. ft. in one story concrete building in good condition. Premises neat.
LOCATION: Located in a new light industrial park.
SUBSIDIARIES: Subject has one subsidiaries.
Tandem Computer GmbH, Frankfurt, Germany (100%) chartered 1975, Operates as a sales entity only. No formal intercompany transactions have yet been finalized.

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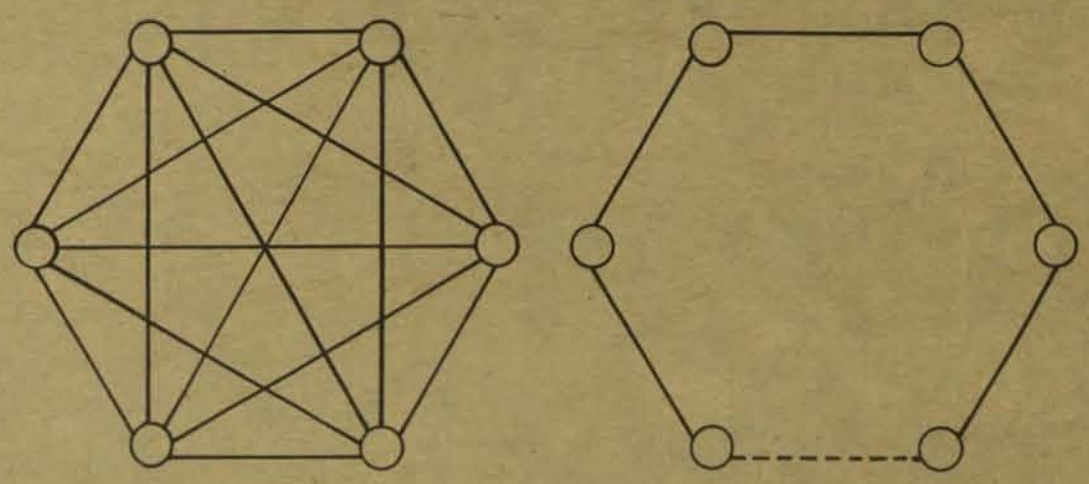
DATA COMMUNICATIONS

Tandem Enters DDP With Expanded Guardian

NEW YORK—Tandem Computers, Inc., entered the distributed data processing field last week by expanding its Guardian single-system computer into a worldwide network called Guardian/Expand.

Designed around the company's fault-tolerant Tandem 16, the new network can accommodate a maximum of 255 geographically dispersed systems, or communication nodes, each with up to 16 CPUs.



A typical network, left, and a Guardian/Expand network, right, illustrating its node-to-node communications capability without traditional point-to-point connections.

No Geographic Limits

ENFORM, Tandem's newly announced systems software, is the key to the Guardian/Expand network. ENFORM allows any node within the network to communicate with any other node—regardless of geographical location—without the traditional point-to-point connections between all nodes, a company spokesman said. No special programming is necessary, and the application environment looks the same whether it is running in the network or on a single Tandem 16 system. This powerful language provides a method for querying data bases and retrieving data from multiple files which may be related in ways which were unanticipated during data-base design.

As a nonprocedural language, ENFORM allows inexperienced users to make queries in simple English.

A network of Tandem 16s is not much more complicated than a single Tandem 16, because the Tandem 16 is already a network of processors, the spokesman said. Even though the nodes within the network may range from a basic two-processor system to a 16-processor system with billions of bytes of on-line storage, the system retains total compatibility of data, software and application programs.

"We have done away with the traditional hierarchical networks and the problems that occur when a system or line breaks down and prevents communication among all the systems below the breaking point. With Expand there are no master-slave relationships. All systems are equally ranked. And significantly, managing the network is completely transparent to the operators and programmers," said Tandem president James G. Treybig.

Treybig was previously Hewlett-Packard's product manager on the HP 3000, the powerful general-purpose computer that forms the center of HP's Distributed Systems Network, now the Tandem 16's closest competitor.

"ENFORM, combined with Expand, allows Tandem users to extract information from worldwide networks when they need to, without time-consuming restraints or negotiation with central EDP departments and without concern for communications reliability or geographic location of data," said Tandem's vice president of marketing Sam Weigand.

Network control is handled by a program called NETMAPS, which provides a facility to display the entire network status as if viewed from a single system. It gives the current status of each remote system and the status and routing of each communications path to each system.

Guardian/Expand supports X.25 protocol, as does Tymnet, Datapac, Telenet and other common carriers. Tandem's end-to-end protocol is said to assure message integrity from source to destination, regardless of the number of intervening systems and resources utilized in the transaction. An Expand network may contain over 8 billion bytes of internal memory.

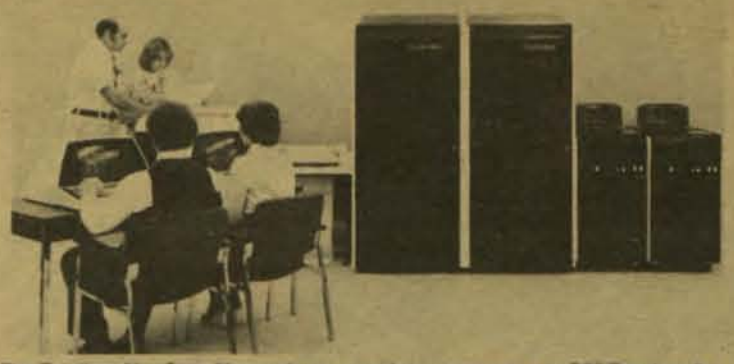
Tandem's Guardian NonStop computer was reportedly developed to offer users a high degree of reliability, primarily for applications heavily involved in on-line transactions. If an individual processor in Tandem's system should fail, its operations are absorbed by another without processing interruption. Tandem's dual-ported controllers and mirrored disk volumes also preclude failures of individual peripherals, and their repair, from halting processing, a company spokesman noted.

Key Is Dynabus

The key to Tandem's fault-tolerance is its unique Dynabus—13 Mbytes per second—dual communications interprocessor path. NonStop's operations control and systems communications are "watched" by individual processors' "eye witnesses," which continually monitor each other's operations through complex procedures in a mode referred to as a "paranoid democracy."

Expand will be available in March 1979. The price of Expand includes a license fee of $10,000 plus a microde charge of $1,500 per processor.

ENFORM will be available by March. It will cost $7,000 for a license fee plus a $1,500 microde fee per processor.



The Tandem NonStop Network can now interconnect up to 255 Tandem Systems to provide worldwide distributed processing capabilities. The Expand network may contain up to 8 billion bytes of memory.

Harcharik, Former Tymnet Sales VP, Now President Of Tymshare Sub.

CUPERTINO, CALIF.—J. Robert Harcharik has been named President of Tymnet, Inc., the communications common carrier subsidiary of Tymshare,Inc. The announcement was made by Warren Prince, Tymshare's group vice-president, financial and network systems.

Since August 1977, Harcharik had been vice-president of sales for Tymnet.

Harcharik joined Tymshare in 1973 after five years with Computer Network Corporation (COMNET), where he was co-founder and vice-president. He moved from Tymshare's corporate business development operations to Tymnet in January 1975 as eastern regional manager.

HP Expands Terminal Line With 2620s

PALO ALTO, CALIF.—Hewlett-Packard has expanded its family of terminals by introducing its new 2620 series. The character-mode CRT terminals models 2621A and 2621P (the printing version) are the lowest-cost HP CRT terminals available.

The HP 2621 units offer users a 15.2 cm by 21.6 cm high resolution screen that displays sharp upper- and lower-case and control characters. Complex characters are accurately represented due to the unit's 9 by 15 dot matrix character cells. For better definition each character can take advantage of half-dot shifts on a row-by-row basis. Also, wide separation between characters and lines makes the display easy to read.

The terminal's 4k bytes of memory can store 48 lines of data that can be viewed 24 lines at a time, page by page, or by scrolling.

By using the built-in printer on the HP 2621P, the user can copy the entire display memory, the screen display or only selected data lines. The terminal, whose printer can be controlled by the computer, has a data-logging mode that provides the user with a printed record of all interactive transmissions.

The thermal printer uses a long-life, thin-film print head that is highly resistant to abrasion and chemical erosion. As with the CRT display, the printer uses a 9 by 15 dot matrix to form upper- and lower-case and control characters. Microprocessor-controlled, the unit prints in both directions at 120 cps.

The layout of the detachable HP 2621 keyboard is like that of a typewriter. It provides an embedded numeric key pad and has eight additional function keys that control editing, cursor positioning and (on the 2621P) the printer.

Information such as baud rate (up to 9600), parity, automatic line feed and communication parameters are stored in nonvolatile memory which can be displayed and changed easily with the keyboard.

The HP 2621 terminal features editing functions designed to work in interactive, character-mode applications without any need for system software modification.

Other features include margins, tabs and a diagnostic self-test that checks the terminal's random access memory, verifies the firmware operation and displays the character set on the screen.

The HP 2621A and 2621P are priced at $1,450 and $2,550 respectively. Estimated delivery is eight weeks from date of order.

The Hewlett-Packard 2621A CRT terminal, the lowest priced HP CRT available, offers the user a high resolution screen and 4k bytes of memory.

Spectra profits

Spectra-Physics Inc., Mountain View, announced record sales and profit for the fiscal year ended Sept. 30.

Sales rose 26% to $66.1 million. President Herbert Dwight said he expects that growth rate to continue in fiscal 1979, so that sales should be between $85 million and $95 million.

Profit rose from $1.05 to $1.45 a share.

In the fourth quarter sales and profit also exceeded the levels of any previous fourth quarter: $18.1 million in sales and 34 cents a share in profit.

Dwight attributed the growth to sales of major new products for underground construction and liquid chromatography, and to general strength in the construction laser business.

Spectra-Physics makes gas laser systems for medical and scientific uses, laser control systems for construction and agriculture and chromatography instruments for chemical analysis.

Foreign exchange

NEW YORK (AP) — Foreign Exchange. New York prices

	Fgn currency in dollars		Dollar in fgn currency	
	Wed.	Mon.	Wed.	Mon.
Argentina	.0011	.0011	900.50	900.50
Australia	1.1510	1.1485	.8688	.8707
Austria	.0726	.0718	13.77	13.93
Belgium	.0341	.0335	29.31	29.82
Bolivia	.0520	.0520	19.20	19.20
Brazil	.0520	.0520	19.20	19.20
Britain	1.9725	1.9785	.5069	.5054
30 day fut	1.9688	1.9765	.5079	.5059
60 day fut	1.9650	1.9716	.5089	.5073
90 day fut	1.9617	1.9685	.5097	.5080
Canada	.8540	.8566	1.1709	1.1673
30 day fut	.8544	.8570	1.1704	1.1668
60 day fut	.8551	.8574	1.1694	1.1663
90 day fut	.8560	.8582	1.1682	1.1653
Chile	.0301	.0301	33.22	33.22
Colombia	.0250	.0250	40.04	40.04
Denmark	.1900	.1900	5.2755	5.2630
xEgypt	2.56	2.56	.3900	.3900
xEcuador	.0371	.0371	26.95	26.97
France	.2334	.2314	4.2840	4.3200
Greece	.0274	.0274	36.45	36.45
Holland	.4930	.4868	2.0280	2.0540
Hong Kong	.2098	.2094	4.7650	4.7740
xIndia	.1290	.1290	7.7519	7.7519
Indonesia	.0024	.0024	415.00	415.00
Iran	.01420	.01420	70.45	70.45
xIsrael	.0542	.0542	18.46	18.46
Italy	.001198	.001187	835.00	842.25
Japan	.005144	.005161	187.05	190.00
30 day fut	.005397	.005109	185.45	188.50
60 day fut	.005439	.005151	183.85	186.85
90 day fut	.005476	.005186	182.60	185.65
Jordan	3.4106	3.3990	.2931	.2942
Kuwait	3.8900	3.7729	.2713	.2651
Lebanon	.2372	.2367	3.9650	3.9700
Mexico	.0439	.0439	22.79	22.79
Norway	.2006	.1976	4.9855	5.0515
xPeru	.0054	.0054	183.67	183.67
Philippines	.1358	.1358	7.3585	7.3585
Portugal	.0219	.0216	45.70	46.35
Saudi Arab	.2326	.2863	3.3050	3.3660
Singapore	.4609	.4882	2.1650	2.1820
So. Africa	1.1505	1.1505	.8691	.8691
Spain	.0141	.0140	71.00	71.60
Sweden	.2212	.2200	4.5210	4.5465
Switzerlnd	.6203	.6067	1.6120	1.6480
30 day fut	.6253	.6127	1.5992	1.6320
60 day fut	.6313	.6182	1.5838	1.6175
90 day fut	.6381	.6242	1.5670	1.6020
Uruguay	.0148	.0148	6.7300	6.7300
Venzuela	.2329	.2329	4.2937	4.2937
W. Germny	.5253	.5253	1.8750	1.9040
30 day fut	.5305	.5252	1.8645	1.8930
60 day fut	.5399	.5375	1.8520	1.8812
90 day fut	.5445	.5347	1.8380	1.8702

Pre closing London prices, gathered by Bank of America, New York.
x—Floating.
y—Official rate.

Spot gold: afternoon fixing $221.75, up $5.40; afternoon fixing $218.80, up $2.45.

Paris: afternoon fixing $220.91, up $5.78.

Frankfurt: close $222.17, up $7.10.

Zurich: $218.50, bid up $2.50; $219.50 asked.

New York: Handy & Harman base price, $219.05, up $2.45.

New York: Engelhard selling price, $219.10.

New York: Engelhard fabricated gold, $224.78.

Handy & Harman spot silver $5.875

Engelhard selling price, New York: $5.875,

Engelhard fabricated silver, $6.022.

Stock Key

Sales figures are unofficial.

Unless otherwise noted, rates of dividends in the following table are annual disbursements based on the last quarterly or semi-annual declaration. Special or extra dividends, or payments not designated as regular are identified in the footnotes.

a—Also extra or extras. b—Annual rate plus stock dividend. c—Liquidating dividend. e—Declared or paid in preceding 12 months. f—Declared or paid after stock dividend or split-up. g—Declared or paid this year, an accumulative issue with dividends in arrears. h—New issue. j—Paid this year, dividend omitted, deferred or no action taken at last dividend meeting. k—Declared or paid in preceding 12 months plus stock dividend. l—Paid in stock in preceding 12 months, estimated cash value on ex-dividend or ex-distribution date.

m—Sales in full.

n—Cld—Called. x—Ex-dividend. y—Ex-dividend and sales in full. x-dis—Ex-distribution. xr—Ex-rights. xw—Without warrants. ww—With warrants. wd—When distributed. wi—When issued. nd—Next day delivery.

vj—In bankruptcy or receivership or being reorganized under the Bankruptcy Act, or securities assumed by such companies. wi—Foreign issued subject to interest equalization tax.

z—Price earnings ratio greater than 99 not shown.

u—new high for year.

d—new low for year.

Over-the-counter listings

Western OTC Ind. Bk & Ins Stocks

NEW YORK (AP) The following bid & asked quotations from the NASD are representative interdealer prices as of approximately 8:30 A.M. interdealer markets change throughout the day. Prices do not include retail markup, markdown or commission.

		Bid	Asked
AcmeGn	.50	7¼	8
AddisnW	.50	8⅜	8⅞
AdvMicr		20	20½
Alamand		2⅛	2⅜
AlexBld	1.20	14½	15
AClipper	.84	7¼	7¾
AGreet	.48	10½	10⅞
AGrtyFn	.5	5¾	6¼
AHomShd		5¾	6¼
AMicros		14¼	14¾
ANatFn	.48	12	12¾
ARecrCf	.20	12	13
AmResv		2¾	3⅛
AndrJcb		4⅞	5⅜
AnheusB	.88	23⅛	23⅝
ApldMtl		6¾	6⅞
ArgoPet		7¼	7¾
ArkWGs	.68	16	16⅝
AssdHst	.24	8½	9
BBDO	2.40	33¼	34
BairdCp	.5	5⅞	6⅜
BkamRt	.75e	11⅛	11⅝
BearCrk	.24	8	8¼
Bekins	.60	6⅞	7⅛
BentlyL		7¼	8½
BioRadL		15½	17½
BlueChip	.24	18¾	19½
Bohemia	.80b	21¾	22¼
Bonanza		4⅛	4⅜
BootheF		17	18
BrwTom		16⅜	17⅛
CalFtBk	96	14⅝	15¼
CalMicr		21	21¾
CalWtSv	2.80	30	31½
CallonPet		5⅜	5⅞
CalnyFd	.20	11	12½
CenBkSv	.40b	10½	11
CnVtPS	1.44	14⅜	14⅝
Centy 21		15¼	15¾
ChartHo	.90b	17⅛	17⅝
Chubb	1.90	30⅝	31⅛
CitzUtA	.5	37⅛	37⅞
Coherent		12¾	13½
Combins	1.20	16½	16⅝
CmptAut	.20	15½	16¼
CmptUsg		2½	3
Cmprvn		19¼	20¼
ConnGn	1.08	33⅛	34⅜
CnsCapR	2.06	24	25½
ConFibr		2½	2
ContCap		7¼	8¼
Coors B	.25	12⅜	13⅛
Cordis		18½	19½
Cyclotron		24	26
DtaDes	.32	2⅞	3
Daylin		2 3/16	2 5/16
DeltbAq	.60	20¼	21
DeltaCal	.25	5¼	6¼
DeLuxC	1.20	27½	28¼
DiagDat		20¼	21¼
DoleJm	.03e	6½	7½
DrexirT		8½	9¼
Ducomn	.40	9¼	10
DunkinD	.20	10½	10⅝
EH Int		2¼	3¼
EarlyCal		5⅜	6¼
EconLab	.80	21½	22
ElPasEt	1.04	10	10⅜
EldorGn		9⅜	9⅝
ElArray		4⅜	4¾
EmpBnt	.25e	18¾	19½
EnRsv		2⅞	3
EqutSL	1	22⅜	22⅝
FalnStaff		1 11/16	1 15/16
FamilCp		2	2¼
Farinon	.08	9½	10¼
FarmBr	.40	16	16⅜
Finnign		13¼	14¼
FtBostn	1e	16½	17¼
FtLncFn		7¾	8¼
FtNtBsh	1.40	21½	22½
FtSLAsc	.40	9½	10½
FtSurety		15¾	16
FredHall	.32	3¾	4¼
Fremont	.44	12	12½
Frndlce	.18	11¾	12¼
FritzIC	.28	8¼	9¼
GRT Cp		1¼	1⅝
GalaxyD		5¾	6
GnAutm		12⅜	13⅞
GnEngy	.10	8	9½
GnReins	2.60	172	178
GTel S6pt	.90	9¼	10¼
Grantre	.24	8¼	9¼
GuarFin	.60	15	16½
GuardPk	.40	8½	9¾
HahnEW	.28	21¼	22
Hanvtns	.36	22¼	23¾
HarpGp	.24	16½	17¾
HawaBn	.80b	11⅞	12⅝
Hexcel		16½	17¼
HmstdF		10	11
Hoover	.84	10⅞	11⅜
HyattCp		16⅜	16⅞
Hyattint		12	14
Hystler	1.20	31⅝	31⅞
ImageSy		3	3½
Impell	.36	18	18¼
IndpBsh	.60	15¾	16¼
Inframd		3⅞	4
IntegEnt	.05e	5	5⅜
IntelCp		48	49½
Intersil	.86e	11⅝	12⅛
IwaSoUt	2.16	23¾	24¼
ItelCp wt		2⅜	2⅝
JBBigB	.12	2⅞	3⅛
Jhirmck	s	15¾	16⅛
Jhirmk wt		6¾	7¼
Jhirmk un		24	25
KDI		2	2 1/16
KaisSt pf	1.46	19¾	20½
Kemper	1.80	38	38¾
Knudsn	.60b	11¼	11¾
LearPet	.10	13¾	14¼
Litrnx		3	3¼
LongFlb	8.20e	265	290
Loomis	.10e	3¾	4½
MB Assc		4	4¼
MCIC		2¾	3
MagmP		3¾	3⅞
MgfAsst		9¼	9¾
MfBkLA	.50	15¾	15⅞
MaulLP	.44	11¾	12¼
Merchin		29½	31
MeyerF	.44b	15¾	16¼
MicroMk		24¾	25⅜
Microdat		10¾	10⅞
Microl		16½	17
MonCap	.94	2⅜	2⅝
Mostek		15¾	15⅞
Natwide	.50	13½	14
NJNGas	1.44	14¾	14⅞
NewpPh		10½	11½
Nielsn B	.76	27¼	27⅞
NobleAff	.16	23¾	23⅞
Nordstr	.32	18¾	19¼
NthPstP		35¾	36¼
NwtNGs	.96	9½	9¾
NuclDyn		10¼	10¾
OlgaCo	.50	4½	5
OlympB	.90	9¼	10¼
OpticCL		10½	11
Orbanco	.60	7¾	8½
PRF Cp		15¼	16
PVO Int	.80	4¼	5¼
PabstB	1.20	12	12½
PacGar	1.60	14	14½
PacCHt	.15e	43	44
PcGab	1.50b	16	16¾
PacifRes	.36b	22½	23¼
PacStdLf		9¼	9½
PauleyP		2⅝	2¾
PavLDo	.48	5¼	6
PayNPk	.60	10½	11
PayNJv	.80	24¾	25⅜
PenLf		24¾	25⅜
PhilGlo	.84e	12	12¼
PicNSav		6¼	6½
Quadrex	.16	5¾	6
Quantor		2¾	2⅞
RainrBn	.92	22½	23⅛
Raychm	.25e	38½	39¼
RMtg	1.26e	11	11¼
RepNLife	.50	11¾	12¼
Revell	.44b	6½	6¾
ReyRey	.72	27	27½
Rochcor		7¼	7⅝
RykoffSE	.60	9¾	10¼
SBE Inc		3¾	4¼
Safeco	1.50	38¼	38¾
Scope	.50	19½	20¼
SecPac	1.80	31¾	32¼
SigmaCp		11¼	12
Siliconx	.10e	7¾	8¼
Society	1.10	20¼	21¼
SonomVl		4¾	5¼
SCalWtr	1.32	13½	14¼
SwGsCp	1.04	11¾	12¼
Sovergn	.10e	6¼	6¾
StockYd	.30	8¼	8¾
Sumito	.96	14¾	15¼
Tampax	2.20a	25	25¾
Tandem		24½	25¼
Tesecrpt	.32	12¾	13
TeracOH		2	2⅛
Tesdata		7¾	8¼
TmsAyLb	.25e	8¾	9¼
Tigrary		2¾	3⅛
TokoKft	.25	8½	9
TopnTr	.28	4	4¼
TotaCp		47	48
UnCbITv	.15e	17	18
US Bcp	.45e	26½	27⅜
UnivRE	.96e	9½	10
VacuDry	.05e	5¾	6¼
ValBkAr	1.04	21¾	22¼
VeleBrnd		3¾	3¾
VictrAst	.10	10½	11¼
WCS Int		7¾	8¼
WD40 Co		24½	26
WatkrSct	.25e	8¾	9¼
WshEmr	1.32	14½	15
Wavetk		8¾	9¼
Weeden	.10	2¾	2¾
Wendys	.28	23	23¾
WnGear	.40	8½	9
WmorC	1.60	27	27¾
Wertrau	.70b	12¾	13¾
Willamt	1.10	26	26½
Z Flash		3¾	4¼
ZenNet	.10e	11½	12½

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GM recalling 1976-77 Chevette subcompacts

By MICHAEL DOAN

WASHINGTON (AP) — Housing construction probably will drop sharply in 1979 because of rising interest rates, the Commerce Department said Tuesday.

In its 1979 construction forecast, the department said mortgage rates will exceed 10% during the first half of 1979. But interest rates should range from 9% to 10% in the second half.

About 1.65 million new houses and apartment buildings are expected to be built in 1979, a decline from the 2 million housing starts in both 1977 and 1978, the department said.

However, strong activity is still expected in construction of industrial and commercial buildings and new sewer systems.

Consumers probably will continue buying houses because they see them as a hedge against inflation, the department said.

"The degree to which high mortgage rates will dampen demand in 1979 seems likely to be less than in the past, since there will be little anticipation of a substantial fall in interest rates," the report said.

Mortgage lending will be limited by a careful screening of borrowers and a tightening of lending terms, forecasters said.

A 20% decline in housing starts would not be as severe a downturn as in past housing recessions, the department said.

The forecast was made on the following assumptions: there will be no recession in 1979; there will be a slower growth rate in 1979; housing prices will rise faster than other prices; and the shortage of mortgage money will not be as severe as in the mid-1960s and early 1970s.

In its five-year predictions, the department said housing construction probably will average about 1.8 million to 1.9 million starts a year and mortgage rates will be less than 10%.

"The shift of construction to Sun Belt areas will continue," it added. "Fast-rising land costs in the larger metropolitan centers will also act as a deterrent to new construction."

Rising labor, construction and land costs will continue to push prices up, the report said.

There will be more use of prefabricated housing and new housing designs to offset rising energy and materials costs, it added.

Despite the housing downturn, an increase of about 5% is expected in industrial construction, the department said.

"The need for more modern and energy-efficient plants is increasing," the report said. "The growing pressures to become more competitive with imports and the growing recognition that greater tax incentives to investment are needed has probably accelerated ...industrial projects."

More commercial buildings also will be built, particularly shopping centers to serve people in the new houses built this year. Rebuilding of downtown centers is also moving rapidly.

Public construction also continues to be strong, particularly sewer and water projects, which are paid for by the federal government.

School construction may fall off because of a decline in the school-age population and possible voter resistance to taxes, the department said.

Unemployment rate declines in California

SACRAMENTO (UPI) — Unemployment in California fell from 8 percent in September 1977 to 6.7 percent in 1978, according to a report released Tuesday by the state Department of Finance.

The report, "California Economic Indicators," said the state's economy "continued to show strength in the month of September" over last year, despite climbing consumer prices.

It noted that employment grew at a rate of 8 percent with the infusion of 700,000 new non-agricultural jobs during the last 12 months. Unemployment reportedly fell from 8 percent in September 1977 to 6.7 percent in 1978.

The report said consumer prices in San Francisco rapidly climbed 2.7 percent this year between June and August. In Los Angeles, the increase was 0.9 percent.

But it projected that Proposition 13 will cause the consumer price indexes for California to drop 2.5 points in December 1978 when the new reduced property tax payments are due.

Civilian employment increased 4.3 percent since August 1977, federal government employment dipped 0.6 percent and state and local government employment climbed only 1.9 percent because of the hiring freeze.

"Employment trends in California reflect the healthy condition of the private economy," the report concluded.

Rising interest rates likely to cause drop in housing

By JEFFERY L. SHELER
UPI Auto Writer

DETROIT (UPI) — General Motors is recalling all 1976-77 Chevette subcompacts to correct what federal safety officials say are potentially explosive fuel tanks similar to those in the ill-fated Ford Pinto.

The company said Tuesday it is voluntarily calling back 320,000 of its hot-selling mini-cars because the fuel systems flunked National Highway Traffic Safety Administration crash tests.

However, a GM official said the firm "has found no reports of fires due to impacts involving Chevette gas tanks," and does not consider the fuel tanks defective.

An NHTSA official in Washington said the agency, whose earlier investigations of exploding fuel tanks prompted Ford Motor Co. to recall 1.5 million pre-1977 Pintos and Mercury Bobcats, was "very pleased" with GM's action.

"In the light of the compliance testing done by the NHTSA and the failures of the 1977 Chevettes to pass our safety standards of fuel system integrity, we believe the company's decision is the proper one to protect the safety of the motoring public," the official said.

He said the agency's findings were "not based on known crashes on the highway, but on compliance tests. We found this one (Chevette) did not comply."

A GM official said the recall involves only 1976 and 1977 model Chevettes. He said 1978 and 1979 models have redesigned fuel systems and are not included in the recall.

Owners of some 187,000 1976-models and 133,000 1977-models will be notified to take their cars to Chevrolet dealers for free repairs, GM said.

Modifications will involve strapping plastic shields around the lower front corners of the fuel tanks and installing larger washers on certain rear suspension parts, the company said.

The NHTSA began an investigation of Chevette fuel tanks earlier this year along with other subcompacts that came under suspicion following a rash of fiery accidents involving Ford Pintos.

The agency later informed GM its tests showed the fuel tanks on 1977 models may not be in compliance with a standard that went into effect in 1977 and was designed to prevent gasoline from escaping from the tank in a rear-end crash.

GM attorney William Weber accused the safety administration of directing a testing laboratory to run rear impact tests on the Chevette at speeds higher than normal for such tests.

In a separate action, GM announced it is recalling 130,000 1975-model Chevrolet Monza, Oldmobile Starfire and Buick Skyhawk models that may have defective front wheel bearings.

Canada company buys Palo Alto firm

Cornish & Carey Insurance Associates, Palo Alto, has been acquired by Reed Shaw Stenhouse Inc., an American subsidiary of Reed Stenhouse Companies Ltd., Toronto, one of the world's largest insurance brokerage firms.

J. David Blackmer, president and chief executive officer of the Palo Alto firm, said it will keep its name and management. He has been appointed senior vice president of the firm, which will now be a division of Reed Shaw Stenhouse Inc. of California.

The Toronto-based parent company has insurance brokerage offices in 28 countries, nearly 5,000 employees and more than $1 billion in annual premium volume.

Tandem reports threefold increase in revenues

Tandem Computers Inc., Cupertino, reported a threefold increase in revenues for the year ended Sept. 30 and a better-than-tenfold increase in profit.

Revenues rose from $7.7 million in 1977 to $24.3 million in fiscal 1978, and from $3.1 million to $8.4 million in the fourth quarter of each year.

Profit for the year rose from $325,000 (12 cents a share) to $3.4 million (94 cents a share), which included extraordinary credit from a tax loss carryforward of $1.2 million. Income before the credit was $2.1 million (60 cents a share), up from $158,000 (6 cents a share).

During fiscal 1978 the company shipped 72 computer systems, bringing its installed base to 109 systems. Tandem's payroll has risen from 137 to 446 employees during the year.

Xidex has record sales

Xidex Corp., Sunnyvale, which made its first public offering of stock two weeks ago, reported record profit and sales for the first quarter ended Sept. 30.

Sales rose 36% to $11 million, while profit rose from $548,000 (21 cents a share) in last year's first quarter to $715,000 (51 cents a share).

Gold & silver

By the Associated Press

Selected world gold prices Wednesday:

London: morning fixing

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RAMONA'S

TANDEM
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FROM: Sam Wiegand DATE: December 5, 1978

TO: All Tandem Field Personnel SUBJECT: ARTICLE ON TANDEM IN DATA COMMUNICATIONS WEEK OF NOVEMBER 20, 1978

Data Communications printed an article on EXPAND and ENFORM which, in general, is a very nice article. However, there are misquotes in the article which, besides being inaccurate, give a completely wrong impression of Tandem's development directions. The intention of this memo is to help you understand what the misquotes are and what our real position is.

The first misquote of significance is that Tandem regards SDLC as a paper tiger that won't be needed by Tandem users for three to five years. This is far from the real case. We believe SDLC to be a major requirement for Tandem and are proceeding on the development of a SDLC controller and associated software with as much haste as we can muster.

The second inaccurate quote is with regard to data encryption. The quote states that Tandem has no provision for data encryption and sees no need for DES or DES-like algorithms. This quote is referring to the NBS data encryption standard which is called DES. With regard to the first point of this that we have no current provision for data encryption, as we all know, this is true. With regard to the second point, that we see no need for data encryption, this is definitely not true and you may be assured that we do see a need for data encryption.

The third misquote arises in the area of who needs networks. The statement is made that a decision to offer networking really came because of customer demands and goes on to explain that Tandy Corporation needed computer-to-computer communications between its warehouses for inventory updates. Again, this is in two parts. The first part is certainly true that customers need networks. However, networks were always a part of our original business plan because this need was recognized long ago. It is also true that customers with similar problems to Tandy will find the network software extremely valuable. However, at the current time, Tandy has no plans to install the network software between its systems and we should not be implying that they do.

The above information is furnished so that you may understand our true position when confronted with these quotes by either customers or competitors. This memo is not intended as a source of new product announcement and should not be used in that manner at all.

Apart from the above, it was an excellent article.

Sam

SJW:cd

EFT protection. *One of the prime markets for DES implementation could be banking networks with automatic teller machines. Unfortunately, reaction from the financial community indicates little enthusiasm for the NBS standard.*

the possible use of DES but has no firm plans for implementation.

Summing up, a spokesman for the American Bankers Association, Washington, D.C., comments that he sees, "minimal use—if any" of the data encryption standard. Why? "Too expensive," he says.

Mainframer sets sights on reliable node hardware

Since 1974, Tandem Computers, Corp., a small Cupertino, Calif., mainframe manufacturer, has carved itself a niche in the giant market for stand-alone processors with its "nonstop" computer philosophy. Now, the firm has a broader nonstop concept in view that includes data communications networks.

Today, Tandem offers a single stand-alone product—the Tandem 16—which is built around a multiprocessor architecture. The key to the Tandem 16's virtually nonstop operation is parallelism. In each system, at least two paths connect any two elements, and every component, including individual disk files, can be duplicated. All resources in the system operate as independent parallel resources.

X.25. Beginning in March 1979, the software to support communications networking, called expand nonstop network (ENN), will be available from Tandem. ENN will allow these redundant computers to communicate, via full-duplex telephone lines or X.25 packet networks.

"The decision to offer networking," says James A. Katzman, Tandem's marketing support vice president, "really came because of customer demands." Katzman explains that Tandy Corp., owner of a consumer electronics products retail chain that operates a large but scattered installed base of Tandem 16's, needed computer-to-computer communications between its warehouses for inventory updates.

Simple. To achieve networking, Tandem was required to do little more than expand its existing computer operating system. Because the Tandem 16 processor architecture was designed for message transfer, with one process sending messages to other processes, it was "distributed" in concept. (See the illustration). Any process from any processor could go to any terminal, or any process could be shared among terminals.

"To move into networking," Katzman says, "an additional layer was designed into the operating system to expand communications beyond one processor location. All other architecture features were unchanged."

The operating system uses a file that knows only the logical name of the message recipient. The file passes the message to a message system, which determines the physical address. It is the message system, already designed for automatic path retries, that was expanded. Because application programs were only logical names, the continuation of the message system outside the computer was accomplished without disturbing processor structure.

255 computers. The expand nonstop network allows up to 255 separately located Tandem 16s to be linked together. According to Katzman, the network appears to be a single computer to a user at a terminal. Databases can be distributed within a user's resident mainframe, or they can reside in another node. Except for recovery speed, a user at a node will notice no difference between a file called from a local or a remote system.

One feature of the Tandem approach is a "least time" path selection scheme. Network software selects the fastest, rather than shortest, path between processors and uses an end-to-end protocol to guarantee delivery. If line failure occurs, messages are routed to the next fastest path.

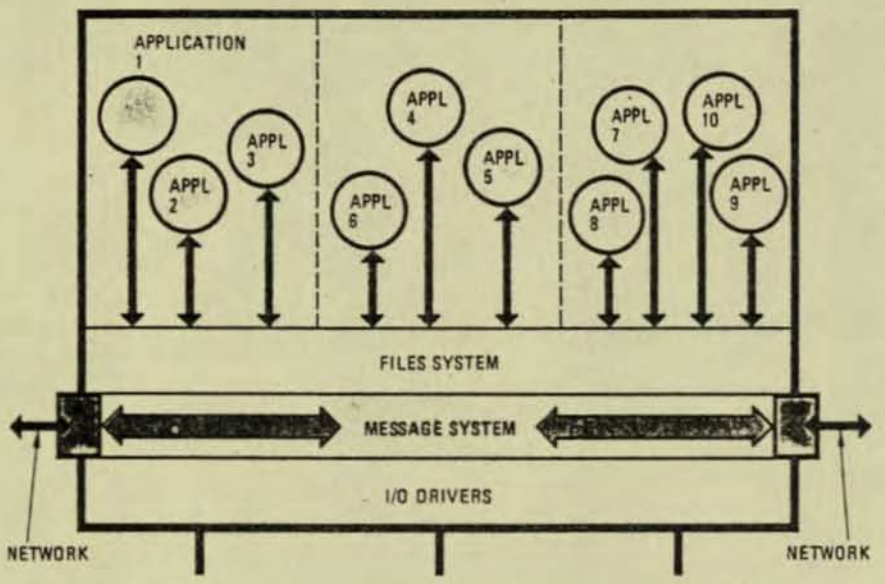
While Tandem products are intended for users requiring highly reliable data communications, the company can do little about the transmission media in the network. Nevertheless, Tandem is relying on a novel end-to-end protocol (as yet un-named) to insure data integrity during transmission.

The protocol directs the transmitting computer to store a "copy" of the data in an unused redundant memory before transmitting it. In case of a line failure, dynamic routing will define a new path and the message will be retransmitted—after another copy is made.

Tandem only. Despite its small size, Tandem has decided to "go-it-alone" in the area of protocols. Only Tandem computers can be used in the network. IBM's SDLC terminals, as well as other communications protocol-equipped devices, are not supported by the

Expanding

Independent. *A unique computer operating system, which separates applications from internal communications, is responsible for Tandem's first network offering. To the user, the network appears as one large computer resource.*



architecture. In fact, Katzman calls SDLC, "a paper tiger, that won't be needed by Tandem users for 3 to 5 years."

Another of Katzman's paper tigers is the NBS data encryption standard, DES. As currently engineered, Tandem has no provisions for data encryption. Katzman says that research is continuing at Tandem, but he sees no need for DES or DES-like algorithms today. Katzman's decision on DES is not surprising in view of Tandem's selection of Martin Hellman, Stanford University, Stanford, Calif., as a consultant. It was Hellman who led a contingent of scientists in a sharp attack of the NBS algorithm last year.

Expand nonstop network, will cost users a one-time license fee of $10,000 plus $1,500 per processor for installation.

NBS to construct local packet network

The National Bureau of Standards may be setting a new benchmark, if not a standard, with a novel local data communications network design that it plans to install in its Gaithersburg, Md., and Boulder, Colo., laboratories.

NBS decided that it needed a local network to interconnect its broad range of computing equipment—from laboratory data-collection devices through large-scale computers. The design staff selected a packet-switching approach based on an Ethernet-type architecture, using a common coaxial cable media to interconnect laboratory buildings. The cable, with a data rate of 1-megabit/s, acts as a closed-circuit "broadcasting" conduit. Data packets, organized to carry from zero to 128 bytes of data between 16-bit destination and source addresses, are injected into the cable by microcomputer-controlled nodes—called TIEs for terminal interface equipment. If two TIEs inject packets of data into the cable simultaneously, a collision detector circuit senses the event. The TIEs back off and retransmit when the cable is clear. Retransmission occurs after a random delay. The contending TIEs then are out of synchronization.

Two boards. Though each TIE contains enough memory and logic to handle transmission protocols and data packaging for virtually any kind of terminal with a data rate of up to 9.6 kbit/s, they are relatively simple physical devices. A basic TIE, serving a single terminal, consists of just two circuit cards. One is a network board, which is coupled to the cable itself. It contains line receivers and drivers, plus the collision detector and other circuits that shut off the unit if it runs out of control and attempts to flood the network. The second circuit card, called a user board, is programmable to suit the protocols of a single terminal. The card acts as a kind of intelligent modem.

To save hardware costs, up to eight user boards connect to a single network board, so that just one tap into the coaxial cable can handle a cluster of up to eight different terminals. The network board constantly polls all its connected user boards for the presence of packets. Incoming packets are passed directly to all user boards. The user boards accept only those packets addressed to their associated terminal.

Production. The breadboard models of the TIEs use microprocessors. NBS engineers have designed the circuit boards up to production level, and the agency has issued a request for bids on production runs.

"There is no large front-end cost in this system," says Thomas N. Pyke, chief of the computer engineering division of NBS's Institute for Computer Sciences and Technology, Gaithersburg. "The system can grow incrementally by nodes, and local networks at different geographic locations can be interconnected by common-carrier links connected through TIEs." NBS plans to interconnect most of its minicomputers in the labs to the network—it has over 100 of them. Pyke believes the network arrangement will allow minicomputers to share peripheral equipment, and will be ideal for such jobs as cross-assembling programs and sending

Schuster

For Networks, Queries

'Expand,' 'Enform' Enhance Tandem Facilities

CUPERTINO, Calif. — Tandem Computers, Inc. has added software and networking capabilities to its multiple-processor systems to allow users to link as many as 255 "geographically dispersed systems."

The added capabilities, called Expand and Enform, allow sites with Tandem CPUs and data bases to be linked together into four-wire private-line or X.25 packet facilities. Traffic on these nets is handled with the aid of data base directory information that is stored at each system site in the network, the company said.

Expand allows inquiries to be routed automatically to data that resides at remote sites using the best path available, but this capability relies on previously programmed data in the system which defines the location of application programs, a Tandem spokesman noted.

Other Features

As part of the Expand capability, the Network Control Process feature allows network links to be reconfigured in the event of malfunctions in specific network connections.

Computing resources and data bases in an Expand network are said to be location transparent to operators and programmers. In addition, a program resident in any system in a Tandem network can access data resident in any other system. But these features depend on directory data available at each multiple-processor system site.

Tandem also introduced its Enform software, which allows retrieval of data from multiple files in ways not anti-

(Continued on Page 30)

Packages Aid Tandem Users

(Continued from Page 24)

cipated during data base design, the company indicated.

Enform reportedly produces reports in less time than conventional languages such as Cobol, and its reporting options allow sorting and summarizing of retrieved data as well as evaluation of built-in or user-defined functions.

Described as a "nonprocedural language," Enform allows users to make queries with simple requests in English statements.

Expand will be released in March 1979 with a one-time license fee of $10,000 plus a microcode charge of $1,500 per processor in the network. Enform will be available at the same time and will cost $7,000 for the license fee and $1,500 for the microcode fee for each processor.

Tandem Computers, Inc. is at 19333 Vallco Parkway, Cupertino, Calif. 95014.

ELECTRONIC NEWS, MONDAY, JUNE 12, 1978

Users Eye Small Computers at NCC

Peripherals

ANAHEIM, Calif. — Small computers, aimed at distributed processing applications, apparently garnered the majority of attention from users who scoured the NCC floor for new products and ideas.

Only three mainframes — from Digital Equipment, IBM and Itel — were shown at the conference, here, but small CPUs, peripherals and terminals were combined with data communications hardware to provide a wide range of distributed processing configurations, according to users.

Exhibitors from all areas of the industry claimed they were getting a healthy response at their booths, even though NCC rules prevent orders being signed on the conference floor.

"Half the people come through just to see our machine for the first time, said Thomas R. Schmitz, vice-president of Itel, whose exhibit included an AS/5 IBM plug-compatible mainframe. "They've all heard of it, but many people have never seen one," he said.

The range of user management levels represented by attendees ran from programmers to systems analysts to occasional data processing managers, according to Mr. Schmitz. Rarely did those responsible for purchasing a mainframe — vice-presidents of finance and controllers — visit the Itel booth, he added, noting that he expected several "solid" leads to result from NCC activity.

Mr. Schmitz said that he had several visits from IBM personnel who seemed interested in the Itel mainframe's design and construction.

Tandem Computers, showing its multi-processor system, was viewed with interest by several OEMs designed newspaper text editing systems, according to Larry Schuster, district sales manager. He declined to name the OEMs, however.

Many of the inquiries received by Tandem, Mr. Schuster said, came from persons who intend to buy hardware soon after the show's end. More OEMs than end-users viewed the booth because the Tandem system was seen as too large for end-user needs, he claimed. Typical OEM applications for the hardware are ranging from inventory control to order processing, it was noted.

American Bankers Life, a Miami insurance firm, sent Robert Nerzig, assistant vice-president, to NCC to evaluate equipment, meet with top vendor executives and gain new ideas for data processing.

"This is the best place to find people who know what they're talking about," Mr. Nerzig said. "We're growing as a company, and I've come to keep up with the state of the art."

American Bankers, he said, is implementing a distributed processing system with a Hewlett-Packard H-P 3000 to be installed this month. The system is taking over work the insurance company has been shipping out to time-sharing firms, he added. The H-P system will front-end a 360/30 mainframe from which computer services may be sold to outside users, Mr. Nerzig said.

system on order, the spokeswoman said. In addition, other vendors were interested in the hardware. IBM was showing its mainframe without peripherals, so the system was running only diagnostics through the model 3036 console.

One user, who asked to remain unidentified, said he was thinking of leaving his present employer, Hughes Aircraft, to market a small business system he had designed. The NCC, he claimed, was the best place to evaluate peripheral equipment for his system, which is MPU-based.

Continued From Pa

Brennan, Datum vice-presi

"Our products are enabli development that couldn't b IBM-only hardware," Mr said. IBM, he added, ha several Datum tape drive evaluation and internal de use.

Major Thrust

"My belief is that the Seri 2 years away from the level pectations would have it ain said. "The major thrust i development is coming fro and service houses, but unti the mass storage they need, a limit to what their so handle."

Datum also offers line pr disk drives for the Series/1 i

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Product M

Add

"We really believe that y
better than National's a
memory for your IBM 3
And so do a lot of other
I tell customers, 'look, rig

would be minimal."

The accident that occurred recently at ADP/First Data Corp., Waltham, MA, was used as an example by "Alert." ADP's equipment was gutted by a fire that started in another office in the same building. But since management had taken a number of steps to guard against just such eventualities, losses were negligible. ADP had an agreement with another organization to use its computers. It also made a practice of copying computer tapes of customers' work and storing them off-premises, so losses were limited to jobs actually being run at the time.

Here are some questions users should ask as suggested by The Computer Security Institute, Northboro, MA: 1) Does the firm have a formal risks analysis program to identify where it is most vulnerable? 2) Does it have a contingency plan to protect customers' records? 3) Does it include specific assignments to the service bureau's employees and is the plan updated periodically? 4) Do employees who enter the facility during nonscheduled hours have prior authorization and is a manager present?

Government

DP study lowers goal for federal help

The Federal Data Processing Reorganization Study aimed at evaluating government DP practices has recruited fewer representatives from *outside* the federal government than originally hoped. Despite this change, project directors still plan to meet their September 15, 1978, goal for delivery of final recommendations to President Carter.

This development was reported at Federal DP Expo 78 in Washington, DC. The three-day exhibit and seminar sessions attracted a total of about 140 exhibiting companies and approximately 4,350 in attendance, slightly higher than at last year's exposition.

The reorganization study update was provided by Wally Haase, deputy director, Information Systems Policy, Office of Management and Budget. He reported that of 50 people working on or committed to the project, 20 or 40 percent, come from private industry, the academic world, and state and local governments. The original goal was to achieve a 50-50 split between federal and non-federal representatives.

Haase explained the change results from delays in the recruitment process, which took longer than anticipated. He said the program's directors decided not to further delay the study while seeking additional non-government representatives, but rather "to proceed with the project with the people who were firmly committed at this time."

-Victor Block

Timesharing

Timesharing service offers econometric model

For the second time in about six months, a computerized economic model has been made available through the cooperative efforts of the model market and a timesharing service. Arthur D. Little Inc., Cambridge, MA, management consulting and research firm, is offering its economic advisory service that "pinpoints purchase-sale relationships among more than 220 sectors" on the General Electric Mark II worldwide timesharing network. The price is $15,000 for a year's subscription, plus line charges.

Samuel C. Flemming, president, Arthur D. Little Inc., said the new service is the "largest on-line system commercially available today for evaluating inter-industry relationships and for forecasting the outlook for key industry sectors."

Development

Nonstop data base gets failure protection

Tandem Computers usually puts processors together to share operations so that even with any system component failure processing continues. A dual processor often does the job, but one customer wanted both nonstop operations and the ability to handle a very large amount of data.

A 10-processor system, Tandem's largest to date, went to the Ohio College Library Center (OCLC), a not-for-profit corporation in the service field.

OCLC uses the 10-processor system to access data from 40 disk drives (expandable to 108 drives) of 300 Mbytes per drive. It acts as a backend to the four host mainframes. OCLC also uses a four-processor tandem frontend to switch on-line operation between host computers when anyone of these fail.

Documation documents a real success story

In 1970, revenues for Documation Inc. were $32 thousand, a rather humble beginning for a company advertising the "world's most cost-effective card punch and the world's best card reader." But somebody believed. Revenue in the fiscal year ending February 3, 1978, should top the $32 million mark and profits should exceed last year's record of $2.02 million. Documation's performance is all the more remarkable when you consider that the firm in 1977 completed the one-year transition from a strictly OEM supplier to a full-fledged end user marketer with a complete line of printer subsystems, 12 different configurations of off-line tape-to-print systems and a series of card input/output subsystems.

Ray Halbert

As company founder, president and chairman, Ray Halbert points out, "We have paid the price to enter the end user market, and through the entire period, we have remained profitable." Today, Documation has 16 domestic offices, one in Canada and four in Europe. According to John Sterling, director, end user sales, the customer base already includes many of "Fortune's" list of top companies.

In January, the firm demonstrated its

... continued on page 36

Tandem Computers just keep on computing

NonStop computer systems lead to 300-percent growth rate for four-year-old Hewlett-Packard spin-off.

Before Tandem Computers came on the scene, a computer that did not go down was a rare sight indeed. The military tried tackling "downtime" from a performance point of view—in typical government fashion they just kept adding zeroes to the price tag until the computer worked. Commercial systems manufacturers tried a different approach: They offered triple modular redundancy (TMR) in which every board was replicated three times and every action by every piece of hardware was performed in triplicate. This meant that the user received three times the hardware at three (or more) times the price for the same performance.

Things changed, though, in November 1974 when Tandem Computers was founded by a number of engineers and marketers from Hewlett-Packard's computer operations. Its sole purpose was to produce an extremely reliable computer that would have a minimum of downtime without giving up any processing power in the bargain. There was never any question in the minds of the principals that the idea of the NonStop computer was viable. They all came from minicomputer companies where each had done his assigned portion of the design at least twice before. In fact at the preliminary design meetings, the hardware and software designers each stated that he thought his part would be easy and the other guys' would be tough. Two key questions still remained: Would such a machine be marketable and where would the financing come from? Marketable meant that the final system had to offer, in addition to extreme reliability, an economical cost/transaction/second—the businessman's benchmark for measuring value. Financing presented a different problem. Tandem was attempting a start-up operation in the middle of a recession when virtually no venture capital was available. Nonetheless, the founders managed to find enough backers who believed that the need for a reliable computer would not go away.

Two years ago Tandem shipped its first NonStop™ computer, and it hasn't gone down yet. The Cupertino, Calif. company is presently experiencing a 300-percent yearly growth rate and last year went public.

NonStop computing is the reason that Tandem computers are selling. Vice president of product management and technical support, David Mackie explains, "If someone is uninterested in NonStop computing he can find all sorts of reasons for making a "safe" buy elsewhere. Initially we were a small, unknown company, and it took a bit of courage to buy from us. We had to have something significantly better that would enable people to take that risk. NonStop is *the* most important thing in the system. It means that you can stop any part and the system will continue to run.

"Obviously, it's possible for the system to stop because in order to achieve real absolutes you need an infinite amount of equipment. Mathematically, however, a simple two-processor NonStop system might have a failure every 60 years. This is orders-of-magnitude better than anything else on the market today or in the near future. Already we have much more computing time than that in machine years and we still haven't experienced our first failure."

The actual design of the computer fell to James Katzman, vice president of engineering, and his staff. He relates that the only constraints he had were time and money. The computer itself started with a blank sheet of paper. "As far as the architecture of the machine went, we had no compatibility constraints," says Katzman. "In fact, early on we realized that it was just these types of constraints that prevented established computer companies from doing it right."

By starting from scratch, Tandem was able to tailor its machine for commercial computing in a transaction-oriented environment. From a hardware standpoint, Katzman points out, "We incorporated some unique features in the system such as intelligent I/O controllers and channels, two separate super high-speed processor channels (the fastest in the industry at 13M bytes/sec each) and mirrored data bases.

"Everyone knows that multiprocessors are necessary for NonStop computing, but people fail to see that it isn't sufficient. For example, NonStop computing means the system is never shut down, even for routine maintenance. The only way to do this is to be able to power down each module or failed part and leave the rest of the system running. This requires UL approval and, as far as I know, we have the only system with such approval. But the accomplishment required an architectural ground-level commitment from day one. Twenty percent of our patents are in power distribution and cooling; areas considered mundane by most companies."

Equally important is the software which was designed in tandem with the hardware. In fact software may be more important to NonStop operation than the hardware although efficiency depends on them operating smoothly together.

Plug it in and go

Family compatibility plays a large part in many computer purchases because every EDP manager envisions the day when he will run out of processing power and need a bigger machine. The EDP manager buys with upward compatibility in mind. An apparent drawback of Tandem's computer, then, is that it's the only one in its family. But Mackie doesn't see this as a problem: "If a user outgrows our basic two-processor system we'll just plug in another one. With the ability to attach up to 16 processors, each equivalent to a PDP-11/70, in a single system it is unlikely that a user would outgrow the system. In this way we do not obsolete any of the customer's programs."

Designer Katzman adds, "With the Tandem approach, when you buy two or three processors you get two to three times the performance. Nobody really hits four times for four processors, but

Vital Statistics

TANDEM
Cupertino, Calif.

All figures for six months ending March 31, 1978.	
Net sales	$9,168,000
Net income	$1,644,000
Net income as % of sales	17.9%
R&D	$861,000
R&D as % of sales	9.4%
Number of employees	243
Net sales per employee	$37,728
Net income per employee	$6,765
Current ratio (asset to liabilities)	7.7
Cost of sales (manufacturing costs as % of sales)	39%

we come closer than anyone else. With a four-processor Tandem system you get 390 percent over what you would get out of a one-processor system."

A less obvious benefit is the elimination of a used computer to sell. The scenario goes something like this, says Katzman. "You buy a computer that does the job. As the job expands you add more terminals, and the data base grows until you need a larger computer. You go back to the same computer company and order a larger, but compatible, model so you can use the same programs. But what are you going to do with your old computer? In the minicomputer market, you bought it and it's your problem."

A company stuck with an older computer does have several solutions available to it. For one it can put that computer to use in another part of the business or maybe use it as a preprocessor for the larger system, thus increasing the overall system processing power. Or if the company is lucky, it has had the original computer long enough to depreciate it a reasonable amount. But with Tandem's NonStop computer this dilemma never develops.

No followers, yet

As far as Tandem knows, no one else is working on a NonStop computer. "We expect to have competitors, but at the moment there are none," says Mackie. "NonStop computing is only about five percent of the market, and every company does them as specials. If we took the whole market we would be taking only five percent of everyone's market, not 50 percent of any particular company's market." Because Tandem avoids this head-to-head competition, it also avoids putting any pressure on any one computer company to produce a comparable product.

Katzman isn't sure other companies can produce a comparable product in less than two or three years. "Other processors have been put in a multiprocessor environment, usually under market duress and as an afterthought. Mostly it is done to increase performance and not to produce a fault-tolerant system; a single failure can still contaminate the entire system or cause it to go down. Much of the magic in making a fault-tolerant system was discovered and invented by Tandem and is, in fact, a trade secret. The entire system is patented and we do not give out the source code of our software."

Tandem envisions that the competition, when it does appear, will come in three stages. First they will say, "We can do that as well," and not do anything different. Secondly, they will make some changes in their I/O and the interconnection between processors. Finally, they will throw away what they have and start all over again. To date Tandem has seen only the first stage of competition.

Tandem's rapid growth put some pressure on the company to go public for two reasons. One was to have a better financial base from which to continue this growth. The other was for credibility: It assured customers, especially financial institutions, that the company could survive an economic downturn. Before the company went public all growth had to be financed by profits and venture capital, both of which tend to disappear at the most inopportune times.

Market analysts view Tandem optimistically. They point to the availability of more software as the prime reason for an increase in the average system's size and price (approximately $250,000). While many do not believe that Tandem can maintain its 300-percent growth rate, they do see a 200-percent yearly growth rate for some time to come. They also feel that the rapid market acceptance illustrates both a need for the product and proof that the system operates as promised. Most of Tandem's customers are Fortune 500 companies.

These same analysts estimate that Tandem's current facilities can handle three times the current production rate to about $60 million in annual sales. They also estimate the market at about $300 million with a $1-billion potential within three years. Tandem should rapidly increase its share of this market.—*R. Grossman*

TRW offers business credit rating service

More than 38 million commercial sales transactions take place everyday among the 13 million business establishments in the US. From 1970 to the second quarter of 1977, credit extended between business firms increased 72 percent to $357 billion. These accounts receivable total nearly twice the amounts loaned by banks, says a TRW Business Credit Services division spokesman. From his viewpoint, it looks as if business, rather than banks, finances other business operations. The faster a business can turn over its accounts receivable, the more money it can make, either through savings on interest or investment.

To help business assess a possible creditor's payment habits, TRW offers a nationwide, computerized business credit reporting service called National Credit Information Service (NACIS). It's aimed at garnering a share of the $210-million business credit reporting market—75 percent of which Dun & Bradstreet controls. Jim Holly, vice president and general manager of TRW Business Credit Services division, says D&B reports often take from several days to weeks to arrive at the inquiring business, and although they're updated periodically, the reports do not always contain the most current information. The average cost of a D&B report runs about six dollars, says Holly. By comparison, NACIS reports provide "objective (just raw data, no conclusions are drawn by TRW), up-to-date trade payment information on more than 3.5 million business locations in hundreds of industries, as well as key business facts on 360,000 companies."

Any teleprinter terminal can tie into TRW's system in Anaheim, Calif. via high-speed data communications lines. More than 1,100 companies have signed with NACIS to contribute their automated accounts receivable information to the file every 90 days. The file now contains more than 8.5 million payment experiences from companies including Hamilton/Avnet, DEC, Control Data and Honeywell, Holly says. Users do not pay for TRW's special software, which allows them to contribute their data, or for the high-speed data communications network; they pay only for the reports they order. An average TRW report costs $3.40, Holly says.

NACIS offers an added service: its trade payment index, which indicates the percentages of current and past-due receivables in 30-day segments by industry category. For example, during the second quarter of 1978, 68.5 percent of the reported electrical equipment industry's accounts receivables were current, down from 69.6 percent for the same period in 1977. The index, says Holly, allows credit executives to compare their actual collection data with an industry standard. Deviation may indicate a problem with collection policies and standards of a company. If TRW collects these averages over a series of quarters, the index could become another leading indicator of trends in a number of industries and in the economy as a whole. ■