TANDEM

NonStop Computer System

An Executive Overview

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On-Line Transaction Processing With Tandem NonStop® Systems

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INTRODUCTION

Information is the most important asset of any corporation. From the customer service representative to the president, sound decisions depend on it. The bank teller checks an account balance before processing a withdrawal. The order clerk checks inventory before promising delivery. The manager uses information to control the business today, and the CEO uses it to guide the business through tomorrow and beyond.

While all computers process information, there are major differences in the way they're designed—differences that can have tremendous impact on the future of your business. How long will development take before the system can be put to use? How expensive will it be to upgrade the computer as the business grows? Will the business outgrow the capabilities of the computer? Will information be available when needed?

Tandem Computers has addressed all these concerns, and more. The result is a highly reliable computer system that keeps on working even if a vital component in the system stops. Tandem NonStop® systems give you accurate, reliable information when you need it—without fail.

Designed to grow with the needs of your company, NonStop systems are easily expandable, able to grow to eight times their minimum processing power. And because Tandem systems are expanded rather than replaced, the cost to upgrade and enlarge is substantially lower than that of other computers.

When even more power is needed, up to 14 full-powered Tandem systems can be connected at a single location by a high-speed fiber optic link that is impervious to electrical interference.

In addition, up to 255 locations can be joined in a powerful network, every system able to access and share information as needed—regardless of location. NonStop systems in the network function as a single, large system.

To shorten development time, NonStop systems support a series of sophisticated programming tools that let the computer begin operations smoothly and quickly. At many sites, Tandem NonStop systems have begun processing work just a few months after installation—and this has meant lower programming costs, higher productivity, and a faster return on investment.

Tandem systems provide:

- Fast, reliable information for sound business decisions. NonStop systems keep track of every single transaction between you and the computer, ensuring that information is delivered quickly and accurately every time.
- Continuous availability, even if a component in the system fails. The system can remain up and running even during maintenance and repair. Because Tandem NonStop systems are fault-tolerant, processing continues, business thrives—without interruption.
- Plenty of room for growth. Tandem systems can grow and expand with the needs of your business. You can start with as few as two processors (the part of the computer where actual computing occurs) in a single system, adding more processors as needed to a maximum of 16 per system. And up to 255 systems can be connected together, functioning as a single, large system. No reprogramming is required and your system remains up and running throughout the changes—while business continues.
- The right amount of computing power for every site. Tandem makes systems that satisfy the computing needs at every company location, from the smallest to the largest. All systems are expandable, so you can start with a system that handles a few transactions, and add to it as your needs demand, until it processes many thousands of transactions—with outstanding price/performance the whole time. And Tandem systems are fully compatible, able to run the same programs, able to work together as a single, cohesive system.
- Ease of use. Information contained in Tandem systems is easy to establish, access, change, and maintain. Some computers use a confusing hierarchical method of organizing data. But Tandem uses a much simpler method that organizes information in such a way that a few commands quickly bring you the facts you want. A special query program permits fast, easy access to the information—and Tandem systems deliver only the information requested; you aren't overwhelmed with unnecessary details that have to be sorted and picked through before you can get to your facts.

- Powerful programming tools that reduce application development time and costs.
- A versatile information movement system that electronically transports messages, documents, and application programs to any single person or group of individuals in the company. Delivery can be immediate or delayed at your option—and dependence on overnight delivery services can be reduced or eliminated. Tandem systems provide fast, economical communications throughout the corporation.
- High throughput. Tandem computers process large amounts of information, providing fast response time for maximum employee productivity and customer satisfaction.
- The ability to communicate with a wide variety of devices. This flexibility protects your investment in existing equipment by allowing you to connect that equipment to your Tandem system.
- The power to support literally thousands of terminals, printers, and other devices. This can result in lower communications costs and improved information flow throughout the corporation.

Tandem NonStop systems represent the state-of-the-art in high-volume communications between the people of the corporation and the information they need. These fault-tolerant systems are designed for businesses that want to use automation for maximum efficiency.

For more information about how we've helped corporations grow and what we can do for you, please read on.

WHAT TANDEM SYSTEMS CAN DO FOR YOU

Current Information — When You Need It

Tandem NonStop computers provide fast, reliable interaction between the people of the corporation and the information they need. We call this on-line transaction processing, which simply means that you communicate directly with the computer. Paperwork and other delays are eliminated, so information is fresh, not hours or days old—and work can be processed immediately, rather than set aside to create backlogs.

With this type of immediacy, availability is critical. Because if the computer fails, the business stops. So to keep your business in motion, Tandem NonStop computer systems continue working even if a major component fails.

Won't Let You Down

Tandem NonStop systems virtually eliminate risk of system failure. Every system consists of multiple components, connections, and processors. If one part of the system fails, a counterpart takes over—and your business doesn't grind to a halt as it might with a conventional computer. Your Tandem system continues working even as the faulty part or module is being replaced.

This does not mean you have to pay for extra computers that stand idle, just waiting for a failure. With NonStop systems, all processors handle their own workloads, much like riders on a two-seater bicycle—both riders pedal, contributing to the speed of the vehicle, but one can take over the full load if the other should fail. Only a small portion of each processor is needed to provide fault tolerance, so if your Tandem system has five processors, it is able to process nearly five times the workload of a single processor.

If one processor should fail in a Tandem computer, its workload is distributed among other processors. Because the system oversees a constant exchange of messages between processors at all times, the running processors know exactly where to intercede and take over—with no loss of time or data in the transition.

The Right System for Every Size Job

Tandem has a NonStop system to satisfy your communications needs, no matter how small or how large. All NonStop systems offer continuous availability, easy expandability to accommodate growth, high reliability for dependable information, and outstanding price/performance.

All Tandem computers are designed to work in harmony—and this gives you unprecedented flexibility. For example, your NonStop systems can be switched around between sites if necessary, without extensive reprogramming. You can reallocate your resources as

your business grows, so you get the most efficiency from the computers you have—and only buy more computing power when you really need it.

As the volume of work increases, add processors, terminals, printers, and other devices. Since your Tandem system is evolving with your business needs, you don't have to worry about replacing it with larger equipment; it *becomes* larger equipment.

Sharing Information, Near and Far

Just as multiple processors are joined in a system, multiple NonStop systems at different locations can be joined in a network. They can be connected in a variety of convenient and efficient ways to systems located in another room, across the country, or around the world.

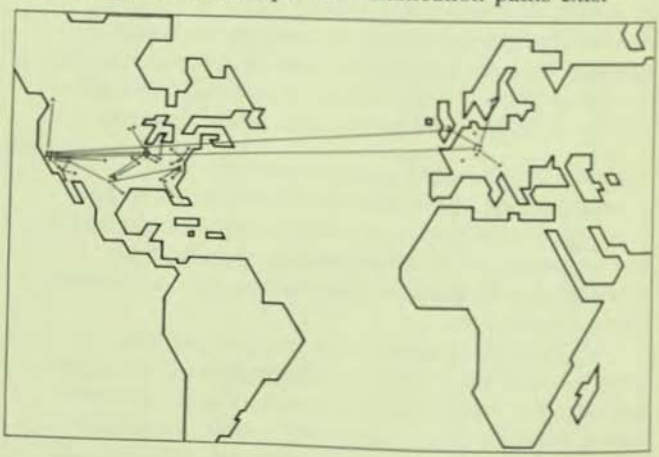
Chances are, some information needs to be shared by these remote locations. For example, offices in both Dallas and Los Angeles may need to review the same customer file, located in New York.

So Tandem developed a "distributed data base," which simply means that you have access to the information you need—regardless of its location. The system keeps track of where the data resides, so you don't have to. You simply request the information, and the system quickly locates and retrieves it for you.

And the speed of this process can be further increased by the NonStop system's ability to store information at the location that uses it most. The information travels a shorter distance, it gets to you faster—and communications costs are reduced.

Fault-tolerant Links between Sites

NonStop systems at different locations can be connected in several ways, including leased telephone lines, satellite link, even fiber optic link. In a typical network of Tandem systems, multiple communication paths exist



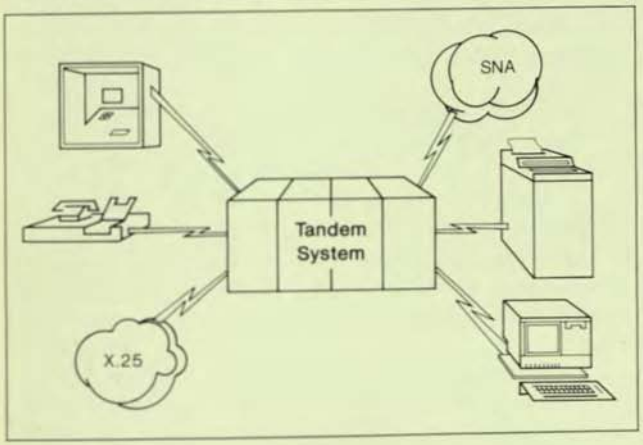
With multiple paths between locations, messages can be automatically rerouted if one path should fail.

between locations. Each NonStop system automatically selects the optimum path, according to predetermined criteria, and routes messages and information along that path. If the selected path fails, the system automatically selects the best alternative path. Information is never lost in transit, nor is it duplicated.

Efficient Corporate Communications

If you already have a sizable amount of data processing equipment, there is no need to sacrifice that investment. NonStop systems can communicate with other manufacturers' systems and devices. All this adds up to more than just a flexible computer system—Tandem systems can support your corporation's entire communications network. Special Tandem products allow you to connect devices of virtually every type, from word processors to facsimile machines to large mainframe-type computers.

We set out to develop the first fault-tolerant computer system, and along the way created a highly reliable, easily expandable, simple-to-operate system versatile enough to support the communications needs of virtually any corporation.



NonStop systems support a wide variety of devices and communications methods, and can link them into a powerful corporate network.

Following are some examples of how large corporations use Tandem systems to manage their information.

WHAT WE'RE DOING FOR OTHERS

Beecham Cosmetics is the fourth-largest domestic supplier of cosmetics and fragrance products in the world. The company markets 3,000 products to 42,000 customers ranging from small family-owned shops to large department stores, and has annual sales in excess of $150 million.

Founded in 1969, Beecham has grown consistently, and today produces and markets products labeled Jovan Inc., Yardley of London, Vitabath Inc., OMNI Cosmetics Corporation, Lancaster, and Hermark.

BEECHAM COSMETICS
Order Processing/ Distribution

The Problem

Beecham's remarkable sales growth, combined with the addition of many new divisions, necessitated greater efficiency and productivity in order processing and shipping. Demand is particularly high during peak seasons. For example, about 60% of Beecham's orders occur during the three months before Christmas.

Volume ranges from 1,000 to 2,500 orders a day, and each order may specify 5 to 20 different items. During the pre-Christmas rush, Beecham ships as many as 35,000 boxes a day.

Most of the order processing/shipping tasks were done manually. A corporate system generated a hard copy of each order which was then sent to a warehouse 20 miles away. All the plant operations were done manually—picking, checking off filled orders on a sheet of paper, writing all the bills of lading, etc. Then the paperwork was sent back to corporate to be keypunched and entered so that the corporate computer could print invoices.

"The sheer volume of orders compelled us to automate," explains Ronald J. Trzaskus, Director of Information Systems. "Although we were running three full shifts at the warehouse, we saw that the constantly increasing volume would be so great that we could not handle it in a 24-hour day."

Why Tandem?

"Actually we never considered any other vendor; I knew that I wanted Tandem. It was the only one that could meet the constraints of our business," comments Trzaskus. "Because of the heavy volume in a very short period of time, not only did we need additional throughput, but a big factor was the need for reliability. We needed a computer that wouldn't let us down during peak workloads.

"Expandability without reprogramming was another key factor. With our incredible growth, it was important to be able to add more hardware to handle new product lines and multiple locations easily and quickly. The Tandem system allowed us to do that."

The Tandem Solution

Beecham installed two three-processor NonStop systems—one at corporate and the other at the warehouse—and linked them together using Tandem's EXPAND™ data communications network. The warehouse system was installed and fully operational ahead of schedule, just eight months from the date of the order. It supported 150 application programs, 10 terminals, and three high-speed printers.

Next, Beecham brought up the corporate order entry system on schedule, within nine months. This system supported 75 to 100 programs with 42 terminals and six printers. Programs were written in COBOL and TAL.

Beecham's data base consists of 1,100 files. Because data integrity is so important (what company can afford to lose orders?), they use mirrored discs.

Current Applications

The corporate system handles all order entry, invoicing, customer file maintenance, and reports. One interesting feature is that data entry clerks don't have to know the account number or how to spell a customer's name. All the clerk needs is the first initial of the name or an approximation of the spelling, and the zip code. The system displays all customer records matching the entry. The clerk simply places a cursor over the correct account, and the system captures all customer information needed to process the order. The order and customer ship-to information is then transmitted to the warehouse system.

"The Tandem system has grown and continues to grow to support new and varied additions to our business," says Trzaskus. "All inventory control is being handled by the Tandem system at the manufacturing facility. And from receipt of components at the receiving dock, to storage and retrieval from component warehouses, to finished product storage and replenishment, all the way through the product picking area, the Tandem system is an integral part of the material flow."

Beecham has instituted a novel approach to storage with a sophisticated high-rise warehouse. Components and finished products are stored in 16,000 pallets stacked eight pallets high in 22 aisles. The warehouse is serviced by six specially equipped lift trucks fitted with remote radio frequency terminals and laser scanners. The Tandem inventory system tracks all orders and tells

trucks which aisle to go to and what parts or components to get. The movement of each truck is monitored by special microprocessors. If a truck is in the wrong place, the driver is automatically notified of the mistake. Potential errors are avoided.

In another specialized application, Beecham provides its sales representatives across the country with hand-held terminals. The salesperson enters order information into the small terminal and it is transmitted directly to the Tandem order entry system at any time, day or night.

As soon as the order passes all edit checks, the Tandem system handles shipping. Previously, all orders were handwritten and then mailed to the corporate office for manual entry into the system. "This new method of handling orders has resulted in a substantial increase in order throughput, since each order is captured, sent, verified, and ready for shipping, all in the same day."

The Tandem system automatically weighs all orders, selects the carrier and routing based on geographic areas, and generates packing slips and manifests. It also automatically handles UPS (United Parcel Service) shipping, including proper zone charges.

"Another benefit of the Tandem system is that it consolidates multiple orders going to a single customer at a given location. Not only is this more efficient, but it reduces freight costs considerably. Prior to the Tandem system, Beecham used only two shipping docks at a time; now as many as six are operational simultaneously, and with improved accuracy."

The Tandem system also helps Beecham optimize manpower. Since the system can generate and route picking lists for a variable number of aisles and shipping docks, Beecham can shut down any of the aisles and docks during slack periods, and reopen them when business demands increase.

After a shipment is confirmed, the warehouse system transmits the data back to corporate for invoicing. If an order was short because of an unforeseen shortage of stock, the system automatically adjusts the invoice and creates a backorder, if the customer so desires. As soon as the stock is replenished, the Tandem system automatically cuts an order to the backordered items.

The Tandem system also generates special reports. For example, the system examines all past due orders and the required ship dates of new orders projected ahead for a user-specified number of days (say, the next 10 days), then checks these against stock levels to see if

there is enough in inventory. Once a week, the system prints a product requirements report to show warehouse demands for *x* number of days ahead, so that Beecham can plan in advance allocating personnel, trucks, materials, overtime, etc.

Most of Beecham's reports are inquiry searches across history files. For example, the customer service department may ask for a report on the volume of a particular item, by sales rep. "With ENFORM™ (Tandem's report-generating software), we can do surveys, shipping analysis reports, whatever a manager wants, within a short turnaround time."

How did Beecham do these reports prior to the NonStop system? "Not very well nor very quickly."

Beecham's order processing/distribution software is available for sale in the form of 12 functional modules, through Decision Consultants, Parkridge, Illinois, a Tandem software house.

Benefits of the Tandem System

"We gained major productivity and throughput benefits when the initial distribution and order entry systems were first installed in 1979 and 1980. Order processing time was cut in half, the number of manual corrections to orders was virtually eliminated, and customer service was improved," reports Trzaskus.

"These are now mature systems, and they continue to provide those same benefits. But today, the expandability of our Tandem systems has become the highlight advantage at Beecham. We've grown from two companies to six since the initial installation, increasing our product base by 200%, and have added major new applications, such as freight bill processing and sales analysis reporting. Our Tandem system has handled this growth by the simple addition of processors and discs."

What about reliability, the critical factor in system selection? In one instance, Beecham's system withstood 14 power outages in 10 days. "The NonStop system has lived up to its name. It has absorbed power spikes with no degradation or loss of data. It has survived numerous brownouts and major blackouts with no loss of continuity to the application in progress at the time of the outage.

"And while single components have occasionally malfunctioned, our system has never effectively gone down. Service to our customers has continued virtually uninterrupted—while we continue to grow."

GTE TELENET Electronic Mail Network

GTE Telenet, a subsidiary of GTE Corporation, is a pioneer in the application of data communications technology. GTE Telenet introduced the first public network designed to lower communications costs by allowing multiple companies to use the same lines. Special packet-switching technology provides customers with efficient, economical communications through full utilization of existing telephone lines.

The Problem

GTE Telenet realized that its public packet-switching network could provide the perfect base for an electronic information delivery service. Such a service could add a new dimension to traditional methods of communication. Information would be transmitted electronically, its delivery virtually instantaneous. Problems like "telephone tag," where correspondents keep missing each other, could be eliminated. And in many cases, charges for expensive overnight delivery services could be avoided.

While the idea of electronic mail had been around for some time, no one had introduced a public information distributing system. One of the biggest problems was the difficulty and cost of establishing a network on which such an application could run.

But GTE Telenet already had such a network and could develop the application—and they could provide the service to subscribers at an affordable price. So GTE Telenet decided to develop the first public electronic mail service. This new service was to be called TELEMAIL™

The first step was to establish goals and objectives for TELEMAIL. These design goals were used as criteria in the selection of a computer system on which to develop the application.

Selection Criteria

System selection was based on the following criteria:

- High reliability and availability. TELEMAIL is a service, so the system must be ready for use whenever the subscriber needs it, and information must be transported accurately every time.
- Transaction processing capability with fast response time, user-friendly operation, and easy programmability.
- Manageability with extensive traffic- and performance-monitoring tools to maintain efficiency.
- Easy expandability through modular expansion.
- System security set by each subscriber to determine who can use the system and for what purpose.
- Accessibility. The system must be able to support the X.25 communications protocol to allow efficient access from any terminal utilizing the GTE Telenet network.

And so the search began for a computer system that could satisfy these requirements. Proposals were received, details discussed, benchmarks performed. In the end, a Tandem NonStop system was selected for the application.

Why Tandem?

Tandem was selected because TELEMAIL requires an operating system that yields high performance from a single, transaction-oriented application—and NonStop systems are specifically designed for high-speed, on-line transaction processing. Other proposed systems were of the time-sharing type, which manage the operation of multiple, concurrently running programs.

Another reason Tandem was selected is its fault-tolerant continuous operation. "Ours is a 24-hour, 7-days-a-week communications service," says C. Thomas Taylor, Vice President, Network Applications and Terminals, GTE Telenet. "Customers expect responsiveness. They expect every single message to be delivered. We can't afford downtime." The NonStop system can even be serviced and maintained while processing continues.

Other factors in the decision to go with Tandem included:

- Modular expandability. NonStop systems can grow with the business without program changes. Easy expandability is crucial in a new marketplace expected to experience rapid growth.
- Flexible, effective data base environment. Tandem's relational data base is simple to use and highly efficient.
- Tandem is certified to support the X.25 interface, a requirement for TELEMAIL.

The Tandem Solution

GTE Telenet purchased a two-processor NonStop system with two mirrored 240MB disc drives in September 1979 to develop TELEMAIL. The development system grew to four processors within the first year, and a second system was purchased in March 1980 for production. It started with three processors, and grew to six processors six months later. Shortly after that, both systems were upgraded to NonStop II® systems.

Today, GTE Telenet has three NonStop II systems in operation: a four-processor system used for development and performance analysis; another four-processor system exclusively for GTE's use (internal TELEMAIL, order entry, other transaction-processing applications); and a 14-processor system, with 12 mirrored pairs of 240MB disc drives, used by TELEMAIL subscribers.

Current Applications

More than 100 of the nation's largest corporations use TELEMAIL to send and receive information within their organizations, anywhere in the world. TELEMAIL systems are also used in the communications networks of the following organizations, providing service to their subscribers:

- Trans Canada Telephone System
- British Telecom
- Manitoba Telephone Systems
- Rabo Bank

Tandem systems used by these organizations will soon be linked to NonStop systems used by TELEMAIL in the United States.

In addition to message delivery, TELEMAIL lets users enter orders from the field, manage sales and distribution channels, even facilitate financial reporting and electronic publishing. More than 15,000 "mailboxes" (representing individual users) are assigned, and the Tandem system handles over 200 interactive sessions per hour during peak periods. Customer usage of TELEMAIL is increasing at a rate of 15% per month. And GTE Telenet has added another service for its customers: it now acts as a software vendor, selling Tandem systems that run TELEMAIL applications.

Some of the basic services of TELEMAIL allow a customer to:

- Compose and send messages.
- Scan and read messages.
- File and retrieve messages.
- Answer, forward, or purge messages.

A series of sophisticated capabilities distinguishes TELEMAIL's services from those of competitors. For instance, the Inform Script feature allows a user to create special formats for specific types of information. It also allows the user to specify what responses are acceptable throughout the format, and what message will display if an unacceptable response is received. For example, if a sales rep enters a customer's name where the amount of the sale should go, the system may display a message that says "ENTER AMOUNT OF SALE."

TELEMAIL also allows the user to specify destinations for a message. A TELEMAIL message can be delivered to an individual or to any size group. The sender can even specify that the message be broadcast to undefined groups via a Bulletin Board option.

Benefits of the Tandem System

"As the world's most advanced computer-based message system," says C. Thomas Taylor, "TELEMAIL service assures our customers that their information will get to the right place—and it will get there on time. The certainty behind that guarantee is our Tandem NonStop II computer system."

GTE Telenet's NonStop II systems provide the high-speed response time, high data integrity, and easy expandability that are key factors to TELEMAIL's success.

"Whether it's providing the TELEMAIL service or supplying an entire TELEMAIL system, we look forward to satisfying more and more of our customers' communication needs. And the contribution of the Tandem NonStop system is essential."

Security Pacific National Bank is the tenth largest bank in the United States, with $30 billion in assets. Security Pacific maintains over 600 branch offices throughout California, with headquarters in Los Angeles.

SECURITY PACIFIC NATIONAL BANK
Automated Loan Collection

The Problem

In 1979, Security Pacific started looking to acquire a computer system for use by its Consumer Leasing Division; loan collection was planned as a secondary application. However, by the end of 1979, the leasing market declined while, at the same time, high escalating interest rates necessitated better control and accounting of loan activity (home improvement, installment loans, and charge cards). Since outstanding money was suddenly worth 20%, loan collections became a high priority.

Debt collections were handled manually at each of Security Pacific's 600 offices and at collection centers. Loan information was scattered in tickler files and on ledger cards. Not only was the paperwork cumbersome, but by the time information was collected and compiled for a summary report, the data was out of date.

The bank decided to centralize all collections to six regional adjustment centers and a charge card center. The six centers would communicate with a central system and data base via a terminal network.

Selection Criteria

The main criteria for system selection were:

- Reasonable cost
- High system reliability
- Backup capability
- Data base management
- Easy expandability
- Efficient system software
- Vendor support
- Data communications capability

Secondary considerations included ease of use, documentation, and the ability to generate management reports.

"We first looked at packaged systems with application software already developed," states Sandy Weinstock, Vice President, Security Pacific National Bank, "but none provided the data base management, system reliability, and modular expandability that we needed. Although the system wouldn't run 24 hours a day, it was imperative that it be operational during working hours. Once business was committed on-line, we could not tolerate interruptions due to downtime.

It's ironic. . . .Customers can understand telephones being down, but not computers. They will tolerate a delay in paperwork, but get annoyed at delays in processing.

"Since we rejected packaged systems, that meant we would be writing our own programs. Software tools to help develop applications then became important."

When a Request for Quote was generated, eight computer companies submitted bids. The project management team chose five semifinalists, including Tandem, for detailed comparative study. Based on this study, Tandem was selected.

Why Tandem?

"It was not the least expensive in terms of hardware, but when we looked at five-year life cycle costs (research and development, investment, and operating cost), Tandem was the lowest. Also, Tandem was the only vendor that had an off-the-shelf fault-tolerant system for the continual availability we needed.

"The deciding factor was Tandem's superior system software for applications development. Since we didn't want to reinvent the wheel, we used all the Tandem software available. Before we started the project, I was told application design/development for the basic collection system would take four or five people at least two years. In reality, with three programmers, we did it within nine months."

The Tandem Solution

Security Pacific has an 11-processor NonStop system with mirrored discs at its Woodland Hills headquarters. The system supports 110 local terminals for charge cards, 170 remote terminals in the regional centers, 10 terminals for credit, 40 for loan recovery, 80 for real estate, and 24 in leasing. The system was installed in its permanent location in December 1980, and was ready by January 1981. Beginning the following month, the regions went on-line one at a time.

The Loan Processing application has over 1.5 million accounts on disc and, at any given time, roughly 80,000 of these are delinquent or "active." Each record is 300 to 500 characters in size. The system handles over 100,000 transactions a day, half of which are data base updates. Each transaction that involves the retrieval of a new account takes an average response time of one second (locally) or five seconds (remote).

The current system consists of 1,200 application programs, all less than 64kB, to take advantage of parallel processing across the Tandem multiprocessor architecture. There are also 200 user screens. (The original 40 screens were developed within 1½ months using the PATHWAY™ transaction processing system.)

Application design and development of the basic collection system were done by three programmers with just one week of NonStop system training; the detailed design took 10 man-months, and programming, 15 man-months. All programs were written in COBOL. "One person who was not a programmer became interested in programming after attending the one-week Tandem training, so we sent her to a COBOL class at UCLA. Before she even finished the course, she was programming on the NonStop system."

Staff members at the regional centers were trained in two days. For the first three days of operation, Security Pacific continued the manual paperwork as a backup, but when it soon became apparent that everything was running smoothly, the manual backup was eliminated.

Current Applications

If a loan payment is five days overdue, the account becomes "active" in the collection system data base. When a payment is 15 days overdue, the Tandem system sends the information to the appropriate collection center where a financial consultant attempts collection. While talking to the customer on the phone, the consultant has the complete account history on the terminal in front of him/her. If a customer responds with "the check is in the mail," the consultant can instruct the system to recall the account again if no entry is posted within the next two or three days.

The Tandem system is also linked to TYMNET® for automatic generation of collection letters.

After loan collections were operational, Security Pacific added general ledger, accounts payable, program development/documentation, and word processing. Later applications were leasing, real estate, loan application processing, and management reporting. The NonStop system will also handle consumer loan recovery and loan charge-offs.

Benefits of the Tandem System

"The first six months on-line at the adjustment centers increased delinquent loan collection efficiency by over 100%," commented Weinstock. The increased productivity resulted mostly from elimination of paperwork and greater labor efficiency. "We reduced financial consultants' paperwork 95%. At the six adjustment centers, the number of effective collection calls placed daily jumped from 7,245 to over 16,500—and with fewer people." In addition, Security Pacific's overall delinquency ratio and loan charge-offs have dropped considerably.

Centralization of debt collection data is a tremendous asset to senior management. Bank executives now obtain information that's current within 24 hours. More importantly, they can spot early trends, such as delinquency in a particular loan class or in a particular region.

What about system availability? Has the NonStop system lived up to expectations? "So far, the system has never gone down by itself, although it seems like we've tried to destroy it a few times. For example, while the system was stored temporarily in a basement, the air conditioning failed one weekend. When we came in on Monday morning, despite the heat, the Tandem system was still running.

"Another time we had a brownout that lasted over an hour. The NonStop system went down for less than 60 seconds, then came right back up with its battery backup power. The other computers in the same facility died, and three days later we still had problems with some of them."

Security Pacific projected and achieved a $4 million savings by the end of the first full year of the collection system's operation due to the more efficient delinquent loan collection operation. The Tandem system paid for itself within eight months.

ROCKWELL INTERNATIONAL CORPORATION
Order Management System

Rockwell International is a world leader in the design and manufacture of aerospace and aviation products. The Avionics Group, part of Rockwell's Commercial Electronics Operations, makes and distributes a broad line of products and systems to airline, business, and aviation industries; and to military and government aircraft industries.

With headquarters in Cedar Rapids, Iowa, and a manufacturing plant in Melbourne, Florida, the Avionics Group has over 7,000 employees.

The Problem

The Avionics Group was receiving orders faster than it could manually process them. Every order, from the smallest to the largest, required several time-consuming steps. Just receiving order information and typing it onto order forms was a major task, since thousands of parts are sometimes included in a single order.

Recognizing that the entire procedure could be vastly improved if computerized, the group began formulating requirements for a new system to fully automate the procedure. User personnel began drawing up requirements for an on-line computer system.

Selection Criteria

The new system would have to be user-oriented, since the operators had no computer background. It would have to be able to handle large numbers of terminals with a fast response time. And it must be able to accommodate many changes in both the orders and the programs that process them.

In addition to these requirements, system selection was based on the following criteria:

- Architectural flexibility (easy expandability)
- Communications capability, including effective networking software
- Reliability and uptime
- Vendor stability and support
- Product compatibility with existing mainframe equipment
- Software development time
- High throughput
- Easy maintainability

Why Tandem?

While the Avionics Group was defining the selection criteria for its new system, an advertisement brought Tandem NonStop systems to its attention. Three of Rockwell's requirements—easy expandability, high data integrity, and constant availability—were stressed in Tandem's ad. So Rockwell invited Tandem to compete for the contract.

The competing systems were studied and compared. Tandem was given the highest marks for reliability and availability, two key criteria. Rockwell's Cedar Rapids system has to be available 24 hours a day, 7 days a week because rush orders and customer emergencies sometimes require extensive overtime. For example, an order may arrive marked AOG, which means that an airplane is stuck on the ground, and parts need to be shipped immediately.

Tandem also rated highest in growth and upgrade capabilities, and in architectural flexibility. The Tandem system is able to expand well beyond expected application growth without the need for reprogramming, and using the same basic hardware.

Add to this Tandem's superiority in networking, maintainability, and throughput, and it's easy to see why Tandem was awarded the contract.

The Tandem Solution

In April 1979, a two-processor NonStop system was delivered to the Cedar Rapids plant. The team of six programmers and developers assigned to the project had no previous experience with Tandem, so all attended Tandem education courses. The designated Order Management System was developed in a modular framework, the first module being released as early as August 1979; the final module was released within 18 months of hardware delivery.

The application programs were written in COBOL. A universally accepted language, COBOL provides easy training for programmers new to the Tandem system. In addition, programmers trained on the Tandem system could be easily moved to work on other applications in the company.

In December 1979, a third processor was installed in the system. This completed the original order. Higher volumes, company growth, and migration of the application to the group's Florida manufacturing plant later justified further system expansion, and in August 1982, a fourth processor was added.

Current Applications

Rockwell's Avionics Group uses the Tandem system in their Order Management System (OMS). Orders are tracked all the way from placement through shipping at the Melbourne and Cedar Rapids plants.

"By virtually eliminating paperwork and the errors that go with it, our Tandem NonStop computer has greatly simplified tracking orders for our avionics products," reports Robert P. Marovich, Vice President and Controller, the Avionics Group. "And that has produced highly visible improvements in the way we're able to respond to our customers' inquiries."

The Tandem system consolidates all data pertaining to the orders, beginning with placement and going right on down the line to shipping. It also transfers relevant information to the appropriate department—to accounting, for example, for the generation of invoices; and to manufacturing, where $175,000 a year in internal freight charges was eliminated by reorganizing ordering/shipping procedures. "The entire operation has helped us reduce order entry errors by 75%," adds Marovich, "while eliminating 140,000 keypunched records and 25,000 reproduced documents every month."

In addition, the Tandem system allows Rockwell to automatically calculate prices, and to control backorders—another factor contributing to vastly improved customer service. "And because the system has virtually eliminated the manual drudgery from employee routines, our people are continually finding new ways to do their jobs better," says Marovich. "The net result is an operation that is helping us achieve some very significant gains in plant productivity."

Benefits of the Tandem System

Rockwell's NonStop systems save time previously spent preparing and handling paperwork, increasing efficiency throughout the ordering procedure. "The system has ended the need for most paperwork, and automatically generates the few documents that remain. Because of this, manual typing of orders, which required a great deal of time, is no longer necessary."

Orders can now be processed the same day received, which reduces inventory carrying charges. When a customer places an order, credit limits are quickly checked, and if necessary, orders are adjusted on the spot. When a customer calls with a question, current account information is readily available; the customer never hears, "We'll have to get back to you."

CHASE MANHATTAN BANK
Account Locator

In 1977, Chase Manhattan Bank's Controller's Office was receiving 1,500 calls a day for account verification and customer account information from other banking departments. Forty-five to fifty clerical personnel manually accessed, updated, and filed 1.5 million 3 × 5 cards on 750,000 customers to respond to these inquiries.

The Problem

The system was completely manual. The cards were kept in 11 Diebold rotating tubs. Access time was typically 1½ minutes. Updating was cumbersome, time-consuming, and required changes in as many as 18 places in the files. Cards were frequently lost or misplaced. An entire room was needed just to store keypunched cards. Even worse, Diebold, because of the age of the automated tubs ("vintage 1946"), no longer offered field maintenance. When the tubs failed, bank personnel had to hand-crank them to gain access to the index cards. To restore these manual tubs to service, Chase Manhattan retained a blacksmith to rework or fabricate new parts.

The operation was "labor intensive, redundant, and inefficient."

Alternatives Considered

The Controller's Office began evaluating several solutions. The first option considered was an on-line utility approach, using a mainframe computer. However, this would require a special communications interface at a high internal charge for the Controller's Office. Also, it wouldn't provide control over data base security and scheduling system resources. The last objection touched on the issue of data base growth and the requirement for system expansion without costly conversion.

Another possibility, a microfiche application, was rejected because of its rigidity. Expansion to allow for growth of the data base (data elements) was not cost-effective using the microfiche concept.

The third option, implementing their own system, gave the Controller's Office three critical advantages: (1) security of the data base and control of the on-line system, (2) access to the data base via terminals so that other sections of the bank could be "self-sufficient," and (3) modular expansion to handle growth through the 1980s.

Selection Criteria

The Controller's Department and their consultants evaluated several systems and narrowed the choice down to three, including the Tandem NonStop system. They based their evaluation on:

- Cost of development
- System reliability

- Field maintenance record
- Modular growth potential without reprogramming
- Backup capability
- Programming language support
- Financial stability of the vendor

At that time, Tandem had been marketing for only a year, so Chase Manhattan had some reservations. These were dispelled by a demonstration of the application. A Tandem representative presented a prototype of the application "with ease," halting processors and discs to show how the NonStop system remained operational. "This demonstration of NonStop systems convinced us that this thing was for real. We decided to investigate seriously."

A consulting firm was asked to evaluate Tandem according to the preset criteria. The firm was skeptical; they proposed a competitor's system and promised to disprove Tandem's claims. However, after on-site analysis of the company and the product, "the consultants came back and did a 180-degree turnaround. They not only recommended Tandem, but they rebid using a Tandem system."

Why Tandem?

Of the three companies, Tandem's bid was the lowest. However, this cost did not reflect the true "bargain" the Controller's Office saw in purchasing the Tandem system. "We were getting the NonStop system architecture and performance—free. Although we selected the Tandem system principally for ease of expansion, mirrored volume capabilities, and flexible file structure, getting fault tolerance for the same price. . .was truly a bargain."

Tandem's easy modular expansion without reprogramming was an advantage over the competition. "If we made a mistake about sizing," said one member of the development team, "we could always add another CPU to our Tandem system instead of facing a major conversion to a more powerful system."

The competition had no high-availability software for multiprocessor systems. Special software was required. However, all the basic tools required for the application, including operating system, utilities, file management system, screen formatter, compilers, and communication package, were available from Tandem and were considered to be superior.

The Tandem Solution

The Chase Manhattan Account Locator and Account Numbering system included two processors with 384kB of memory each, two tape drives, five 240MB discs, one line printer, and 31 terminals. They have since expanded to three processors, seven discs, and 60 terminals.

The application program was written by Monchik-Weber software consultants and a Chase Manhattan programmer trained at Tandem's education classes. Implementation was very rapid—from mid-February to June, 1978.

Since then, Chase Manhattan has installed three more Tandem systems for other applications.

Current Applications

With the Account Locator system, inquiries can be made by customer name or account number. Partial keys can be used if the name is misspelled or if the information is incomplete. The data base contains 1.3 million accounts, and roughly 2,500 new accounts are added each week.

Up to 60 operators can access the system from terminals located throughout downtown New York. The operators handle 1,500 to 2,000 inquiries a day with an average response time of two seconds. In addition to new accounts, there are over 2,000 changes (data base updates) each week. The system creates a transaction record and a log of inquiries for updating.

Another five-processor Tandem system is used to process customer information that results in the delivery or collection of funds via the Automated Clearing House mechanism. This area is responsible for the collection of 3.5 million repetitive transactions each month, such as insurance premium collections, which are automatically deducted from personal accounts at any U.S. bank or thrift organization.

The Tandem system automatically handles electronic delivery to banks that are ACH members, and produces preauthorized checks for the nonmembers. Other credit entries, including payroll and pensions, will also be distributed via the ACH network. The same system is also used to transfer large dollar-value transactions between corporations.

A third Tandem system at Chase Manhattan uses three processors to manage insurance funds transfer. Insurance premiums are automatically deducted from personal accounts, sorted by insurer, processed through a clearinghouse, then distributed to the various insurance companies' respective banks. Funds are transferred five times a day.

Other Tandem systems are used for communications, directory assistance, and as part of a bond brokerage network at IDC, a division of Chase Manhattan located in Boston.

Benefits of the Tandem System

Major cost savings of the Account Locator system resulted from the reduction in clerical personnel. Fifty percent of the original staff was freed for more productive projects, resulting in a return-on-investment (ROI) of 34% and payback in approximately 18 months. Data base integrity increased dramatically, and access time dropped from 1½ minutes to 2 seconds. In addition, "bank personnel don't have to make five phone calls to get the information—they now go to one source and get the information almost instantly.

"We have much tighter control over the data base. We now have a good grasp on incoming data and know that data can't get lost. The biggest advantage to Chase Manhattan is that the data base is current—before, it was as much as a week old."

The Tandem system can be operated by clerical personnel—with little or no formal training. "When we got praise on the ease of running our Tandem system from a Grade V clerk, we were impressed," reports a Controller's Office vice president. "We were overwhelmingly surprised with Tandem's reliability. They didn't overpromise."

Said one Controller's Office spokesman in summation: "Our system has served us well. We got what we wanted—a reliable, well-designed, well-integrated system—at a cost we could afford."

MOTOROLA INC. Wafer Production Network

Motorola is one of the world's leading manufacturers of electronic equipment and components. With annual sales in excess of $3 billion, it is company number 125 on the Fortune 500 list.

Motorola's Semiconductor Sector, headquartered in Phoenix, manufactures semiconductors, circuits, microprocessors, and a variety of other products for both the military and private industry.

The Problem

The semiconductor business is one of the most intense, competitive, and fast-changing of all high-technology industries. Designs change constantly; there may be as many as 500 to 1,000 specification changes a month, all of which impact manufacturing. The creation of a single wafer can take seven to ten weeks, and may require up to 300 different processes. Every process requires close monitoring, and problems must be quickly identified and corrected. In addition to all this, new product lines are added constantly.

The need for a highly reliable on-line system is critical; when production slows to isolate and correct problems, output (and profit) suffers. And a system failure could be disastrous.

So in late 1979, the Semiconductor Sector started planning an on-line wafer production system to collect data, monitor process variables, and pinpoint trouble spots. This new worldwide distributed processing network would:

- Increase productivity
- Reduce paperwork
- Better utilize production machinery
- Provide timely and reliable data

It was decided that each manufacturing and assembly plant would have its own system to handle local data processing needs. In addition, each of these systems would be connected to a "host" system at headquarters, and would feed cost and other information to the host for corporate analysis.

Selection Criteria

System selection was based on the following criteria:

- Communications capability, including effective networking software and support for IBM devices
- Transaction processing capability with easy programming (e.g., software development tools), fast data base access, user-friendly operation, and screen formatting capability
- Language support for COBOL, FORTRAN, and an assembler-type systems language
- 24-hour availability

- Flexibility to support data base changes
- Ability to support a query/report writer
- Expandability, both for individual systems and for the network, with no need for reprogramming

Why Tandem?

Of the four vendors considered, only Tandem was able to satisfy all the requirements necessary to achieve Motorola's goals. Continuous operation and easy expandability were Tandem exclusives, and only the NonStop system was specifically designed for on-line transaction processing.

The Tandem Solution

A three-processor NonStop system was delivered to Motorola's Bipolar facility in Mesa, Arizona, in September 1980. Since then, the system has grown to five processors with 768kB of memory, five mirrored discs, 55 terminals, and 12 printers. Motorola uses Tandem products AM3270, TR3270, and EXCHANGE™ to interface with their IBM 3081 mainframe.

In March 1981, the system went into production. Design and development took just over six months. In this time, the Motorola staff wrote over 41,000 lines of code, developing programs in COBOL and Tandem's system programming language.

PATHWAY is credited with the fast development time. According to one Motorola project leader, "It would have taken 40% longer if this application had been implemented on any of the other proposed systems."

Since the initial installation, Motorola has added nodes in Phoenix, Austin, Scotland, France, Malaysia, and Korea. These systems improve plant operations and provide instantaneous information management for fast, accurate corporate decisions. By mid-1984, the company intends to install Tandem systems in all of its wafer fabrication, final test, and assembly facilities around the world.

Current Applications

The major functions of the distributed wafer systems are:

- Specification maintenance
- Inventory tracking
- Production line scheduling
- Furnace management
- Equipment maintenance
- Manpower scheduling
- Resource management
- Performance reporting
- Reject analysis

NonStop systems track wafers from operation to operation, collecting on-line data about process and inventory activity, and measuring cycle times and yields according to standard. Nine manufacturing areas are on-line.

Each system easily handles thousands of transactions daily, providing direct and instant feedback. Motorola uses this information to control the production process, placing resources where they are most needed, and streamlining the entire operation. In addition, trouble spots are identified, isolated, and corrected before they have a chance to cause serious problems.

Benefits of the Tandem System

Motorola has realized increased yields, lower costs, reduced cycle times, lower inventories, and a significant overall increase in productivity. "We now have control of work-in-process in a way that was never before possible."

WELLS FARGO BANK
Distributed Processing Network

Wells Fargo is the twelfth largest bank in the United States and has its headquarters in San Francisco. Its assets exceed $22 billion, and nearly 400 branch offices are located throughout California.

The Problem

In 1980, Wells Fargo began investigating ways to improve profitability in its consumer credit activities. Two major changes were recommended: the first was the establishment of regional loan processing centers, and the other was to market a more diversified range of products. To support the increased volumes created as a result of these changes, automation would be required.

Automated processing would considerably increase efficiency, allowing more effective customer service and an enhanced competitive posture. Employees could process more transactions in less time and with better accuracy.

The bank issued a request for proposal (RFP) for a system to automate consumer loan activities. The new system would handle loan application processing, title maintenance, payment processing, and inquiry handling. The loan processing function at each branch would be consolidated into four regional centers, each with its own system. The four production systems would have to be able to support from 200 to 400 video display terminals, 50 to 100 per location. A fifth system, used for software development and maintenance, would be located at central headquarters in San Francisco.

Selection Criteria

Critical system requirements were defined as follows:

- High availability
- Modular design
- High data integrity
- Good networking capability
- Ease of use
- Competitive overall system cost

Against this evaluation framework, several vendors claiming on-line or distributed data processing capability competed for the contract. Wells Fargo narrowed the competition down to two vendors; in the end, Tandem was awarded the contract.

Why Tandem?

Tandem was selected for overall economy and because it offered the following features:

- Constant availability. Tandem systems are specifically designed for continuous operation, even if a major component should fail. For a bank like Wells Fargo, even a short break in processing can result in very expensive penalties.

- Modular expandability. The systems could grow according to Wells Fargo's needs without expensive software changes and without the need to switch to larger machines. This would result in considerable savings over the long term.
- Extensive terminal connectivity. Tandem systems can support several hundred terminals, each with access to both local and remote data. This is important to Wells Fargo because of the large number of terminals accessing the same data base.
- High data integrity. Reliability is critical in financial transactions, and Tandem's emphasis on data integrity provides undisputed accuracy.

"With automation of our service centers, the productivity of over 600 employees would be dependent on the availability of our on-line systems," says Jack Kopec, Executive Vice President. "Tandem's architecture provided us not only with the availability that we required, but also with the ability to easily modify or expand our systems in response to changing business requirements—and with minimal incremental costs."

The Tandem Solution

A two-processor development system was delivered to Wells Fargo's San Francisco headquarters in April 1981. A team of programmers and analysts attended three weeks of Tandem classes, and the first application went live within ten months of the date the initial development system was delivered. "Tandem software tools, combined with the ease of making changes on the Tandem system, greatly enhanced our ability to meet our implementation schedules," reports Barbara Doherty, Vice President and application development manager.

During the development period, the team formulated an application development method so flexible that it has become a template for all Tandem applications in the Consumer Credit Division.

The first phase went into pilot in March 1982. All four production nodes began operations over a six-month period. This first phase supported customer inquiry, title maintenance, and data base maintenance for customer demographics. A short time later, the second phase began, adding fully automated payment processing for installment loans.

Current Applications

Today, the system processes and monitors all stages of consumer loan and auto lease applications including data entry, fraud detection, automated credit bureau report retrieval, credit scoring, and document preparation.

One centralized technical support group manages the operations staff, which develops all new applications. A Tandem quality assurance group provides assistance as needed. New software is distributed across the network by the technical support staff.

"The time and effort required to support our systems have been substantially reduced by our use of Tandem's EXPAND network," reports Catherine Scuderi, Vice President and Chief Systems Officer. "EXPAND enables us to monitor and control hardware and software problems in all production nodes from our one centralized development site."

The current terminal network supports over 450 terminals at the four California production sites located in Walnut Creek, Sacramento, San Jose, and Santa Ana.

Future phases of the program will include automating revolving credit processing, implementing automobile lease accounting, and installing credit card application processing.

Benefits of the Tandem System

With the automated procedures, Wells Fargo can process more work per employee. Operational head counts have remained steady while productivity has increased. This type of efficiency has helped Wells Fargo position itself to take advantage of the emerging consumer market.

"The Tandem system has enhanced our ability to effectively deal with our customers," says Kathy Burke, Vice President, Consumer Credit Operations. "We can now immediately interact with customers via on-line data as opposed to retrieving information from customer files and/or paper reports. This allows us to deal professionally with our customers and, in general, has resulted in increased customer satisfaction with our services."

REPRESENTATIVE CUSTOMER LIST

Manufacturing

DYSAN INC.
Manufacturing Requirements Planning (MRP)

EXXON
Wiring and Instrumentation Design and Documentation

GENERAL DYNAMICS
Defense Bidding and Control

LOCKHEED MISSILES AND SPACE COMPANY, INC.
Shop Floor Control

MOTOROLA
Production Control

THYSSEN HENRICHSHUTTE AG
Steel Manufacturing Quality Control

Retail Banking

CHEMICAL BANK
Home Banking

GREAT WESTERN SAVINGS
ATM Support

SECURITY PACIFIC BANK
Automated Loan Collection

UNION BANK OF FINLAND
ATM and Teller Terminal Support

WELLS FARGO
Consumer Loan and Automobile Lease Processing

Wholesale Banking

CREDIT AGRICOLE
Domestic/International Money Market

CHASE MANHATTAN BANK
Automated Clearing House

INTERFIRST BANK DALLAS
Electronic Funds Transfer

MERCANTILE BANK
Electronic Funds Transfer

PRIVATBANKEN A/S
Foreign Exchange

International Banking

BARCLAYS BANK
Worldwide Corporate Databank

CHAPS INTERBANK SYSTEM
Funds Transfer Network, U.K. Retail Banks

CROCKER NATIONAL BANK
Worldwide Funds Transfer

FIRST NATIONAL BANK OF CHICAGO
General Banking Functions

Financial	CASA DE BOLSA BANAMEX Brokerage
	CHICAGO BOARD OF TRADE Commodities Exchange
	COMMODITY NEWS SERVICES Commodities Quotes/News
	COX CABLE Home Banking Services
	DAFSA Brokerage
Retail Trade	CONVENIENT TICKET On-Line Multiple-Location Retail Ticketing
	DROGUEROS, S.A. Order Entry/Distribution
	FEGRO On-Line Commodity Control/Checkout (POS) with Inventory Control
	KARSTADT AG Integrated Sales and Information, Furniture Department
	TARGET STORES Distribution Processing
Wholesale Trade	BAUSCH & LOMB Order Entry/Shipping
	BEECHAM COSMETICS Order Entry/Processing/Shipping
	HAMILTON AVNET Order Entry/Inventory Control
	LIEBERMAN ENTERPRISES Retail Distribution
Transportation, Communication, Public Utility	BUCKEYE PIPE LINE Oil Flow Control
	GTE TELENET Electronic Mail
	INDIANA BELL Order Servicing/Billing
	MEMPHIS LIGHT, GAS AND ELECTRIC Customer Service
	VIKING FREIGHT SYSTEM, INC. Fleet Maintenance

Services

DIRECCION GENERAL DE POLICIA
License Plate Control/Arms Distribution/Vehicle Maintenance/Criminal Records

FAST-TAX (COMPUTER LANGUAGE RESEARCH, INC.)
Service Bureau

ON-LINE COMPUTER LIBRARY CORP. (OCLC)
Interlibrary Cataloging

ORANGE COUNTY COMMUNICATIONS
Message-Switching into California Law Enforcement Telecommunications System/Information Exchange between Nuclear Generating Site and Local Government

Hospitals/Universities

COMMUNITY HOSPITAL (OF INDIANAPOLIS)
Patient Care

DISTRICT OF COLUMBIA GENERAL HOSPITAL
Patient Care

HOSPITAL AUGSBURG
Patient Registration/Records

UNIVERSITY OF CALIFORNIA, BERKELEY
Undergraduate Admissions/Registration

UNIVERSITY OF COLORADO
Medical Research

Automotive

FORD MOTOR COMPANY
Engine Assembly and Test Information System

PEUGEOT
Automobile Production Control

PORSCHE
Inventory Control

RENAULT
Automated Manufacturing

HOW WE'RE DIFFERENT, AND WHAT IT MEANS TO YOU

Tandem Systems Are Expanded Rather than Replaced

With most computers, growth is very expensive. As your workload increases, you need extra computing power—and with conventional systems, that means replacing your computer with a larger machine. Expensive reprogramming is often necessary. In order to delay these major expenses, some vendors sell you more computing power than you initially need. But in the end, when your business demands outgrow the system's capabilities, expensive changes are inevitable.

At Tandem, we view growth as the simple addition of processors. You start with what you need, adding more processors as necessary. Since NonStop systems are expanded rather than replaced, you won't need to pay for a costly conversion—and you're free from tying up funds in extra equipment.

Every NonStop system can grow from 2 to 16 processors. If you need still more computing power,

up to 14 systems with 16 processors each can be connected by high-speed fiber optic links for a total capacity of 224 processors at a single site—greater computing power than some of the largest mainframes. And you'll still be using the same system you started with. With Tandem, you don't have to scrap previous investments as your business grows.

You can also connect 255 different NonStop systems—over 4,000 processors strong—and place them at your company's locations throughout the world. Each location has immediate access to its local information base and can also get information from other sites. And from your corporate headquarters' system you have access to information at every site for fast, accurate business decisions and for long-range planning.

When you install Tandem NonStop systems, you get:

- Computers that expand with your business—without expensive hardware or software changes

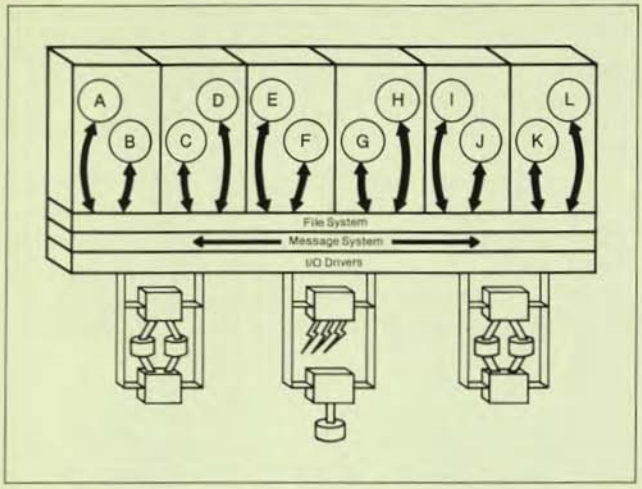
- The right amount of computing power for every corporate location, from the smallest to the largest
- An advanced information movement system that speeds electronic messages throughout the corporation, reducing paperwork and increasing efficiency
- An easy-to-use relational data base that simplifies interaction between you and the computer
- Programs and devices that protect your investment in existing equipment by permitting communication between Tandem and non-Tandem equipment
- A series of programming aids that cut application development time by as much as 50%
- A variety of computer languages familiar to your programmers, to keep programmer productivity high

Tandem Does More So You Can Do More

All Tandem processors communicate with each other as if they were in the same system—no matter how distant they actually are. This means that a Tandem system at one location can get information stored at another location without the operator having to know where the data is stored. For example, you may want to check a customer's records to determine whether he is a good risk for a loan. You simply request information, and the system automatically finds and retrieves it for you, regardless of its location.

All this is possible thanks to Tandem's GUARDIAN™ operating system. GUARDIAN is a series of programs, written by Tandem, that controls the operation and function of every Tandem system. GUARDIAN keeps track of the names and locations of every processor, device, and user in the network. Because you get information directly from Tandem systems at other locations, telephone calls and paperwork between sites are reduced. Your employees respond faster to customers and have more time for other productive activities.

GUARDIAN helps keep down the cost of processing by letting you put that power where it's needed most. On conventional systems, computing power is often wasted due to changing demands on the system. For example, your business may reach a peak at about 10 a.m. each day, and the program that controls, say, order processing requires extra computing power. An unbalanced workload can result, and on conventional systems, it is extremely difficult to redistribute the system's resources. The purchase of more computing power is often recommended.



GUARDIAN allows you to balance processor loads according to your needs, and keeps your system operating right through a processor failure.

But with Tandem NonStop systems, you can dynamically rebalance the workload whenever necessary, placing computing power wherever it's needed most. And this means you purchase only the power you need, when you need it.

Another benefit of this ability to reallocate the workload comes about when a component in the system fails. In a conventional system, a failure can halt processing. Or worse, it can corrupt the information in your data base. But in a Tandem system, GUARDIAN automatically responds to system failures by reallocating the workload as necessary. Processing continues, and most important, GUARDIAN ensures that your information remains reliable.

Keeping Lines of Communication Open

When the information you need is stored at another location, GUARDIAN automatically brings it to you. In the form of electronic impulses, your data can travel between corporate locations in a variety of ways, including telephone lines, satellites, and fiber optic cables. But whatever method you use, a communications failure between sites can stop the flow of information.

So to protect you from communications failure, Tandem systems support multiple paths with a powerful computer program we call the EXPAND data communications network.

In an EXPAND network, all communications paths are available to speed information from location to location. If one path fails, an alternate path is automatically selected—and the flow of information continues.

Optimum Routing of Information

EXPAND keeps track of all available communications paths, and automatically chooses the optimum route—based on your priorities. Whatever criteria you specify for a particular type of transmission, be it speed or economy, EXPAND selects the appropriate path.

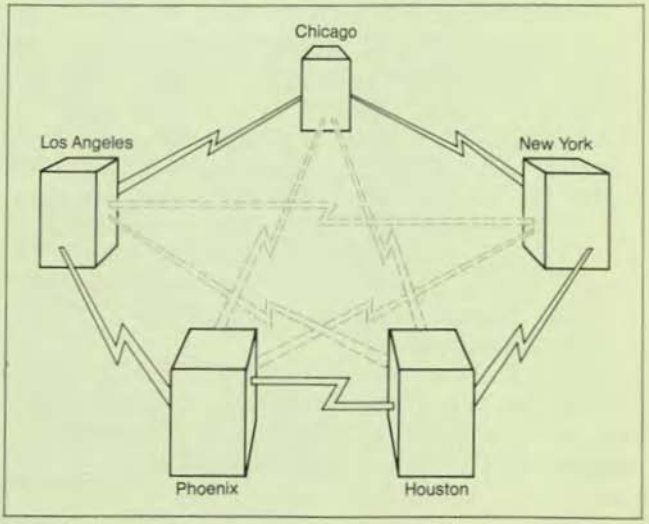
For example, if you need to transfer large amounts of information coast to coast, and you have a satellite link established, you may want to transmit the data over this route. If economy is the major concern, you may choose an economical type of telephone line. EXPAND sees which paths are available, selects the best path per your instructions, and transmission begins.

As new communications paths are added to or removed from your network of Tandem systems, EXPAND automatically updates its "routing tables" at each site to ensure that messages continue to be routed along the best path.

Fewer Lines, Lower Cost

EXPAND also helps keep down the high cost of communication between sites by allowing one location to relay information to another. For example, your offices in New York and California do not have to be directly connected to each other if they are both connected to the Texas site. The Texas site simply passes the information along to its destination.

This "passthrough" capability can result in considerable savings in the cost of communications between company locations. And the more sites you have, the greater the savings. For example, the illustration shows five sites. If each site were directly



Passthrough capability means fewer communications lines, lower communications costs.

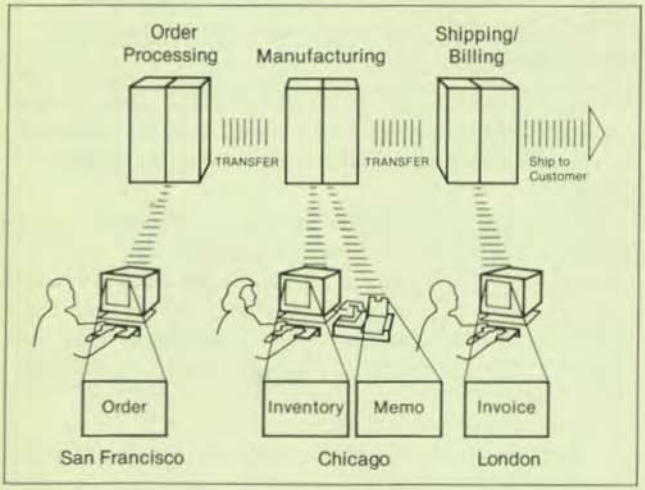
connected to all others, ten communications lines would be required. But through EXPAND, only five lines are required. If one line fails, EXPAND automatically routes your message in the other direction. You save money on communications costs, and fault tolerance is your bonus.

Information from Many Sources

When you need to send information to other locations, powerful Tandem programs help you do it with a minimum of effort. And you can control both the format and delivery of your messages through Tandem's TRANSFER™ information delivery system.

TRANSFER lets you send "information packages" containing data from many different sources, such as data files, word processors, and facsimile machines. You can, for example, send a message consisting of a cover memo; a file containing the current product catalog; and a set of illustrations to be transmitted via a facsimile machine (using Tandem's TRANSFER/FAX software)—all combined in a single package.

With TRANSFER, you can compose and send messages easily, with the speed and reliability of the computer. Forget paying for overnight delivery—your messages are delivered in minutes, whether they're going next door or around the world.



Order information can be taken at one location; passed via TRANSFER to another location, where a memo is attached; then the package can be forwarded to the location that handles shipping. No paperwork is involved, and the entire procedure can be accomplished in minutes.

TRANSFER also lets you determine when a package is to be delivered. You specify the earliest and latest delivery times, and your correspondent can receive the package whenever convenient within those times. You can, for example, send a message on Monday that will be available to the recipient between Wednesday and Friday; and if the message isn't received by Friday, it will disappear, and the system will notify you that delivery was not completed.

TRANSFER also lets you communicate with application programs, and even supports non-Tandem programs. You can send a message scheduled to arrive at a specific date and time that orders a program to begin processing. For example, if an application involves a process in which a very large number of files are to be manipulated, TRANSFER can be instructed to wait until after working hours, or whenever computer resources will be available to handle the load.

TRANSFER is perhaps most frequently used to support Tandem's easy-to-use electronic mail program, TRANSFER/MAIL. TRANSFER/MAIL helps you compose messages that originate from a variety of sources, such as word processors, facsimile machines, or data files. And special screen formats help you organize the message right on your terminal.

When information is sent to you by way of TRANSFER/MAIL, your terminal displays a one-line message informing you of its arrival. After viewing the message, you have several options: you can save it in a file for future use, purge it, respond to it, or add your own memo and forward the package to someone else.

In other words, you can handle the exchange of information just as if it were on paper, the same way you've always done in the past—only faster, easier, and more economically.

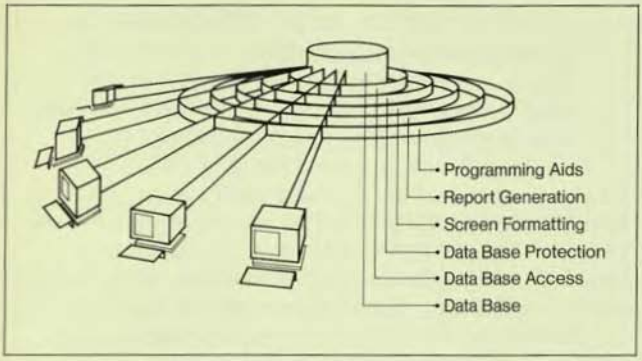
Keeping It Simple

At Tandem, we recognize that many of our users are not computer experts. So we've developed a set of programs specifically designed to simplify use of the NonStop system.

These high-performance programs constitute Tandem's ENCOMPASS™ distributed data base management system, which helps you redistribute processing power to accommodate peak workloads, system expansion, changes to your information base, and application program growth. You can use ENCOMPASS with a single NonStop system or with a worldwide network of Tandem systems.

Complementing the file management capabilities of GUARDIAN, ENCOMPASS provides additional capabilities to access, query, manage, secure, and protect the integrity of your information base. ENCOMPASS consists of the following Tandem software products (programs):

- PATHWAY transaction processing system. PATHWAY consists of a set of programming tools that reduce application development time by as much as 50%. PATHWAY frees your programmers from several repetitious and time-consuming tasks



ENCOMPASS helps you redistribute processing power to accommodate peak workloads, system expansion, changes to the data base, and application program growth.

that are part of the programming process, allowing them to concentrate their efforts on solving the problem at hand. Program development and maintenance expenses are reduced, and as the cost of labor continues to climb, your savings continue to grow.

- ENABLE™ Screen COBOL generator. Another programming tool, ENABLE lets your programmers develop small application programs easily, almost automatically. This contributes to your savings in programming costs.
- ENFORM query language/report generator. ENFORM makes it easy to retrieve information in proper format for those necessary reports. ENFORM responds to a few simple keyword commands and works with GUARDIAN and EXPAND to get information from your information base. Easy-to-use screen layouts help you organize the information right on your terminal screen. You then send the information to the printer, which prints out the completed, formatted report. You eliminate the expense of printed forms and the time required to fill in blanks.

  Even minor formatting functions are simplified by ENFORM. Short keyword commands can be given that center headings, space columns of data, or skip to a new page. Other keywords provide totaling and subtotaling capabilities, and can format numbers with commas, decimal points, or currency signs. Automatic settings used for your standard reports can also be overridden to produce customized reports.
- Transaction Monitoring Facility (TMF). TMF helps maintain the integrity of the data base. TMF backs out all transactions in progress that cannot be

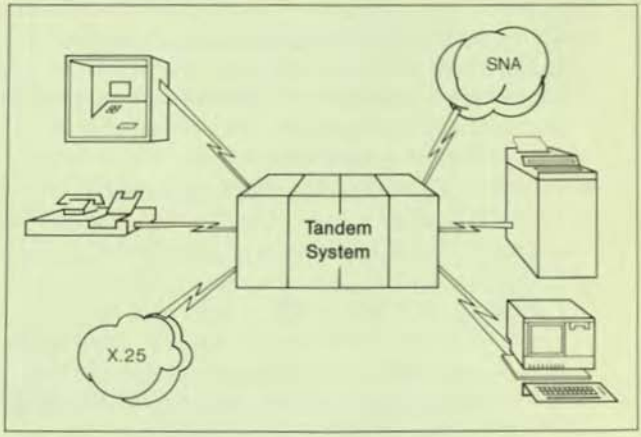
completed due to a failure. When the alternate component or processor takes over, relieving a faulty one, TMF restarts the transaction. Nothing is lost, nothing is duplicated. And it all happens so fast that you may not even know that a failure occurred.

Preserving Your Investments

It would be very convenient for your corporation if all computer manufacturers used the same computer languages and methods of communication. Unfortunately, this is not the case. Yet Tandem makes it seem that way.

Tandem supports the most popular programming languages, as well as virtually every major communications method. This not only helps to preserve your investment in previously purchased equipment, it also means you can use your network of Tandem systems as your primary communications network, to which other computer and communication devices are attached.

NonStop systems support many types of devices, even those made by other manufacturers.



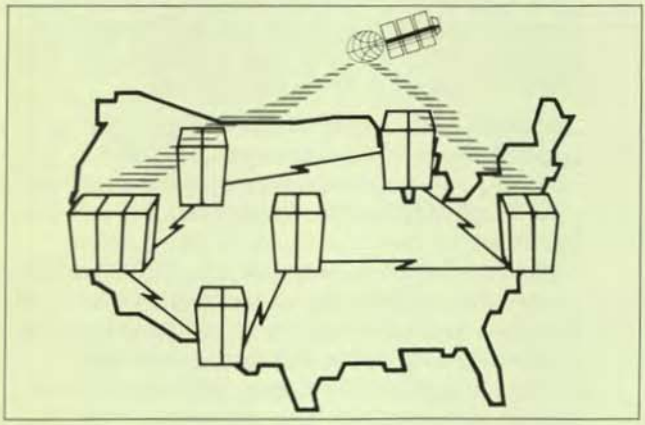
NonStop systems support a wide variety of devices manufactured by other vendors, including word processors and facsimile machines. Tandem systems can be programmed in COBOL, FORTRAN, BASIC, MUMPS, and TAL (Tandem's system programming language). And they support virtually all popular communications interfaces and protocols, including SNA (IBM's Systems Network Architecture) and X.25.

The list of Tandem communications products includes:

- SNAX—Allows your Tandem system to communicate with SNA devices and computers. Using SNAX, you can connect all your SNA devices to a NonStop II or NonStop TXP™ system. Or, if you have a large SNA host, you can use a NonStop II

or NonStop TXP system to reduce the workload on that host, moving your transaction processing applications to the Tandem system.

- INFOSAT™—The first computer network with fully integrated satellite communications, the INFOSAT communications system is a joint product of Tandem Computers and American Satellite Company. Using satellite communications to transfer large amounts of data between distant sites can be considerably less expensive than other methods. And with INFOSAT, your entire computer and satellite network is viewed as one system with continuous availability, high data integrity, and single-source maintenance.



- FOX (Fiber Optic Extension)—Allows up to 14 full-powered Tandem systems to be joined at a single site using fiber optics. Fiber optic cabling is not affected by electrical interference and moves information at the speed of light for very fast response times.
- X.25—A commonly used method of connecting computer equipment over distances. Tandem computer systems have the versatility to support virtually every major version in use today.
- AM3270—Allows your 3270-type terminals to operate when connected to a Tandem system.
- TIL (Tandem to IBM Link)—Links one or more NonStop systems with any IBM 370-compatible system.
- THL (Tandem Hyper Link)—Links a Tandem system to local NSC (Network Systems Corporation) HYPERchannel networks, allowing your NonStop system to communicate with a variety of systems made by other vendors. If you

have other large computer systems, THL will allow you to use them in conjunction with your Tandem system, preserving your investments in other equipment.

- EXCHANGE—The EXCHANGE remote batch workstation allows a Tandem system to appear as a 2780 or 3780 terminal to a host computer. It also provides certain remote job capabilities.

Other Tandem software programs make it easy for you and your staff to use the NonStop system. These include:

- Utilities—Tandem provides a series of utilities to simplify the interaction between you and your terminal. A text editor gives your terminal many of the attributes of a word procesor, making it easy to compose text on the screen. Changes are all made before the final copy is printed. No more need for erasers or white-out products.

  Tandem's TGAL utility makes it easy to get printed copies in the format you need. The DEBUG utility saves programming time, and the SORT utility helps you organize data the way you need it.
- XRAY™—A performance monitor, XRAY provides information to help your computer people balance loads on the system and fine-tune applications for optimum performance. XRAY monitors total system performance and spots overloads in work distribution. Bottlenecks in programs, processors, or devices are pinpointed for corrective action.

The Right System for Every Site

Some of your company's locations have greater processing demands than others. So to provide outstanding price/performance, Tandem offers a selection of systems that can be matched to the demands at each site. Every system is easily expandable from two to sixteen processors, and is fully compatible with other Tandem systems, able to share the same information and use the same programs.

The Tandem NonStop computer systems come in three performance ranges:

- The NonStop TXP system is designed for high-volume locations that process enormous amounts of data, support hundreds or thousands of terminals, and still require extremely fast response times. The most powerful computer specifically designed for transaction processing, the NonStop TXP system offers the highest performance for your computing dollar.

- The NonStop II system is ideal for sites with moderate to heavy computing requirements. This full-size computer system supports all of Tandem's products, and has the capability to grow larger and more powerful than many mainframe-type computers.
- The NonStop 1+™ system is designed for use at low-volume sites where less processing power is needed. The NonStop 1+ system provides a low-cost alternative for some of your company's smaller sites, which do not require the communications diversity of our larger systems.

State-of-the-art Peripheral Equipment

Perhaps the most visible part of a computer system is the peripheral equipment (terminals, printers, etc.). And Tandem offers a complete line of reliable, easy-to-use equipment designed for long hours of comfortable use. These state-of-the-art peripherals become an integral, complementary part of your NonStop system. They allow you to fully utilize the performance and convenience features designed into these powerful machines. Tandem's line of peripheral equipment includes:

- A variety of terminals—The 653X family of terminals are designed and built by Tandem to function as an integral part of your NonStop system. They are compatible with Tandem's extensive array of software products, and come in three sizes with 9-inch, 12-inch, and 15-inch monitors. They support 3270 terminal emulation, and voice and bar code input. And all Tandem terminals are ergonomically designed for increased user comfort and maximum productivity.

Tandem terminals support a variety of input methods, including bar code, wand, and voice.

- A series of printers—Full-size Tandem printers range in speed from 600 to 900 lines per minute and use the latest "band type" technology for reliable, trouble-free performance and flexibility. The band can even be changed for different type styles. Tandem also offers a matrix printer that types a fast 340 characters per second, and a letter-quality printer with easily interchangeable print wheels.
- A variety of disc drives—Tandem offers two types of disc drives: some have removable discs for high security, while others have sealed discs for easy maintenance. All drives offer good price/performance. They range from a small 64MB drive to a large-capacity 540MB drive. You choose the size and type of drive according to your needs.
- A series of tape drives—Reel-to-reel tape drives come in different sizes for different purposes and provide high reliability and good price/performance. Tandem's top-of-the-line tape drive operates at a very high speed and packs information onto the tape very densely. The result: information can be moved quickly, less tape is needed, and employees spend less time changing tape reels.
- A fault-tolerant earth station—When you move information via satellite using Tandem's INFOSAT product, you use the first earth station specifically designed to function as an integral part of a fault-tolerant computer network. You get sophisticated performance monitoring and single-vendor maintenance and repair.

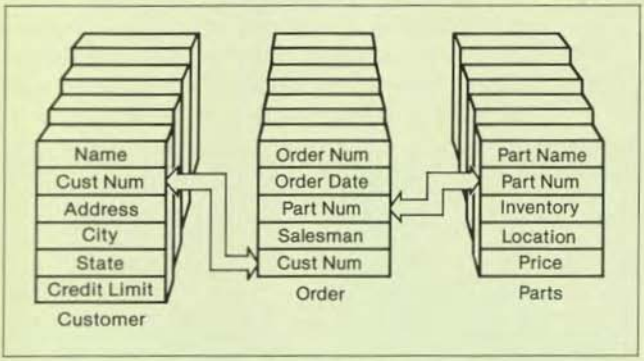
Relational Data Base—Capability without Complexity

A major difference between Tandem and conventional computer systems is the structure of the data base itself. Application programs are ever-changing in response to business requirements. A data base that is structured, unwieldy, or difficult to change poses more problems in the long run than it solves. So Tandem discarded conventional data base designs (e.g., hierarchical, network) and instead perfected a "relational" approach.

A relational data base simply means that information is organized in the form of tables. Since that's the way you look up information every day (e.g., stock market listings, airline schedules, financial statements), Tandem doesn't impose any additional artificial structure just because the data is managed on a computer; no strange computer acronyms, strings of numbers, or pointers.

To obtain information, simply use a key word (such as customer name or inventory item) or value (such as account number, order number, or part number) as your means of reference.

These tables or records can be located anywhere—on a single system, or on several systems, at one or several locations. And you don't have to keep track of where the data is stored; Tandem's GUARDIAN operating system locates and retrieves the information you need.



Tandem's relational data base stores information in a familiar, easy-to-use table format. Data is easy to access, and you needn't know at what location the information is stored.

The chief advantage of a relational data base is its simplicity. Setting up a data base merely involves creating and filling in the tables with pertinent data. To expand the data base, merely add new tables or add more rows of information to existing tables—without rewriting or modifying existing programs. The simplicity of the relational approach saves on program maintenance costs as well as initial development.

Such tremendous versatility is also your best insurance against data base obsolescence. Applications are flexible, so that weeks, months, years after startup, when unforeseen changes arise over and over again, your data base is adaptable and responsive.

Like the NonStop system architecture itself, Tandem designed its data base management system with your growth and expansion in mind. With Tandem, you don't pay a price for success, because we have already planned for the future.

TANDEM EXECUTIVE INSTITUTE

Tandem Executive Institute (TEI) was founded in 1981 to provide an educational forum for senior executives of large companies. Since its inception, over 275 senior managers from companies around the world have attended the Institute.

Issues discussed at the Institute revolve around managing and using information, the most vital of a corporation's assets. Because the emphasis in the conferences is on effective business management rather than the technical details of information systems, little or no knowledge of data processing is assumed.

Corporations are facing increasing pressure due to competition, the regulatory environment, and the economy. Although these pressures vary by industry, topics of interest in most conferences include changes in the industry, economic trends, strategic planning, the evolution of technology, information systems planning, and the use of technology to gain competitive edge.

Most conferences are industry-specific. Programs for the financial services, banking, manufacturing, and telecommunications industries are offered, in addition to a program for software houses. These conferences take place in Cupertino, California; Reston, Virginia; and London, England. Enrollment is limited to 25 participants so that the sessions are interactive.

Conferences include presentations, team case study workshops, demonstrations, and hands-on labs. Presentations are made by prominent academicians, industry executives, and Tandem executives.

In addition to the industry-specific programs, the Institute holds conferences for the senior executives of a single company. These programs are arranged on a custom basis for companies exhibiting a high level of interest throughout the executive organization.

CUSTOMER ENGINEERING

According to *Datamation* surveys, Tandem consistently rates highest in customer satisfaction above all other computer vendors (source: Cowen and Company/ *Datamation* 1980, 1981, 1982 and 1983 computer surveys).

Contributing to this high level of customer loyalty is Tandem's Customer Engineering group. This team of professionals is available to respond to your service needs 24 hours a day, 365 days a year.

And the service starts long before your system is installed. Customer Engineering helps you determine basic system configuration, aids you in site planning and preparation, and coordinates the installation of your NonStop systems. This comprehensive predelivery service helps ensure that installation proceeds smoothly and on schedule.

In addition, Customer Engineering offers complete training for your staff. Subjects range from basic user information to operator diagnostic instruction.

From over 100 sales and service offices throughout the world, Tandem offers a variety of flexible, yet comprehensive support programs that let you choose the level of service you need. Whether you require continuous service from on-site personnel, or simple per-call service, Tandem's Customer Engineering team of professionals has a plan to fit your needs.

SOFTWARE EDUCATION

The goal of Tandem's Software Education program is to educate you and your staff in the operation and use of NonStop systems. Classes are taught at Software Education Centers worldwide.

Each class covers subjects relevant to its participants, from the highly technical programmer to the nontechnical user. Some of the subjects discussed include system operation, application program design and development, data communications, Tandem technical support, and performance management.

The classes are divided into six categories. Some are considered required courses, some are recommended, and the rest are optional, depending on your specific needs. In addition, they are designed to cover different levels of technical depth to accommodate the technical expertise of the participants. All courses emphasize hands-on experience and include numerous laboratory sessions. Students are encouraged to make use of Tandem documentation, including technical manuals.

The six categories are as follows:

- Operations—These classes are designed for the nontechnical user who is unfamiliar with the computer, and unconcerned with the more technical aspects of its use.
- Application Design—This set of courses covers the analysis and design of an application program. Typical job titles related to application design might be programmer, analyst, project manager, systems analyst, data base designer, and data base administrator.
- Application Development—These classes include the writing and implementation of application programs. Titles related to these courses include application programmer, programmer/analyst, lead programmer, and systems analyst.
- Data Communications—These courses meet the needs of developers responsible for the design and implementation of data communications interfaces and networks. Associated job titles include network designer, data communications specialist, and systems analyst.
- Performance Management—Performance Management courses cover system load balancing and other subjects related to performance evaluation

and management. Job titles associated with these courses include systems programmer, system manager, and performance specialist.

- Technical Support—System-level software, system generation, and overall management of the system are covered in these courses. Attendees include systems programmers and system managers.

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COMPANY HISTORY

Tandem Computers Incorporated was founded in 1974 by four computer and business professionals who recognized the need for a computer that could continue processing without fail. Eighteen months later, the first Tandem NonStop system was shipped. A multiple-processor computer, the NonStop system keeps on running even if one of its vital components fails.

Tandem NonStop systems satisfy a full range of computing requirements at the largest of corporations. The NonStop TXP system is the world's most powerful computer for on-line transaction processing, able to handle enormous volumes of information, while providing very fast terminal response time; the NonStop II system is ideal for sites with moderate to heavy computing requirements; and the NonStop 1+ system is designed for use at lower-volume sites with small to moderate processing needs. All NonStop systems are compatible, able to use the same programs and share the same information.

Tandem became profitable in its third year and went public in 1977. Revenues have increased from $7.7 million that year to over $418 million in 1983. Operating income has grown from $400,000 to $49.8 million, while net income rose from $325,000 in 1977 to over $30 million in 1983.

Today, Tandem is among the Fortune 500 largest U.S. industrial corporations. Over 750 organizations use 6,800 Tandem processors worldwide (as of March 1984) in over 25 industries including manufacturing, banking and other financial services, wholesale and retail distribution, medical, communications, computer services, transportation, printing and publishing, legal, and utilities.

Tandem's success is due in part to our ability to meet the needs of our users. The Tandem system's fault-tolerant architecture, integrated GUARDIAN operating system, and easy-to-use programming tools enable users to implement critical on-line applications such as credit verification, electronic funds transfer, medical life support systems, message-switching, reservation systems, and distribution. Continuous system availability, modular expandability without reprogramming, and data base integrity are designed into all Tandem NonStop systems.

At Tandem, we have focused our marketing strategy on selling to corporations that are implementing major on-line applications. As a result, the majority of our business is done through direct sales to end users. The ratio of repeat business is high; many of our customers

expand their systems within 12 to 24 months of the initial purchase. This customer loyalty and satisfaction is due also to our responsive support with a worldwide staff of systems analysts, customer engineers, and software education instructors.

Tandem operates manufacturing facilities at Cupertino (headquarters), Santa Clara, and Watsonville, California; Reston, Virginia; Austin, Texas; Bensenville, Illinois; and Neufahrn, West Germany. Tandem has over 65 sales and service offices in the United States, and maintains offices in Australia, Belgium, Canada, Denmark, England, France, Hong Kong, Italy, Japan, the Netherlands, New Zealand, Norway, Singapore, Sweden, Switzerland, and West Germany.

Which one of the following most closely describes your position?

- ☐ President
- ☐ Vice President
- ☐ General Manager
- ☐ Division Manager
- ☐ Department Manager (specify)

  _____
- ☐ Staff (specify) _____

  _____
- ☐ Other (specify) _____

  _____

What is your company's annual sales?

- ☐ Under $100 million
- ☐ $100 – $500 million
- ☐ $500 million – $1 billion
- ☐ Over $1 billion

TANDEM

NonStop® Computer Systems

Which one of the following most closely describes your business classification by end product or service?

- ☐ Banking
- ☐ Other Financial
- ☐ Manufacturing
- ☐ Wholesale Trade
- ☐ Retail Trade
- ☐ Transportation
- ☐ Communications
- ☐ Medical/Hospital
- ☐ Printing/Publishing
- ☐ Energy
- ☐ Service Bureau
- ☐ Federal Government
- ☐ Other _____

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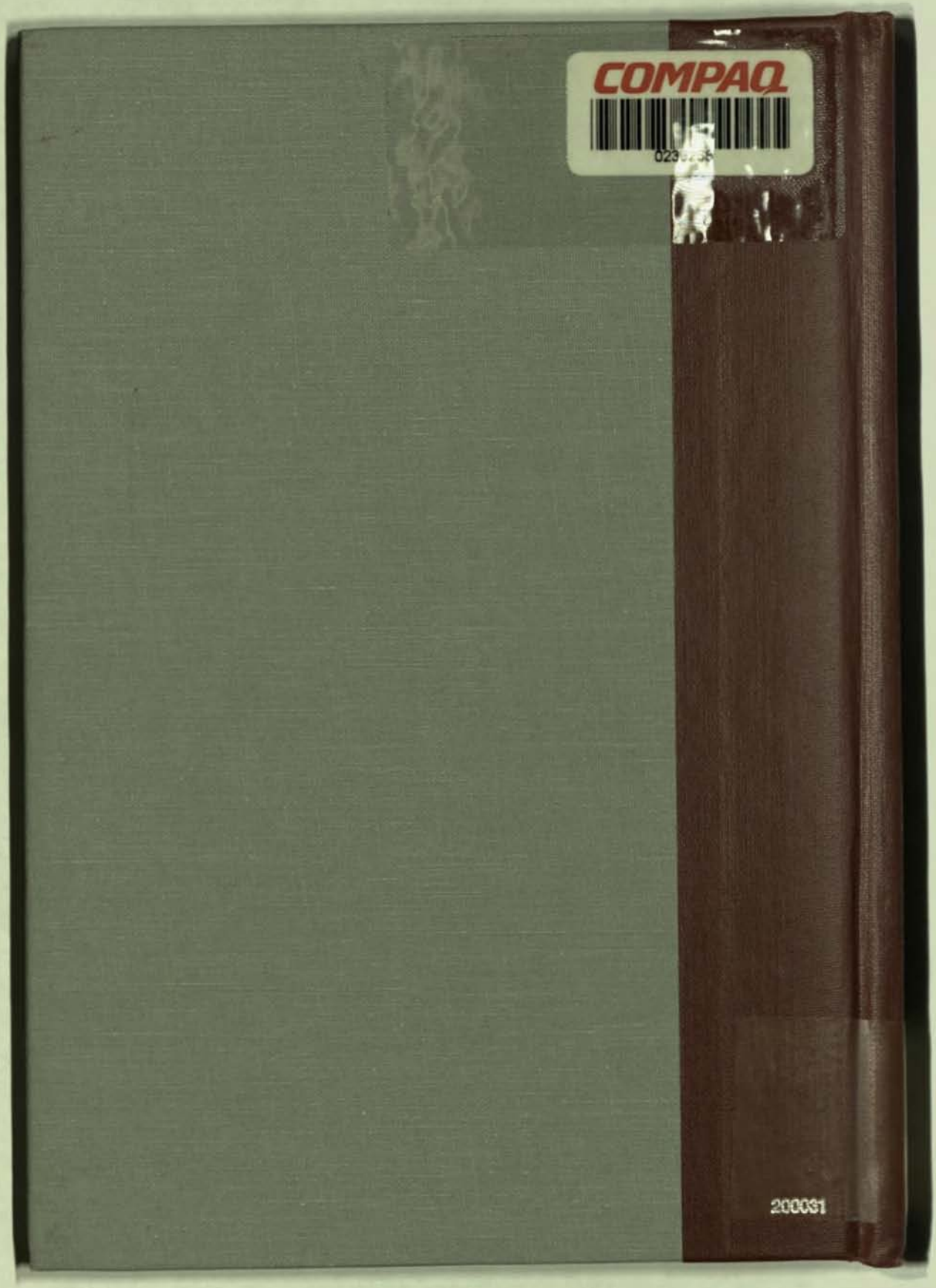
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