Conf-9110344--4

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WSRC-MS--91-391

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# WISDOM: A PROTOTYPE OFFICE IMPLEMENTATION OF THE SRS COMPUTING ARCHITECTURE (U)

by

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A paper proposed for presentation at the
***Westinghouse Computing Symposium***
Monroeville, Pennsylvania
October 20 - 21, 1991

and publication in the proceedings

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This paper was prepared in connection with work done under Contract No. DE-AC09-89SR18035 with the U.S. Department of Energy. 

# WISDOM:

**A prototype Office implementation of the SRS Computing Architecture**

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The Savannah River Site has historically allowed the purchase of IBM MS-DOS and Apple Macintosh computers based on user request. As workgroup file services are implemented on the Local Area Network users desire to share data to a greater extent. This has resulted in mixed groups who now wish to share data files cleanly among dissimilar operating systems.

WISDOM was designed as a system of network services, workstation platform standards, installation procedures, and application choices which would address data integration from the user perspective. Novell Netware provides a basis for file transfer, while Microsoft Windows supplies the GUI necessary to compliment the Macintosh. Central administration, networking protocols, host connectivity, and memory management restrictions required imaginative solutions.

This paper describes the current status of the 500-workstation prototype; user acceptance and training; and outstanding issues to be addressed. Details are given on the design philosophy, some of the technology utilized, the implementation process, and future directions.

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**Introduction:**

The Savannah River Site covers over 300 square miles in South Carolina along the Georgia border. Currently employing over 23,000 people, it has an enterprise-wide Ethernet to which the over 14,000 current workstations are attached. In addition to local file servers, these workstations require attachment to Vax, Cray, or IBM mainframe computer resources. There are approximately equal numbers of IBM MS-DOS and Apple Macintosh computers, and individual workgroups often utilize both machines. These groups wish to access host services via the Ethernet and share data files cleanly among dissimilar operating systems.

WISDOM was designed as a system of network services, workstation platform standards, installation procedures, and application choices which would address data integration from the user perspective. It utilizes TCP/IP connectivity with host-based services as a migration toward government dictated Government Open Systems Interconnection Profile (GOSIP) standards.

Novell Netware provides the basis for file services, while Microsoft Windows supplies the GUI necessary to compliment the Macintosh. Shared printing services are a cost effective way of obtaining high-quality output from all workstations.

Remote central management, automated workstation installation and update, and disaster recovery were also major design goals.

simplified picture of site network

**Summary:**

WISDOM is not a product. It is a system defined by a set of guiding concepts or principles. The concepts shape the implementation of the system and provide current and future direction. The system is built from commercially available hardware and software with a minimum of customization. Care was taken to keep the parts modular such that the best module for each task could be chosen. Whenever possible high quality vendors were selected who provided cross-platform products. However, products were not selected which would force integration under a single vendor. A major part of the design is the ability to adapt to change. Thus, WISDOM implementation is an ongoing process striving to adjust to changing user needs and available vendor products.

During a major move into new office facilities a rare opportunity existed to implement a large-scale prototype of the design. Sufficient funds were available to replace or update older computers with current models, limiting the equipment variety to be supported. The required system and applications software was purchased as part of the prototype .

The SRS prototype has successfully implemented most of these concepts on the IBM Windows-based computers. A major effort is being placed on implementation of the Apple Macintosh. OS/2-based IBMs have not been significantly addressed at this time.

Because the prototype spans two physical locations and encompasses users with a variety of needs, it provides a test of not only the technology, but the organization necessary to support it. Issues of network traffic, communications failures, and remote management were considered in the design.

A full cost/benefit analysis of the system has not been completed. By gathering actual hardware, software, and administration costs and savings as well as user responses to surveys concerning training and productivity we hope to determine realistic figures.

**Design Goals:**

Although Savannah River has considerable investment in scientific and engineering computing as well as process control, WISDOM was not designed to address these areas, and was limited to an office implementation.

The acronym WISDOM stands for Workstation Integration System for DOS, OS/2, and Macintosh. Its objective is to maximize the benefits of personal computing to the office worker by providing site standardization and management, workstation inter-operability, data interchange, utilization support, and personal freedom, while reducing downtime and overall cost. The system encourages the interchange of data through native interfaces among office workers regardless of their location or computer equipment. It provides a structured use of the graphic user interface on both Apple and IBM equipment; common network file and print services; standardized cross-platform applications; access to host-based services; and automated installation and maintenance systems.

Most importantly, WISDOM provides a known platform upon which applications may be built, and from which users may migrate in the future. It provides the required infrastructure to support implementations of client/server applications, and third-generation office such as mail, workflow, and information services. Additionally, it allows for management of the inevitable changes which will be required to keep current with vendor updates and changing user needs.

## 1. Workstations:

The user workstation today is a highly sophisticated personal computer. Growth of the personal computer industry has been influenced by a user desire to do computing without MIS control. This has generally had a positive effect on the industry and increased the utilization of computing by the average office worker. However, this autonomy has created the impression that the computer is the personal property of the individual, rather than a site resource, and encouraged a lack of standardization. This has created an impossible task in hardware and software maintenance, and the inability of users to share data.

WISDOM attempts to separate those parts of the personal computer which should be standardized and centrally maintained from those preferences and attributes which make the computer truly personal. By standardizing and centrally updating

system and some applications software it is possible to insure that users will have an efficiently operating workstation with minimum support required. Centrally maintaining the personal information for each user's workstation within the network creates the ability to have a portable desktop.

When the user attaches to the network, the workstation software revision levels are checked. When necessary, the standardized part of the workstation software may be automatically updated from a network file server. This guarantees that the workstation will be current and correct without requiring central support. The major user benefit is in supplying solutions before the user encounters the problem. The standardized part of the software is optimized for typical operation and includes virus scan software, performance enhancing mini-applications, and a password-protected screen saver.

The concept of the portable desktop allows a user to work at any workstation of the same general type with the perception that he or she is located at their own machine. Upon entering the network, those characteristics defined as personal are downloaded as necessary to recreate the desktop conditions such as color, style, and user preferences that make each user's machine unique. The fact that this information is actually stored on the network is automatic and transparent to the user.

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Although lesser machines are capable of running Microsoft Windows 3.0, memory constraints, display concerns, and future power needs dictate a minimum 386SX processor. Inadequate computers were replaced and re-deployed as print stations. Apple Macintosh computers below the SE are unable to utilize an Ethernet card and were re-deployed. Each computer was attached to the building Ethernet network via unshielded twisted-pair universal wiring.

Microsoft Windows 3.0 (and future updates) create a Graphic User Interface capable of running a variety of application software packages. As with the Macintosh the interface provides exceptional font control and "What you see is what you get" printing; inter- and intra-application cut and paste; and consistency in user operation. Its DOS foundation allows the use of batch files which make workstation updates easy. A custom-written program pulls user preferences from the network and merges them into the workstation during the startup process.

In order to integrate the Macintosh and address the desired operational goals System 7 was installed. This operating system introduces the use of alias folders and scripting, simplifying user operations. Lack of expertise has seriously delayed this part of the WISDOM implementation.

Both IBM and Mac users required training on the network principles so that they would be able to locate and share data and utilize the network services efficiently. However, the use of Microsoft Windows required a significant amount of additional training for IBM users, as most of the population was not familiar with the product. The trauma associated with change was obviously higher for the IBM users.

**2. File Space:**

The network provides two major types of file services: private and shared. The private file space is accessible only to the individual user and is protected by his or her user ID and password. Shared spaces may be allocated for defined workgroups, allowing data interchange among individuals.

The actual location of specified file spaces can be transparent to the user. In general a significant effort is made to reduce network traffic by placing the file space within the same network segment as the user's normal office location. To an IBM user (DOS-Windows or OS/2) the file spaces appear as standard drive letters with subdirectories; Mac users view the spaces as Appleshare volumes with folders.

The key product for accomplishing this goal was the use of Novell Netware 3.11 and the Macintosh NLM. Netware provides login security and rights to view or access file spaces based on a user profile. DOS (or OS/2) login scripts automate many processes.

It is important to encourage users to place important data into the reliable and secured network file space rather than on local storage. This is accomplished by setting the initial defaults of all standard applications to direct data to the network unless otherwise specified. Because it can be accessed from any WISDOM workstation (regardless of type) data placed in the network file space is always accessible. By selecting private, workgroup, or public network file spaces a user can control access to the data. Automatic nightly backup of all network data insures reliability in the case of equipment failure.

Although no archive service is currently provided, because of staff resource restrictions, it would not be technically difficult to provide for long-term storage.

Accidental erasure of network-saved files can be rectified by the user easily though the use of a menu-driven salvage utility.

mac screen --------- file server ---------- ibm screen

## 3. Applications:

Because network file spaces are easily accessible, regardless of their actual server location, a key requirement for data interchange among the workstation types is compatible applications. Efforts are continuing to seek out vendors who provide common applications on all workstation platforms. Additionally, applications that provide common file formats or built-in conversion routines are preferred. This aids user operations, training, and data interchange.

Standard applications are maintained on a read-only file space geographically close to the workstation rather than on local storage. The applications are read-only, execute-only, preventing them from being copied to local storage or accidently altered. The "preferences" for each application are maintained in the user's private space, thus customizing the application to the user's style and allowing for personal dictionaries, templates, and display options. Windows, OS/2, and Macintosh applications are segregated such that only the correct versions are accessible by a workstation.

Maintaining the standard applications on the file servers allows for fast, convenient software upgrades. Where applicable, either site licensing or concurrency provide reduced costs. Software which is generally less used may benefit from the increased exposure by making it available to all users. Attempts are being made to define the standard software guidelines within the contexts of training, support, data interchange, and functionality. As new releases of current software arrive the migration problems of user training may be eased by making both versions available for a specified time.

Metering software is available to help enforce concurrent license agreements where the vendor has not provided a system for monitoring.

## 4. Network Communications

The SRS Enterprise network is based on Ethernet, Token-Ring, and FDDI transport of specified protocols. Government guidelines dictate a future move toward OSI, but TCP/IP is utilized currently as the protocol most often used to link heterogeneous systems. The WISDOM prototype supports the use of Novell IPX (between IBM computers and the file server), Appletalk (between Macintosh computers and the file server), and TCP/IP (between all workstations and host services) over Ethernet. Expansion to include token-ring is not excluded and has been investigated, but has not been installed in production to date.

The TCP/IP addressing scheme allows a maximum of 250 workstation addresses per Ethernet segment. This is consistent with our belief that between 100 and 200 workstations present reasonable network cable traffic and an optimum file server load. The system is therefore designed such that the largest traffic is within the local segment. Cisco Systems Inc. routers, which support routing of all key network protocols, are used to isolate the segments, passing only needed traffic to the site network. Because most often the user obtains applications and personal data from a file server within the local segment, it is mostly TCP/IP traffic which is passed to the site.

## 5. Geographic Territories:

Each Ethernet segment defined in the communications section above is referred to as a territory. For smaller buildings this might encompass several entire buildings, while larger buildings are likely to have multiple territories. In one part of our prototype the building is broken into first and second floor territories. In the other

building,the segments are actually intermixed across the building, with assignment to one territory or the other based on individual workgroup assignments. More than a technical issue, this becomes an administrative control issue when people shift physical locations within the building.

Each territory is supported by a standardized file server, but may contain additional workgroup or specialized application servers. Two such special servers exist in our prototype.

All file servers are physically and logically divided into a "system" part, an "applications" part, and a "data" part. The "system" part includes the network operating systems software, and the standard utilities. Except for a remarkably few files which contain name and address information this part of all servers is identical. In a similar fashion the "applications" part for all territorial servers is identical. This standardization is a key design element required to support central administration and control, the portable desktop concept, and the reduction of network traffic. An automated process was created to build the system part of servers or extend them to be territorial servers. A process similar to the workstation update is used to keep the standard parts of all file servers current.

The "data" part of each server is unique and must be backed up daily. The private file spaces for users in a territory as well as small workgroup spaces are in the "data" area. Larger workgroup spaces would typically be placed in separate workgroup servers as in our prototype.

When users log into the network from workstations outside their normal territory, the system attaches them to their private space on their assigned territorial file server, even over communications links if necessary. However, the system also attaches to the local territorial file server for the standardized network utilities and user applications. This limits the sitewide network traffic to the unique user data, and does not require that applications files be transported outside the territory.

Shared print services across the network should provide the user with transparent access to any desired printer for which they are authorized. The workstation or network should adjust to the capabilities of the selected printer automatically. The native Macintosh operating system does this very well. Windows, on the other hand does not deal well with network printing. Windows Workstation, a product of Automated Design Systems, affords a "chooser like" interface for selecting printers, adjusting printer drivers, controlling network print queues, and output notification. It's user interface has been of exceptional benefit in making printer services convenient for the user, and the product retains default connections for the workstation.

## 5. Central Administration:

As stated previously WISDOM provides an infrastructure upon which applications may be built, and a platform from which the system itself can migrate. A key component is the ability to easily manage the inevitable changes. Automated installers for both the workstations and servers begin the process; while automatic updates maintain them. The entire process is designed for central administration as a cost effective way of supporting all these standard parts of the system.

The workstation installer depends on a data base keyed against the assigned property number of the CPU box. This data base contains information on the owner, location, and the configuration of the workstation. Assuming that users have used the network file space and not stored data on the local storage it is possible to replace the hard drive and rebuild the workstation in less than 15 minutes.

The updates applied to workstations can be added to the territorial file servers from a central location via the network. Therefore it is possible for all site workstations to be updated remotely. The update design also allows for staged updates or updates of only specific workstation types or configurations. When a workstation which has not been utilized for an extended period of time attaches to the network all required updates, in sequence, will be performed.

The remote console feature of Novell Netware 3.11 allows a remote workstation to perform almost all functions typically done at the file server itself. This allows control, update, and performance tuning of the file servers from a central location. The servers themselves are securely located in the communications rooms associated with the Ethernet segments. Electrical power protection is provided by individual Uninterruptable Power Supplies.

Management of user accounts may also be done from a central location. This includes creation, password reset, workgroup membership, and relocation to another territory.

**Futures:**

As of the date of this paper the prototype has produced significant benefits to the users and the support staff. Attempts are being made both to measure the hard cost/benefits and quantify the soft productivity gains. The update processes have been frequently used as the system is constantly adjusted and improved.

Although incoming users were trained on the windows operations it is felt that additional training for all users on the network sharing and productivity tools would produce a significant return. Macintosh users are still not completely integrated and obtaining many of the benefits of the system. Major emphasis is currently being placed on completing this work and training the Mac users.

In the prototype installation decisions had to be made on which shrink-wrap applications would be supported. Selections of software and related technologies (which TCP/IP implementation) were made more on the basis of what was available and would work than on site standards. As true site standards and site licensing are established by evaluation and/or competitive bid the system will be adjusted. Planned site-wide applications such as LAN-based mail may also require some changes. The modular nature of the design assumes that anything can change if required.

Perhaps the most obvious weakness observed to date is the organizational structure required. If this prototype is to be expanded to become a site-wide system budgeting and staff management considerations must be addressed. An MIT sponsored seminar "Management in the 1990's " recently reported "Significant investment in new information technology without parallel organizational change is unlikely to yield good results". The implementers of this prototype would concur.

# END

# DATE FILMED

4/21/92