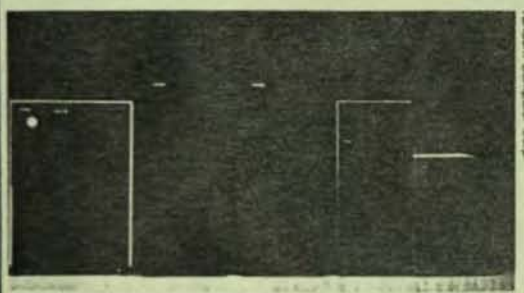
Tandem Enhances Product Line

Offers six new VLX models; cuts EXT, TXP prices; adds communications subsystem



Tandem Computer Corp.

Tandem has added two configurations to its VLX multiprocessor mainframe system

The Tandem product blitz continues this week with the introduction of four packaged systems and two new configurations in its top-of-the-line VLX product family, and a new communications subsystem. The company also reduced prices in its midrange TXP and EXT product lines.

A member of the "announcement of the month" club since February, Tandem's most recent hardware introductions came just two weeks ago (see *InformationWEEK*, April 20), when it moved the bottom of its line down with a CMOS-technology line of CLX computers. In February it unveiled software for batch processing, while March saw introduction of Tandem's Nonstop SQL relational database software (see story, page 22).

The high-end packaged systems—designated the VLX 801, 802, 803, and 804—range in price from $2.1 million to $8.5 million, and in performance from 50 transactions per second to 200 SQL transactions per second, using from 8 to 32 VLX processors. They are packaged with disk drives, tape drives, Tandem's new 6100E communications subsystem, and its mainline Guardian 90XL operating system.

At the same time, Tandem brought out new, smaller VLX models. When the line first came out a year ago (see *InformationWEEK*, April 21, 1986) it cost about $1 million and could not be ordered with fewer than four processors. Now customers can buy a two-processor model for $585,000 and a three-processor unit for $759,000.

All the new VLX hardware is available immediately; Nonstop SQL software is slated for third-quarter 1987 availability.

Tandem also made moves to boost its midrange EXT line. It added a new cabinet capable of holding 16 input/output slots, two cartridge tape drives and four disk drives (available in the fourth quarter); boosted asynchronous support from 96 lines to 144 lines, and improved tape backup time 55%. It cut EXT25 prices 23% and TXP prices between 15% and 25%.

Finally, the company brought out its fault-tolerant microprocessor-based Tandem 6100E Communications Subsystem, which can support as many as 180 communications lines. The system is available immediately at a price of $14,696 and up, depending on configuration. IW

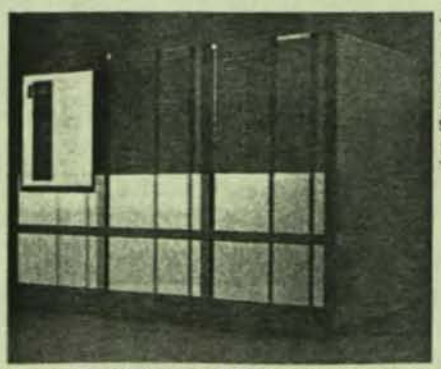
Reorganized Pyramid Offers RISC-Based Unix Supermini

Three high-end models debut on schedule; firm also plans support for Lisp, Cobol, 3270

With its management lineup refilled and a new set of users targeted, Pyramid Technology Corp. this week added an essential arrow to its quiver when it unveiled three new superminis, all of which use the Mountain View, Calif.-based firm's proprietary reduced instruction set computing (RISC) architecture to run the Unix operating system.

The management shakeup started last November (see *InformationWEEK*, November 24), when E. David Crockett ended his year as president with an abrupt resignation just as the firm launched its 9000 product line. His successor, Richard H. Lussier, kept Crockett's emphasis on database applications, connectivity, and software development, but added on-line transaction processing. And, although the 9000 line itself was six to nine months late, Lussier brought out its new high-end members this week on the schedule he set.

The 9840 is a four-processor, 25 MIPS Unix/RISC computer priced at $500,000, while the 9830 uses three processors to provide 16 MIPS for $400,000. They use the same processor as the previously introduced two-processor, 13-MIPS, $300,000 model 9820 and the one-processor, 7-MIPS, $200,000 model 9810.



Pyramid Technology Corp.

Pyramid's 9840 Unix/RISC supermini: four processors, 25 MIPS for $500,000

The line was also extended downward with a one-processor, 3.5-MIPS, $129,000 model 9805. All processors can now connect 512 users, up from 256. Deliveries of the processors start in July; that month will also see shipments of 3270 SNA communications software, the Cobol 85 and Common Lisp languages, and a 1.2-gigabyte disk drive.

After that? Lussier says Pyramid is 18 to 24 months away from introducing a CMOS technology implementation of its RISC-based Unix architecture. He promises that this time the company will be on time.

—Paul E. Schindler Jr.

Tandem Cuts Prices, Adds Systems

BY ERIC NEE

CUPERTINO, CALIF. — Tandem Computers Inc. last week cut prices on its midrange systems up to 25 percent, introduced an enhanced version of its communications processor and repackaged the system configurations of its high-end VLX computers.

Price tags on Tandem's midrange EXT 10, EXT 25 and TXP systems were cut in response to market pressures and to bring them in line with Tandem's new low-end CLX systems, a spokeswoman said. The EXT 10 and EXT 25 were introduced in August 1986, while the TXP systems are two to three years old.

The price of the EXT 10 in its base configuration was cut to $74,900 from $82,500, while a basic EXT 25 was reduced to $250,000 from $325,000.

A two-processor TXP was dropped to $299,000 from $399,000, a three-processor model to $446,000 from $531,600, and the four-processor offering to $593,000 from $697,300.

Tandem also rolled out an enhanced version of its 6100 communications subsystem, dubbed the 6100E. It can reside up to 1625 feet from the host computer, compared with only 200 feet for the 6100. In addition, it need not be located in a controlled-environment computer room, as did the older model. Other features, as well as the $14,696 price, remain the same. The 6100E, which replaces the 6100, is available immediately.

Tandem now offers two- and three-processor versions of its VLX systems. Previously, a four-processor model had been its smallest VLX configuration.

The two-processor VLX302 with 16 Mbytes of memory, 1.6 Gbytes of disk storage and a tape subsystem is priced at $585,000. The three-processor VLX303 with 24 Mbytes of memory is priced at $759,000. The existing four-processor VLX304 with 32 Mbytes of memory and 2.1 Gbytes of disk storage remains at $995,275.

Tandem also is offering packaged configurations of its 8-, 16-, 24- and 32-processor VLX computers that for the first time include the initial license fee for Tandem's proprietary Guardian operating system, as well as the 6100E communications processor. The newly packaged VLX systems offer savings of between 5 percent and 6 percent compared to the cost of purchasing the items separately, a spokeswoman said.

The eight-processor VLX801 with 64 Mbytes of memory, 6 Gbytes of disk storage and one tape subsystem is priced at $2,141,000. The 16-processor VLX802 with 128 Mbytes of memory, 12 Gbytes of disk storage and two tape subsystems is priced at $4,282,000. The 24-processor VLX803 with 196 Mbytes of memory, 18 Gbytes of disk storage and three tape subsystems costs $6,423,000. The 32-processor VLX804 with 256 Mbytes of memory, 24 Gbytes of disk storage and four tape subsystems is $8,564,000.

Phoenix Plans Copyright Infringement Suits

BY MARIANNE KOLBASUK

NORWOOD, MASS. — Phoenix Technologies Ltd. last week said it will file a copyright infringement suit in Taiwan against at least 12 unnamed Taiwan companies within sixty days.

Phoenix recently received full copyright protection from the Taiwanese government covering its IBM Personal Computer-compatible ROM BIOS products.

The company also plans legal action against approximately 30 U.S. and Canadian companies for suspected infringement of Phoenix's copyrights in those jurisdictions, according to Phoenix copyright enforcement director Stephen Abt.

"We have retained legal counsel in Taiwan and have begun investigations there," Abt said. "The penalties for copyright infringement in Taiwan are much stiffer, because there are criminal liabilities. We suspect that a number of those Taiwanese companies will settle with us once we file the first products in Asia, Abt said. With the subsidiary's help, Phoenix expects to uncover more Asian companies infringing on the copyright during the next several months, he said.

In February, Phoenix settled for an undisclosed sum a suit against Ultimate Business Systems, Toronto, a PC clone maker that admitted illegally copying and selling Phoenix's ROM BIOS in Canada, Abt said.

"That settlement had a big effect on us," he said. "We've doubled the number of licensees for our BIOS in Canada since the settlement."

Among the IBM PC clone [illegible] to which Phoenix sells

Quarterdeck Unveils DESQview For The PS/2

SANTA MONICA, CALIF. — Quarterdeck Office Systems Inc. last week launched a version of its DESQview multi- background while the user runs another program. The new release requires no loaders to make any DOS program run

LEVEL 1 - 7 OF 7 STORIES

May, 1987

SECTION: PRODUCT/SERVICES ALERT; Pg. 254

LENGTH: 252 words

HEADLINE: Electronic mail goes multilingual

BODY:

Tandem Computers Inc. (Cupertino, Calif.) has made its distributed electronic mail package, called PS Mail, more attractive to European markets by adding versions that support eight different foreign languages.

Users of desktop devices including IBM 327X, IBM PCs or compatibles, Tandem 653X terminals, as well as Dynamite and 6AX workstations can now exchange text electionically in Danish, Finnish, French, German, Hebrew, Norwegian, Spanish, and Swedish. National-variant terminals are used to correctly display accents and other special characters.

Where PS Mail is used internationally, an accenting scheme allows variant characters in user names even when one of the corresponding terminals is unable to display the international characters.

More than one version of PS Mail can exist simultaneously in a network of Tandem NonStop devices or on a single Tandem unit, and users of different versions can exchange messages.

Users of PS Mail can have national-language support at no additional charge. PS Mail is also available free of charge to transfer licensees for use with Tandem terminals and workstations and with IBM PCs and compatibles connected to Tandem NonStop networks using Tandem PC software.

PS Mail for 327X and TTY terminals has an initial license fee of $2,000 per network for NonStop II, TXP, and VLX environments; price for EXT is $1,000 plus a per-network monthly license fee of $200 for NonStop II, NonStop TXP, and NonStop VLX; the monthly fee for NonStop EXT is $100.

May, 1987

SECTION: SYSTEMS AND EQUIPMENT; Pg. 97

LENGTH: 97 words

HEADLINE: Tandem Announces New Software

BODY:

Tandem Computers Inc. offers NonStop SQL software for Tandem NonStop system, a new high-performance distributed relational database management system incorporating the ANSI-standard Structured Query Language (SQL).

Tandem's SQL implementation of the relation model provides the performance needed for high-volume, on-line transaction processing (OLTP), and fully supports transparent data distribution. Data in a network of Tandem systems can be read, written or updated with full transaction protection, and the database will always reflect the current state of a business.

PROFILE

HOW JIMMY TREYBIG TURNED TOUGH

His Friday beer blasts and laid-back style made Tandem Computers a Silicon Valley legend. Then came trouble. After Treybig began acting like the boss, revenues took off. ■ *by Brian O'Reilly*

THINGS ARE HOT at Tandem Computers these days, largely because of Chief Executive Jimmy Treybig, a pioneer of Silicon Valley–cool management. After a four-year slump, Tandem's earnings have risen 80% so far this year and the company is hurtling toward a record billion dollars in revenues for 1987.

Ask the head man why, and he will credit anything but himself—Tandem's computers that keep running even if some components fail, dedicated employees, the technology called parallel processing. But Tandem really owes its turnaround to its boss's turnaround. Three years ago, as Treybig's grip on the company began to slip, this big-picture strategizer, this friendly, one-of-the-boys manager, forced himself to adopt a whole new style. He began grappling with details and holding his executives more accountable. It was a painful process. "I used to be a cheerleader," he says. "Now I'm a manager."

From the outside Treybig looks much the same. He is still slightly rumpled and stocky. At 46 his hair is grayer, but it continues to explode from the side of his head in a curly frizz. His eyeglasses still refuse to perch properly on the bridge of his nose, preferring to park themselves crazily at the other end. His shirttails remain as rebellious as ever. And the man who bestowed so much stock on employees that he once described Tandem as a "socialist" company seems to worry about his employees' welfare as much as ever.

He is tired, though, of discussing the beer parties Tandem throws every Friday afternoon for employees. The idea behind these "unstructured communications" was for people from different departments to mingle and discuss ideas. But they quickly became a symbol of a new management style supposedly evolving in Silicon Valley as corporate anthropologists spread their fame far beyond Tandem's Cupertino headquarters. Mind you, Treybig is not tired of attending the gatherings—he loves a cold beer and interesting conversation as much as anybody. "But that's all anybody outside the company ever cared about," he complains.

Treybig was a marketing manager at Hewlett-Packard 15 years ago when he came up with the idea for Tandem. On his rounds for H-P he often ran into bank managers, newspaper editors, and stock exchange executives who worried that they would be in big trouble if their computers "crashed" for a few hours or, worse, wiped out data. Treybig says that Hewlett-Packard showed no interest in building a computer that would run even if some of its components failed. So he quit and spent 18 months tinkering with the concept. In 1974 he started Tandem to build a computer with several identical processors working in parallel, like toll booths across a highway. If one processor failed, data could be shunted to the others.

The unorthodox way of managing that Treybig came up with for Tandem soon overshadowed his nifty engineering. The company had 11 vice presidents but no organization chart. Treybig refused to install time clocks and did not hold regular meetings with subordinates. Instead he delivered stem-winding motivational speeches in tents erected in the company's parking lots, and concocted an elaborate diagram to show every employee how his or her contribution affected the whole company. "One time he called me and didn't recognize my secretary's voice," recalls Carol Hubler, a division manager. "As soon as he heard she was new, he ran down two flights of stairs to introduce himself." Adds venture capitalist William Davidow, an early board member: "He used to manage through inspiration. It was a holistic approach. He thought everyone would do the right thing if they appreciated the company's goals and their place in the organization. It took him a while to learn that people would abuse that."

It was precisely Treybig's confusion of motivation with management that got his company in trouble. In December 1982, Tandem's auditors forced the company to restate results for the fiscal year that ended in September, revising sales downward from $336 million to $312 million. Net income changed from $37.3 million to $29.9 million. The Securities and Exchange Commission began an investigation and eventually charged Tandem with fraud. The SEC said that Tandem employees, feeling pressure from managers to boost quarterly sales growth, sometimes recorded sales of computers that hadn't yet been shipped to customers.

ALTHOUGH Tandem denied the charges and the SEC settled the case without assessing fines or penalites, the allegations shook Treybig. He says the restatement hurt him even more than the divorce he was going through: "When people talk about fraud, you have a sense of shame." Tandem went into a prolonged slump. Earnings stagnated at about $30 million a year, despite increasing revenues. Then in the spring of 1984, as the whole computer industry sagged, Tandem's earnings plunged 80%. "I was driving to work one day," says Treybig, "and I knew I was failing."

Management by inspiration was over; management by perspiration was in. Treybig canceled plans for a vacation and assembled his vice presidents one July morning in 1984. "There was a fundamental change," says Patricia Becker, director of marketing support. "Suddenly every part of the company was exposed to incredible scrutiny." Treybig, an avowed meeting-hater, plunged into them. "It used to be you could stand up at a meeting once a year and state your goals, and nobody ever came along and asked if you met them," says Becker. "Now there are weekly staff meetings and quarterly staff reviews. If you don't make your

REPORTER ASSOCIATE *Stephen J. Madden*

His style has a lot more bite *these days, but Treybig is still a soft touch for his pet coonhounds, Dee and Lulu.*

goal, you'd better have an explanation."

The man who used to manage by consensus became authoritative, putting an end to what one senior manager called "anarchy" among executives. Says Stephen Schmidt, vice president for operations: "It used to be hard to get a resolution on certain things. A strong individual could go to the mat and the consensus process couldn't change it. Jim went from being reluctant to order people to do things, to being willing."

No one imagines that Treybig enjoys all these changes. "Ask Jim if he likes sitting through an operating review, and he'll say no," says chief operating officer Robert Marshall. "He'd rather be brainstorming with customers about new products." Clashes with executives seem painful for him. "He doesn't like to criticize," says Gerald Peterson, Tandem's vice president for marketing. "It's not uncommon for him to deliver a blistering critique and then say, 'But I'm not being critical.' " Observes chief financial officer David Rynne: "He has more difficulty with poor performance than most senior managers. He is personally disappointed. He hopes every person can grow into the job. If they don't, he can be frustrated and angry." Treybig himself says simply: "It's not hard to be tough. It's just not much fun."

PLAYING THE TOUGH GUY has helped Treybig solve some knotty problems. After concluding that five groups were working on essentially the same project, he reassigned dozens of employees. He cut expenses and increased productivity to match flattening revenues. Salaried workers had to put in 10% overtime without pay, new hiring stopped, all travel required a vice president's approval, and salary increases were frozen for six months. Tandem even installed devices to turn off the lights in company buildings automatically.

The necessity to cut costs tends to induce a little humility. Years of fast growth had made Tandem—and Treybig—arrogant. "We had a problem with Tandem service a few years ago and complained to Treybig," recalls Richard Leyh, executive vice president of Securities Industry Automation Corp., the computer arm of the New York and American stock exchanges. "He was defensive and arrogant." These days, says Leyh, Treybig has mellowed. "When we gave an order to a competitor a while ago, he was here in person, asking, 'Where did we go wrong?' "

Although it sometimes seems that way, Tandem is not Treybig's whole life. He occasionally leaves work early to be with his son when he's home from college, or flies off to see his two teenage daughters, who live in Texas. More often he turns on his ham radio, a hobby he picked up from his father, a Texaco geophysicist who raised his family in Bellaire, Texas.

Once or twice a year Treybig and a few friends go to a remote island for two weeks of broadcasting on an obscure frequency, bouncing signals off the moon to see how far around the world they can communi-

PHOTOGRAPH BY PAUL FUSCO—MAGNUM

cate. Even when they're battling scorpions and crabs, as they did on a Caribbean island last year, the trips mean a lot to Treybig. "I like to know I can do more than manage people," he says. "I get away and feel pride in what I can do as an individual."

AS FOR COMMUNICATING with the folks at Tandem, Treybig keeps looking for ways to accomplish what he once thought could be done just with a Budweiser and a Friday afternoon. With 6,200 employees in 130 offices around the world, he says, "it's all very structured. I spend a lot of time working on systems that allow the communication." Nearly everyone has an electronic mail terminal, used for anything from announcing the birth of kittens to surveying workers' job satisfaction. Major offices have satellite dishes to catch live TV feeds from Tandem's in-house broadcasting facilities. Treybig periodically visits Tandem offices for lengthy question-and-answer sessions with employees, who may quiz him on new products or complain about the inadequacy of shower facilities for joggers.

To be sure, Treybig preserves some aspects of his former, laid-back managerial approach. He occasionally gets out of his chair, wanders down a hall, and plops in somebody's office. He still makes his appointment calendar available to all employees, who scribble in their names for a session with the boss. And watch out: When Tandem finally hits $1 billion in sales, its founder's dream for more than a decade, Jimmy Treybig plans to throw the beeriest, foot-stompingest party ever held in Silicon Valley. ◧

INVESTOR'S SNAPSHOT

TANDEM COMPUTERS

SALES (LATEST FOUR QUARTERS)	**$901.8 MILLION**
CHANGE FROM YEAR EARLIER	UP 36%
NET PROFIT	**$89.2 MILLION**
CHANGE	UP 137%
RETURN ON COMMON STOCKHOLDERS' EQUITY	**14%**
FIVE-YEAR AVERAGE	11%
RECENT SHARE PRICE	**$67.50**
PRICE/EARNINGS MULTIPLE	**35**
TOTAL RETURN TO INVESTORS (12 MONTHS TO 4/24)	**114%**
PRINCIPAL MARKET	**NYSE**

PEOPLE TO WATCH

Carl E. Dranoff

■ Dranoff, 39, gives Americans a chance to live in the past. He is president of **Historic Landmarks for Living**, a Philadelphia company that renovates historic buildings and converts them into rental apartments. The largest rehabilitator of antique structures in the U.S., HLFL had 1986 revenues of nearly $100 million. The company raises money by selling limited partnerships; the new tax law still allows a tax credit for people who invest in historic renovations. Dranoff, who became a real estate developer after receiving an MBA from Harvard, has brought life back to 36 vacant buildings in 20 cities. He'll have to wait awhile for his own home to become a relic, though; the brick townhouse was built in the 1970s.

Richard J. Lyons

DAVID WYKES

■ Instead of asking the chairman of Celanese for a raise, Lyons asked for a subsidiary. He got one. Lyons, 36, is chief executive of Hoechst Celanese's newly formed **Corporate Class Software**, which develops and sells financial software to corporations. You may have seen its ads, which talk about how Lyons's boss, C. Robert Tully, 65, Celanese's chief financial officer for 15 years, is putting his reputation on the line as chairman of the venture. He's not the only one. The software company's first product, a $25,000 financial reporting program, was designed by Lyons when he was head of Celanese's internal financial software systems.

Daniel C. Lawson

BRENT JONES

■ As a black growing up in Kentucky, Lawson was forced to sit in the back of the bus. Today the 41-year-old head of **Lawson National Distributing** sits in the driver's seat of one of the largest bus suppliers in the U.S. Lawson has sold 1,500 buses to 14 cities since he founded his business in 1980. In 1986 revenues jumped 100% to $52 million. A defensive back for the Washington Redskins, Lawson injured his knee in 1967 and soon quit football, moving on to become an administrator at the Houston transit authority. Any city that receives federal grants from the Department of Transportation is required to do a certain percentage of its business with minority-owned companies, and, not coincidentally, some of Lawson's biggest contracts have come from cities with black mayors. "Buses were symbols of civil rights in the 1950s," says Lawson, who recently filed to take his company public. "I want my buses to become symbols of new economics for blacks in the 1980s."

Guy L. Smith IV

JOHN CHIA

■ As head of corporate affairs for **Philip Morris USA**, Smith, 38, has one of the toughest P.R. jobs around—keeping the critics of smoking from burning his company's $7.1-billion-a-year cigarette business. A cigar smoker himself, Smith seeks to preserve the right of habitués to smoke in public places and the right of cigarette companies to advertise in the print media. "Do we want behavior control or freedom of choice?" he asks. "Today it is tobacco. Tomorrow it will be something else." In 1985 Smith launched *Philip Morris Magazine*, the first publication explicitly aimed at smokers. The quarterly includes features such as a history of smoking in the White House.

Robert Greenberg

ROGER DEAL

■ Watch out, George Lucas. Greenberg runs a New York production company that has become famous for its dazzling special effects. **R/Greenberg Associates** created, for example, the scene in *Garp* where the baby floated through the air. Greenberg, 39, was managing a Royal Crown Cola subsidiary in Canada when he decided it would be more interesting to help run his brother's filmmaking business. In the past ten years R/Greenberg Associates has done work for over 800 clients, including IBM, Bell Atlantic, and Paramount Pictures. Besides special effects, the company produces commercials and promotional films for companies. It recently won a special Academy Award for developing a computerized film printer. **—Kate Ballen**

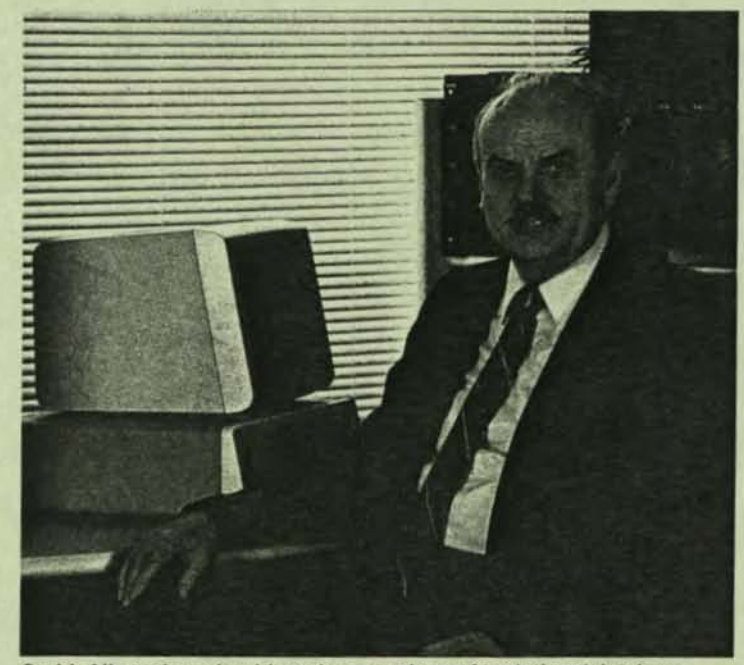
1987: The Beginning Of A New Era In Data Processing

By E. F. Codd

The announcement by Tandem Computers Inc. of their new product NonStop SQL (see *InformationWEEK*, March 23) represents a major advance in data processing as significant as the introduction of:

- Virtual memory into computer design.
- Transistors as basic components.
- Multiprogramming as a new type of auxiliary storage.

Clearly, then, I do not consider this to be "just another routine announcement by a vendor." I heartily congratulate Roberta Henderson and her excellent team of developers for their significant contributions to data processing.



Codd: All vendors should produce versions of a relational database

The reason for this enthusiasm is that the new Tandem DBMS represents a unique combination of relational database management; very high performance that is improvable even more by adding more interconnected processing units; fault-tolerant architecture pioneered by Tandem; support for distributed databases with distribution independence.

With this combination, nonrelational DBMSes have finally become obsolete! After all, why should anyone now sacrifice the many established advantages of going relational for alleged performance advantages of nonrelational when these latter advantages no longer exist?

The Dual Database Strategy

A few years ago, IBM announced its relational DBMS products, SQL/DS and DB2. Since then, IBM has widely proclaimed its "dual database strategy," involving the continued marketing of the old, nonrelational IMS as well as the new DB2. Since this strategy was based on the myth that one could not achieve performance with a relational DBMS, both the strategy and IMS are now doomed to the collapse which I quietly predicted many years ago.

A few software-only vendors have tried to correct their declining position in the DBMS market by rushing out and buying relational DBMSes developed by small companies, then modifying these systems and renaming them to look like a part of their product line. This approach has caused at least one of them to fall into the dual database strategy trap.

My advice to these vendors is to follow the example of Tandem: In other words, invest the time and effort of your best technical people in understanding the relational model and the approach to database management based on it (several hundred technical papers on this subject have been published), then request these people to use their own ingenuity in developing a high-performance implementation.

However, a warning may be appropriate: To achieve the very high performance of Tandem's NonStop SQL, Tandem modified their own operating system, and it now seems highly unlikely that the Tandem level of performance can be achieved without modifying other vendors' operating systems also.

A clear result of the Tandem NonStop SQL product announcement is that the dual database strategy together with the false claims on which it is based are finally dead. Why should any user acquire two DBMS products to do the job that one (NonStop SQL) can do? It should now be clear to everyone that all the unproved and unintelligent allegations that relational DBMSes were unable to provide performance as good as nonrelational DBMSes were (and are) weak and unacceptable excuses by certain vendors and certain consultants for not having invested enough people and brainpower into solving the problem.

Performance

Our staff was called in by Tandem to provide a technical audit of the performance tests. Tom Sawyer checked numerous aspects of the testing (including the cabling, the coding, and the timing) and witnessed the performance of NonStop SQL on a banking debit-credit type of workload consisting of on-line transaction processing equivalent to that arising from 25,000 terminals of the automatic-bank-teller type. The installation consisted of 32 interconnected Tandem VLX processing units plus one EXT unit plus 80 Tandem disk drives.

The system showed it could handle 208 transactions per second with 90% of those transactions completed in two seconds or less. It could also handle more transactions per second than 208 with a transaction response time of three seconds or less. In addition, with more processing units than the 32 in the test installation, this system could

demonstrate transaction rates of more than 1,000 per second with response times for each transaction of the same order of magnitude as before.

Although I am not familiar with the details of Tandem's approach to automatic optimization of the target code from the source SQL code, they do support both compilation and automatic recompilation when necessary. Moreover, I do not believe they would be able to demonstrate such outstanding performance unless the optimization techniques were well conceived and well implemented.

Fault Tolerance

In the middle of a heavy load of transactions, Sawyer of our staff shut down the power to one processing unit to simulate a failure. The remainder of the system continued to operate when the transactions were not processed by the disabled unit, and when that unit was switched on again, the system recovered automatically—including successful re-execution of those transactions adversely affected by the unit that was turned off. It is worth noting that, in contrast to earlier approaches to fault tolerance by vendors other than Tandem, no processing unit plays the role of a standby that is completely idle until a fault is detected.

Fidelity To Relational Model

Neither NonStop SQL nor IBM's DB2 is 100% faithful to the relational model (an example is the way they treat missing information). However, NonStop SQL is more faithful than IBM's DB2. It supports every feature DB2 supports plus the semantic feature known as the primary key concept.

This concept is an important step on the way to referential integrity, although an important extra step (among other things not yet supported) is the foreign key concept. In the future, both of these concepts must be supported, not only for referential integrity, but also to implement a systematic approach to view updatability as required by the relational model.

The extent of support for the relational model is enough for the product to qualify today as a genuine (but not fully) relational database management system. Tandem can extend the NonStop SQL DBMS in future releases to become fully relational without upsetting their customers' investment in application programming and in training of end users at terminals. Although Tandem has not yet declared their intention to make such extensions of NonStop SQL, I feel confident that they will exert leadership in this direction also.

A final note: The same version of Tandem NonStop SQL software runs correctly on presently available Tandem hardware (specifically the processing units of all sizes) whether small, medium, or large in scale.

Distributed DBMSes

Tandem's NonStop SQL is a leader in this respect. Most of the DBMS products released to date (I am, of course, ignoring prototypes) do not support distributed database management at all. A few support retrieval of data from distributed databases, but do not support remotely requested insertions, updates, and deletions. Tandem supports all four kinds of activities: retrieval, insertion, update, and deletion with a certain degree of distribution independence.

Tandem Computer Corp.

Tandem's EXT system supports the firm's new NonStop SQL database manager

In part, Tandem's leadership in this area is due to the fact that its NonStop architecture requires treating data that is stored entirely locally in a single database as if that database were distributed. This architecture represents a more significant departure from the classic von Neumann architecture than merely supporting concurrent access to data in auxiliary storage. It is a departure in which *many* full-scale processing units are interconnected and are operating in parallel (that is, concurrently with respect to each other), and an innovation which I expect many other vendors to copy.

Conclusion

The motivation for other vendors to follow Tandem's example is that NonStop SQL provides effective support for the many companies that are staking their business on systems that manage databases efficiently and provide powerful control over the maintenance of logical and semantic integrity.

An important reason for these companies to feel secure about their investment is that the relational approach to database management (in contrast to all other approaches) has a precise mathematical foundation. Although everyone is free to attack and destroy this foundation if they can find and demonstrate an uncorrectable technical or theoretical error, no one has yet managed to do this (and my first publication in this area was in August 1969).

A common remark among data processing professionals was: "One never gets fired for selecting IBM machines." A more appropriate saying for today is: "He who fails to consider Tandem systems as a candidate is bound to be fired." Incidentally, I don't own any Tandem stock, but if I were not a vendor-independent consultant I would certainly do so.

Congratulations to Tandem for this major advance, for laying to rest the incorrect allegations that relational DBMSes cannot perform well, and for disproving similar allegations that distributed versions of relational DBMSes cannot perform well. It has been a rewarding experience to meet the team that developed Tandem's NonStop SQL, people who are willing to consider ideas on their merits instead of being slaves to dogma.

—E.F. Codd is president of the Relational Institute, a nonprofit company based in San Jose, Calif., that specializes in educating the business world on database management. He is also chief scientist of Codd & Date Consulting Group, which numbers Tandem Computers Inc. among its many vendor clients. During a lengthy career at IBM, Codd was the originator of the relational database model.

LEVEL 1 - 2 OF 3 STORIES

Business Wire

May 4, 1987, Monday

DISTRIBUTION: Business Editors

LENGTH: 615 words

HEADLINE: TANDEM; (TDM) Tandem Computers adds six new VLX models, enhances mid-range line, offers new communications subsystem

DATELINE: CUPERTINO, Calif.

BODY:

Tandem Computers Inc. (NYSE:TDM) Monday announced six new models of its NonStop VLX mainframe line, enhancements for its mid-range NonStop EXT systems and a new high-end 6100E Communications Subsystem.

Price reductions also were announced for its mid-range NonStop EXT10, EXT25 and TXP systems.

Tandem introduced the VLX801, VLX802, VLX803 and VLX804 packaged systems. When used with the NonStop SQL (Structured Query Language) relational database, these packages offer more than 50, 100, 150 and 200 transactions per second.

Addressing high-volume transaction processing requirements in the large mainframe market, these four packaged systems include from 8 to 32 processors, memory, disk and tape drives, the new 6100E CSS and the GUARDIAN 90XL operating system. VLX80x prices range from $2,141,000 to $8,564,000 (U.S.)

Tandem also introduced Monday new VLX hardware configurations priced at $585,000 and $759,000 (U.S.). These are two- and three-processor configurations, respectively, and include memory and disk and tape drives. When announced in April 1986, the entry-level VLX hardware package had four processors and prices began at $995,275 (U.S.).

EXT10 and EXT25 enhancements include a low-cost input/output add-on cabinet that accommodates 16 I/O slots, two cartridge tape drives and up to four disk drives; an asynchronous communications extension package that supports up to 144 lines; and a cartridge tape system that can now operate in streaming mode. A new cost-saving, on-line maintenance option also is being offered for the EXT10 system.

Network unit pricing of the EXT10 for 25 to 39 units is $59,171 each. Pricing of the EXT10 in single quantities is $74,900, a 9 percent reduction. An EXT25 system now has an entry price of $250,000, a 23 percent reduction. These EXT systems can process 4 to 18 SQL TPS, with an add-on processor cabinet. An EXT10 can be upgraded to an EXT25. Prices are in U.S. dollars.

Prices of TXP systems in two-, three- and four-processor configurations have been reduced by 15 to 25 percent and are $299,000, $446,000 and $593,000 (U.S.) respectively. These TXP systems can handle 9 to 18 SQL TPS and are expandable up to 16 processors.

Tandem's new 6100E communications subsystem, which can operate outside of a computer room, is for large communications networks. Through the use of fiber optics, the 6100E CSS can be located up to 1,625 feet from the host computer. It can be placed in a telecommunications center, thereby reducing costly cabling to communications devices and saving expensive computer room floor space.

The Tandem 6100E CSS is a fault-tolerant, microprocessor-based subsystem that manages communications between a Tandem host and hundreds of other devices.

The stand-alone subsystem is compatible with all Tandem NonStop systems, except the low-end CLX system, and supports from one to 180 communications lines.

The modularly expandable 6100E CSS has an entry price of $14,696 (U.S.).

The EXT I/O add-on cabinet is available fourth calendar quarter 1987. All other prices and new offerings are available immediately. Tandem Computers Inc. manufactures and markets computer systems and networks for the on-line transaction processing marketplace. Its headquarters are located at 19333 Vallco Parkway, Cupertino 95014. The telephone number is 408/725-6000.

CONTACT: Tandem Computers Inc., Cupertino
Jeri Eaton Flinn, 408/725-5462

MIS Week May 4, 1987 p 10

Tandem Beefs Up VLX Line, Cuts EXT, TXP Tabs

By IRWIN GREENSTEIN

CUPERTINO, Calif.—In a product blitz this week Tandem Computers Inc. rounded out its VLX line of fault-tolerant processors, announced enhancements and price cuts to its mid-range EXT family, reduced prices on some models in its other mid-range line of TXP systems and rolled out a large communications processor.

In the last two weeks, Tandem also won a $15.4 million contract over Unisys Corp. and Britain's largest computer maker, ICL, to supply a new command and control computer system for the Royal Hong Kong Police.

Separately, Tandem and Coopers & Lybrand, an international public accounting and consulting firm, announced an agreement under which both companies will work together to implement on-line applications in the manufacturing market.

Among the four new VLX systems classified as the 80X, the 804 VLX lashes together 32 processors in an $8.5-million mainframe system—the company's most powerful fault-tolerant offering to date. Geared for very high-volume, on-line transaction processing (OLTP), it performs over 200 transactions per second (TPS) running Tandem's NonStop SQL relational database.

The three other new VLX 80Xs—801, 802 and 803—use eight to 24 processors to achieve 50, 100 and 150 TPS, respectively. With prices starting at $2.1 million for the 801, they are all bundled with memory, disk and tape drives, the Guardian 90XL operating system and the new 6100E Communications Subsystem. The VLX products are available immediately.

Previously, Tandem's existing VLX line was comprised of 4 to 16 processors performing 40 to 160 TPS, with an entry price of $995,275.

Terry Redford, Tandem's manager of processor and memory products, compared the performance of the VLX family with IBM's 3090 mainframe line. Moreover, the 200-TPS performance of the 804 challenges a 30-processor VAX cluster from Digital Equipment Corp., he said.

One industry analyst, however, cautioned against such comparisons. "I would not argue with his (Redford's) numbers, but it's hard to do comparative benchmarks with other vendors, since Tandem is optimized for on-line transaction processing and DEC and IBM are more generalized," said Jeffrey Canin, senior technology analyst at Hambrecht & Quist in San Francisco.

Still, by introducing the mainframe-class VLX 80Xs, Tandem is solidifying its position in the high-end spectrum of OLTP. This week's product avalanche on top of its mid-April introduction of the low-end NonStop CLX line and the company's first Unix, non-fault-tolerant system (see April 20 MIS Week, page 8) makes for "very exciting times at Tandem," Canin said.

With the new VLX 80Xs, "Tandem is pushing upwards and upwards," he said. "It's very clear that Tandem's product line is not just super minicomputers, but covers from supermicros with the LXN, to minis to mid-range mainframes. It's an impressive array."

George Elling, senior vice president at the Wall Street firm of Oppenheimer & Co., said that, by virtue of Tandem already having the VLX line, "when you really look at what Tandem was selling, they already are in the mainframe business." Redford countered that "We always have been a mainframe vendor."

By introducing the VLX 80Xs, "They (Tandem) realize the utilization of on-line transaction processing is moving up, and up, and up," Elling said. "They want the presence, to be well-known and to be a leader."

While the VLX 80X family are configured in multiples of eight coupled processors, Tandem introduced two low-end, fault-tolerant VLX configurations that set new price points for the product line and, for the first time, make it available in systems smaller than four processors.

Priced at $585,000 and $759,000, they are two- and three-processor systems, respectively. Running NonStop SQL, the two-processor system performs at 13 TPS, while the three-processor VLX is rated at 19.5 TPS. When announced in April 1986, an entry-level VLX had four processors and prices began at $995,000, Redford said.

He compared the two-processor VLX in price/performance to an IBM 4381, and the three-processor system to an IBM "entry-level 3090."

Introduction of the two- and three-processor VLXs fulfill a promise to bring out a low-end VLX made that April, according to Redford. "We are opening it (VLX) to price-sensitive people," he said.

Slashes Prices, Enhances

In that vein, Tandem cut prices on some models in the EXT and TXP mid-range, fault-tolerant line and enhanced some EXT models.

Single-quantity pricing of the EXT10 is now $74,900, reflecting a nine-percent discount. An EXT 25 now has an entry price of $250,000, a 23-percent reduction. These EXT systems can process 4 to 18 TPS running NonStop SQL and, with a new add-on cabinet, can accommodate 16 I/O slots, two cartridge tape drives and up to four disk drives, an asynchronous communications extension package that supports up to 144 lines and a cartridge tape system that can operate in the streaming mode. The cabinet sells for $25,000.

Delivery of the EXT add-on cabinet will begin in the fourth quarter.

Tandem lowered prices of TXP systems in two-, three- and four-processor configurations by 15 to 25 percent. They are priced at $299,000, $446,000 and $593,000, respectively. They can handle 9, 13 and 18 TPS, respectively, with NonStop SQL.

According to H&Q's Canin, the price cuts bode that "over the next year, the EXT and TXP will be phased out." He called the price reductions "mid-life kickers."

Tandem's Redford, meanwhile, claimed that the new pricing repositions the EXT and TXP. "Having introduced the (Unix) LXN two weeks ago, and bringing the VLX down (today), we had to position the two products (EXT and TXP) in that lineup, so they are positioned correctly for a price/performance increase," he said.

Communications Processor

Tandem also announced the 6100E high-end communications processor. It is a fault-tolerant subsystem that manages communications between a Tandem host and other devices. Through a fiber-optic link it can attach to a host up to 1,625 feet away. The 6100E supports one to 180 communications lines. Local or remote diagnostics can be run while on-line. Prices start at $14,696.

The system for the Hong Kong police will replace the police department's 10-year-old equipment. It is designed to reduce response time and help control several subsystems dealing with personnel and managment and link several external data systems. A main function of the system will be to speed up communications within the department to provide instant data on manpower availability for immediate response to problems within the British colony.

The system is also expected to product up-to-date maps, reducing dependence on published maps that quickly become outdated due to Hong Kong's rapid construction pace.

The system will also generate near-instant profiles of neighborhoods, regarding crimes ranging from petty theft to murder. Police say speedy statistical analysis is vital here, where housing projects and apartment complexes spring up quickly and illegal aliens from China sneak across the border daily.

One source said Tandem's system was favored because of its fault tolerance.

In addition to massaging its product line-up, Tandem was busy forging an agreement with Coopers & Lybrand to jointly develop and deploy OLTP applications for manufacturing concerns.

As part of the agreement, Coopers & Lybrand will provide services that include project management, pre-installation analysis, post-installation implementation, training and support. The partnership covers all areas of manufacturing with special emphasis in electronics, automotive, process and aerospace.

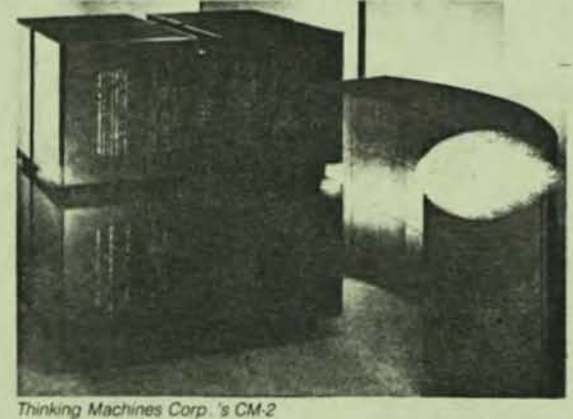
(Reporting for this story was contributed by Paul Charles Ehrlich in Hong Kong.)

Says CM-2 Is Fastest Supercomputer

By BILL DOOLEY

CAMBRIDGE, Mass.—Thinking Machines Corp. introduced what it calls the world's fastest supercomputer, the "CM-2," rated at 2.5 billion instructions per second (bips) at its headquarters here last week and will target the government, scientific and huge number-crunching applications in private industry.

C. Gorden Bell, former vice president of engineering at Digital Equipment Corp., said, "The Connection Machine (CM), by exploiting massive parallelism is providing the next jump in (computer) performance today and is opening a clear path to the teraflop." One teraflop is one trillion floating-point operations per second.



Thinking Machines Corp.'s CM-2

Bell was also one of the founders of Encore Computer, Marlborough, Mass., a start-up parallel processing firm which markets its Multimax system, and serves as assistant director of computers, information science and engineering for the National Science Foundation.

The 64,000-processor CM-2 supports eight I/O channels and operates at 40 Mbytes per second per channel with a total system memory of 512 Mbytes.

The CM-2 will be available in the fall in either 16,000- or 64,000-processor versions and will shortly be going out to beta test. For its currently installed user base of the CM-1 upgrade kits will be available in the fall and pricing will depend on the currently installed configuration.

Danny Hillis, founding scientist of TMC, said, "All Connection Machine computers are data parallel systems which means they automatically associate elements of processing power directly with elements of data and systems include up to 64,000 processors working parallel."

TMC also introduced its Data Vault, a mass storage unit which includes a "self diagnostic and self healing capability" along with a Fortran compiler encompassing the data parallel extension of Fortran 8X and a color graphics capability. It interfaces 42 Winchester disk drives into a 5-Gbyte system and is expandable to 10 Gbytes. Its will be available in 5-Gbyte and 10-Gbyte configurations.

Explaining the system's ability to "self-diagnose and self-heal," a spokesman explained, "the Data Vault is the Connection Machine's mass storage system. Each Data Vault unit stores its data in an array of 39 individual disk drives and each 64-bit data chunk received from the CM-2 I/O bus is split into 32-bit words.

"After verifying parity, the Data Vault controller adds 7 bits of Error Correcting Code (ECC) and stores the resulting 39 bits on 39 individual drives. Subsequent failure of any of the 39 drives does not impair the reading of the data since the ECC code allows any single-bit error to be detected and corrected.

"While operation is possible with a single failed drive, three spare drives are available to replace the failed units until they are repaired. The ECC code permits 100 percent recovery of the data on the failed disk, permitting a new copy of this data to be rewritten and reconstructed onto the replacement disk. Once the recovery is complete, the database is considered to be healed."

As to what the future holds for parallel processing, Thinking Machines president and founder Sheryl Handler indicated that the pace of that technology's development, which is already rapid, will only increase. She said users are demanding solutions to even more intensive problems, citing the move from 2-D scientific simulations to 3-D as increasing data intensity "by a factor of 1,000 or more."

Data Parallelism Bridge

She added, "There are already progams written that could use a system with a million processors. The semiconductor and storage industries are continuing to produce more and more cost-effective components and data parallelism is the bridge, putting proven products to work in exactly the way large-scale users want them."

She concluded by adding, "Data-parallel computers are already exceeding conventional computers in performance and ease of use and the gap will widen even further in the future."

TMC was founded in 1983 and began with $5 million in funding from the Department of Defense as a part of its research effort in

SEE CLAIMS PAGE 11

LEVEL 1 - 2 OF 4 STORIES

May 4, 1987

SECTION: NEWS; Pg. 101

LENGTH: 616 words

HEADLINE: Tandem to recast product line;
Firm to add to high-end packaged systems, cut prices on mid-level CPUs

BYLINE: By Jeffry Beeler, CW Staff

DATELINE: CUPERTINO, Calif.

BODY:

In a wide-ranging shake-up of its product line, Tandem Computers, Inc. is expected today to broaden its selection of high-end packaged systems and reduce both the single-quantity and volume-discount prices for its intermediate-scale CPUs.

The company also is expected to enhance its communications capability with an additional front-end processor model and expand the I/O capability of its existing EXT computer family with an add-on cabinet that holds extra disk and tape modules.

To its VLX processor line, Tandem has added two entry-level packaged systems, one configured with two of the firm's existing VLXs and the other configured with three. Prices for the VLX 302 and VLX 303 start at $585,000 and $759,000, respectively.

High-end packages

At the opposite end of the same CPU series, the vendor has added four other system packages incorporating eight to 32 processors and ranging in price from roughly $2.1 million to almost $8.6 million.

Previously, the VLX line came with just one packaged system model containing four CPUs and starting at $1 million.

Availability of the eight- to 32-processor packages "will certainly increase the flexibility with which customers can upgrade their configurations" beyond four machines, according to Ray Wolfe, vice-president of business development at Litton Computer Systems, Inc. Wolfe, a VLX user, works for the Mountain View, Calif.-based firm that develops software for retrieving systems maintenance and reliability information.

At the high end of the VLX family, Tandem's aim in enlarging its packaged systems options is to highlight their price/performance edge over competing IBM models. For users, the system packages simplify the task of estimating how much hardware and money would be needed to achieve a given level of internal throughput, according to Terry Retford, Tandem's manager of processor and memory products.

Along with dropping the entry-level price point for its VLX packaged systems, Tandem will cut, by 15% to 25%, the price of two-, three- and four-processor TXP configurations.

Similar pricing changes will be announced for Tandem's EXT processor family, which can be upgraded to the TXP, Retford said. As a result of today's announcement, the firm has trimmed the single-quantity price of a basic EXT10 by 9%, to $74,900. The EXT10's larger sister system, the EXT25, has simultaneously had the price of its minimum-configuration unit lowered by 23%, to $250,000.

Tandem's price cuts also extend to EXT10 and EXT25 systems that are bought in bulk. In quantities of 25 to 39, for example, the cost of an EXT10 has dropped from $61,875 to $59,171.

The price reductions come hard on the heels of Tandem's introduction of two distributed processing systems costing less than $60,000 and strengthens suspicions that the EXT10 is nearing retirement, according to Bear Stearns & Co. analyst Jonathan Fram.

Mid-range additions

In other EXT-related developments, Tandem will offer users of the mid-range machines an optional add-on expansion cabinet that holds 16 I/O slots. The enclosure provides room for two cartridge tape drives, four 5 1/4 -in. Winchester disk units, a streaming-tape system and a communications package that supports 144 asynchronous lines.

Starting immediately, Tandem also plans to ship an enhanced version of its Model 6100 communications subsystem. Unlike its predecessor, which requires special environmental controls, the 6100E can operate in an ordinary business office and can be installed up to 1,625 feet away from its host. With the original 6100, the limit was 200 feet, according to a Tandem source.

Prices for the enhanced subsystem start at $14,696.

GRAPHIC: Chart, Tandem VLX packaged systems, CW Chart

BY FRANK BARBETTA

NASHVILLE, TENN. — Northern Telecom Inc. has merged several switching and data product operations in order to beef up its data communications presence and to buttress its Meridian DV-1 integrated voice/data product line.

Northern Telecom handed over DV-1 development, production and marketing, as well as its packet switching business, to a new Data Communications and Networks group. It will be headed by Edmund Tagg, who was named group vice president of the new unit.

Previously vice president of corporate networks at the firm's Integrated Office Systems group, Tagg retains responsibilities for marketing a variety of large switching systems to major corporate accounts, the federal government and specialized and radio common carriers.

Tagg and Desmond Hudson, Northern Telecom Inc. president, said the new organization would zero in on data networks as a central strategy. It will introduce local- and wide-area network systems, T-1 multiplexing equipment and software and hardware for complex network management and computer connectivity, he added.

"The new products and organization will enable Northern Telecom to focus its total resources on meeting demands for flexible, cost-effective data communications," said Hudson.

Tagg said the new products, which could be unveiled by the third quarter for deliveries early next year, will be skewed toward compatibility with IBM's Systems Network Architecture environment. They will reshape the role of the DV-1, a 32-bit processor and PBX combination introduced more than two years ago.

"We have had several activities on the data side of the business, but to date, these have often been handled as adjuncts to some independent business product lines," he said. "The new organization is being formed also to pull together a more coordinated thrust."

Tandem Supplying Its Systems To Hong Kong's Royal Police Force

CUPERTINO, CALIF. — Tandem Computers Inc. has signed a five-to-10-year agreement to supply the Royal Hong Kong Police with a new computer system.

The contract is valued at about $15 million over the first five years.

Tandem will provide a network of three NonStop TXP systems with a total of 19 CPUs and an undisclosed number of disk drives. The company also will supply some of the 500 terminals to be installed in regional offices. Most of the terminals will be large-screen graphic units supplied by Lynwood Scientific, U.K.

Among other subcontractors supplying equipment for the Enhanced Command and Control Computer System is Communications Services Ltd., Hong Kong, which will supply communication equipment.

Jardine Logica Systems Ltd., also of Hong Kong, will supply software for interfacing the Tandem system with existing computers from The Perkin-Elmer Corp., Norwalk, Conn., and International Computers Ltd., U.K.

Application software will be written by the Hong Kong government.

circuits terminating in all areas served by the operating companies of BellSouth Corp., Atlanta; Southwestern Bell Corp., St. Louis; and US West

EDS Sets Its Joint Ventur

BY CHRISTINE BONAFIELD

DALLAS — Electronic Data Systems Corp.'s quest to build a worldwide network came closer to fruition last week with an announcement that it is setting up shop in China.

EDS said it is working out a 30-year joint venture with the Beijing Commission for Science and Technology. It would include construction and operation of an information processing center—similar to the 18 centers already run by EDS across the globe—and a Chinese-built packet network.

An EDS spokesman said the company hopes eventually to tie the Beijing center into the 24-nation voice and data network it has assembled primarily for its corporate parent and largest customer, General Motors Corp.

EDS already has established a major presence in South Korea through an agreement with the Lucky-Goldstar Group, Seoul. It will consolidate information processing centers and establish an integrated communications network for about 20 of the conglomerate's companies.

EDS also has a data processing center in Singapore and has a toehold in Japan, where it has teamed with Nippon Telegraph and Telephone Co. to provide high-speed teller terminal network services to Citibank N.A. locations.

According to the EDS spokesman, while the size of the China contract is not yet firm, EDS

CORPORATE INFORMATION CENTER

Computer System News May 4, 1987 p21

TANDEM CORPORATE INFORMATION CENTER

INVESTEXT/COMPUTERS AND OFFICE EQUIPMENT
May 11, 1987

Tandem Computers, Inc.

Tandem is a leading supplier of minicomputers for transaction processing. David Rynne, chief financial officer; Jerry Dusa, director of marketing; and Dennis McEvoy, vice president of software development; made presentations to our group.

Revenue in fiscal 1986 was $768 million and the pretax margin improved to 15%. For fiscal 1987 the company expects strong revenue and earnings growth. Management's goal is to achieve 16-18% operating profit margins (higher pretax) and if the year continues to be as strong as it has started, the company may reach such goals this year. Tandem has $240 million of cash with almost be debt; management believes that if the company grows faster than 25% per year it will need cash. The present cash position means the company has no need to limit its growth rate in any way.

Gross margins are benefiting from higher percentage of new products (both processor and peripherals) in the mix. In terms of products, the VLX high end continues to do well while the EXT 10 and 25 are doing better than expected. Geographically international continues strong; it has moved from 30% of total revenues to 40% over a 15-month period. The sales reorganization is now well settled but a sequentially slightly down March quarter can be expected.

The current cash position, its should be noted, is after buying two buildings for $15 million.

Approximately 45% of Tandem's revenues are from international markets; the company has 160 locations throughout the world for sales. While finance remains the largest market for the company (banking was about 27% of revenues in the first quarter and other financial accounted for 10% of revenues), manufacturing has been increasing significantly as a revenue contributor (19% in the first quarter). Telecommunications is a relatively new market for Tandem and accounted for about 11% of revenues in the first quarter. GTE is one of the company's largest single accounts.

Government, particularly state and local governments, is coming on as important customers for on-line applications. The company views insurance and brokerage firms as important potential markets for its products with their transaction orientation.

According to Tandem, it is increasingly important to be viewed by customers as a provider of solutions. Tandem's Alliance program to encourage existing third-party software developers to write for Tandem computers has been very successful. Future partnerships in products and technology and perhaps in marketing are envisioned by management. The

company's goal is to reinforce its leadership position in on-line transaction processing.

Tandem computer architecture is the framework for on-line transaction processing. It provides modular expandability, linear performance, geographic independence, data integrity and continuous availability. Tandem's NonStop VLX system is designed for high-volume transaction processing; the base system provides 40 ET1 transactions per second. Developments in the VLX line can be expected to use VLSI technology, high-speed fiber optics and a high-speed interprocessor bus.

The Non Stop EXT 10/25 is a compact, low-cost system. Plans call for this system to be extended downward. In the future, 90% of the components are intended to be user serviceable and the equipment is expected to have dramatic improvements in reliability.

New products expected this year include new low-end systems in hardware and SQL query language software for data bases. The low-end systems will have more power, dramatically fewer circuit boards and floor space, lower cost and fit in an office environment. The idea is to populate nodes for the network and true distributed processing. Industry-standard SQL similarly will make distributed data bases much more effective.

In sum, the outlook for Tandem is strong. The company recognizes that in this industry it is a small company and it is imperative to get big. Trailing 12 month revenues are up 32%, but we feel this is coming off a depressed period and is not a growth rate. The DBL estimates for fiscal (September) 1987 are $2.30 per share and for fiscal 1988 $3.00 per share.

Securities mentioned in this Report

Company	Symbol	Exchange	Contest Price 3/6/87	Current Price 3/19/87	DBL Rating
Amdahl (N)	AMH	ASE	39	37 3/4	N-1
National Semiconductor (N)	NSM	NYSE	15 1/4	16 3/8	N-1
Comdisco, Inc. (N,U,B,W,C)	CDO	NYSE	27	26 5/8	NR
Cray Research (N)	CYR	NYSE	127	122 5/8	N-1
Convergent Technologies (N,M)	CVGT	OTC	10 3/8	10	N-1
MAI Basic Four (U,V)	MBF	NYSE	17	17 1/4	NR
Sun Microsystems (N)	SUNW	OTC	29 1/8	30 1/2	NR
Tandem Computers (N,M)	TNDM	OTC	67 1/8	70 1/2	N-1
Atari Corporation	ATC	ASE	25 1/2	27 1/4	N-1
CMS Enhancements	ACMS	OTC	1 1/4	1 5/8	NR
Tandon Corporation (M)	TCOR	OTC	3 3/4	4	N-2
Wyse Technology	WYSE	OTC	28 7/8	25 1/4	NR
Network Systems Corporation (N)	NSCO	OTC	16 5/8	15 7/8	N-1
Novell, Inc.	NOVL	OTC	41 1/2	40	NR
Maxtor Corporation	MXTR	OTC	29 1/8	29	NR
Quantum Corporation	QNTM	OTC	33	31 1/2	N-1
Seagate Technology (N,*)	SGAT	OTC	35 1/4	34 3/4	NR
Alloy Computer Products (M,U)	ALOY	OTC	8 1/2	8	NR
Cipher Data Products (N)	CIFR	OTC	15 5/8	14 1/8	B/H
S & P 500			290.66	294.08	

LEVEL 1 - 3 OF 4 STORIES

May 12, 1987, Tuesday

DISTRIBUTION: Business Editors

LENGTH: 422 words

HEADLINE: TANDEM/ADVEST; (TDM)(ADV) Advest installs Tandem systems for on-line securities processing

DATELINE: CUPERTINO, Calif.

BODY:

Tandem Computers Inc. (NYSE:TDM) and Advest Group Inc. (NYSE:ADV) announced Tuesday that they have installed two Tandem NonStop VLX computer systems valued at more than $2 million for processing securities on-line at Advest Inc., one of the largest U.S. regional brokerage firms.

Advest Inc. has installed a four-processor NonStop VLX system valued at $1.5 million at its Hartford, Conn., headquarters. The system will initially handle on-line order entry for branches, and proviDe order match and message switch services starting in late 1987 using software from Securities Industry Software Corp. of Evergreen, Colo.

''Advest is committed to utilizing the best technology available to service the needs of our customers,'' said Allen Weintraub, senior executive vice president and chief operating officer of Advest.

The firm also plans to use the system to handle other applications, including portfolio management, client information and back office accounting.

Advest has installed a $690,000 two-processor NonStop VLX system for developing software programs in-house.

John Reynolds, group vice president-director of information systems of Advest Inc., commented, ''The Tandem systems will give us the sophisticated computer technology, greater power and capacity we need to process transactions on-line and support brokers' and clients' expanding information requirements.''

The system will connect to a network of 1,000 terminals in Advest branch and back offices as well as to the major U.S. stock exchanges.

A member firm of the New York Stock Exchange, Advest Inc. provides a full range of brokerage products and services to investors through a network of more than 80 offices in the Eastern United States. Advest Inc. is a subsidiary of Advest Group, a holding company whose subsidiaries provide a wide range of financial services to individuals, institutions, corporations and government bodies.

Tandem Computers Inc. manufactures and markets computer systems and networks for the on-line transaction processing marketplace. The company is headquartered at 19333 Vallco Parkway, Cupertino, Calif. 95014. Phone is 408/725-6000.

CONTACT: Tandem Computers Inc., Cupertino
Tom Waldrop, 408/725-7191
or
Advest Inc., Hartford
Allen Weintraub, 203/525-1421

INVESTEXT/COMPUTERS AND OFFICE EQUIPMENT
May 18, 1987

Minicomputer Monthly Review
(continued)

Table 2
Possible Results By Fiscal Quarter for Tandem in F1987
$ in millions, except per share data

[Part 2 of 3]

	Q1E F1987 ($)	Q2E F1987 ($)	Q3E F1987 ($)	Q4E F1987 ($)
Equipment Sales	198.7	193.0	218.0	237.5
Service Revenues	39.3	40.0	41.0	42.5
Net Sales	238.0	233.0	259.0	280.0
Less:				
Cost of equipment	53.6	53.6	61.2	66.7
Cost of service	27.8	28.8	29.5	30.4
Marketing, general & administrative	86.8	88.0	97.5	104.5
Research & development	24.3	24.4	26.0	27.4
Interest income (net)	2.8	3.0	3.2	3.4
Pretax income	48.3	41.2	48.0	54.4
Income tax	21.3	18.1	21.1	20.7
Effective tax rate	44.0	44.0	44.0	38.0
Net income	27.0	23.1	26.9	33.7
Earnings per share	0.58	0.49	0.56	0.70
Average shares outstanding	46.8	47.4	47.8	48.2
Percent of Sales				
Equipment sales	83.5	82.8	84.2	84.8
Service revenues	16.5	17.2	15.8	15.2
Cost of equipment	27.0	27.8	28.1	28.1
Cost of service	70.7	72.0	72.0	71.5
Marketing, general & administrative	36.5	37.8	37.6	37.3
Research & development	10.2	10.5	10.0	9.8
Interest	1.2	1.3	1.2	1.2
Pretax income	20.3	17.7	18.5	19.4
After-tax income	11.3	9.9	10.4	12.0

[Part 3 of 3]

	% Change			
	Q1 versus Q1 (%)	Q2 versus Q2 (%)	Q3 versus Q3 (%)	Q4 versus Q4 (%)
Equipment Sales	41.6	32.0	33.5	30.1
Service Revenues	32.1	32.7	9.2	12.0
Net Sales	39.9	32.1	29.0	27.0
Less:				
Cost of equipment	23.8	29.2	40.9	41.9
Cost of service	21.8	16.3	9.6	0.7
Marketing, general & administrative	34.0	28.0	25.8	24.7
Research & development	22.4	14.4	16.6	16.1
Interest income (net)	67.4	27.0	55.8	40.8
Pretax income	130.1	84.3	47.0	41.4
Income tax	-328.1	-282.2	-245.3	-222.4
Effective tax rate				
Net income	131.8	85.9	48.3	56.3
Earnings per share	106.0	67.9	40.6	48.8
Average shares outstanding	12.5	10.7	5.5	5.0
Percent of Sales				
Equipment sales	0.5	-1.9	0.5	-1.9
Service revenues	-2.3	9.4	-2.3	9.4
Cost of equipment	-8.0	-6.3		
Cost of service	7.1	-12.7		
Marketing, general & administrative	2.4	-1.0		
Research & development	3.7	-8.3		
Interest	36.2	-23.7		
Pretax income	2.8	28.2		
After-tax income	2.8	28.2		

Note: Fiscal Year Ends Sept. 30.

Table 3
Possible F1987 and F1988 Results for Tandem
$ in millions, except per share data

[Part 1 of 2]

	Estimated		Actual	
	F1988	F1987	F1986	F1985
Equipment Sales	$1,080.0	$847.0	$632.3	$523.4
Service Revenues	195.0	163.0	135.5	100.7
Net Sales	1,275.0	1,010.0	767.8	624.1
Less:				
Cost of equipment	$305.0	$235.0	$175.2	$185.6
Cost of service	142.0	117.0	104.7	83.0
Marketing, general & administrative	478.0	377.0	294.9	231.6
Research & development	130.0	100.0	87.0	73.8
Interest income (net)	10.0	12.0	8.5	6.3
Pretax income	230.0	193.0	114.5	56.4
Income tax	$85.0	$81.0	$50.7	$22.0
Effective tax rate	37.0%	42.0%	44.3%	39.0%
Reversal of deferred taxes on DISC				
Net income	$145.0	$112.0	$63.8	$34.4
Earnings per share before DISC	$2.95	$2.35	$1.44	$0.82
Earnings per share after DISC				
Average shares outstanding	49.2	47.5	44.2	41.8
Percent of Sales				
Equipment sales	84.7%	83.9%	82.4%	83.9%
Service revenues	15.3	16.1	17.6	16.1
Cost of equipment	28.2	27.7	27.7	35.5
Cost of service	72.8	71.8	77.3	82.4
Marketing, general & administrative	37.5	37.3	38.4	37.1
Research & development	10.2	9.9	11.3	11.8
Interest	0.8	1.2	1.1	1.0
Pretax income	18.0	19.1	14.9	9.0
After-tax income before DISC	11.4	11.1	8.3	5.5

[Part 2 of 2]

	% Change		
	F1988 versus F1987	F1987 versus F1986	F1986 versus F1985
Equipment Sales	27.5%	34.0%	20.8%
Service Revenues	19.6	20.3	34.6
Net Sales	26.2	31.5	23.0
Less:			
Cost of equipment	29.8%	34.1%	-5.6%
Cost of service	21.4	11.7	26.1
Marketing, general & administrative	26.8	27.8	27.3
Research & development	30.0	14.9	17.9
Interest income (net)	-16.7	41.2	34.9
Pretax income	19.2	68.6	103.0
Income tax	4.9%	59.8%	130.5%
Effective tax rate	(11.9)	(5.2)	13.5
Reversal of deferred taxes on DISC			
Net income	29.5	75.5	85.5
Earnings per share before DISC	25.5	63.2	75.0
Earnings per share after DISC			
Average shares outstanding	3.6	7.5	5.7

Percent of Sales

Equipment sales
Service revenues
Cost of equipment
Cost of service
Marketing, general & administrative
Research & development
Interest
Pretax income
After-tax income before DISC

N.B.: The First Boston Corporation has, within the last three years, served as a manager or co-manager of a public offering of securities for Concurrent Computer and Data General. The First Boston Corporation makes a primary market in issues of Concurrent Computer, Stratus Computer, and Tandem Computer.

INVESTEXT/COMPUTERS AND OFFICE EQUIPMENT
May 18, 1987

Minicomputer Industry Report
FIRST BOSTON CORPORATION (THE) - Peterson, S.
04-13-87 (RN=706472)

Minicomputer Industry

First Calendar Quarter Update on Earnings Estimates; Raising DEC F87 and F88 Estimates and Cutting DGN 88 Estimate; BUY TMDM

Since the technology feeding frenzy by investors in January, the minicomputer stocks have settled down to perform in line with the market with the exception of Tandem, which keeps stretching to a new level and holding it. We summarize the January move as the group's reaction to the "Christmas vacation effect" - over the holidays, Wall Street economists took the time to revise their 1988 GNP upwards and, upon their return, sparked a better-than-market rally in all the beat-up cyclical stocks, starting with technology.

Now that the group has made its big move, the stocks that remain buys are the ones that still have estimates moving up for the second half of 1987 and 1988. These are the strong players with technological "golden movements" - strong product cycles with an innovative twist in a vacuum of competition. We can debate, for the top-tier vendors, where they are in the cycle of their "golden moment", but we believe it is clear that those companies who lack the buoyancy of superior products or the resilience of a first-rate sales force have and should continue to underperform the group and market. For instance, Wang's improving cost controls still have not fixed its dearth of differentiated products or taught the sales force how to consult for big customized contracts, and the stock's recent flat performance reflects this.

Here are our updated expectations for the other vendors' quarters, all of whom (except CCUR) will report in the latter part of April:

Digital Equipment: Hold

Third Quarter and Full-Year Estimated Earnings Per Share Changes (1)

	From	To	Change	Versus
Third quarter 1987	$2.20	$2.35	$0.15	$1.32
1987	8.05	8.35	0.30	4.81
1988	9.35	10.10	0.75	8.35

(1) Expected to report: week of April 13th.

Comment - Third fiscal quarter estimate: $2.35 versus $1.32, up 78%. This is a dime above our previous estimate and in line with Street expectations of $2.25 to $2.35. Although most analysts are using published estimates around $2.25, DEC's habit the last six quarters of significantly beating expectations has led analysts to verbally project higher numbers, which are reflected in the stock. Since there is a wide speculation that DEC had $2.25 in earnings by the end of February and is deferring shipments until the June quarter to finish the fiscal year with a bang, we expect that any number below $2.25 could trigger a major sell-off, an apparently remote possibility.

Similarly, if DEC's quarter comes in above $2.40, we would expect a repeat of last quarter's 12-point one-day rally. The company has reported strong domestic and international orders all quarter, so the question becomes one of how strong is strong. We are raising our fiscal 1987 and fiscal 1988 numbers, as explained in today's companion DEC broadcast, to reflect higher revenue growth based on DEC's new discount and pricing schedule. With 3,000 new sales staff, DEC has the people and prices in place to go after the easiest market share around: its own resellers. Longer term, we see rougher competition from IBM's 9370 and other vendors' workstations and are prepared to see expectations cooling for fiscal 1988. F1986A $4.81, up 55.7%; F1987E $8.35, up 74%; F1988E $10.10, up 21%.

Data General : Sell

Second Quarter and Full-Year Estimated Earnings Per Share Changes (1)

	From	To	Change	Versus
Second quarter 1987	$(0.25)	-	-	$0.08
1987	0.20	-	-	0.21
1988	0.75	$0.40	$(0.35)	0.20

(1) Expected to report: April 22nd.

Comment - Second fiscal quarter estimate: $(0.05) versus $0.08. This estimate is unchanged. The bulk of the Street is looking for $0.05 to a break-even quarter, with a minority expecting a small loss. Since the stock has dropped seven points from its January high, we believe the bad news is in the stock and that a big loss or gain is required to elicit much of a surprise.

Data General's quarter is hard to precisely estimate because the company is running close to a breakeven rate. There has been little change from last quarter's weak order pattern, and service revenues are under pressure, as 32-bit systems with significantly less expensive maintenance contracts replace 16-bit systems. The comparisons with last year are notably hard because last year's revenues included a new high-end and low-end system which started shipping in March.

With SG&A costs tracking the growing sales force and losses in its telecommunications subsidiary still flowing, DGN's lack of fresh product to bring new customers on board could continue to plague the company for the foreseeable future. We are preliminarily cutting our fiscal 1988 estimate to $0.40 based on DGN's product outlook, rising costs and moderate GNP assumption and will look to the quarter's results for further guidance. F1986A $0.21, down (6.4)%; F1987 $0.20, down (4.5)%; F1988 $0.40, up 100.0%.

Prime Computer: Hold

First Quarter and Full-Year Estimated Earnings Per Share Changes (1)

	From	To	Change	Versus
First quarter 1987	$0.19	-	-	$0.19
1987	1.00	-	-	0.87
1988	1.10	-	-	1.00

(1) Expected to report: April 21st.

Comment - First quarter estimate: $0.19 versus $0.19, no growth. The Street consensus is uniformly at $0.19, so any disappointment below $0.17 could lead to weakness in the stock.

PRM announced its new workstation in March and is expected to add a new high-end minicomputer and super-minicomputer in April. Any slowness in the first quarter will be attributed to customers delaying purchase decisions until the new products arrive, but we worry that the company is simultaneously facing a fairly saturated customer base and slower-than-expected ramp-up of its new products while users consider alternatives. PRM's plans to purchase another technology company could also be slower than expected while high stock prices make all the obvious candidates seem overvalued. We thus see roughly equal opportunity for upside and downside surprise from these levels and would wait to buy the stock until the situation is less speculative. 1986A $0.97, down (19.2)%; 1987E $1.00, up 3.1%; 1988E $1.10, up 10.0%.

Tandem Computers : Buy

Second Quarter and Full-Year Estimated Earnings Per Share Changes (1)

	From	To	Change	Versus
Second quarter 1987	$0.47	$0.49	$0.02	$0.29
1987	2.35	-	-	1.44
1988	2.95	-	-	2.35

(1) Expected to report: April 13th.

Comment - Second fiscal quarter estimate $0.49 versus $0.29, up 62%. The Street is clustering around estimates of $0.47, so we believe it would take earnings above $0.50 to move the stock. Anything below $0.45 would disappoint, but the company is fastidious about avoiding downside surprises, so we don't look for one.

We recently boosted our fiscal 1987 estimate by a dime and our fiscal 1988 outlook by 45 cents. This recognizes the momentum of Tandem's new products, new sales staff, and new markets, which are growing TNDM's revenue line at a clip closer to 30% than 20%. In particular, the company's new networking products, workstations, and replacements sales with its $1 million VLX are hot. Tandem sells computers that deliver real productivity gains with good cost controls and without a lot of competition, and analysts keep moving up their estimates to reflect that success. Given the leverage in Tandem's cost structure and its small revenue base, several large contracts could make earnings exceed even our new estimates. F1986 $1.44, up 75.6%; F1987E $2.35, up 63.2%, F1988E $2.95, up 25.5%.

Concurrent Computer : Hold

Second Quarter and Full-Year Estimated Earnings Per Share Changes (1)

	From	To	Change	Versus
Second quarter 1987	$0.10	-	-	$(0.06)
1987	0.60	-	-	0.58
1988	0.80	-	-	0.60

(1) Expected to report: May 14th

Comment - Second fiscal quarter estimates: $0.10 versus $(0.06). Since Concurrent has another month to go in its quarter, estimates have not settled down. Management's guidance is for $0.16 to $0.20. Revenues could be up 3-5% over last quarter as the 3280 parallel processing system gains some more steam, but the order outlook is still cautious. CCUR's relationship with Nippon Steel to resell 3280's into the Japanese market is progressing and might contribute to the third quarter, but the large Weather Service "Wind Shear" contract, originally set for award this quarter, looks postponed until the fall. We will need to rethink our fiscal 1988 estimate if there are further delays. Short term, we don't see a reason for the stock to pop. F1986A $0.58, down (58.7)%; F1987E $0.60, up 3.5%; F1988E $1.10, up 83.3%.

April 10, 1987, closing prices:

Concurrent Computer (CCUR) : 16 1/4
Data General (DGN) : 31 1/8
Digital Equipment (DEC) : 166 1/8
IBM (IMB) : 145
Prime Computer (PRM) : 22 1/8
Tandem Computers (TNDM) : 71 1/8
Wang Labs (WANB) : 14 7/8

LEVEL 1 - 1 OF 1 STORY

May 27, 1987, Wednesday

SECTION: TECHNOLOGY TODAY; Technology Topics; Pg. 6

LENGTH: 192 words

HEADLINE: TANDEM GETS AVAIL

BYLINE: Yvette D. Kantrow and Jeffrey Kutler

BODY:

Tandem Computers Inc., Cupertino, Calif., said that Avail, the statewide electronic funds transfer network in Georgia, has installed a Tandem NonStop VLX mainframe that will begin switching transactions among member financial institutions in late 1987.

The system will process transactions from 2,500 automated teller machines and point-of-sale terminals owned by more than 145 institutions and serving 2.4 million cardholders.

Avail's operator is Georgia Interchange Network Inc., a consortium of 12 financial institutions.

The network currently switches 2.2 million transactions per month.

Avail's own Tandem VLX will take the place of a three-year data processing service contract, which expires in December, with Citizens & Southern National Bank, Atlanta.

Ron Dennis, president of Avail, said Citizens & Southern has provided excellent service using its own Tandem computer, but growing transaction volumes now make an in-house arrangement more economical.

Software will be provided by MTech of Dallas. MTech is a member of the Tandem Alliance, a program to encourage development of application software that runs on Tandem systems.

ComputerWorld May 18, 1987 p100

COMPUTER INDUSTRY

Tandem signs Big Eight firm

CUPERTINO, Calif. — Tandem Computers, Inc. recently added a member to its roster of partners in the manufacturing market, signing up Big Eight accounting firm Coopers & Lybrand as a marketing and consulting partner.

New York-based Coopers & Lybrand will work with Tandem as a "solutions implementor," a Tandem spokeswoman said. The two firms will share sales leads and work together on factory automation projects for customers. Coopers & Lybrand consultants will provide services such as project management, analysis, training and support to Tandem customers implementing on-line transaction processing applications for manufacturing. The agreement will specifically emphasize electronics, automotive, aerospace and process manufacturing.

Tandem signed a similar agreement last year with Big Eight firm Arthur Young. The transaction processing systems vendor also has agreements with two Pittsburgh-based manufacturing firms — Dravo Corp. and Westinghouse Electric Corp. — to jointly implement manufacturing systems. Tandem recently announced its intent to develop a formal manufacturing and networking systems agreement with Boeing Computer Services.

impact, and questions on the company's commitment to the computer market still exist. The problem on the computer side of the product set is a lack of differentiation from other midrange competitive products. AT&T's real potential for the DSD products lies in focusing and establishing a high degree of synergism between its computer and communications products. In effect that is what Cassoni is attempting with his discussion of departmental processing and Starlan connectivity as part of the latest announcements. But at the same time the announcements highlight new communications connectivity with DEC's VAX products, certainly a distraction from any sales focus on 3B computers.

The selling process will be difficult to manage for several reasons. In an effort to place 3B2s and PCs, AT&T will probably beef up sales incentives for "system sales," which would include products from all three product groups. But in that effort, AT&T will face the same problems that other vendors have seen when moving from selling "iron" to systems sales: the sales cycle expands from six months to 12, 18 or even 24 months. As a result, it is likely that the sales force will find it personally more rewarding to emphasize short-term product sales which could detract from 3B sales efforts. In fact, the company will have difficulty faulting that approach in its desire to move toward profitability. The most recent AT&T announcements still do not make it clear to us (nor we believe to the market in general) that AT&T is fully committed to the general-purpose midrange computer market. The goal of profitability, in the relatively short term, may be less an agreed possibility than an ultimatum from above. In the absence of real product differentiation, the challenge will be to convey the story first to the sales force and then to the customer in a convincing form. At the same time, AT&T must generate additional product capability and the needed differentiation to compete in the larger minicomputer markets. There, it faces a formidable field, ranging from IBM, DEC and other mini vendors, to Unix champions such as NCR, Unisys and others in commercial, as well as education and technical markets.

Minicomputers: C-937-527 (4/17/87)

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Tandem's Non-Stop SQL: A Strategic Shift

Tandem took a significant step forward in becoming a mainstream midrange systems vendor and has proven relational database need not be performance-bound. IBM and DEC may be affected most.

Tandem's March announcement of Non-Stop Structured Query Language (SQL) was unquestionably a breakthrough in applying the relational database technology of SQL to a production environment. Whereas a great deal of hyperbole has been generated by some database vendors, Tandem has again quietly proven its strength in distributed database management, but now within the SQL standards universe. By cleverly offloading much of the performance dependencies from the application level to the disk process level, Tandem has achieved benchmarks up to 200 transactions per second (TPS) on a 32-module VLX complex. It has also demonstrated the first truly distributed SQL (see Figure 5). Moreover, Tandem has broadcast its intention to shift itself strategically into a mainstream midrange vendor as a serious competitive alternative to DEC and IBM.

Performance Benchmarks

# Processors	TPS
VLX	
4	29
8	52
16	106
32	208
EXT10	3/processor
TXP	1/processor

Figure 5.

In addition to the performance issue, we believe there were other significant SQL-based accomplishments: 1) the ability to partition and replicate database segments across local or geographic systems; 2) apply Tandem's integrity and consistency protection on reads, writes and updates; 3) provide node autonomy through a distributed data dictionary such that data access is not dependent on the availability of all network nodes: and 4) provide both interactive (via a command interpreter) and embedded program access (via Cobol).

Unique Tandem SQL Extensions

Own distributed naming convention (node, disk, directory, file)
Integrity (mirrored tables, record level lock, transaction abort recovery)
Database partitioning (across multiple disk volumes on a network)
Own security
Assertions (data validation)
Support for primary and foreign keys
Distributed data dictionary (replicated at each node)

Figure 6.

We believe that Tandem's advances will negatively affect DEC, Stratus, IBM and Database software vendors such as Oracle and Relational Technology. DEC's VAX Information Architecture (VIA) is less sophisticated, lacking a distributed dictionary, network operating system, read/write/update across dispersed nodes and integrity features. Stratus is weak in database management for production environments (it currently uses Oracle, which slows TPS considerably), IBM has failed to generate the performance requirements of its DB2 and SQL/DS relational products, and lacks Tandem's distributed architecture. Oracle and Ingres have promised, but not yet delivered on the functionality and performance demonstrated by Non-Stop SQL; their distributed SQL lacks not only performance, but also multinode update capability.

Worldwide OLTP Shipment Revenues of U.S. Vendors ($B)		
1986	1991	CAGR
25.1	61.4	19.6%

Figure 7.

Tandem's SQL extensions (listed in Figure 6) are unique to its Guardian operating system environment and therefore cannot be applied interchangeably with other SQL databases (although data can be exchanged, and there is some applications portability). Tandem has also not addressed DB2 extraction, which means users must wait until future releases for heterogeneous and IBM mainframe integration.

Tandem has been successful in improving price/performance and lowering the entry-level pricing to its systems. As Tandem continues this evolution, while migrating its systems and users to an increasingly open architectural environment, its market opportunities should broaden. In 1986, most of Tandem's revenues were generated among existing users. With Non-Stop SQL and new low-cost departmental systems coming, Tandem is well-positioned to bite off ever larger slices of the OLTP market (see Figure 7).

Minicomputers: P-906-530 (4/17/87)

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Distributed Systems: A Productive CIM Workgroup

MIS managers are finding workgroup environments that use transparent distributed computing on 32-bit workstations more effective than the more limited PC networking of time-sharing situations.

Workgroup computing is becoming increasingly important to companies that utilize computer-aided engineering (CAE). The same techniques can be used in a computer-integrated manufacturing (CIM)

LEVEL 1 - 2 OF 2 STORIES

Advanced Manufacturing Technology
(formerly Industrial Robots International)

May 25, 1987

SECTION: TAKE NOTE; Vol. 8, No. 10; Pg. 10

LENGTH: 56 words

HEADLINE: Online

BODY:

Tandem Computers will work with the accounting and management firm Coopers & Lybrand to implement online solutions in manufacturing. Tandem will develop online transaction processing applications assisted by C&L. Details: Tandem Computers Inc., 19191 Vallco Parkway, Location 4-40, Cupertino, CA 95014-2599. Phone: 408-725-6000.

Tandem Corporation - Company Report
DREXEL BURNHAM LAMBERT INCORPORATED - Orr, J W.
04-21-87 (RN=707023)

TANDEM COMPUTERS, INC.
(TDM - $64)
Second Quarter Earnings:
A Little Less Than Expected

Rating:	Neutral-1	Shares outstanding:	49.0 million
52-Week Range:	75 1/4-27 1/4	Dividend: None	Yield. None
EPS 1986A:	$1.44	P/E 1986A:	44.4x
1987E:	$2.30	1987E:	28.8x
1988E:	$3.00	1988E:	21.3x
Projected 5-year growth rate:	17.0%	Operating return on tangible assets:	21.4%
Market proxy ROR1.	2.5%	Total debt/equity:	1.2%
Company ROR1:	(15.5)%	Return on equity:	11.9%
Market cycle beta:	1.71	Reinvestment rate:	11.9%

Fiscal year ends September.

POINT OF VIEW

Tandem's earnings for the second quarter of fiscal 1987 were a little less than we had expected even though revenues were higher than our projection. However, the increase in expenses appears to us to be controlled and we believe the margins will show modest improvement in the remainder of the year. We are making no change in our fiscal 1987 and 1988 estimates at this time and continue to rate the stock Neutral-1 based on its current valuations.

Discussion

In the second quarter of fiscal 1987 Tandem revenues increased 37.5% to $242.4 million compared with $176.3 million a year ago. Product revenues showed the biggest gain, up 41.5% from $142.8 million to $202.0 million this year as service and other revenues increased 20.2% from $33.6 million to $40.4 million. Net income was $22.4 million, or $0.46 per share, up 57.8% from $12.4 million, or $0.29 per share, in the second quarter of fiscal 1986. Although revenues were higher than we had anticipated, net income was less than our expectation due to higher costs related to services revenues and higher marketing, general and administrative expenses. Business continues to be strong, however, and we are making no changes in our estimates for Tandem at this time.

Product revenues benefited from strong processor demand in the second quarter. International accounted for 42% of Tandem's revenues with international revenues up over 47% from a year ago while domestic revenues increased more than 30% in the quarter. Domestic business has shown some firming in the most recent quarter while the rate of growth in Europe has declined somewhat. Tandem has cut some prices overseas reflecting the change in the value of the dollar to foreign currencies. Japan and the other foreign markets have been strong for the company. Communications revenues grew 50.3%, securities revenues 63.4% and banking revenues 64.7% in the most recent quarter

The gross margin on services declined in the quarter largely due to building the service organization particularly overseas. Since the margin is somewhat volume related, it is expected that the gross margin on services should increase during the remainder of the year. Marketing, general and administrative expenses increased more than revenues as the company invested in some new projects, upgraded some of its demo equipment and funded more software developers.

Tandem's balance sheet remains extremely strong with cash at $286 million, long-term debt and capitalized leases at $8.4 million and shareholders' equity of $634.5 million ($12.94 per share). In the second quarter capital expenditures were $22.4 million; the budget for the year is $70 million excluding the possible purchase of buildings which the company is currently negotiating. Employees increased by 5.8% in the quarter to 6,296 from 5,950 at the end of December. Most of the increase was in the service, marketing and R & D organizations; the company expects to increase the employee count by 18-20% in fiscal 1987.

Outlook

With demand continuing to be strong, the gross margin on services increasing and more moderate gains in M G & A expenses for the rest of fiscal 1987 we are maintaining our earnings estimate of $2.30 for the year. Our preliminary estimate for fiscal 1988 is $3.00 which assumes another strong revenue gain but, more importantly, a lower tax rate by about five points. We continue to believe our outlook for the company is reflected in the current stock price and we are maintaining our Neutral-1 rating on the stock at this time.

Brokerage Buys 2 Tandem Sys.

CUPERTINO, Calif. — Tandem Computers Inc. has been awarded a contract to supply transaction processing systems to a regional brokerage firm.

Tandem said the Advest Group Inc. has purchased two Tandem NonStop VLX computer systems valued at over $2 million for processing securities on-line at Advest Inc., its regional brokerage subsidiary.

Advest Inc. has installed one, a four-processor NonStop VLX system valued at $1.5 million, at its Hartford, Conn., headquarters. The system will initially handle on-line order entry for branches, and provide order match and message switch services starting in late 1987 using software from Securities Industry Software Corp. of Evergreen, Col.

The firm also plans to use the system to handle other applications, including portfolio management, client information and back-office accounting.

Advest has installed the other system, a $690,000 two-processor NonStop VLX, to develop software programs in-house.

The system will connect to a network of 1,000 terminals in Advest branch and back offices as well as to the major U.S. stock exchanges.

In another development, Knowledge Data Systems Inc., a value-added reseller of Tandem Computers Inc., has been awarded a $4.5 million contract to install components of its medical center information system at Saint Luke Hospital, Fort Thomas, Ky.

Knowledge will install its administrative, patient care, and ancillary support programs — including laboratory, pharmacy and radiology subsystems — and manage all of the hospital's data processing activities for the next 5 years.

The medical center information system is based on Tandem's NonStop computers running under Tandem's integrated relational database management system.

Knowledge said it beat out two other Tandem resellers for the contract but declined to identify them.

Knowledge develops proprietary data processing software for health care institutions and medical laboratories. The company, which has been a Tandem VAR since 1981 and a member of the Tandem Alliance — its remarketer supply program — since 1985, had sales of $5,000,000 in 1986.

Electronic News 5/25/87 p23

To: John Grebenkemper Loc: 103

Date:_____

From: Corporate Information Center

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In March, the company announced a joint marketing agreement with Palladian Software Inc., Cambridge, Mass. That pact allows Apollo to offer the Palladian Management Advisor on its workstations.

"This is really the first time we've focused on specific vertical applications," said Michael Frank, marketing manager for Apollo's financial and commercial markets.

According to Frank, Apollo intends to "agressively pursue" the financial services market, which has already been penetrated by workstation vendor Sun Microsystems, Mountain View, Calif.

Last week, Sun announced a joint marketing agreement with Stratus Computer Inc. to provide fault tolerant computers for networks of Sun workstations.

Apollo is a latecomer to the financial services market, Frank acknowledged. "However, we intend to aggressively promote ourselves to capture the main share . . . . The big opportunities are still to come," he said.

Contessa on the Apollo DN3000 monochrome workstation, with an 80-Mbyte or 150-Mbyte disk and 4 Mbytes of memory, is priced at $25,000. The software costs $7500 for an unbundled system. It will be available 90 days ARO.

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Telesis, was named vice president and general manager of the new PCB division. He reports to Hajjar.

Robert McAuliffe, former vice president of finance and administration and chief financial officer at Telesis, was named to the new post of vice president and director of European finance and administration. He also reports to Hajjar.

Hajjar also has assumed the post of acting chief financial officer. Valid's chief financial officer before the merger, Jim Lau, resigned earlier this month.

Valid enginering director Mike Price was named vice president of engineering, replacing Frank White, who retains his other title of operations vice president. Price continues to report to White.

PCs, and 3.5-inch drives, resellers said. The fate of the older product line and pricing for ITT's old and new PCs are unknown. *—Jenny McCune*

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Suits Of The Same Fabric

NEC Information Systems Inc. and dealer **Standard Business Systems Ltd.** are locked in breach of contract lawsuits, each claiming the other interfered with attempts to sell computers to a medical equipment firm. According to a suit filed in U.S. District Court in Boston, SBS maintains it had the right to sell products to Virginia-based **Beverley Enterprises Inc.** under its agreement with NECIS. SBS, Fairview Park, Ohio, alleges NECIS tried to undercut it by selling to Beverley at a lower price. In a countersuit, NECIS argues that Beverley was its account, and SBS interfered with the sale. Beverley switched to a third vendor because of the dispute, and NECIS and SBS blame each other. SBS claims it lost $4.5 million, while NECIS has not listed a specific damage. No trial date has been set. *—Rick Whiting*

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Out To Relax

Arete Systems Corp. sales and marketing vice president David Mackie has quietly resigned after a 19-month stint. His departure comes at a time when Arete and **Plexus Computers Inc.** are planning a merger. One inside source said Mackie had disagreements with Arete president Doug Davis, but others said he left to relax and enjoy the fruits of his investments. Mackie is a former U.S. marketing vice president for **Tandem Computers Inc.** and reportedly holds a large stake in the company. Neither Mackie nor Davis could be reached for comment. *—Eric Nee*

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In The Drivers Seat

Epson America Inc. next week will up its ante in the desktop publishing market by introducing several software drivers in support of its laser and dot-matrix printers. The drivers—slated for July availability—will support **Microsoft Corp.**'s Windows and **Digital Research Inc.**'s GEM operating environments. Epson plans to offer the drivers to its authorized dealers, who will be able to sell a complete desktop publishing system for $3300 to $9000. *Brian Deagon*

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Getting Into Bed

Superworkstation vendor **Silicon Graphics Computer Systems**—formerly Silicon Graphics Inc.—of Mountain View, Calif., has signed joint marketing agreements with three minisupercomputer and supercomputer vendors in recent weeks. The pacts are with **Cray Research Inc.**, Minneapolis; **Alliant Computer Systems Corp.**, Acton, Mass.; and **Cydrome Inc.**, Milpitas, Calif. According to sources, Silicon Graphics signed the deals after the successful test of a similar joint marketing agreement with **Convex Computer Corp.**, Richardson, Texas. The minisupercomputer and supercomputer vendors find that customers are increasingly interested in high-performance workstations as a means of interpreting complex data. *—Eric Nee*

Computer Systems News 5/25/87
pg 3

LEVEL 1 - 1 OF 1 STORY

May 20, 1987, Wednesday

DISTRIBUTION: Business Editors

LENGTH: 417 words

HEADLINE: TANDEM-COMPUTERS; (TDM) AVAIL network installs Tandem mainframe for electronic switching services

DATELINE: CUPERTINO, Calif.

BODY:

Tandem Computers Inc. (NYSE:TDM) announced Wednesday that the AVAIL network, 11th largest regional electronic funds transfer network in the United States, installed a Tandem NonStop VLX mainframe to handle network switching services starting in late 1987.

AVAIL's Tandem system will process transactions from 2,500 ATM and point-of-sale terminals that belong to more than 145 AVAIL member institutions throughout Georgia. Operated by Georgia Interchange Network Inc., a consortium of 12 Georgia financial institutions, AVAIL has 2.4 million cardholders and handles more than 2.2 million transactions per month.

Processing of AVAIL transactions is now done by Citizens & Southern National Bank of Atlanta under a three-year contract expiring in December 1987. Ron Dennis, AVAIL president, said that C&S has provided excellent service to AVAIL using its own Tandem system, but growing transaction volumes now make an in-house arrangement more economical.

''In-house operations will also give AVAIL the flexibility to respond to market needs and opportunities more quickly,'' said Dennis.

The NonStop VLX system installed by AVAIL is valued at $1,156,000. Software will be provided by MTech (NASDAQ/NMS:MTCH), of Dallas. MTech is a member of the Tandem Alliance, a program to encourage development of application software that runs on Tandem systems.

Tandem is a leader in EFT network switching. Tandem systems are used to run 130 switches worldwide, including 30 of the top 50 U.S. regional EFT networks and networks throughout Europe, South America, Asia and Australia.

MTech is the nation's largest third-party technology provider to banks, savings banks, thrift institutions and credit unions. MTech provides electronic banking services and software products to financial institutions and operates MPACT, one of the nation's largest proprietary ATM networks.

Tandem Computers Inc. manufactures and markets computer systems and networks for the on-line transaction processing marketplace. The company is headquartered at 19333 Vallco Parkway, Cupertino, Calif. 95014, phone is 408/725-6000.

Note to editors: Tandem, NonStop and NonStop VLX are trademarks of Tandem Computers Inc.

CONTACT: Tandem Computers Inc., Cupertino
Tom Waldrop, 408/725-7191
or
AVAIL, Atlanta
Ron Dennis, 404/993-3070

LEVEL 1 - 1 OF 4 STORIES

Financial Times

May 19, 1987, Tuesday

SECTION: SECTION I; Appointments; Pg. 10

LENGTH: 37 words

BODY:

Tandem Computers Europe has appointed Mr David F Sim as director - new ventures, Europe. The former senior partner of Simtech Technology Consultants will be responsible for new investment in high-technology companies.

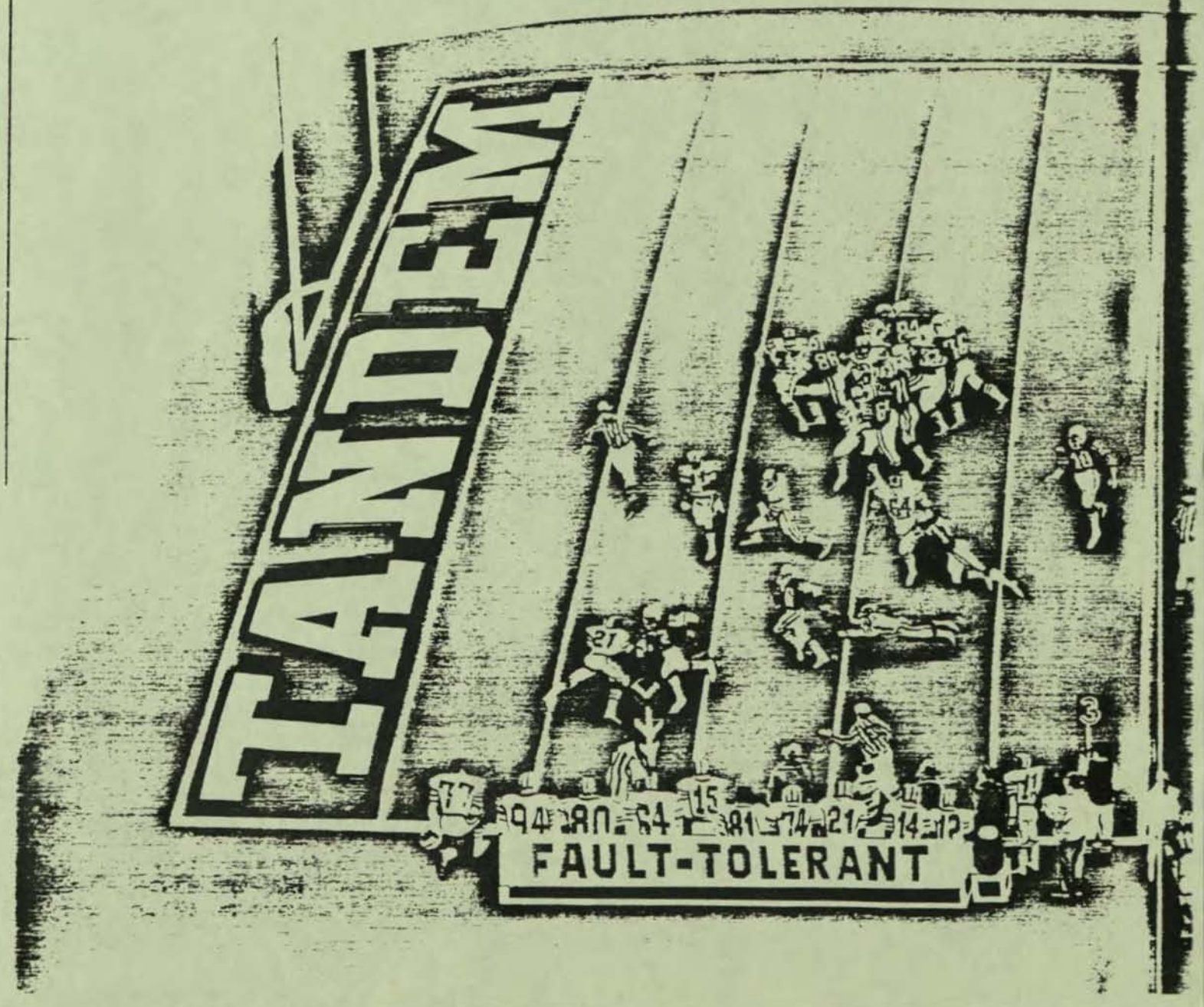
DP/MIS Challenge: TANDEM

As volume and demands on reliability grow in the securities business, two vendors are

With trading volumes on a seemingly continuous upward spiral, many brokerage firms are finding their services limited either by an inability of their on-line transaction processing system to handle the increased volume or by a lack of computer reliability.

The solution to both problems may be found with a fault-tolerant computer system. Fault-tolerant computers have the ability to detect errors in the system—be they chip failures, power outages, mechanical fan malfunctions, or noise spikes, to name but a few. These systems are designed to automatically recover from any malfunctions in a way transparent to the user and with no loss of transaction processing.

Reliability is a particular concern of brokerages because of the poten-



vs. STRATUS

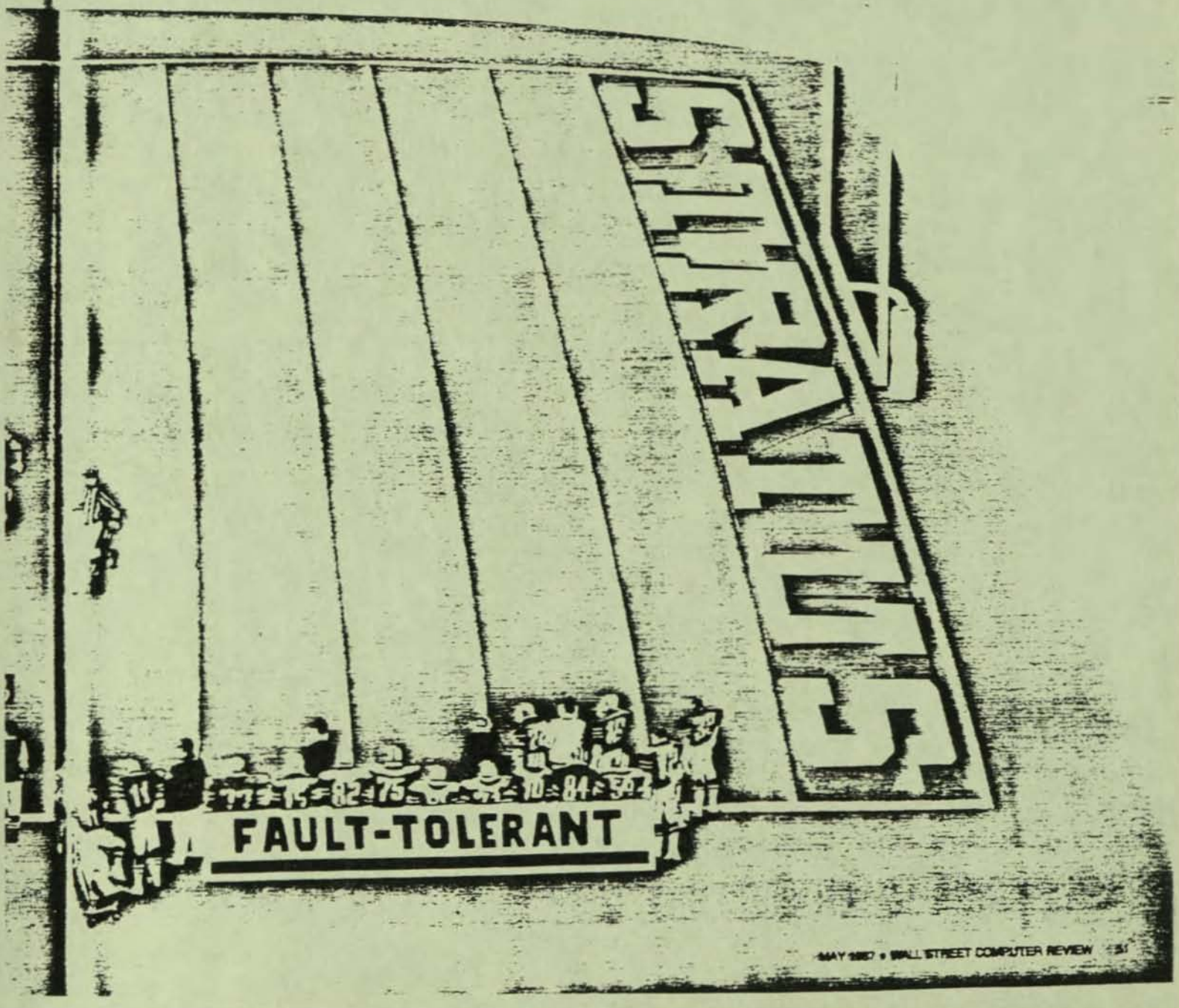
BY SAM DIAMOND

struggling to win the OLTP Bowl. Though Tandem leads, Stratus is gaining yardage.

tial for dollar losses. Although no figures are available, several firms report sustaining losses when their systems went down, preventing a transaction from being completed at a specified price. Not only do they have to revert to a more expensive manual system when this happens, but the company also has to absorb any price differentials occurring from the delayed trade.

"You cannot develop a real-time system for the brokerage community that has downtime. It's not an option, it's a requirement, and fault tolerance is the only solution," says Steven Silberstein, president, Bridge Brokerage Systems, Inc., New York. "If you're risking money, the system has to be available to handle transactions."

Emerging as the leaders in fault-



tolerant computers are Tandem Computers, Inc., Cupertino, Calif., and Stratus Computers, Inc., Marlboro, Mass. Each firm has a different approach to the technology—Tandem depends on software, Stratus on hardware redundancy.

With Tandem systems, fault tolerance is programmed into the code of an application package. It is a process that was once considered a disadvantage but which has now been greatly improved with programming aids. The fault-tolerant capability works by sending messages back and forth between the processors in the system to continuously verify that everything is working properly.

"The way our approach works," explains Gerald Peterson, Tandem vice president of marketing, "is that whenever a particular program in a particular processor reaches a critical point, it does a checkpoint to another processor in the system. If, at that time, the status of both processors is not identical the system takes action to shut that ill processor down and transfer its workload to the remaining processors."

Stratus systems, on the other hand, provide fault tolerance through the use of duplicate components and processors. Essentially, these systems involve a minimum of two sets of hardware running the same workload in parallel as a check against each other.

Pros and Cons

Tandem and Stratus each claim different benefits in their approach to fault-tolerant technology. Stratus pushes the fact that hardware redundancy translates into easier programming, while Tandem highlights the fact that because each of its processors only runs a portion of the workload, greater software protection is provided.

'You cannot develop a real-time system for the brokerage community that has downtime,' says Silberstein of Bridge Brokerage.

The one factor both manufacturers seem to agree on is that to the end-user, the method in which fault tolerance is provided is not nearly as important as its simple availability. As Bill Foster, president of Stratus, says: "Probably from a user's standpoint there are no major differences in terms of functionality. Both companies appear to offer about the same thing."

Peterson concurs: "As long as they're confident that fault tolerance is an integral part of their machine, user's don't care how it is provided. Customers are more interested in looking at the business issue of building a new application that might be critical to solving a problem they have."

Even more notable is the fact that users also echo this sentiment. "On the processing side I don't see any difference in the hardware or software approach to fault tolerance, especially given the reliability of processors these days," says Silberstein.

Of more concern to Wall Street users of fault-tolerant computers, according to Peterson, should be whether their product choice can expand

OTHER COMPETITORS FILL UP THE FIELD

Tandem and Stratus, although sharing the bulk of the fault-tolerant on-line transaction processing market, are by no means alone.

Tolerant Systems, San Jose, Calif., a start-up firm, has not yet offered any serious competition, nor has NCR with its 9800 mainframes. But IBM is another story, one that is not bedtime reading for Tandem either. In a first-of-its-kind move, IBM is buying Stratus computers and reselling them under its own System/88 label. Stratus estimates the arrangement could account for more than 15 percent of its sales.

A new entrant on the fault-tolerant scene, and one competing with Stratus more directly than Tandem, however, is Sequoia Systems, Inc., Marlborough, Mass. Their Series 100 32-bit fault-tolerant systems have taken a hardware approach to the technology, and therefore more closely resemble the offerings of their geographic neighbor, Stratus.

A key difference between Sequoia and Stratus is the number of backup processors each provides. "In both systems, a pair of modules runs together in lock-step to provide fault tolerance," says Art Campbell, vice president of marketing at Sequoia. "When that pair finds a difference in Stratus systems it flips to a backup pair. But in our system, depending on the configuration, there are up to 63 additional backup processors."

Another significant distinction between Sequoia and the rest of the market is an operating system that provides Unix compatibility for applications programs. Sequoia's capabilities in the Unix arena were recently verified when the Series 100 system passed the more than 5,000 tests that comprise the Unix System V Validation Suite (SVVS) developed by AT&T. "This is a distinct advantage of our system," Campbell says, "because it allows portability of applications from other Unix machines."

Sequoia was founded in 1981 and shipped its first system in October, 1986. Its success in the Wall Street community can only be enhanced by a joint marketing agreement with Standard & Poor's stipulating that S&P will sell the Sequoia Series 100 as the hardware component of S&P's Price Machine™. Price Machine is a proprietary product that provides a dedicated computer system to maintain an on-line database of real-time market prices for stocks, options, futures, and commodities.

"The Price Machine is the total solution for traders, market makers, arbitrageurs, and other investment specialists who require frequent, instantaneous access to real-time pricing data," says Chuck Peck, vice president of marketing at S&P. "Coupled with the Sequoia technology, which is designed specifically for large-scale transaction processing, the Price Machine provides the ideal solution for the user who demands the highest quality financial information in a fault-tolerant environment."

S&P is not the only user in the brokerage community. QV Trading Systems, Inc., New York, a service bureau established eight years ago, recently purchased a Series 100 because "Sequoia has the Unix, the Unify relational database, the fault tolerance, and the communications we needed," explains William Weeden, chief financial officer.

Unix availability was a critical factor in QV's decision because Weeden felt it would not limit their future expansion. "We want to make sure we can grow as the industry grows and not be committed to a particular type of hardware," he says. "And we want to be able to write software that's portable to various machines."

Knowing a good idea when they see one, Tandem is working on providing some Unix capability, and Stratus already claims to do so. Which only goes to show that even market leaders should be tolerant of their faults. **S.E.**

with their needs in terms of both the number of terminals the system can handle and the number of transactions each terminal can "gracefully" manage.

"Our biggest distinction against any other competitor is our capability for graceful growth, and it is one of the reasons the New York Stock Exchange has been able to deal with the increased volume they've been seeing. We've demonstrated growth ranges of 30 times with performance increasing linearly," Peterson says.

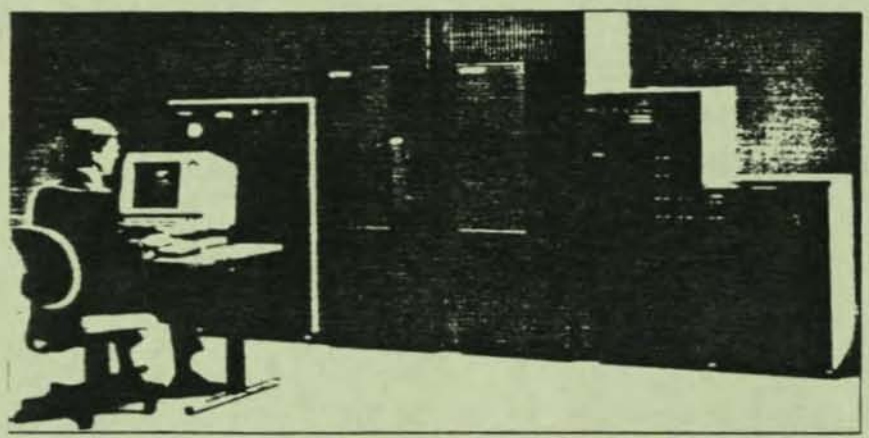
Tandem's Strengths

A study recently completed by InfoCorp, a research firm based in Cupertino, Calif., confirms that Tandem's architecture is, in fact, more advantageous in this regard. According to the report titled "On-Line Transaction Processing Update," in tightly coupled systems, such as those that are hardware redundant, each CPU contributes less than 100 percent of its unit processing power. As a result, at some point, adding another CPU adds no processor power because of contention. Contention is a condition where two or more devices or programs request use of the same resource.

Both manufacturers agree that to the end-user, the particular fault-tolerant method is not nearly as important as its simple availability.

But for Tandem's more loosely coupled software approach each CPU operates under its own operating system and additional CPUs each contribute their full processing power to the system. As many as 224 processors can be linked in a Tandem VLX system using their trademarked fiber optic link called FOX. In a geographically distributed network, Tandem systems can grow to 4,080 processors.

Another advantage of looser coupling is highlighted by Silberstein. "In a closely coupled fault-tolerant system where the redundant processors are running the same copy of the operating system, if the operating system crashes your whole machine goes down," he says. "But with Tandem's loosely coupled multiple processor architecture each processor is running its own version of the operating system in a different state, so if you do have an operating system problem it tends to be localized to one processor and the impact is decreased."



Tandem's top-of-the-line NonStop VLX™ system boasts 4 CPUs, 64 MB of memory, 4.2 GB and 1.3 GB disks and an internal expert system for diagnostics.

In other areas, however, hardware redundancy has distinct advantages. Stratus, for example, points out brokerages should consider the ease of tightly coupled systems repair. "Service is tied into the hardware architecture," Foster says. "Because of its duplication of components and processors, our computer is able to identify precisely what components fail, down to the printed circuit board level.

"The computer turns a red light on the processor housing the failed component," he continues, "and then automatically calls the Stratus service center in Marlboro, Mass. to report the problem. In many cases, we just ship a new processor which the customer can replace himself by just pulling out the bad board and inserting the new one—all without stopping the system."

The Networking Factor

Networking capabilities and connectivity to existing systems are also critical factors to consider, so previous applications, or existing databases, can be transferred into the new operating environment. A superior stance in this area was one reason Silberstein opted for Tandem.

"Developing good communications protocols and debugging them requires a certain amount of time to work out the kinks," he says. "And Tandem has already successfully done that with many different protocols, including SNA, 3270 bisynch, 3270 SNA, 3770 SNA, X.25, and asynch—all of which we use. The Stratus protocol handling was good but not up to Tandem's."

Another concern is the ability of the processors to be distributed among several sites for both disaster recovery reasons as well as efficient use of hardware. "If you have a five-node network tieing the application together," Peterson says, "you don't want to replicate the data five times. You want to have the pieces of data dispersed geographically depending on where it's needed."

In some applications, this can even be more critical than fault tolerance. "For managing our transaction processing message switching network, fault tolerance was a minor issue compared to the network switching capabilities," reports Melvin Moskowitz, vice president of telecommunications planning at Merrill Lynch.

"The reason we went with Tandem was their ability to distribute their processors," he continues. "I needed a system that would let me put processors wherever I needed them, manage them as if they were one entity, and distribute the work and handle it with a variety of communications protocols. If I have three data centers I can put pieces of the message-switching system in each place across the country or around the world and it still looks like one system to the user—Stratus doesn't have anything like that."

On the other hand, Moskowitz points out that if cost and development languages are more critical factors, Stratus may be a wiser choice. "I view Stratus as an excellent choice

for central site applications in transaction processing, that is, if you have something you want to locate in one place and have a very good cost per transaction ratio and a choice of languages in which to develop."

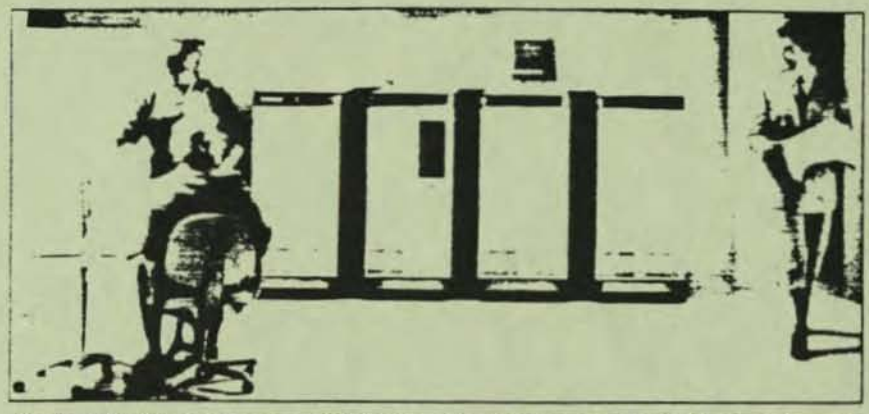
Stratus' Strategies

Making Stratus more appealing where cost per transaction is concerned is their new XA2000 series that includes a high-end model that has more than three times the performance of the company's previous systems and a cost per transaction that is about half that of previous Stratus models. The company claims this line offers the highest transaction per second (TPS) rating in the industry.

If language choice is a user concern, as mentioned by Moskowitz, Stratus appears to have the advantage over Tandem's limited choice of languages. "Our application design people don't have to know special software languages to develop systems on Stratus machines," says Michael Simmons, president of Fidelity Systems, the data processing subsidiary of Fidelity Investments. "They can write in PL/1 or COBOL or whatever. They don't have to take into consideration any additional parameters that are necessary to use software fault tolerance."

John Darous, vice president of the operations, switching and order processing group at the Securities Industry Automation Corporation (SIAC), offers another factor to consider when considering a fault-tolerant system. Ease of use is the primary reason he gives for choosing Tandem for SIAC on-line systems, including the price display units on the NYSE and AMEX floors, the designated order turnaround (DOT) system, the limit system for limit orders, the DOT option system for option market orders on the NYSE, and the consolidated quote system, to name but a few.

But SIAC is not necessarily committed to the Tandem name, just the product's capabilities. "We're constantly looking for the best possible way to get our business done," Darous says, "and just because we've been using Tandem doesn't mean we'll be using Tandem for ever and ever. I don't think it's wise for any user to stick with one vendor necessarily. There are some distinct advantages of Tandem but we have to be open minded about what's happening in the industry."



Stratus' flagship is the new XA-2000 series, which offers over 50 ET-1 transactions per second, or three times the power of existing models at half the cost-per-transaction.

In fact, in the last year, SIAC has begun an "experimental pilot program" using a Stratus system for an application that automates the trading of less active traded issues on the NYSE. A Stratus has also been purchased for use in the AMEX market data system.

"We want to see the strengths and weaknesses of Stratus—we have an open mind about equipment selection and we feel they have some good features. We want to see the system in action," Darous explains. "Tandem is the premier company in the fault tolerance business and now we're also trying the number two guys."

Beefing Up Both Sides

And so the battle between Tandem and Stratus continues, with Stratus bringing forth an updated version of its Virtual Operating System (VOS) and Tandem's recent release of an enhancement they feel will provide a significant advantage to potential users—SQL, or Structured Query Language. VOS release 6.0 includes improvements to increase performance in file operations, transaction protection, floating point calculation, and network communications. The company claims that performance in certain transaction protected file operations under the new VOS is improved 120 percent.

Taking advantage of the full 32-bit data paths on the new Stratus XA2000, Release 6.0 provides an expanded 128 MB program size, allowing for larger memory resident databases and larger disk buffer caches. The release is fully compatible with previous VOS releases and runs all existing applications software without modifications.

Tandem's introduction of Structured Query Language is equally impressive. "SQL systems query language and the relational database underneath it have become a de facto standard because IBM offers it with DB II (Big Blue's own relational database system)," says Tandem's Peterson. "And now we offer SQL as a data language to interface with our relational databases."

The SQL interface is an integral part of Tandem's standard operating system architecture, so it shares the system's advantages of being fault-tolerant and having the capability of being geographically distributed. In addition, the company claims its implementation of SQL offers two to five times the price performance of other SQL implementations, making it particularly attractive for on-line transaction processing applications.

Both Tandem and Stratus continue to evolve, mature, and grow. As fault tolerance becomes more the rule than the exception, it will be product capabilities, more than fault tolerance, that will be the hallmark of on-line transaction processing machines. Tandem, being the older of the two companies has apparently already discerned this future eventuality and is taking steps to change its focus in this direction.

"The way I see the market evolving," says Silberstein, "is that Tandem is slowly maturing into a real-time data processing machine more than just a fault-tolerant machine. I see Stratus today where Tandem was after five years, doing specialized real time message switching type applications." ■