SSA's Plans for Using IWS/LAN Technologies

4

The Social Security Administration is planning to move from a computing system centered on large mainframe computers to one that relies more on smaller personal computers. This strategy is being pursued by most companies in the private sector, as well as other federal agencies. For several reasons, a system based on personal computers promises to provide a more cost-effective and responsive infrastructure for the agency's operations. However, the full benefits of the proposed new hardware will not be realized without the development of software that implements the many SSA functions that are still performed manually or are only partially automated.

SSA SYSTEMS PLANS

Trends in Computer Technology

In the past, large organizations such as SSA typically built their data-processing operations around expensive mainframe computers. These large computers were at the hub of a network of terminals located throughout the organization. Terminals look just like today's personal computers, with a keyboard and a display, but have limited processing power of their own. They are used by employees in the field to enter data for transmittal back to the mainframes, which then do all the necessary processing, access databases, and send a response back to the terminal. In the case of SSA, 39,000 terminals in 1,300 field offices are connected to mainframe computers at the National Computer Center at SSA headquarters in Baltimore, MD.

Today, many organizations are moving away from an environment in which all processing is centralized at the mainframes.1 Instead, they are using distributed or cooperative processing in which more of the processing is done at the employee's desktop. The "dumb terminals" are replaced by personal computers with considerable processing power of their own. Personal computers are built around microprocessors—small silicon chips with the power of mainframe computers of a decade ago. While early personal computers were usually used by themselves, they are increasingly being integrated into an organization's data--processing operations, linked to each other and to mainframes or other specialized computers through high-performance networks.

There are two main trends that explain why organizations are choosing to rely less on mainframe computers to do all their processing. First, for some types of applications, personal computer technology is a more cost-effective source of processing power than mainframe technology. In many cases, it may be less expensive for an organization to add capabilities at the user's desktop than to upgrade the costly mainframe computers in the data center. Second, computer network technology has advanced to the stage where computers at widely separated locations can quickly exchange data and work together to solve a problem. There is no need for all of the processing power and data to be in one central location; the data and programs needed to solve a problem can be located where it is most cost-effective.

A distributed system that relies on personal computers has other benefits. First, there is considerable competition in the high-volume market for personal computer hardware and software, which brings prices down. Second, many analysts believe that software for the new distributed systems can be developed at a lower cost and more quickly, allowing organizations to make changes rapidly and take advantage of new opportunities. Third, the processing power at the user's desktop can be used to support graphical user interfaces that are user-friendly. Potentially, several applica- i ions can use a similar user interface, reducing the time required to train employees to use new applications.

Personal computer-based systems can also introduce fundamentally new types of applications into an organization. Imaging technologies, for example, area promising development for organizations that manage large volumes of documents. Most personal computers are equipped with high-resolution displays that can show detailed images. When documents are stored in electronic form as images, they take up much less space than their paper equivalents and can be accessed more quickly. While image-related applications still strain the microprocessor and memory technologies of today's personal computers, many believe that they are quickly becoming cost-effective. SSA has also been looking at other new types of applications, such as electronic mail, facsimile, online manuals, and expert systems to assist in evaluating claims.

Most organizations with data-processing needs similar to SSA's are planning to move from mainframe-centered systems to distributed systems. The computer industry trade press devotes considerable space to articles about a type of distributed processing called "client-server" computing. Servers are usually powerful machines that perform functions for several "clients' '-even when processing power is distributed, there may be reasons to centralize some functions at a few computers. For example, a program executing on one computer, the client, may request data from a second machine, called a "database server," that handles accesses to a centralized database. Main-

---

1See, for example, peter Nulty, "When To Murder Your Mainframe, " *Fortune*, Nov. *1, 1993,* pp. 109- 120; Laurie Hays, "IBM Tries To Keep Mainframes Afloat Against Tide of Cheap, Agile Machines," *Wall Street Journal,* Aug. 8, 1993, p. B I; "How 1S Can Answer Corporate Needs With Client/Server Computing," *Datamation*, vol. 39, No. 12, June 15, 1993, p. S2.

frames may evolve into database servers: they will no longer handle an organization's entire processing load, but will manage the database for a network of personal computers.[2]

While there are several reasons why distributed processing is considered to be the architecture of the future, there are also concerns associated with managing the transit ion from mainframe-centered systems. One problem is that millions of dollars have been invested in mainframe-based systems: organizations would like to preserve as much of this investment as possible. In addition, designing and programming distributed systems may demand new skills of systems employees. Finally, the new distributed systems are, in some ways, more complex to design and manage. Among the new concerns are questions of security and reliability in an environment where data and processing power are no longer under central control in a computer center. Despite these uncertainties, many organizations believe that distributed systems are the systems design of the future, and that early deployment allows them to begin gaining experience with the new technologies.

SSA's Existing Computer System

Today, SSA uses a mainframe-based system that connects about 39,000 terminals to the mainframes at the National Computer Center at SSA headquarters in Baltimore.[3] These terminals are located in approximately 1,300 field offices throughout the United States. Terminals are also used in the 37 teleservice centers that serve callers contacting the agency through its toll-free telephone number. The terminals are connected to the mainframes through an extensive data network, SSANet. Software executing on the mainframes controls the terminals, generating text on the terminals' displays that leads SSA employees through the processing of a claim. In response to these prompts, the field representatives or teleservice representatives enter data. The data travel back through the network to the mainframes, and then are processed or stored in one of the agency's databases.

In addition to the terminals, the field offices also have a limited number of personal computers that are used for word-processing and other office automation functions. These are stand-alone machines, not part of the mainframe-based system used for processing claims and for other programmatic functions. Because most offices have only one or two personal computers, shared among all employees in the office, SSA field representatives currently have to leave their desks in order to use one of the personal computer-based applications.

The current SSA computer system is, in many ways, typical of large data-processing operations. It reflects the longstanding dominance of International Business Machines (IBM) in mainframe-centered computing: the mainframes are IBM products, and the programming languages, operating systems, and network protocols are typical of those used in an IBM mainframe environment. For example, the network uses IBM's Systems Network Architecture (SNA) protocols, not the more "open" Transmission Control Protocol/Internet Protocol (TCP/IP) or Open Systems Interconnect (OSI) protocols available from multiple vendors. SSA software is written in Common Business-Oriented Language (COBOL) or Customer Information Control System (CICS), languages rarely used by programmers developing software for newer personal computers, minicomputers, or workstations.

The current SSA system has been pieced together over several years at a cost of several billion dollars. The major initiative was the Systems Modernization Plan of the mid-1980s, which modernized the mainframe computers, upgraded the storage hardware for the agency's databases, and saw the installation of terminals in SSA field

[2]Steve Lohr, "Present at the Transition of IBM," *New York Times*, Oct. 26, 1993, p. D1; Laura B. Smith, "Mainframes Hang On," *PC Week*, vol. 10, No. 33, Aug. 23, 1993, p. 87.

[3]For a description of SSA's computer systems, see Social Security Administration, "Information Systems Plan," September 1993.

offices. As a result of this initiative, SSA was able to stabilize its systems operations and improve several aspects of its operations.[4] The basic claims-taking for retirement (Title II) has now been automated, Social Security numbers can now be obtained in less than a day, earnings records are updated in a timely fashion, and the agency has been able to institute 800-number service.

While SSA's computer systems have stabilized, there are still important shortcomings. First, SSA has only moved part of the way to a full online system in which transactions are processed as they are entered. Several functions are still processed in batch mode overnight, which prevents SSA employees from verifying information as it is entered or completing the processing of a claim in a single session. In addition, the agency maintains separate databases for each of its programs, preventing a "whole person" view of SSA clients.[5] In its recent management report, the General Accounting Office (GAO) noted that this was a major shortcoming.[6] Finally, like other large organizations, SSA has a considerable amount of older software that has been criticized as poorly documented and maintained.

Another serious problem is that many of the objectives of the Systems Modernization Plan for automating SSA business processes have not been achieved—many agency functions remain largely paper-based. Of the three major SSA programs—retirement, supplemental security, and disability---only the retirement program has been significantly automated. Even for the retirement program, however, more complicated cases frequently cannot be processed to completion in the computer system, and require manual intervention. Software that would automate claims-taking for the more complex Supplemental Security Income Program has been completed only recently, and its deployment has been limited by a shortage of terminals in the field offices and mainframe capacity.

The complicated disability program has been automated only to a very limited extent. For each applicant, a large paper file of forms and medical evidence is assembled by various components of SSA, state disability offices, and doctors who provide medical evidence. Today, the claims-taking is done in SSA field offices using paper forms. Once the file has been compiled, it is mailed to the appropriate state disability office, which then gathers medical evidence and adjudicates the file. The level of automation and type of computer hardware vary from state to state.[7] There is also no uniformity in the software packages used by the states and only limited connectivity between the state computer systems and the SSA computer system.[8]

IWS/LAN—Technologies

SSA intends to move from its current mainframe-centered environment to one that makes greater use of distributed processing.[9] The foundation for this transition is the proposed purchase of 95,000 personal computers, to be installed over several years between now and 1999. The mainframe computers will continue to play an important role in SSA computing, but the dumb terminals will be replaced by more powerful and flexible personal computers. These personal computers will be located throughout SSA, linked to each other and to the mainframes by local area networks and SSA-

---

[4]Ibid., pp. *1-6, 1-7.*

[5]Ibid., p. 3-49.

[6]U.S. Congress, General Accounting Office, *Social* Security: *Sustained Effort Needed To improve* Management and *Prepare for the Future*, GAO/HRD-94-22 (Gaithersburg, MD: October 1993), p. 39.

[7]SSA, op. cit., footnote 3, pp. 3-44, 3-45.

[8]Ibid., pp. 3-45, 3-48.

[9]Ibid., pp. 4-30, 4-31.

Net. The initiative is called the IWS/LAN project; IWS refers to *intelligent workstation* (SSA's term for personal computers) and LAN to *local area network.*

The computers are intended to standardize computing throughout the agency. Computers like those that will replace the dumb terminals in the field offices will also be deployed in the state disability offices, processing centers, and other locations within the agency. Currently, there is little uniformity in agency computing—for example, about 1,500 users at headquarters use a UNIX-based system. A variety of systems are used by the states, although the majority use Wang products. SSA believes that a standard hardware platform will allow the agency to standardize software packages, improve inventory and contract management, and simplify the development of applications linking several parts of the agency.

The new personal computers will provide a more flexible computing platform than the dumb terminals they replace. SSA employees will be able to use the same mainframe-based programs that they currently access through the dumb terminals, but the personal computers will provide additional capabilities. First, the programs that previously ran on the stand-alone personal computers will now be available at each employee's desk. Second, the user will have access to a variety of new programs, such as an electronic version of the agency's regulations and procedures. Third, the personal computers will allow the user to access several programs at the same time in separate windows on the screen. Finally, the personal computers will have a graphical user interface, replacing the characters-only interface of the dumb terminals.

However, it should be emphasized that it will be some time before IWS/LAN significantly changes the way SSA employees handle agency business. The public will not see the benefits of automat ion until SSA develops the software needed to support its programs. IWS/LAN only provides the hardware platform for this programmatic software. Software for many of the agency's major programs still needs to be developed, especially in the disability program. In some cases, the development of good programmatic software will first require the rethinking of the agency's business processes. Even for those SSA programs that are already automated, work will have to be done to take advantage of the IWS/LAN computers' new capabilities.

It should also be emphasized that the IWS/LAN project will not fix all of SSA's systems problems. IWS/LAN encompasses only the deployment of personal computers and associated LAN hardware. Other key projects, such as the modernization of the agency's databases, are outlined in SSA's Information Systems Plan or in the tactical plans of the Agency Strategic Plan, but are not considered part of IWS/LAN. IWS/LAN is integral to the agency's efforts to continue upgrading its systems, but is only one component. Progress will require sustained attention to the entire SSA systems infrastructure, as outlined in the agency's Information Systems Plan.

IWS/LAN Hardware

The intelligent workstations that SSA plans to deploy are personal computers that use microprocessors made by Intel Corp. [10] SSA's use of the term *intelligent workstation* may cause some confusion because the computer industry typically uses the term *workstation* to refer to a more powerful class of desktop computers, typically built around a different type of microprocessor and incorporating a higher resolution display than is commonly used with Intel-class machines. Intel-class personal computers have been produced since the early 1980s and have the largest market share of desktop computers. Every few years, a more powerful version of these computers arrives on the market, but each generation is compatible with older versions--old software can still be

[10] Details of the IWS/LAN configuration can be found in Social Security Administration, "System Zero," June 2, 1993 and Social Security Administration, "The Interim Acquisition," June 2, 1993.

used with the faster processors. The generation that SSA plans to acquire is referred to as a "486" machine; a more advanced generation has now reached the market, but is considerably more expensive.

The personal computers in each field office will be linked together by local area networks. As with the personal computers, the network technology that SSA plans to use is proven and widely used. SSA intends to use "token ring" local area network technology, one of the two most widely used types of local area networks available today. Both the token ring networks and the other prominent LAN technology, Ethernet, are industry standards, but the token ring format has been closely associated with a single company, IBM, and is typically used in business environments that have an installed base of IBM equipment. As part of the IWS/LAN project, SSA will buy the LAN hardware, which is electronic circuitry installed in the personal computers that converts computer data to the format expected by the network and provides a connection between the computer and the cabling. SSA will also install new cabling throughout the field offices, teleservice centers, and other facilities.

The local area networks will allow employees to share data and exchange electronic mail messages. They will also provide access to printers and "servers," specialized computers shared among all network users. One example of a server will be the CD-ROM[11] server that will be used to access an electronic version of the agency procedures manual. Another important component of the network will be a bridge that will connect the local area network in each field office to the agency's network, SSANet. If, for example, a field representative entered data for a retirement insurance claim at a personal computer, the data would travel from the computer, through the local area network to the bridge, and then through SSANet to the mainframes in Baltimore.

IWS/LAN Software

Another important component of the IWS/LAN system will be the system software. SSA has to make decisions about the operating system for the computers on its representatives' desks and for the servers. There is considerable uncertainty in the market for operating systems, as major software developers have recently introduced new products specifically tailored for today's more powerful computers.[12] In a pilot configuration, SSA has been using DOS and Windows™, but it is looking at newer operating systems for future deployments. Also included in the system software is a "network operating system," which coordinates the computers on the network, and "network management" software. SSA plans to monitor the operation of the IWS/LAN system using an IBM network-management product. The agency believes this will allow operations to be controlled centrally by the National Computer Center, avoiding the need for specialized technical personnel in each field office.

The applications programs that SSA plans to deploy on IWS/LAN fall into several categories. First, the agency will acquire commercial, off-the-shelf software for word-processing, spreadsheets, and electronic mail. Second, each employee will be provided with copies of SSA-developed PC software now found on the stand-alone personal computers in each field office. Third, SSA is developing several new applications that assist SSA employees. One example of this kind of software is the 800-number expert system that leads teleservice representatives through a series of scripts that provide answers to telephone inquiries. SSA believes that use of this program will result in more consistent responses to caller inquiries and will be especially valuable to new teleservice representatives.

---

[11] CD-ROM (compact disc.read only memory) systems use the vast information-storage capabilities of compact disks to store computer data.

[12] Laurie Hays, "Computer Giants Duel Over Operating Systems." *Wall Street Journal, Nov. 30, 1993,* p. B1.

The most important component of SSA software development is the programmatic software. It is important to note that this work is being done in-house as part of the regular information systems budget. For programs that are already automated—retirement and supplemental security—SSA will use the existing mainframe software for the foreseeable future. The personal computers will be used as if they were the old terminals: special software on the personal computers allows "terminal emulation." The terminal emulation strategy permits an easier transition to the new hardware, reducing risks and preserving the large investment in the existing software. It also requires only limited software development resources.

Terminal emulation does not, however, take full advantage of the new IWS/LAN platform. Over time, SSA will have to write new software. The first step will be to continue to use the mainframes for most of the processing, but to write new software for the personal computers that will replace the existing character-based input screens with new graphical input screens. In the long run, more of the processing will be done by the personal computers. The agency envisions that the mainframes will gradually evolve into database servers—they will manage the databases and provide data in response to queries from programs running on the personal computers. This evolutionary strategy is typical of most organizations making the transition to distributed computing systems.

At the same time, the current focus of software development at SSA is on software for the disability program, which is currently not automated. This software is being written specifically for the new IWS/LAN system; there will be no mainframe version. Over 100 developers at SSA are working on this project, the Modernized Disability System (MDS). MDS will automate all of the major steps of the existing process. The paper forms will be replaced by an electronic record for each applicant, and as much of the medical evidence as possible will be maintained in electronic form. Instead of mailing the record to a state disability office, it will be transmitted electronically. Computer support in the state disability offices will assist in maintaining records, requesting medical evidence, and adjudicating cases. The first release of MDS is expected to be completed in mid-1995, and will be pilot-tested in time for full-scale deployment in 1996.

Development of IWS/LAN

SSA has been evaluating the IWS/LAN technologies since 1990. Several factors contributed to the move to the new technologies. First, the agency had begun to plan for the steps to be taken when the dumb terminals deployed beginning in 1986 began to reach the end of their systems life. The original estimated systems life for this hardware was 5 years, although the first terminals deployed have now been in service for 7 years and appear to be functioning satisfactorily.

Second, by 1990, most organizations with data-processing needs similar to SSA's had begun to move toward the wider use of networked personal computers. This was reinforced by a 1990 report from the National Academy of Sciences that recommended that the agency consider a move to distributed processing. The Academy pointed out a number of weaknesses *in* the existing centralized architecture, and called for SSA to "retain the present centralized database architecture but plan for the introduction of 'intelligent' workstations providing increased local support to the users of the system and embodying a common user interface for performing any agency function."[13]

Third, the agency was getting ready to begin automating the Supplemental Security Income program and was beginning to consider the appropriate platform for this effort. Recognizing the aging of the old architecture and the technological changes behind the National Academy of Sciences' recommendation, the agency analyzed

[13] National Research Council, *Systems Modernization and the Strategic Plans of the Social Security Administration* (Washington, DC: National Academy Press, 1990), p. 5.

whether it was appropriate to support the SSI modernization by buying additional dumb terminals. In fact, the initial deployments of IWS/LAN equipment are considered to be part of the SSI modernization program.[14]

During 1990, a number of different system designs were considered. At least two were clearly viable—a UNIX-based system and an Intel-based system. SSA selected the Intel/token ring configuration, chiefly on the grounds of compatibility with the installed base of IBM equipment in the agency's systems. SSA then began a program of experimentation with a test system installed at the National Computer Center, referred to as "System Zero." After the agency had gained experience with the technology using System Zero, it was then deployed to 10 pilot field offices. The IWS/LAN equipment has been operating successfully in these offices as part of day-to-day SSA operations since the middle of 1992.

IWS/LAN--Costs and Schedules

The IWS/LAN project envisions the purchase of about 95,000 personal computers to outfit all of SSA's operations—about 14,000 to the state disability offices and the remaining 81,000 to all parts of SSA. [15] The proposed number of personal computers is more than twice the number of terminals currently deployed because IWS/LAN will be deployed in more locations than just the field offices. The personal computers and local area networks will be deployed between 1995 and 1999 in two phases. The deployment schedule is still undergoing revisions; in early versions, SSA planned to outfit the field offices in the first phase and the remaining SSA offices and the state disability determination services in the second.

Funding for IWS/LAN will come from several sources. The regular Information Technology Systems budget funded the acquisition of about 3,000 personal computers for state disability offices in FY 1992.[16] An additional 9,000 computers will be funded by the "interim acquisition," a $65-million purchase of computers, network hardware, systems software, and off-the-shelf applications software. [17] Another important component of the IWS/LAN project, the development of the programmatic software, will also be funded through the regular information systems budget. However, the bulk of the IWS/LAN deployment was to be funded by the Automation Investment Fund (AIF), $1.125 billion in no-year funding that was to be used to supplement the regular information systems budget over a 5-year period, in part to facilitate the deployment of IWS/LAN equipment. For comparison, the SSA Information Technology Systems (ITS) budget was $253 million in FY 1993.

Not all of the funding in the AIF was intended for IWS/LAN. Only about $500 million of the $1.125 billion was to fund personal computers, network hardware, and associated software. A total of$313 million was to fund other information technology expenditures that have not been specified at this time, and $307 million was to fund ergonomic furniture to be installed in the field offices before the IWS/LAN computers were deployed. The ergonomic furniture is required under the terms of an arbitrator's decision. In the FY 1994 budget process, Congress appropriated $300 million, not the full $1.125 billion; the $300 million figure is approximately the amount that SSA had intended to obligate from the fund in FY 1994.

---

[14] The "interim acquisition" of 9,000 personal computers, Of which 5,300 deployed to the field offices are considered part of SSI modernization.

[15] SSA, op. cit., footnote 3, p. 6-22.

[16] SSA, Deputy Commissioner for Systems, "Cooperative 1.2 Tactical Plan," Jan. 26, 1993, p. 4.

[17] Gwendolyn S. King, Commissioner, Social Security Administration, Memorandum to Deputy Assistant secretary for Information Resources Management, Department of Health and Human Services, Jan. 13, 1992.

The initial deployments are being funded primarily under the interim acquisition. Site modifications at 90 field offices are underway to prepare them for deployment of personal computers and local area networks in 1994. In addition, several state disability offices will be provided with equipment from the 3,263 computers funded in FY 1992. The deployment of computers to the state offices is not considered to be part of the full national deployment of IWS/LAN to be funded by the AIF. Instead, these deployments are considered to be an interim effort to provide low-level, baseline automation to states that currently have no computer support, or only minimal support. The software that will be used is not the full Modernized Disability System that is scheduled for deployment in 1996, but adaptations of software already in use by other states.

ANALYSIS OF IWS/LAN TECHNOLOGIES

In many ways, SSA's plan to purchase thousands of personal computers represents an encouraging sign—an effort to keep up with the state of the art in computer systems. In the past, particularly in the early 1980s, SSA fell behind technology developments until it found itself with overburdened and obsolete equipment. In part, a new focus on staying current may have led to a technology-centered planning process dominated by the systems component of SSA. There has been considerable concern that the technology planning has not been adequately integrated into overall SSA planning; this is discussed further in the next section and in chapter 3.

Transition to a Distributed System

SSA's decision to proceed with the development of a distributed computing platform is consistent with the plans of large private-sector corporations with similar data-processing needs. Most insurance companies, banks, and airlines began to move away from mainframe/terminal configurations in the late 1980s; the question of how best to manage this transition is a major topic in the trade press for corporate information systems professionals. Moreover, by developing the IWS/LAN system, SSA is following the advice of a National Academy of Sciences panel, which recommended that the agency move to a "distributed system, with mainframe computers serving as the hub of the system," combined with "local intelligent workstations to support service agents."

Once SSA decided to move to a distributed system, it had to choose from several possible architectures. It appears that the IWS/LAN configuration selected by SSA is solid and proven. The computing power that is being purchased is appropriate for SSA's needs in the medium term, supporting current applications and allowing sufficient room for the development of new programmatic software. The type of personal computer and LAN hardware that SSA has chosen has been proven in other organizations over several years—Intel-class computers are dominant in the marketplace, and token ring networks have a significant installed base. The choice of operating systems will be more difficult, however, as there is considerable uncertainty in the market while vendors try to position new products. '8

Questions could be raised about some aspects of SSA's systems design. For example, much of the reasoning that led to the configuration chosen by SSA reflects the agency's large installed base of IBM equipment. Other organizations moving to client-server architectures have relied to a greater degree on open systems; a UNIX-based system was one of the two architectures supported by the National Academy of Sciences panel (the other was the architecture eventually chosen by SSA). In analyzing the competing designs, the ease with which equipment could be integrated with IBM network protocols and network management packages contributed heavily to the favorable score for the system chosen.

Questions have also been raised about the choice of the token-ring local area network over

[18]"Betting on the server," *InformationWeek*, Nov. 15, 1993, p. 68.

the alternative, Ethernet. Ethernet has a larger market share and is significantly less expensive.[19] The cost differential is due, in large part, to the fact that token ring development has been controlled by IBM, which dominates the market for token-ring local area networks. However, these networks do have technical characteristics that some users, particularly large organizations with mission-critical applications, believe justify the cost differential.[20]

Risks Associated With IWS/LAN

The basic architecture chosen by SSA should minimize the risk that there will be cost overruns or delays due to the technology. While trying to keep up with industry trends, the agency will not beat the leading edge with its attendant risks. The IWS/LAN project uses common industry equipment; the personal computers and LAN hardware are commodity items with millions of users in industry, homes, and government. The agency has avoided a common mistake of some federal agencies that have purchased nonstandard equipment because of perceived special needs. The transition plan, which envisages the continued reliance on mainframes and existing programmatic software, could be more aggressive, but again minimizes risk—the agency is trying to reuse what it already has in place.

SSA has proceeded in a measured fashion to learn about alternative technologies, conduct experiments, and pilot-test the technology. The pilots have now been operating in 10 offices for over 1 year, and appear to be stable, operating reliably, and well received by employees. However, there are still questions related to problems that may arise when the technology is deployed on a larger scale. The relatively small number of pilot sites may not adequately test all of the potential problems that could arise when the equipment is deployed to 1,300 sites throughout the organization. In particular, the agency will have to carefully monitor the management requirements as the IWS/LAN system grows larger. SSA believes that it is possible for the system to be centrally maintained by the National Computer Center in Baltimore, MD, without the need for specially trained system managers in each of 1,300 SSA locations.

Flexibility of IWS/LAN Technologies

In part, the successor failure of SSA's systems design depends on the degree to which IWS/LAN will be able to accommodate future needs and avoid the need for a costly systems redesign for as long as possible. The IWS/LAN technologies have large installed bases and will likely be supported for several years—they are not unique to SSA and are unlikely to be orphaned. Given the large installed base, vendors are also likely to provide upgrade paths for IWS/LAN-type equipment—a more powerful generation of computers compatible with the type that SSA has selected is already on the market. In other words, IWS/LAN will establish an architecture for SSA: a systems design that will allow individual components to be replaced as demands change, but will not require an entirely new system. For example, to buy hardware with the capability to handle image-based applications at this time would likely not be cost-effective. However, as computers get more powerful and networks more capable, SSA should be able to upgrade the components of IWS/LAN to provide image-handling capability without changing the overall systems design.

Another part of the infrastructure will be the technical skills of SSA's Systems employees. The Information Systems Plan recognizes that many new skills will be required as the agency moves from a mainframe-centered environment to one that is based on personal computers and local area networks.[21] Several new technologies will be introduced at once, each demanding new trouble-

[19] Margie Semilog, "Can Token-Ring Still Compete?" *CommunicationsWeek, No. 467,* Aug. 16, 1993.

[20] Cheryl Krivda, "Token Ring: A New Beginning," *LAN Magazine, vol. 8, No. 9,* September 1994, p. 123.

[21] Social Security Administration, op. cit., footnote 3, pp. 7-23, 7-24.

shooting and systems administration skills. In addition, software development for the new platform will require familiarity with new programming languages and operating systems.[22] SSA plans to meet these needs mainly by retraining existing employees, partly because of budget constraints on new hiring. SSA will have to ensure that training budgets are adequate to support the development of the skills that will be needed to fully utilize the IWS/LAN equipment.

SSA's JUSTIFICATIONS OF IWS/LAN

Despite the fact that SSA's strategy appears to be workable technologically, it still has to be justified from a business standpoint. Justifying any information technology purchase is a difficult task because the benefits often lie in the future, are difficult to measure, and are subject to disputes over underlying assumptions. Typically, in the private sector, both financial and nonfinancial factors are weighed in determining whether to proceed with an investment. Financial analyses place an emphasis on determining the rate of return on the information technology investment, comparing costs with benefits such as reductions in the cost of doing business. Nonfinancial factors include such objectives as cutting product-development time or improving customer service. SSA has proceeded in a similar fashion in justifying IWS/LAN, conducting a cost-benefit analysis and also justifying the investment on other, nonfinancial grounds.

SSA's Cost-Benefit Analysis

SSA has justified its IWS/LAN purchase using a cost-benefit analysis performed during the course of the pilot tests conducted in 1992.[23] In conducting this analysis, SSA measured the time required to perform certain functions both before and after the installation of the IWS/LAN in the pilot offices. SSA estimated that about 2,000 workyears would be saved in the field offices over the life of the equipment, translating into cost avoidance of about $750 million. By comparing this figure with the estimated life-cycle cost of$315 million, SSA estimated cost savings of $450 million, or a cost-benefit ratio of 2 to 1.

These data would indicate that IWS/LAN is probably a cost-effective replacement for the dumb terminals as they approach the end of their useful life. Drawing any further conclusions is difficult because the agency did not use the pilot tests to explore changes in the way the agency does business. Each dumb terminal was replaced with a personal computer, which was used in terminal emulation mode with the same programmatic applications as before. The increased processing power of the personal computers was not used to any great extent—the field representatives used the computers as if they were terminals, and performed their jobs in much the same way. In fact, over half of the workyear savings found in the cost-benefit analysis were due to the fact that SSA employees no longer needed to walk from their desks to one of the shared personal computers, as they were required to do in offices equipped with dumb terminals.

It will be some time before SSA uses IWS/LAN in a way that significantly improves the quality of service delivered to agency clients. True improvements will require continued progress on the development of software to implement SSA programs. The IWS/LAN hardware alone does not provide service improvements of the kind that would be significant to clients. For example, SSA estimated, in "Track 2" of the pilot evaluation process,[24] that IWS/LAN hardware with today's programmatic software decreased the average wait-time at the Mondawmin pilot office in Baltimore by only 6 minutes, from 34 minutes to 28

[22]Peggy Wallace, "Client Server Computing Requires Top Corporate Developer Training," *InfoWorld*, vol. *15*, No. *45*, Nov. 8, *1993*, p. 64.

[23]Social Security Administration, "Field office, PSC & TSC Benefits From IWS/LAN," June 2, 1993.

[24]SSA, "The Social Security Administration Analysis Methodology of the Performance & Benefits From the Distributed Data Processing Pilots," Jan. 17, 1992.

minutes.[25] The package of software that SSA has in place for IWS/LAN at this time is significant, but does not have an appreciable impact on the level of service provided to the agency's clients. The first project that may significantly improve client service is the Modernized Disability System software, but its deployment is not scheduled to begin until mid-1996.[26]

It should be recognized that SSA's cost-benefit analysis applies only to a subset of the 95,000 computers that the agency plans to acquire. It is valid only for the replacement of the dumb terminals in the field offices and the teleservice centers, which represents about one-half of the total of 95,000. No similar analysis has been done for the computers to be deployed in the state disability determination services, some federal offices that are part of the disability process, and administrative components of the agency. Offices that are part of the problematic disability determination process may have significantly different roles in the future, which may argue against early deployment to these locations.

SSA's Other Justifications: IWS/LAN as Infrastructure

As noted above, the new IWS/LAN hardware by itself does little to improve the quality of service delivered to SSA clients. SSA contends that the computers and local area networks constitute an infrastructure that will provide a foundation for future performance improvements, and that this factor should be taken into account when evaluating IWS/LAN. While SSA is not currently in a position to take full advantage of the technology, the agency believes that it will be able to add new capabilities, such as the Modernized Disability System, once the hardware is in place.

The key problem for SSA in arguing that IWS/LAN is infrastructure is that the benefits and costs lie in the future. The agency is currently unable to demonstrate real improvements in the service delivered to agency clients. GAO has expressed concern that these benefits will not materialize. At the same time, because IWS/LAN is only one part of the information systems investment needed to achieve better performance, there is concern that costs have been understated, GAO has estimated that the total costs over the next 5 to 7 years could be $5 billion to $10 billion,[27] far higher than the $1.125 billion requested for the Automation Investment Fund. According to SSA's IWS/LAN tactical plan, "IWS/LAN is designed to build an infrastructure and, as such, is principally a cost producer, necessary to achieve the benefits of many related initiatives being designed to operate on this platform."[28]

All information technology deployments will have aspects of infrastructure—the hardware will be deployed with the intent to add components over time. Some capabilities will be available as the equipment is first deployed; others will be added as limited organizational resources permit their acquisition or development. This is demonstrated by SSA's current software development strategy: an initial emphasis on MDS, with other projects to follow. Ideally, before the computers are deployed, SSA would be further along with efforts related to using the new infrastructure and be able to demonstrate how it plans to improve client

---

[25] SSA, op. cit., footnote 23, p. 16.

[26] SSA, op. cit. footnote 3, p. 5-5.

[27] General Accounting Office, op. cit., footnote 6, p. 5. Elsewhere in the report, GAO states that "SSA has not fully identified the costs and benefits of implementing its modernization effort. This effort includes 159 initiatives and we believe could cost from $5 billion to $10 billion through fiscal year 2005."

[28] SSA, op. cit., footnote 16, p. 20. Additional costs will come from a variety of sources. In the medium term, there are costs associated with the development of the new software that will use IWS/LAN. SSA has plans to update the software in all of its major business areas, and has instituted a major effort to provide automation for disability claims, the Modernized Disability System (MDS). Attempts have been made. at least in some contractor documents, to look at these costs. Also in the medium term, there are hardware costs, such as upgrades to the mainframe computers or network capacity. In the longer term, SSA has plans to distribute its database and move to a greater extent to imaging technologies.

service. SSA should be able to pursue an aggressive program of trials and experimentation before embarking on the time-consuming development of production software. The results of these experiments would create greater confidence that the IWS/LAN technology will improve agency operations.

In addition, the agency should create a more comprehensive planning package that ties together the disparate elements of the IWS/LAN project and clearly shows the agency's concept of how the new infrastructure will be used. One problem, for example, is that the software projects that are key to the success of IWS/LAN are not included in the $1.1 25-billion Automation Investment Fund that will be used to buy the hardware. A comprehensive package, describing both software and hardware configurations, timelines, budgets, and performance goals for each SSA program, would also help allay fears that the agency is underestimating the cost of IWS/LAN and would provide a yardstick to measure the progress of the project. In addition, the package could outline the experiments that SSA is conducting to explore future uses of IWS/LAN, such as the paperless pilot test in Chicago.[29]

ANALYSIS OF SSA JUSTIFICATIONS FOR IWS/LAN

SSA believes that its information systems spending over the past decade has allowed it to process growing workloads with significantly fewer staff. It can also point to significant improvements in some processes—for example, Social Security numbers are now issued overnight, whereas a few years ago the same procedure took 6 weeks. Still, quantifying the benefits of information technology spending has proven to be difficult. One book on the use of computers by business states that ● 'there is no relationship between expenses for computers and business profitability."[30] Some economists have argued that there is no clear evidence that new technologies have raised productivity or profitability, despite the rapid advances in information technology over the past decades. Top managers in both the public and private sectors no longer take the potential benefits of technology investments on faith, and are increasingly demanding more solid justifications for their organizations' growing expenditures on information technology.

IWS/LAN and Reengineering

There is a growing consensus that information systems purchases will only have an adequate payoff if careful attention is paid to their application.[31] In the past, it was implicitly assumed that information technology would automatically reduce staffing requirements, cut costs, and reduce the time required to complete tasks. In some cases, this may have been an accurate assumption: SSA's dramatic improvement in the time required to issue Social Security numbers may be an example of such a process. In other cases, however, adding computers to the process does not appear to have made much difference.

Researchers have looked at successful information systems projects to determine the factors that contribute to solid payoffs. One emerging theory is that an organization that is taking best advantage of information technology will operate in different ways from one built around moving paper. If organizations have not seen adequate payoffs from past information technology projects, it is because the technologies have been incorrectly applied. Stated another way, information technology is the newest tool available to management; ways of doing business that were developed be-

[29] SSA, op. cit., footnote 3, pp. 3-49, 4-87, 4-88.

[30] Paul A, Strassman, *The Business Value of Computers* (New Canaan, CT: The Information Economics Press, 1990). P. xvii.

[31] Thomas H, Davenport *Process Innovation: Reengineering Work Through Information Technology (Boston,* MA: Harvard *Business* School Press, 1993), Michael Hammer, "Reengineering Work: Don't Automate, Obliterate," *Harvard Business Review*, July-August 1990, pp. 104-1 I 2.

fore the advent of information technology should be rethought to take advantage of these new tools. If information technology is simply applied to existing ways of doing business, the potential for payoffs is much smaller.

The restructuring of ways of doing business is referred to as *reengineering* or *process innovation.* It has become a common topic in the management and information systems literature, and management consulting firms now advertise their reengineering services. A key tenet of the reengineering theories is that organizations have to be willing to radically restructure their business practices; incremental change is not enough. Proponents of reengineering believe that organizations should be able to achieve dramatic performance improvements by using information technology, not just incremental improvements. They cite examples of companies that are able to complete a process in a fraction of the time previously required. In many cases, these examples involve insurance or credit companies that perform tasks that are similar to those of SSA—the processing and evaluation of claims.[32] In justifying IWS/LAN through its cost-benefit analysis, SSA has emphasized that it will be able to maintain current service levels as the workload grows or staffing declines. Until recently, there had been no effort to achieve more significant improvements in the service delivered to clients.

In late 1993, in response to GAO criticisms of its justifications for IWS/LAN, SSA established a reengineering task force to look at the agency's most pressing problem, the disability determination backlog. The disability process bears many of the indicators of a process that needs to be rethought. Currently, there are many stages in the process, complex federal-state interaction, and the participation of several players. Only a small fraction of the time between filing a disability claim and award or denial is spent actually working on the file. Most of the 100 days or more required to process an application involves time spent sending the file from one place to another, waiting for the next stage in the processing, and waiting for replies from medical examiners.

Other SSA programs may not require the same type of rethinking. Compared with the disability determination process, the SSI or retirement insurance processes are less complex, and a sustained effort to complete the automation of these functions may yield significant benefits. Today, the most time-consuming aspects of retirement claims involve special cases that cannot be handled by the software that is currently deployed. In its 1990 report, the National Academy of Sciences emphasized the significant benefits that could be achieved by completing this software.[33] The first versions of the SSI software are now being deployed, and the agency should soon be in a position to evaluate its performance.

IWS/LAN and Service Delivery

While much of the rhetoric of reengineering is new and the tradeoffs involved in its application to an essential public sector program uncertain, one of its basic principles is well known: information systems spending should be driven by a clear idea of the process that is to be supported and its performance objectives. In its 1991 report, the National Academy of Sciences panel that looked at SSA automation wrote that "technology itself must not drive systems evolution"[34] and that "technology must be chosen based on its ability to help fulfill the agency's goals." More recently, GAO has stated that "the lack of a long-term business strategy has forced SSA to focus its technol-

[32]Mutual Benefit Life reduced the time required to process insurance applications from 5 to 25 days to 2 to 5 days, with 100 fewer field office positions. Cited in Hammer, ibid.

[33]National Research Council, Op. cit., footnote 13, p. 35.

[34]National Research Council, *Elements of Systems Modernization for the Social Security Administration* (Washington, DC: National Academy Press, 1991), p. 22.

ogy upgrades on simply automating current, inefficient processes, rather than optimizing the benefits that automation can provide to reengineer and streamline operations. "

Chapter 3 notes that important aspects of SSA's future strategy for providing service to clients are still uncertain. Developing a more comprehensive strategy that links service objectives to information systems purchases is more difficult than simply choosing new technologies, It requires cooperation among many components of SSA, most notably between Systems and Operations.[35] SSA's systems planning has led other planning efforts-the service delivery plan has not been completed, and the reengineering task force was established only belatedly in response to GAO criticisms. This makes it difficult for the agency to show a clear linkage between its goals, the problems it needs to solve, and IWS/LAN.

Because important components of SSA planning are not complete, and because SSA is not in a position to demonstrate significant performance improvements due to the new technology, deploying IWS/LAN at this time would seem to violate the principle that an organization should have a clear idea of its business objectives before major information systems purchases are made. SSA has responded primarily by arguing that IWS/LAN is infrastructure, able to accommodate whatever changes are recommended by the planning processes currently underway.

The IWS/LAN architecture does appear to keep open many options for the future. It is built around commodity, proven hardware that is used in many different ways in private industry and government. Furthermore, the basic architecture is flexible and should permit upgrades in processing capability, memory, and display technology without changing the overall architecture. It is very likely that computer systems of the type currently specified for IWS/LAN will be an important component in delivering services to SSA clients in the future, whatever the results of the disability reengineering and service delivery planning efforts. In addition, early deployments will provide additional experience that the agency can use to plan for future deployments and applications of IWS/LAN.

However, the ongoing planning efforts do significantly impact the number of machines required and the locations in which they should be deployed. In a draft version of its service delivery plan, SSA mentioned several options for developing new kinds of offices, increasing the size of some offices, and integrating operations more closely with the state disability determination services.[36] Similar changes may result from the disability reengineering effort, including the possibility of a significant change in the state-federal relationship. These changes would clearly affect the number of computers required—the state of SSA planning raises serious concerns about the justification for buying 95,000 computers.

Furthermore, future changes in the organization could impact the locations in which the new computers are to be deployed. Even if the number of employees remains the same, they could be doing different kinds of jobs in different kinds of offices. As a result, the ongoing planning efforts affect strategies for the phasing of IWS/LAN deployments. In developing a deployment plan, the agency should carefully analyze the impact of the ongoing planning efforts and keep open as many options as possible. It is important to minimize costs that might be incurred by wiring offices

[35] Willis H. Ware Chairman, Committee on Review of SSA Systems, National Research Council, letter to Gwendolyn S. King, Commissioner, Social Security Administration, June 30, 1992, p. 15.

[36] Social Security Administration, "improving Service Delivery at the Social Security Administration: A Conceptual Proposal," Oct. 21, 1993.

that could be closed or restructured and to minimize the cost of moving computers from one site to another.

SSA is currently rethinking its strategy for deploying IWS/LAN. In the first version of its deployment plan, early deployments were to be focused on the field offices and teleservice centers. These offices had been studied as part of the cost-benefit analysis, and were believed to be relatively stable. As a result, the agency could be reasonably confident about deploying the equipment to these locations. Components of SSA associated with the disability process, on the other hand, were less stable and were generally slated to receive computers in the late 1990s. An exception to this strategy was SSA's plan to provide some states with personal computers as part of the baseline automation effort. In recent months, however, the agency has indicated that, in response to GAO criticisms, it would reorient its deployment toward field offices, teleservice centers, and state disability offices with the greatest disability backlogs and, presumably, the greatest potential for the new equipment to make an impact.

The concerns about the limited performance improvements shown to date and the current state of the planning effort have led some to suggest that deployments be delayed or drawn out until the agency is in a position to use the computers effectively during their entire systems life. By mid-1 994, the agency should have completed its service delivery plan and progressed in rethinking its disability process. However, SSA argues that its dumb terminals are quickly approaching the end of their useful lives. In the agency's view, delays in deploying IWS/LAN run the risk of hurting service delivery or incurring high repair costs, and the next-generation equipment needs to be procured and deployed as soon as possible. In addition, delays in the procurement process may result in further delays in the actual deployments. An alternative strategy would be to replace dumb terminals as needed, if in fact they are no longer serviceable, until SSA is in a position to demonstrate service improvements resulting from IWS/LAN.