

Chapter 5

THE TECHNOLOGIES OF INFORMATICS

Table of Contents

	<u>Page</u>	
5.1	INTRODUCTION	5-3
5.2	WHAT IS SOFTWARE?	5-6
5.3	PROFESSIONAL SERVICES	5-8
	5.3.1 Real-Time Systems	5-8
	5.3.2 Display and Inquiry Systems	5-9
	5.3.3 Financial Systems	5-12
	5.3.4 Communications Systems	5-12
5.4	SOFTWARE PRODUCTS	5-13
	5.4.1 Implementation Systems Products	5-14
	5.4.2 Information Retrieval and Reporting Products	5-16
	5.4.3 Communications Systems Products	5-16
	5.4.4 Application Software Products	5-17
5.5	INFORMATION SERVICES	5-19
	5.5.1 Information Facilities Management	5-20
	5.5.2 Data Base Design and Management	5-20
	5.5.3 Information Dissemination	5-22
5.6	DATA SERVICES	5-22
	5.6.1 Initial Efforts	5-23
	5.6.2 The Second Effort	5-24
	5.6.3 Over-The-Counter Batch Processing	5-25
	5.6.4 Remote Batch Processing	5-25
	5.6.5 On-Line Transaction Processing	5-25
	5.6.6 Hybrid Applications	5-26
5.7	PRELUDE TO THE MICROCOMPUTER	5-26
	5.7.1 The Minicomputer Era	5-27
	5.7.2 The Microcomputer Era	5-27
5.8	REFERENCES	5-28

Chapter 5

THE TECHNOLOGIES OF INFORMATICS

5.1. INTRODUCTION

The history of technical development and expertise in Informatics is not one of many brilliant inventions of new technology, although there were a few. It is mostly a story of evolution, teamwork, experience, the merger of various kinds of knowledge, and the continued and repeated building upon prior knowledge and experience to create new and improved software applications, systems, products, and services. Nevertheless, Informatics personnel made several noteworthy technological inventions. Some of these were:

DOCUS--by Werner Frank, which long preceded modern screen-oriented applications development systems.

CRM--designed by Richard Hill, Wilson Cooper and Jules Mersel (based on an idea by William Cutler, then at IBM and later at Informatics), and implemented by Robert Heckathorne. It was the seminal concept for software performance measurement systems.

MARK IV--by John Postley, which was the first successful effort to make the computer easy to use, and upon which was built the methodology for developing, marketing, and supporting true software products.

ICS IV/250--by Walter Levy and his staff, which was the first time an independent software company developed "portability" for a large program from a 32 bit computer to a 16 bit computer.

PUBNET/ORDERNET--by Richard Kaylor, which provided major economics to wholesalers and manufacturers by means of a common order-switching system.

Descriptions of these will be found in later chapters.

But it was not by major breakthroughs, but by evolution, that Informatics has built up strong capabilities in a very wide variety of computer applications and technologies, probably wider than any other computer services company. This chapter can only give a sample of them, intended to illustrate how the company evolved its expertise in these areas in a "bootstrap" approach, using the combination of different computer technology and systems. Only brief descriptions are given for each illustration; more detail will be found in later chapters.

The buildup of any technological capability usually began with a contract with a customer to develop or improve the customer's existing systems, and was followed later by internal development. Some technology was acquired by purchase but in such cases Informatics immediately developed the in-house capability to extend and enhance its acquired software. Informatics has made an art of using follow-on contracts and evolutionary development of technology to

increase its business revenues and enhance its capability. The company has used custom programming and systems design contracts for individual customers to first identify additional customer needs and then to explore whether any of these needs are common to an industry group or to computer users in general. If so, the next step is to determine if a generalized solution or product can be developed and sold to a large number of potential customers and not just the original customer for custom services. In this way Informatics has used its professional custom services contracts to identify potential markets and to develop standardized proprietary software products and information management services. For example, GIRLS, the early IBM 7090 version of a general-purpose file management system for McDonnell Douglas engineering data was developed into MARK I and later MARK II for use on the IBM 1401 computers as an urban information management system for a consortium of five southwestern cities. Then the City of Alexandria, Virginia was persuaded to fund the development of a better system, MARK III, and the design of the data base for a more sophisticated version of the same application on the IBM 1410. Building on the MARK III concept, Informatics was able to design and perfect MARK IV, a file management software product for the IBM 360 that sold in quantity and was easy for computer installations to use and thus enabled users to create their own simple applications without aid from professional programmers. The general nature and ease of use of MARK IV in turn made the product attractive as a remote computing service for those who could not afford to own their own IBM computer. It also created a market for MARK IV custom programming and training services whereby complex applications for a customer were implemented using MARK IV.

Defying the conventional wisdom that the essential ingredient for success is to "find one niche and dominate it," Informatics is broad based and eclectic in its technological strategy and development. Its strategy was to find many "niches" and fill them with technological competence, dominating as many as possible. This is best described by one of its own capabilities manuals:

Informatics performs a variety of systems software tasks from design consulting to total implementation of large-scale information handling systems. Informatics is staffed to assume total software responsibility including such services as: function requirements specification, systems analysis, systems engineering, program design, implementation, documentation, and system operation The company also designs and develops, for sale or lease, proprietary information handling and data processing software products for a broad spectrum of applications.

Informatics experience in applying systems software techniques has involved clients at all levels of government from municipal corporations to the federal government, and to industry from retail business operations to giant corporations and public utilities. Projects have included the full range of technology from manual operation to multicomputer applications with widely varying system requirements.(1)

If there is one common thread that runs through Informatics diverse participation with software technology, it is its devotion to the computer user-

-the using customer--because its founders had been users, not "one niche" systems programmers, as was true of many of its competitors.

Informatics was born of a need to supply high-quality professional services from the user point of view--services to supplement the client staff or to assist in challenging technical areas.(2)

This devotion to providing dedicated quality service to computer users has caused the company to develop capabilities and expertise in a variety of applications, hardware, operating systems, and programming languages. It does not favor one manufacturer over another nor one software language over another. Much of its work involved IBM computers--because that was where the market (read "money") was. It uses the equipment specified by the user and provides programs in the language desired by the user. In its early years it would aid users in evaluating and selecting equipment for purchase but only after completing a thorough study of the user's current applications and future needs and available resources.(3) In later years it applied this principle to specific applications, and developed and sold "integrated turnkey products" composed of software and the best computer for the application. The success of this eclectic strategy has been proven by Informatics growth, which has far outstripped the majority of its "one-niche" competitors, no matter how thoroughly each dominated its own corner of the world.

Because of its multifaceted involvement with software, it is difficult to break up Informatics technological growth into time periods or into different types of technology. Most of its technological achievements were evolutionary efforts which were accomplished by the gradual experience and knowledge gained from preceding work. Most of the advanced software systems and services designed, programmed, and offered by Informatics are not creations of a single technology or discipline of knowledge. Rather they are hybrids of at least two and often many different types of technology. Thus an information clearinghouse data service such as TOXLINE, which provided on-line inquiry and retrieval service to the medical profession about toxic substances, represented expertise in timesharing, on-line display systems, real time programming, data base management, information abstracting and classification, and remote telecommunications, as well as the appropriate taxonomy for the subject matter and an expertise in the sources of the information.

However, the one technology underlying almost all of Informatics work is software, so the next section provides an elementary tutorial for the reader who may be unfamiliar with it. The rest of this chapter is divided into four sections covering the four major business areas of Informatics in 1982, and an epilogue describing the prelude to the company's involvement with the new world of the microcomputer. The four major areas are: 1) Professional Services, 2) Software Products, 3) Information Services, and 4) Data Services. These sections provide, for those readers unfamiliar with the subject, a general discussion of the company's technical capability in the four major genre of computer software services and products. Hence it is on an elementary level. Detailed information on specific applications, products, projects, and market areas can be found in Chapters 6 through 12. However, to put the technology in context, brief summaries of many of these are given in this chapter.

5.2. WHAT IS SOFTWARE?

Software is the combination of specific programs and documentation that permit the computer (the "hardware") to perform numerous and varied tasks and functions useful to its user. The computer is a fast, accurate, and reliable machine, but has no intelligence of its own. It has a built-in "machine language," internal "instructions," expressed in "binary"--a string of ones and zeros represented by states of electronic devices--that signify certain elementary functions the machine can perform. These provide a vocabulary of 50-300 instructions used to designate the performance of such functions as adding, subtracting, shifting, comparing, and branching to a different sequence of instructions. Underlying these instructions, in many computers, is another level of micro-instructions, which change the state of the logical elements on the electronic chips which make up the processors. But that is beyond the scope of this discussion--indeed few programmers are even aware of the art of such microprogramming!

As it comes from the factory, a general-purpose computer does not have any built-in ability to express in its "machine language" any useful combination of such instructions. Instead it is guided through any required sequence of functions by "programs," which are logical sets of coded machine instructions that allow the computer to solve a particular problem required by its user.

Programs are designed and written by "programmers" who first analyze the function or task to be performed and then design the sequence of instructions for the computer to follow. The programs may be written by the programmer in "assembly language" (a symbolic representation, for use by humans, of machine language) which is translated into machine language by a program called an "assembler." More frequently, the programmer writes statements in a higher level language which is less detailed than an assembler and thus easier for the programmer to use. Such higher level statements are translated into machine-language code by other programs which are language translators, commonly known as compilers. There are a number of standard higher-level languages used for programming (such as FORTRAN, COBOL, PL/1, PASCAL and BASIC) that come in various dialects, subsets and supersets for use with various computers.

Programming requires considerable analytical skill, creativity, attention to detail, and problem-solving ability. The programmer must identify the specific steps the computer must do to perform a task, order these steps in proper sequence and in some optimal combination, and code them using the proper vocabulary for the language that is going to be interpreted to the computer. As might be expected, the initial version of the program is often replete with conceptual errors in overall design, intellectual errors in logic, and clerical errors in combining the intricate symbols (words, letters, numbers, and punctuation) in accordance with the complex and unforgiving laws of the language being used. Discovering all these errors and correcting them (known as "debugging") is a major part of the programmer's skills. It is an arduous intellectual task, requiring a high order of intellectual puzzle-solving ability.

The "application" program created by the programmer to do what the user wants done, normally has to "interface" (communicate, coordinate and interact) with other programs and systems (which adds complexity to the job). Almost

always it must interface with "systems programs," executive control programs resident in the computer which are used for shepherding application programs through the computer, scheduling them, initiating and terminating them, sending commands to input and output peripheral devices such as disc storage, tape drives, printers and terminals, and monitoring the overall performance of the computer system to detect errors or problems in both the hardware and the programs that are being used. These "operating system" programs also perform other "services" for application programs, such as allocating memory space in the computer's main memory and peripheral storage devices, formatting data on magnetic media so it can be properly read and stored, and linking and loading related programs so they can be run at the appropriate time. The application programmer is also assisted by a large library of enabling "systems" software, such as compilers and assemblers, debugging aides, sorting and merging functions, data base management, and library filing and maintenance programs.

As noted above, the operating systems programs and supporting enabling libraries are usually referred to as "systems" software while the "user" programs that perform very specific tasks or functions (such as the processing of payroll checks or the searching of data bases for a specialized purpose) are generally known as "applications" software. Sometimes an application program looks to a programmer very much like a systems program; for example, a communication application would require the skills in machine language possessed by a systems programmers, whereas a general ledger application would not.

Conversely, a general ledger application requires that its programmer have an understanding of the nuances of financial systems that are of no interest to systems programmers. Both applications and systems software can be custom created for a specific function or computer system or installation or they can be standardized ready-to-use programs that can be used by numerous customers who use the same type of computer system and have the same need for a function to be performed. In the latter case they are called "software products." Sometimes, however, a software product must be modified or enhanced to fit the particular computer configuration (the environment of specific types of computer equipment connected to each other and operating under the control of a specific operating system) and/or any unusual requirements or characteristics of the function the program is to perform.

Informatics designs, creates, and installs both systems and applications software which can be custom built or can be a standard software product. This software is produced for a variety of computer systems and applications, although the majority of it is produced for use on computers produced by IBM. This is primarily because IBM is the largest computer systems manufacturer and the majority of computer installations use its machines. The IBM computer market is therefore a large one and provides by far the largest number of potential customers for a software company like Informatics. Since IBM has traditionally (until 1982 when production of the IBM Personal Computer began) made mostly "mainframes" (large-scale computer systems), which are used to simultaneously perform a number of complex, large-volume comprehensive tasks, the vast majority of software work performed by Informatics has been for IBM mainframes used by businesses and government agencies. Recently, however, Informatics has produced software for use by mini and microcomputers. The company has also offered automated information and data processing services based on the software it has produced.(4)

5.3. PROFESSIONAL SERVICES

In the computer services industry, "professional services" refers to software system analysis and design, custom programming, and consulting provided to meet the specific needs of specific customers. Informatics began business by providing professional services and has frequently used this highly profitable and comparatively risk-free line of business to identify and design software products. It has used the know-how and opportunity provided by custom programming contracts to fund the financially risky development, acquisition, and marketing of software products. Informatics specialties in professional services have historically been large-scale real time communication and on-line display applications and applications development services in the area of business management. In its early years, Informatics consulting services involved hardware evaluation for computer systems manufacturers and needs-assessment studies for customers planning to develop and install large-scale or unique computer systems and applications. Unusual examples include conceiving, designing, and implementing the first Control and Reproducibility Monitor in 1965 (a systems program for IBM during 1965 to isolate and reproduce errors in the System/360 operating systems) and, in 1967, performing long-range planning and design studies for the Advanced Naval Tactical Command and Control System for the United States Navy. In the latter contract, Informatics evaluated long-range requirements, performed technology assessment, prepared systems specifications, and produced the implementation plan for the Navy and Marine Corps. By and large, however, most of Informatics professional services efforts have been in the areas of systems design and programming services. Its capabilities in these areas are discussed below.

5.3.1 Real Time Systems

Real-time systems are those computer applications in which data is processed simultaneously as it is created and input into the computer--there is a near instantaneous result or output in response to the input. Such instantaneous response is mandatory when the input comes from and the output goes to another piece of equipment, such as a tracking radar or a high-speed device which the computer is controlling. Informatics was formed in 1962 with a specialization and prior experience (gained by its founders from previous work experience at Ramo-Wooldridge Corporation) in real real time applications when such systems were at the forefront of computer technology. Among the earliest and most pioneering efforts in real time systems performed by Informatics were projects conducted for the United States Navy Pacific Missile Range, the Office of Naval Research of the United States Navy, NASA's Jet Propulsion Laboratory, and IBM Federal Systems Division at NASA's Johnson Space Center.

The epitome of such early real time systems was exemplified by Informatics work with the Pacific Missile Range. This project was obtained from the Navy in early 1963 for the systems design and implementation of a multi-computer radar tracking anti-missile software system. It involved a series of ten geographically separated radar tracking stations on the California coast, each with its own computer. The purpose of the system was to provide the Navy a test environment to simultaneously detect incoming "attack" missiles by continuous input of radar data, perform automatic aircraft vectoring, analyze trajectories, and compute the necessary trajectories and guidance data for "anti-attack"

missiles launched against the flying targets. This system provided the equivalent of a modern warfare shooting range for the purpose of developing an anti-missile defense system with many times greater accuracy and speed than the then current defense system for the Navy.

Also performed for the Navy (Office of Naval Research) under subcontract to General Instruments Corporation was Informatics efforts on the Sonar Array Subsystem (SASS), better known as Project Honey, starting in August 1963. Informatics performed software system design, programming, and implementation for a computerized real time sonar detection and mapping system installed aboard a naval research ship for the purpose of automatically generating maps of the ocean floor for submarine warfare intelligence use. Company personnel were responsible for installing the system and field testing it while on cruise with the Navy.

During 1964 Informatics became subcontractor to IBM Federal Systems Division to provide programming services to NASA's Johnson Space Center near Houston, Texas. In this capacity the company was responsible for mission control programming efforts in support of the Gemini and Apollo space missions in the area of computer control for launch abort, orbit, rendezvous and re-entry spacecraft procedures. Additional aerospace projects were performed for NASA at the Jet Propulsion Laboratory in Pasadena, California, where Informatics provided real time systems design and programming services in support of the Viking, Pioneer F and Mariner satellite missions. These projects were performed continuously since 1966 and included the Viking Computer Command Subsystem (CSS) Test Program to provide hardware test and system checkout for the Viking satellite; the Deep Space Net (DSN) Simulation System Program to provide real time simulation of a deep space station and training support for the 1971 Mariner Mars mission and Pioneer F missions; the Telemetry and Command Multiple-Mission software package to provide telemetry (satellite communications) data handling for Pioneer F space missions performed for scientific information gathering beyond the orbit of Mars; the Mariner Viking Mars (MVM) '73 COMGEN Program in support of the Mariner 1969, 1971, and 1973 space missions; and the Viking Spacecraft Data Systems Simulation Study to develop requirements for a software system to generate and evaluate command sequences for the Viking spacecraft data system.

Other advanced real time systems were designed and installed by Informatics for the United States Army as subcontractor to Litton Industries for the TACFIRE project and for the NASA Ames Research Center. The TACFIRE project, performed in 1968, involved the development of software for a mobile minicomputer-controlled field artillery system which provided field commanders a system to expedite decisions in planning and executing artillery missions, perform automated artillery calculations, and transmit target intelligence and messages using digital and voice communications. Work for Ames Research Center has involved real time systems in support of the world's largest complex of wind tunnels for aeronautical research and to control a large airborne telescope for unique astronomical observations.(5)

5.3.2 Display and Inquiry Systems

This technology comprises terminal-oriented data processing applications, usually called "on-line, in which users communicate directly with the computers

by entering data at a keyboard, causing the computer to display responses to the user on a cathode-ray tube (CRT), a television-type device. Such on-line systems by their nature are also real time systems since the user expects and does receive an immediate response. But they have a technology all their own which is required to achieve the optimal results from man-machine interaction, and, in business data processing, to handle immediately all the consequences of each transaction as it occurs (as described in Section 5.6.5).

Microcomputers of the 1980's have made on-line computing commonplace and have formed the general public's current notion of computers and data processing as on-line systems. But in the early 1960's on-line systems were state-of-the-art applications and considered in the forefront of developing computer technology. Informatics was one of the earliest pioneers in developing and perfecting on-line and man-machine interface computer software systems, helping to develop the "menus" so common in today's microcomputers. This work was performed using the first display systems available and involved designing the conventions by which users and computers would communicate with each other. Eventually, Informatics work in providing custom systems design and programming for on-line systems would lead to the development of software products for the implementation of on-line displays for applications for the full range of large-scale, mini- and microcomputers.

Advanced and pioneering on-line display and inquiry systems were designed, programmed, and implemented by Informatics for the National Military Command System Support Center (NMCSSC), the United States Air Force's Rome Air Development Center (RADC), the Strategic Air Command (SAC), the United States Army's Surveillance Research Laboratory, and the U.S. State Department. Informatics on-line systems efforts began with NMCSSC in 1963. The NMCSSC was the highest ranking military data processing installation reporting directly to the Joint Chiefs of Staff of the combined armed services, the Secretary of Defense, and the President. The purpose of the center was to provide up-to-the-minute status reporting pertaining to military manpower requirements, equipment and resources, troop movements, and damage assessment.

The precursor agency to NMCSSC was the Department of Defense Damage Assessment Center (DODDAC), established to record and monitor potential damage resulting from a nuclear attack. For it, some of the country's earliest work in important applications using on-line systems was done at Ramo-Wooldridge in the period 1958-1962. While at Ramo-Wooldridge, Bauer and his colleagues were responsible for systems design, programming and implementation of the DODDAC computer system. This experience enabled Informatics to obtain several major contracts with NMCSSC beginning in 1963 to provide on-line display real time inquiry to permit NMCSSC to interrogate subordinate computer reporting and control systems for the separate military branches and immediately retrieve required information. This system involved the use of the Bunker-Ramo BR-85 display terminal to respond to inquiries via its keyboard. Initially intended only for experimental use in an information retrieval system originally designed for card input and printer output, the BR-85 display system rapidly replaced cards and printers and became the primary input device for the military data base inquiries and system control data entries of that era.

Beginning in 1963, Informatics undertook contracts for RADC on projects for a Display Oriented Compiler Usage System (DOCUS), an Integrated Image Processing

System (INTIPS), and a system for the Mobile Wing Reconnaissance Technical Squadron (MWRTS). Initially called DOTS, DOCUS was conceived and developed by Werner Frank. It demonstrated a methodology for computer users to solve day-to-day problems in an on-line environment by compiling various predetermined computer programs at the display terminal. Informatics treated the terminals "as general purpose stored program computers and demonstrated that language and procedures for their use can transcend specific hardware" by developing a display procedure language. This approach was unique in that it was based on generality. The various elements which comprise the heart of the system were "fundamentally independent of a particular display/query console or computer" and user friendly by allowing users to "extend and modify the program without recourse to professional programmers" by direct inputs at the terminal. This effort allowed Informatics Eastern Operations to conceive and design the DISPLAYALL software product during 1969 which provided easy implementation of on-line displays systems for large-scale computers. This is an example of technology that originated in Informatics. But it was too early for commercial exploitation; the technology developed here did not become widespread until many years later, when IBM popularized it with its first Display Management System.

On the INTIPS project Informatics designed and implemented the executive control program for a large-scale integrated multiple-computer surveillance information and image processing system. MWRTS was an airborne portable in-the-field computer system designed and implemented by Informatics in support of field reconnaissance and photo interpretation activities. INTIPS and MWRTS were the first efforts to automate military photo interpretation operations to speed up the processing and analysis of surveillance imagery. These systems allowed photo interpreters to automatically retrieve, classify, and store past and current photographic images and information from numerous reconnaissance flights for purposes of comparison to identify "enemy" movements and operations. Informatics also designed and installed a Visual Analysis Subsystem which provided on-line information retrieval, surveillance analysis, and file maintenance for the Strategic Air Command of the Air Force during 1965. This was a user-oriented system which permitted users to enter commands in English-like terminology, allowing them to update and store specific systems displays as required.

For the United States Army Personnel Research Office and Surveillance Laboratory, Informatics designed and implemented, in 1965, on-line display systems for ergonomic studies of display use, one of the earliest efforts at making a computer "user-friendly." Informatics also designed, programmed, and implemented an Automated Inquiry System for the United States State Department. Work on this project began in 1965 and involved developing an international on-line query system permitting United States consulates and embassies throughout the world to retrieve necessary passport and visa information on individuals. This project involved developing interfaces for worldwide telecommunications and establishing a large data base stored on disc files.(6)

Throughout the years Informatics has continued its on-line development work not just by producing software products that permit implementation of on-line display systems, but also by producing other products and services that are based on on-line displays and inquiry systems. The majority of systems created by Informatics Information Services, discussed in Section 5.5, involve on-line information data bases that permit users of information services to search and

retrieve needed information. Informatics Software Products has developed on-line versions of batch-oriented file maintenance software products, such as MARK IV, and more on-line oriented products such as MARK V, TRANS IV, INQUIRY/IMS and Answer/DB. Another illustration of the evolution of on-line technology was the development of MINI MARC (described in Section 11.6.3). In the latter case, Informatics while providing professional services for NSAS's Goddard library, saw the need for a small computer system to improve productivity in the acquisition and cataloging of books, and developed and marketed a solution to the problem.

5.3.3 Financial Systems

In 1967 Informatics was selected by Dean Witter and Company to design and install a complete automated back-office brokerage house accounting system. The functions of the system included communications with branch offices, processing of stock purchases and sales transactions, computation of stock margins, maintenance of security records, and generation of dividend statements and fail notices. The back-office system was able to route buy or sell stock transactions to the floors of both the New York and American Stock Exchanges, route them back after execution, compute commissions, taxes, fees, and costs of the trade, and send confirmation to the customer while recording data for the exchange clearing houses and preparing daily reports on trading activity for the whole company and its branches. Later, under a marketing arrangement with Dean Witter, the software was offered for sale for a price of \$750,000 under the name of SECURITIES IV for installation on the larger IBM System 360 computers at other brokerage houses. Three modules or major subsystems of the back-office accounting system--the margin system, the stock record system, and the fail system--were also offered separately. Though several brokerage firms seriously considered purchase, none did so, and the offering was withdrawn.(7)

Informatics has also performed professional services for both major stock exchanges. For the American Stock Exchange (ASE), the company developed 50 programs on a GE 415 computer for a fully automated clearing and settlement system for use by the ASE Clearing Corporation and the National Over-The-Counter Clearing Corporation. For the New York Stock Exchange, Informatics designed and programmed a Central Certificate System which was planned to eliminate the need for issuing stock certificates. Both of these projects were undertaken in 1968. Informatics has also provided financial systems to banks. For First National City Bank of New York it developed an international funds transfer system.

5.3.4 Communications Software

In 1964 Informatics entered the communications software market, which by its nature involves real time processing. The company obtained a subcontract with Univac Corporation to design and program communications software for a large-scale computerized communications program being installed for the General Services Administration of the United States Government. The project was performed successfully and rapidly led to an approximately \$500,000 contract with Western Union for the systems design and programming of Western Union's commercial nationwide computerized message-switching and control system to handle Telex, TWX, telegraph and facsimile transmissions.(8)

This successful performance for Western Union allowed Informatics to gain superior expertise in programming computerized data communications systems and firmly established it in the marketplace as a systems designer for such large-scale communications "switches." This reputation led to a number of additional custom designed "message-switching" contracts. In 1967 Informatics obtained a subcontract from RCA, who had the prime contract from the State of California, for the design and implementation for the California Law Enforcement Telecommunications System which provided on-line computer telecommunications among the state's Highway Patrol offices, other local law enforcement agencies, the California Department of Justice, and the Department of Motor Vehicles in Sacramento. It was still operational in 1982.(9)

For the Federal Reserve Bank of New York, Informatics assisted in planning the automation of the Bank's data handling system including the implementation of several large-scale computer systems. Of these the most important was a duplex configuration message-switching system for which Informatics recommended and assisted the bank in procuring Xerox Sigma 5 computers to provide transmission facilities and transaction processing for the Bank's money transfer system, which handled 80 percent of the dollar volume of the U.S. Federal Reserve System. Obviously, this required a highly reliable hardware/software system. The money being transferred had to balance to the penny each day. Hence the system could not tolerate any errors; in particular, lost messages could create chaos in the Nation's banking operations. The system was designed and cut over to routine operation between 1968 and 1970. With evolutionary upgrades in the hardware, the system has functioned with great success up to this writing in 1982. From it was derived the ICS IV Communications Systems, an integrated "turnkey" product, discussed in Sections 5.4.3 and 11.6.2.(10)

"Turnkey" initially referred to a custom designed, programmed, installed, and implemented computer system for a specific application or purpose which was then turned over ready-to-use for the customer to operate. Turnkey systems usually include the selection and supplying of just the right hardware equipment to support the application and always includes training of customer personnel to operate and use the system. Herein we use "integrated turnkey" to mean a hardware and software system which can either be a product or a custom-made system. Informatics has developed and installed a variety of integrated turnkey systems. The first of these was the ICS IV Communications System.

5.4 SOFTWARE PRODUCTS

Informatics was one of the first two computer software companies to sell in any significant quantity standardized computer programs as off-the-shelf products which could meet the common needs of a large number of computer users and potential customers. The company's first software product was MARK IV, which was announced in 1967. Informatics was founded with the intended strategy to develop and sell "proprietary software packages"--products--which could be used in multiple applications and computer installations and thereby sell in volume. So from its beginning, Informatics has always sought out computer software and application needs to identify, design, and produce software products to serve a variety of customers to "fulfill the computer's promise," a slogan that the company used for several years.

Since 1967 Informatics has developed or acquired and marketed a variety of software products, becoming the recognized leader in this field. Most of these products are for large-scale computer systems, particularly for large IBM computers ("mainframes") which are the most prevalent business computers. These are described in detail in Chapter 11. The technology underlying the company's mainframe software products can be divided into four major areas: 1) implementation systems products; 2) file maintenance and information retrieval products; 3) other systems products; and 4) application products.

5.4.1 Implementation Systems Products

Implementation systems products, a name coined by Informatics and used for several years, are those software products designed to aid professional programmers develop computer applications. Today they are commonly called application development systems. They differ from application products which are designed to support a specific function or perform a specific task that a user requires, for example, the processing of payroll, the monitoring of inventory levels, or the preparation of personalized letters for mass mailings.

The first implementation system product that was created by Informatics was MARK IV, which is also a file management and retrieval product. MARK IV is a batch-oriented system which permits the easy generation, updating and maintenance of master files (on any secondary storage supported by the Operating System), and the generation of many types of reports needed by the user. If the "updating" of the files involves extensive processing, MARK IV functions as a true implementation product. On the other hand, if little or no transformation of the data is required, MARK IV functions as an information retrieval and reporting product.

The innovative technology of MARK IV was invented in the early 1960's to bring into practice the (previously) "impossible dream" of making the computer much easier to use, even by non-programmers. The external design involved a set of standardized forms with multiple-choice answers and boxes to check, which enabled either professional programmers or casual computer users to implement quickly file creation, information retrieval, report generation, and data processing applications which otherwise would require tedious, lengthy and error-prone custom programming efforts. The internal architecture of the system of programs which converted these forms into complex computer code was also, in many ways, an innovative technology. Versions of MARK IV including many optional special features have been made available for the IBM 360 family, the RCA Spectra 70, some Univac computers, and, of course, all the computers designed by other companies which would run the programs developed for those original models.

The advantages that MARK IV offered when it was first developed were pointed out by John Postley. As the "father" of MARK IV, he may be forgiven the slight hyperbole in the following, written in 1965:

With Informatics present file management systems (MARK IV and its prototypes), reduction in the elapsed time (from when the problem is conceived in the mind of the manager to when the problem is ready to run on the computer) by 50 or 100:1 is considered average. Reduction of 1000:1 or more under certain

circumstances would not be surprising. Thus, designing in one day an application that might take a week to program is probably a minimal savings, one hour of filling out forms instead of one to three weeks of programming is average, and completing forms in an hour for a problem that might take six months to program is entirely feasible.

The applicability of the generalized file management concept to the preparation of reports and analyses is increasingly evident. Independent of the type of data in any particular application, such systems can provide listings, quantity and dollar totals by category, extensions, and an almost unlimited variety of summaries and analyses for operation and management use. Management can use these systems directly without becoming programmers themselves. Informatics six years of experience in developing and using generalized file management systems now makes computers a truly effective management tool.(11)

Everything that Postley says above is true--but only for very simple applications. In order for MARK IV to be effective in developing complex systems, it required the skill of a professional MARK IV programmer--which Informatics was happy to supply, and out of which grew profitable professional services business. Nevertheless, the ease of use of MARK IV by noncomputing professionals, the available special features, the rapidity with which new user applications can be implemented on the computer by skilled professional MARK IV programmers, and the popularity of IBM System/360 and System 370 computers has made MARK IV, by 1982, the largest selling (by other than IBM) large-scale system software product in the world with over 2,500 installations to that time.

During the 1970's Informatics developed special features for MARK IV which allowed systems to be implemented on-line without manual completion of forms but with the end result being batch-oriented applications. Late in 1981 the company made the long-expected announcement of MARK V, an implementation system product for applications oriented to on-line transaction processing. Initially it was available only for development in a batch mode for on-line systems in the environment of IMS, IBM's data base management and data communications system. Later versions were to provide on-line development for IMS applications and for applications to run under CICS, IBM's other data communications system.

Other implementation systems products of Informatics, at various times in its history, include DISPLAYALL, CL*IV, SERIES IV, TRANS IV, and TAPS. DISPLAYALL was developed in 1968 to permit the design and implementation of custom displays for specific on-line applications. It was designed for use in large-scale systems. CL*IV, acquired in 1972, was a COBOL preprocessor product which produced programs written in COBOL for subsequent compiling. SERIES IV was acquired in 1978. It permitted the implementation of very sophisticated data input systems on the Digital Equipment Corporation PDP/11 series of computers. TRANS IV was acquired by the company in 1978 to provide a temporary product offering until MARK V was ready to permit on-line implementation of on-line applications in a CICS environment. TAPS was acquired in 1980 and permits the implementation of on-line systems for mini and microcomputers, as well as the 360. Over the years, some products which were failures in the marketplace

because of shrinking markets and/or technological obsolescence were discontinued; for example, DISPLAYALL, CL*IV, and SERIES IV.

5.4.2 Information Retrieval And Reporting Products

Information retrieval and reporting software products (which usually have some file management capability) are those which help the user (who is frequently not a professional programmer) in the creation, updating, storage, and especially retrieval of specific information from computer data files. MARK IV, discussed above, when used simply, falls into this category. (When its full potential is used, it is an implementation systems product.) Answer/2 and Answer/DB, derived from MARK IV, and INQUIRY IV/IMS, are file management and information retrieval and reporting products which are designed to be even easier to use than MARK IV for certain applications in certain computer operating environments.

MARK IV and its descendants work with structured files. But much information is expressed in the unstructured text of natural language. Informatics was one of the leaders in the technology of handling such information in the computer. For this purpose it has developed RECON IV, a very sophisticated system for data base creation, updating and on-line search and retrieval, for data which is expressed in natural language (e.g., English). RECON IV was developed by Informatics Information Systems and Services between 1968-1970, based on a previous simpler version, for use by NASA in its Scientific Technical Information Facility, which was operated by Informatics. It has been used by the company to implement and maintain large data bases and information clearinghouse services such as TOXLINE, ENVIRON, and POPINFORM. In 1973 Informatics began offering RECON IV as a proprietary product to support data base management and inquiry. It provided the foundation for and is an indispensable tool for the company's very profitable litigation information management services business. The technology encompasses not only RECON IV and its use, but the intellectual skills necessary to design the data base, and the management techniques involved in physically handling and organizing very large numbers of source documents.

5.4.3 Communications Systems Products

Informatics first product in the area of communications was a hybrid, basically an application product and yet largely composed of what most programmers would call systems programs. As discussed in Section 5.3.4, based on its prior custom services work for the General Services Administration and Western Union, Informatics, during 1969, designed and developed the ICS IV/500 communications system which included both hardware and software for computerized message switching. This was a large-scale communications system that had the capacity to perform, in real time, applications processing on the data being transmitted. It was initially developed as a custom system for the Federal Reserve Bank of New York, and subsequently was sold as a product to Dun & Bradstreet, General Foods, Japan National Railroad, and KDD, the Japanese communications organization. These were all highly successful installations. The ICS IV was the "Rolls Royce" of message switching, and priced accordingly. So there were very few potential customers.

Competition was fierce from under-priced systems on the emerging minicomputers. Most of these competitors eventually were unprofitable and disappeared, but in 1971 Informatics believed it was necessary to match their offerings. So in early 1972 Informatics obtained a \$165,000 contract from Bankers Trust Company for message switching for an automated money transfer system on the ICS IV/250, which was to be a minicomputer version of the ICS IV/500, to "provide the controlled entry and recording of domestic and foreign transfers, confidence in the timely processing of the transactions, and accurate reporting of position and status for customer or management inquiry purposes." But later when the Bank got around to specifying the load on the system, it would have to handle 600,000 domestic and one million foreign currency transfer transactions, each requiring extensive processing in real time. Such a load required major upgrading of the initial hardware. The Bank refused to fund such expenses and the project was abandoned. By now it had become evident that the market for message-switching systems was far smaller than initially estimated, so Informatics withdrew from that business after several years of profitable operations.(12)

When the ICS IV was used to communicate with an IBM 360-type computer, the latter needed a very sophisticated program called a "communications monitor." In the early 1970's, IBM did not supply one with the proper characteristics. The best available was INTERCOMM, supplied by Programming Methods Inc. (PMI), so the company acquired a marketing license from PMI, but never sold one. Ironically, in 1975 Informatics acquired Programming Methods, Inc., and thus obtained full title, not only to INTERCOMM, but also to BETACOMM and MINICOMM. BETACOMM and MINICOMM were separate computerized communications monitor products created for smaller size 360 systems and operating system environments. After several years of marginal market performance, Informatics divested itself of these products and left the communications market in late 1978.(13)

5.4.4 Application Software Products

Application products are those that are uniquely designed to perform a particular function or task (an "application") required by the computer user. Informatics has developed a variety of application products particularly in the areas of accounting and life insurance.

Informatics first venture into applications software products was in 1973 when it acquired from PRAXA two programs to process accounts receivable and accounts payable, which were written in MARK IV for use in a service bureau. It was necessary to completely reprogram them for sale as software products. They were sold to MARK IV users during the early 1970's, but were not very popular. The MARK IV accounting products have since been discontinued. One MARK IV application had a modest success. Initially it was an unsuccessful joint venture with SD.A. Leisdesdorf, a large public accounting firm, and was called AUDITALL. It was to provide support to the auditors of business financial records. Later it was reprogrammed by Informatics and sold profitably.(14)

Informatics acquired its first major accounting application product, a General Ledger system, from Asystance, Inc. in 1973. Originally written in PL/1 for a textile manufacturing company, Informatics converted it to COBOL. In 1975 Accounts Payable and Accounts Receivable systems were purchased from Computer Applied Systems Company. The company improved and enhanced these packages and

developed all three into a product line known as ACCOUNTING IV. ACCOUNTING IV was sold for several years until its reputation was destroyed by the release to customers of a new version which had not been properly tested. The product line was sold in 1981.

An area of application product technology in which Informatics has been a leader is life insurance home office processing. IBM had dominated this market with its CFO product during the era of its 1400 series computers. For the IBM 360 computer IBM developed ALIS, which was not too successful. Hence, most life insurance companies were using unsatisfactory IBM 360 versions of CFO. Equimatics, the joint venture between Informatics and The Equitable, had products that were enhancements for CFO. Most important was ISSUE-COMM which permitted on-line individual insurance policy updating and maintenance, and subsequent batch calculation and billing of premiums due.

In 1973 Equimatics embarked upon a bold software product design effort to create LIFE-COMM. This was a modular, highly advanced life insurance software product which provided all the processing functions needed by a life insurance business. It would provide on-line terminals, direct access storage, and an integrated data base for multiple users. The system was developed over a two year period with \$1,500,000 sponsorship from eight customers, and ultimately, approximately \$2,500,000 additional investment from Equimatics. Offered to the market in 1975, LIFE-COMM rapidly became the leading life insurance processing software product. Full systems cost over \$400,000 for the product and about as much for assistance in installation. It has produced substantial profits and has served as a basis for Informatics offering remote timesharing data services to insurance companies who were too small to purchase the entire system.(15)

Other products for life insurance companies are the Mortgage Loan System and the Stock and Bond System. Mortgage Loan is an application product that allows an insurance business to control and monitor its various loan and mortgage investments, including the processing and generation of billing. Stock and Bond is a portfolio management system for the control and processing of the insurance company's securities investments. Both produce the reports in the standard forms required by numerous regulatory agencies.

Besides the major application products mentioned above, Informatics has developed or acquired other application products; for example, PRODUCTION IV, MINI MARC, and CSS, the Corporate Shareholder System. PRODUCTION IV was acquired in 1972 from Parsons & Williams, a Danish firm which had originally designed and marketed this product in Europe. PRODUCTION IV is a comprehensive, integrated and modular production control software product for use in manufacturing. Its various modules provide automation of functions related to master scheduling, resource planning, capacity allocation, material planning, inventory management, purchasing, shop scheduling and control, cost control, and manufacturing data control. Designed to operate on IBM System/360 and larger computers, PRODUCTION IV could be sold as separate modules for the performance of specific functions or in its entirety, as an integrated system. Informatics updated the product for offering to the American manufacturing marketplace. It sold a number of systems, but the market grew too slowly to finance the modernization of the program necessary for the 1980's. So it was phased out as a fully-supported offering. Informatics, however, still continues to support PRODUCTION IV in terms of software maintenance and consulting services. The

customers have funded many modernizing enhancements. As a result, in 1982 there was a small but steady rate of sales of unsupported product modules.(16)

MINI MARC was developed in 1975 to enable a librarian to easily generate customized catalog cards. It ran on an inexpensive minicomputer. Input was the Library of Congress data about new publications, in their "MARC" format, on a floppy disc. The cataloger used a CRT to construct from these MARC records the exact form of catalog cards that his library needed. These were output on a disc and printed on cards or catalog listings.

In 1975 when Informatics acquired PMI, it acquired a license to sell an application product, the Corporate Shareholder System (CSS). It is a fully automated system which provides complete control of all stockholder accounting functions. CSS is used to maintain shareholder records by banks which perform the function of registrar and/or transfer agent for corporations with public shareholders. It is also used by the data processing departments of those corporations which perform these functions themselves. It turned out to be highly successful; has been installed by more than 100 banks and corporations, and by 1982 had been used to process the stockholder records of more than 2,000 major companies.

5.5 INFORMATION SERVICES

Information services is that part of Informatics business devoted to the collection, description, processing, organization, storage retrieval, dissemination, and general management of information about specific subjects which is required by researchers and government professional and commercial organizations. In its simplest form, it is data base management--the organization, maintenance, and storage and retrieval of various records or data which are related to a given field. Computers may or may not be used, as appropriate. However, Informatics provides services beyond data base management. It offers a full spectrum of information resources management--not only to assist them in retrieval of specific information through on-line searches, the generation of indexes and abstracts of stored information but also systems design, OCR scanning, photocomposition, micrographic, and other services to disseminate this information to users through on-line terminals, printed matter or microfiche. When appropriate, Informatics provides information facilities management services to collect, process, and distribute the information on behalf of the customer at the customer's site.

Informatics entered the information services business in 1968 when, in a joint venture with Information Dynamics Inc., it won a facilities management contact to operate NASA's Technical and Scientific Information Facility. From this simple beginning, there developed a wide range of expertise and capability leading to numerous prestigious contacts and several new markets. The company's technological capability in information services can be divided into three general service areas which are often combined together for the performance of specific projects. These are information facilities management, data base design and management, and information dissemination.

5.5.1 Information Facilities Management

Information facilities management is simply the service of managing and operating the customer's information processing equipment and facilities at the customer's site. This is in contrast to turnkey systems where computer systems are designed and installed and then turned over, ready-to-use, to the customer to operate by itself with its own staff. Information facilities management may or may not include the development of new applications, but has the benefit of providing the customer with the expertise of professional information scientists, programmers, and equipment operators without the overhead and expense of recruiting and training them or managing the information processing operations.

Informatics acquired its first information facilities management contract in 1968 when NASA held a competition to select a contractor to manage its Scientific and Technical Information Facility (NASA STIF) in College Park, Maryland. NASA STIF serves as a reference center for collecting, indexing, abstracting, and disseminating literature on space technology and related subjects for use by NASA and its contractors. Informatics role with NASA STIF included the design of an on-line bibliographic data base, computer-assisted abstracting of literature, implementation of an on-line reference and retrieval service, and the distribution of requested indexes, abstracts, bibliographies, and reprints of literature in hard copy and microfiche. Provision of these services requires expertise in library science, computer technology, photocomposition, and micrographics.

Informatics successful performance for NASA STIF has led to other information facilities management contracts involving both information management services and data processing services. In the information management area, the company has operated information clearinghouse systems on alcohol treatment centers for the National Institute of Alcohol Abuse and Alcoholism and on Family Planning Centers for the Department of Health and Human Resources. In information clearinghouse services, Informatics usually maintains, updates, and manages a computer data base for a government agency, which is made available to users via printed periodicals, monographs, etc., or via telecommunications. In the latter case, the subscription pays for the installation of an on-line terminal and the assigning of passwords, instructions, and training to permit the user to access and use the data base. The user is also charged for actual computer time and telephone charges while using the system. On some occasions Informatics has assumed responsibility for marketing the system to users and providing training for its use as necessary.(17)

5.5.2 Data Base Design and Management

Informatics has designed and implemented on-line data bases in the areas of space research, population research, environmental control, and medical research and services. The more significant data bases designed and implemented by Informatics have included:

1. NASA STIF: Performed for the National Aeronautical and Space Administration between 1968 and 1978 to manage an on-line data base of technical literature on space exploration and research involving 20 million records, 800,000 journal articles, 75,000 additional titles per year, and 12,000 searches and requests for information per month.

2. POPINFORM: Performed for the United States Department of Agriculture beginning in 1970 to provide on-line data on worldwide population research.
3. TOXLINE: Performed for the United States National Library of Medicine between 1971 and 1973 to implement and manage an on-line data base containing 200,000 abstracts on pesticides, toxicity studies, poisons, adverse drug reactions, environmental pollutants, and biochemicals for subscription use by the general public.
4. ENVIRON: Performed for the United States Environmental Protection Agency beginning in 1972 to provide storage and retrieval in 225 subject categories in the areas of EPA research projects, water quality monitoring, oil and hazardous materials, noise levels and effects, and pollutants.
5. EXCERPTA MEDICA: A commercial on-line data base collection and retrieval service offered to the public in 1973 and discontinued in 1975 to provide international medical bibliographic references to the medical profession and industry, based upon the hard copy international bibliographic reference Excerpta Medica.
6. NATIONAL CANCER RESEARCH DATA BANK: Performed for the National Cancer Institute to collect data and implement a data base on worldwide cancer research to provide a catalog of NCI systems and services, the directory of individuals and organizations offering research and treatment, the international register of tumor immunotherapy, and to publish progress reports of cancer research and its results.

In 1975 the company applied this technology to the private sector. It designed and built a data base of the documents pertinent to anti-trust and product liability litigation for the Petroleum Research Group, which was composed of lawyers representing a number of major oil companies. Out of this effort grew a highly profitable business in litigation information management where Informatics is the dominant company, supporting litigators in lawsuits which involve large quantities of documents. Though it is not properly called a "technology," Informatics has developed unique management techniques for rapidly mobilizing, for each lawsuit, large temporary staffs of para-professionals to build such data bases in time to be useful by trial date. Out of this has grown another business in the legal field, the supplying of turnkey systems for automated management of the administrative and operational aspects of law offices.

To support the development and management of these data bases, Informatics has developed its own proprietary software for the creation and retrieval of information from them. These software products include RECON IV which provides on-line search and retrieval based upon user specified index terms and phrases, and its two supporting products, STIMS IV which permits data base implementation by batch methods, and ITSO IV which helps to manage the data base on-line.

5.5.3 Information Dissemination

This is another type of business that grew out of the technology developed at NASA STIF. In addition to designing and implementing specific data bases, Informatics also provides the processing and distribution of information generated from or stored in these data bases. This has generally occurred in two ways. One is microform publishing, or the production of stored computer data, whether it be catalog information or articles, books or reports, on computer-output microform (COM). The other way is electronic photocomposition.

COM permits the low-cost duplication and storage of printed material and reports created by the computer. It allows easy mail distribution of the information since it has been reduced to the size of 4" X 6" pieces of film each containing between 98 and 297 pages of information. COM is usually created by the display of computerized information on an on-line cathode ray tube which is filmed in rapid sequence by a microfilm recorder. The original filmed and processed microfiche can be quickly and cheaply duplicated via diazo reproduction methods.

Informatics also offers automated electronic photocomposition services to prepare stored information for hard-copy printing. The company gained this capability in 1973 when it acquired exclusive licensing rights to CS IV, a photocomposition software product developed by Autocomp, Inc. It provides full page, camera-ready output. The process is especially well suited for printing loose-leaf publications which are frequently revised and updated, such as tax reference handbooks and parts catalogs. This has developed into a highly profitable business.

5.6 DATA SERVICES

Data services refers to the providing of data processing performed for customer applications by Informatics on its own computers, generally on a remote-access basis. This is to be distinguished from data center facility management where the company operates computers on the customer's site. In the latter area, Informatics has operated government-owned computer centers for NASA's Jet Propulsion Laboratory and for its Ames Research Center, as well as at NASA STIF. It has also operated large commercial data centers owned by United Airlines and American President Lines.

Normally, Informatics offers various applications, which are available on its own machines, to customers who cannot afford to buy their own computer system or chose not to design their own custom application. This is a less expensive means of acquiring automated functions and meeting data processing needs for many customers whose total volume of data processing requirements may not warrant the purchase of their own computer and the development of in-house programming expertise or who prefer not to install certain programs on their in-house machine. This business originally was done "over-the-counter"; that is, the customers input data and output results were carried to and from a local service bureau, where the processing was done in batch mode. Today, access to Informatics computers is gained through terminals, installed at the customer's own site that are connected by telephone lines to Informatics data processing facilities. A customer can use Informatics computer to run and process a

customized application of its own or select one of Informatics proprietary services or products to use, such as MARK IV or DISTRIBUTION IV, or software products from other suppliers which Informatics is licensed to resell. If the customer does not supply his own software, he is usually charged for the use of that supplied by Informatics.

5.6.1 Initial Efforts

Informatics always planned to be a full service supplier in the computer services industry, which would include supplying data services. In 1965 it acquired CPM Systems, which provided over-the-counter batch data services to the construction industry. In 1967 it developed and marketed MACS, which provided remote batch data services to advertising agencies. Both failed in the marketplace.

In the middle 1960's a large number of companies were started up to provide "timesharing," as remote problem solving was then known. Informatics cast envious eyes on this area of business, but was deterred from rushing into it because it was so capital-intensive. Very large amounts of cash had to be put at risk to establish and operate a computer center, a communications network, and a field force of salesmen and customer support engineers. It could be many years before positive cash flow could be achieved. So Informatics prudently refrained from starting up a time-sharing business. The wisdom of this decision was confirmed when most of the timesharing start-ups found themselves undercapitalized and went out of business, losing all their investment in the recession of 1969-1971.

In about 1968 Informatics reasoned (incorrectly) that the market of the future lay in remote transaction processing for small business. But the company had no experience marketing to such customers. How could it gain such experience and "boot-strap" its way into such data services business? After considerable study, management conceived a way for the company to "have its cake and eat it." Informatics stock was selling at unprecedented highs. The company decided to use this stock (at values probably higher than it could be sold in a public offering by a reputable underwriter) to buy from The Rucker Company three small batch service bureaus in California, and from The Interpublic Group, a 70 percent interest in Dataplan, a larger batch service bureau in New York City, which did all the processing for Interpublic. The board of Directors approved the plan, with Irwin Tomash expressing some misgivings.

Thus by 1969 Informatics was in the data services business. The strategy was to 1) fully understand the market, 2) build the cash flow to respectable levels, and 3) use that cash flow and Informatics communications technology to convert the customer base, first to remote batch services and then finally to on-line transaction processing.

The strategy had one fatal flaw. Technology could not cope with the effects on revenues of a recession. The prices to the small businessman were based on units of service; e.g., so much per report. When the recession hit the customer, he immediately cut down on his output. Moreover, the many customers within Interpublic resented the loss of control over their data center, and major disputes about payments arose. The aggregate result was a massive reduction in revenues. Though heroic technological efforts were successful to

implement major improvements in operating efficiencies, costs could not be reduced proportionally to revenues. The result was catastrophic negative cash flow. Informatics management prudently decided to shut down the business as cheaply as possible. The investment in Dataplan was sold back to Interpublic (as settlement of a suit for rescission brought by Informatics), and the customer contracts of the other data centers were sold to competitors.

Meantime, the company had an opportunity to leap ahead into a very sophisticated on-line transaction processing data service. As described in more detail in Section 4.4.2, Informatics was sought out to supply its computer communications and on-line technology to a start-up company, in the field of airline reservations for travel agents, Atar Computer Systems, Inc. (AtarCSI). Through a series of investments and options, it eventually had the opportunity to control that company and assigned Frank Wagner as its president. After a very successful marketing effort to the airlines and travel agents, AtarCSI developed the system. But the Civil Aeronautics Board would not approve AtarCSI's contract with the airlines, and the company ceased to operate at the end of 1970. Thus, by January 1, 1971, Informatics, sadder and wiser, was out of the data services business.

5.6.2 The Second Effort

Informatics re-entered the data services business in earnest in 1971 when it jointly formed Equimatics, Inc., with The Equitable Life Assurance Society of the United States. Equimatics established computing facilities in Fairfield, New Jersey, and set up a regional time-sharing network to provide remote processing for Equitable offices in the New York metropolitan area. This system was established around an IBM System/370 Model 145 with a virtual machine operating system which permitted the emulation of multiple computing systems. In essence, this time-shared internal memory of the computer among the various users and allowed each one to seem to have a personal IBM System/370 complete with operating system and associated software. Subsequently, Equimatics acquired United Systems International which operated two small batch data centers in the Dallas/Fort Worth area, serving life insurance companies in that metropolitan area.

In 1974 Informatics was acquired by The Equitable, and Equimatics and Informatics were merged. With this change the Fairfield network was expanded to a nationwide basis and began offering general purpose remote computing services to customers outside the insurance industry. The network was further expanded in 1977 with the acquisition of Management Horizons Data Services of Columbus, Ohio, which provided computing services, using proprietary software called DISTRIBUTION IV, to wholesale distributors throughout the U.S. and Canada. Generally, the data services offered by Informatics Data Services Group can be divided into two forms: a) remote batch processing systems, and b) on-line timesharing systems. Both use a terminal installed at the customer's site. The difference between the two types of services is how soon processing takes place after the data is input, and how quickly the results of processing are delivered to the customer. Both technologies are described below, following an introductory section on the technology from which they evolved.

5.6.3 Over-the-Counter Batch Processing

The earliest way of providing data services was to set up a central processing facility within easy physical delivery range of the customers. The data was delivered to this computer center like garments for dry cleaning, "over-the-counter," processed according to whatever priority the customer was willing to pay for (usually on a first come, first served basis). Then after a lapse of a day or many days, it was redelivered to the customer over-the-counter. Of course, couriers were frequently supplied to pick up and deliver to the customer's site. As computer-communications technology gradually evolved, it became practical to use telephone lines instead of couriers, and provide on the customer's premises a card-reader for input and a printer for output. Obviously, this permitted customers to be at much greater distances from the data center.

5.6.4 Remote Batch Processing

Remote batch processing refers to the collecting of batches of data required for a specific application, inputting the batched data into the computer over a communications line, waiting for the computer to process this data in its turn with other applications also waiting to be processed, and receiving the required reports, updated files, or information after a lapse of time (which can be a few seconds or overnight). After the input of the data, no further input for that batch can be made until the computer is finished with its task. Thus if a customer discovered an incorrect piece of data after the input step, he would either have to abort the processing of the data entirely or wait until the processing was finished before correcting the mistake, and reinput a new batch of data for reprocessing. Batch processing normally takes longer than on-line transaction processing, described in Section 5.6.5. But it is far less expensive and is especially useful for those applications where processed results are not needed immediately, the task being performed is repetitive, and inquiry to the computer with immediate response is not necessary. Such applications may involve the updating of files, the printing of invoices, the creation of payroll checks, or the generation of periodic reports.

Informatics has offered remote batch services for all data processing applications commonly required by business. MARK IV is sometimes used to allow customers to design and implement their specialized applications.

5.6.6 On-Line Transaction Processing

On-line transaction processing is that technology in which the customer uses an application program that allows him to process data for each transaction as it is being input, and if appropriate, receive output immediately. The "transaction" can be a simple inquiry of the system (not requiring transformation of the data or files), which produces an almost immediate answer or report, or the transaction can require extensive processing. On-line systems permit direct communication between the user and the computer whereby both can ask for and receive required information. They are used for applications where a response or processed report is needed quickly and/or where there is great variation in the individual requests or tasks required by the user for the system to perform. On-line systems are usually used in conjunction with information data bases to provide rapid updating, search, and retrieval of specific information required by the user. On-line services cost significantly more than batch services, since the required task cannot be delayed or performed overnight during off hours.

Among the most used and significant on-line services offered by Informatics Data Services Group are order entry and distribution processing provided to wholesale distributors through the use of DISTRIBUTION IV, and a complete data processing service to apparel manufacturers. An interesting outgrowth of this technology, coupled with technology developed in a previous study (which provided the design of a system called PUBNET for a major publisher), is the ORDERNET system. It allows wholesalers to generate and place orders for goods directly to various industry manufacturers and at the same time specify the required distribution and delivery of these goods to various warehouse points throughout the nation. This reduces both the wholesalers and manufacturer's costs, and reduces delivery time for goods to reach their destination. The offering of ORDERNET began in 1980 and has grown steadily since.(18)

5.6.6 Hybrid Applications

Many data services applications use all technologies described above. One such large application was Medicare claims processing for The Equitable which performed this function for various states. Some of the input was handled on a remote batch basis, and some was done via on-line timesharing. Processing was done as remote batch but the checks were printed at Informatics facility (under strict financial control) and delivered by courier, just as the old-fashioned over-the-counter batch method used to handle the output.

Another illustration of a hybrid (technologically speaking) application was life insurance policy management using LIFE-COMM. The basic file maintenance, and many of the functions required for life insurance administration were done in the remote batch mode. However, the issuance of a new policy and several other functions were done in the on-line timesharing mode.

5.7 PRELUDE TO THE MICROCOMPUTER

For the major part of its history, Informatics has been involved with software technologies for the large computer, commonly called the "mainframe." From the foundation of Informatics in 1962 through the late 1970's, the mainframe totally dominated the market for computer services. In fact, products and services to support IBM mainframes alone probably represented 80 percent of the market. Among all users, however, beginning in the very early 1970's, the minicomputer began to assume significant importance. And by the late 1970's, it was becoming apparent that the microcomputer would be of tremendous importance during the 1980's and beyond. Definitions of these classes of computers are frequently expressed in terms of selling price, or for the more technically inclined, in terms of computing power, both moving targets. However, for the layman, a somewhat facetious, but illuminating definition might be the following:

Mainframe--has a central processing unit which probably cannot be lifted by two strong men.

Minicomputer--has a central processing unit which probably can be lifted by two hands.

Microcomputer--has a central processing unit which can be lifted by two fingers.

As the power of the microcomputer began to exceed the power of the mainframes of only a decade before, Informatics began to take more and more interest in the marketplace for products which did not involve the mainframe, since it appeared possible that a very large market for such products might evolve. Because of their increasingly lower prices, it did not appear that purchasers of microcomputers (or to any great extent minicomputers) would provide very much of a market for services. In the 1960's, however, Informatics occasionally provided services involving what were then the beginnings of the minicomputer era. Some work was done on the Bendix G15, the SDS 910, the CDC 160, and a number of experimental computers built for the military by RCA, Litton and several other manufacturers. Perhaps the most advanced of these was a part of the TACFIRE project for Litton, which developed and delivered to the U.S. Army an artillery fire-control system based on a portable minicomputer.

5.7.1 The Minicomputer Era

Informatics first involvement of a serious nature with the minicomputer was the development of the ICS IV/250, an integrated hardware-software product to provide digital message-switching. By an ingenious development of some special-purpose hardware, it enabled a PDP-11 16-bit minicomputer to run 32-bit mainframe software. Although it was a technological tour de force, the market for it simply did not develop.

The second foray into this market was somewhat successful. In contrast to the technological elegance and complexity of the ICS IV/250, the MINI MARC product capitalized on the simplicity and low-price features of minicomputers. It also was an integrated hardware-software product, which enabled librarians to improve substantially their efficiency in producing catalog cards and lists for their new accessions. In addition to supplying the product, Informatics also supplied a service, which periodically provided the customer with a floppy disc containing catalog cards for all recent accessions of the Library of Congress.

A third attempt to penetrate this market was SERIES IV, a software product that ran on the PDP-11. It was a generalized data entry/validation system which allowed the customer to customize for himself an on-line, interactive program for data entry and validation. Although it was intended to be sold as an integrated hardware-software system, it proved much too expensive for the function, and failed in the marketplace.

5.7.2 The Microcomputer Era

Bridging the era from minicomputers to microcomputers was the TAPS product. It is an application development product for transaction-oriented on-line applications, providing standardized functions for the repetitive aspects of developing and maintaining them. When it was initially conceived, it was on the forefront of screen-oriented applications. But its major technological breakthrough was in being portable among many mainframes, minicomputers, and microcomputers. "Portable" means that the TAPS product can be modified to run on different computers with relatively little effort, and develop the same application for each of them. Although TAPS was another technological triumph,

its marketplace acceptance has been questionable, except among military and other very advanced customers.

Informatics finally took the plunge into the microcomputer world at the beginning of 1980. Werner Frank, executive vice president of Corporate Development, initiated "Project 80" to define and develop Informatics first product for a microcomputer. The project he defined and designed was INFORMATICOM, and he selected the Ontel microcomputer as its hardware. It was an intelligent workstation that could be free standing or attached to a computer with communications capability, useful for the creation, manipulation, and query of personal files held locally or supported by MARK IV on an IBM mainframe. It could submit to the mainframe a MARK IV request along with a local file from the workstation to produce a MARK IV report and output it at the workstation. In addition, it was a state-of-the-art wordprocessor and could be used as a network component of an electronic mail system. This remarkable technological achievement failed in the marketplace, since the Ontel microprocessor on which it ran was never widely used and eventually became obsolete. However, INFORMATICOM got Informatics firmly planted in the microcomputer world, and its technology formed the basis for Informatics microcomputer products of the future.(19)

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