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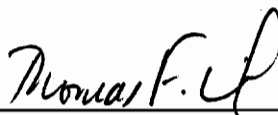
by

John R. 'Jake' Ruppert

Project submitted to the Faculty of the
Virginia Polytechnic Institute and State University
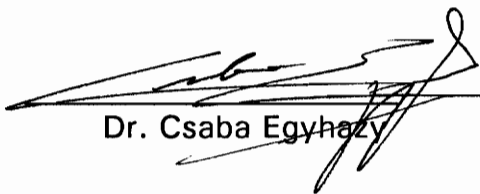in partial fulfillment of the requirements for the degree of

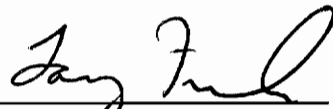## MASTER OF SCIENCE

in

Information Systems

APPROVED:

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OFFICE AUTOMATION MIGRATION STRATEGY

By

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(ABSTRACT)

The strategic direction of the next generation of office automation hardware and software needed by an integrated government/contractor team supporting a classified defense installation is analyzed. Both existing platform upgrades and potential replacement platforms are evaluated against management constraints and system requirements to select the most cost efficient design that meets the office automation requirements.

An integrated SUN and personal computer networked environment is selected due to minimal impacts to current operations and lower cost. The migration strategy addresses the phases necessary to ensure a smooth transition from the current system to the new system.

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Section One : Introduction

1.1 Overview

The advancements in computer technology are happening at such a rapid pace that the impact to the office environment is often overlooked. Information Systems (IS) managers are confronted with the task of satisfying the automation needs of a diverse user community, anticipating the operational impacts of the newest technology, and protecting the company's large investment in hardware and software. Additionally, the manager must do so with a smaller staff to reduce the capital needed to operate and maintain the computing complex. However, it is no longer sufficient to simply rely on the IS manager to develop the most cost effective method of upgrading technology bases. Upper level management must provide the support necessary to ensure that the introduction of new technology will not adversely impact the organization. Also, the information technology must continue to serve as a strategic resource to the firm. Burn asserts that "there are four prime reasons for use of Information Technology as a strategic resource:

- to gain competitive advantage

- to improve productivity and performance

- to enable new ways of managing and organizing

- to develop new businesses

and as a consequence Information Technology [IT] and Information

Systems should no longer be considered support activities but harnessed to support [the] firm's strategy and structure."[1]

When considering the firm's IT resources as strategic entities, managers must remember what "science fiction writer Isaac Asimov once said: 'That it's easier to foresee the automobile than the traffic jam.' Put another way, the march of technology is inexorable and, to some extent, predictable. But, the resulting corporate and organizational ramifications are much harder to imagine."[2]

Therefore, as companies strive to maintain their position in the marketplace while simultaneously being confronted with the constant flow of new products to service the needs of the office automation community, they must address both the technological and organizational impacts of an office automation migration strategy. The company's current office automation environment consists of several proprietary and non-proprietary systems that are 'Islands of Automation', i.e., there is little or no connectivity between the systems. A strategy must be developed to move the office automation complex into a more open environment where information and data can be easily transferred between the platforms. This paper is organized as follows:

1. Section 1 provides the Introduction of the Office Automation Migration Strategy.

2. Section 2 is an examination of the Open System Interconnection (OSI) model and its impact upon the office automation environment.

3. Section 3 presents an overview of the current office automation environment.

4. Section 4 covers an evaluation of the platform options under consideration for the next generation of office automation.

5. Section 5 discusses the methods by which management can plan to minimize the impact of the technological changes on the organization.

6. Section 6 is the migration strategy that will bring the office automation environment closer to an OSI environment.

The purpose of this paper is to analyze the steps necessary to develop and implement a strategy to migrate the current office automation environment to the next generation of hardware and software tools available in the open market. The combined government/contractor management team wants to maximize the use of the technological advances offered by the computer industry. The strategy must minimize the impacts to current operations, maximize cost effectiveness, and increase office automation interoperability over multiple systems.

1.2 Organizational Environment

The organization is a combined government and contractor team supporting a classified defense contract. The major sections within the organization are production, engineering, data processing and support. Figure

1.1 presents a breakout of the subsections within each section. Each section

has both technical and non-technical personnel who interface with the data

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                        GOVERNMENT

                      CONTRACTOR  TEAM


     PRODUCTION       ENGINEERING       DATA  CENTER        SUPPORT


     PRODUCTION        SOFTWARE          OPERATIONS        LOGISTICS

       TEAMS          ENGINEERING


     PRODUCTION        HARDWARE           SYSTEMS          PERSONNEL

      SUPPORT         ENGINEERING        PROGRAMMING


                                         HARDWARE         MAINTENANCE
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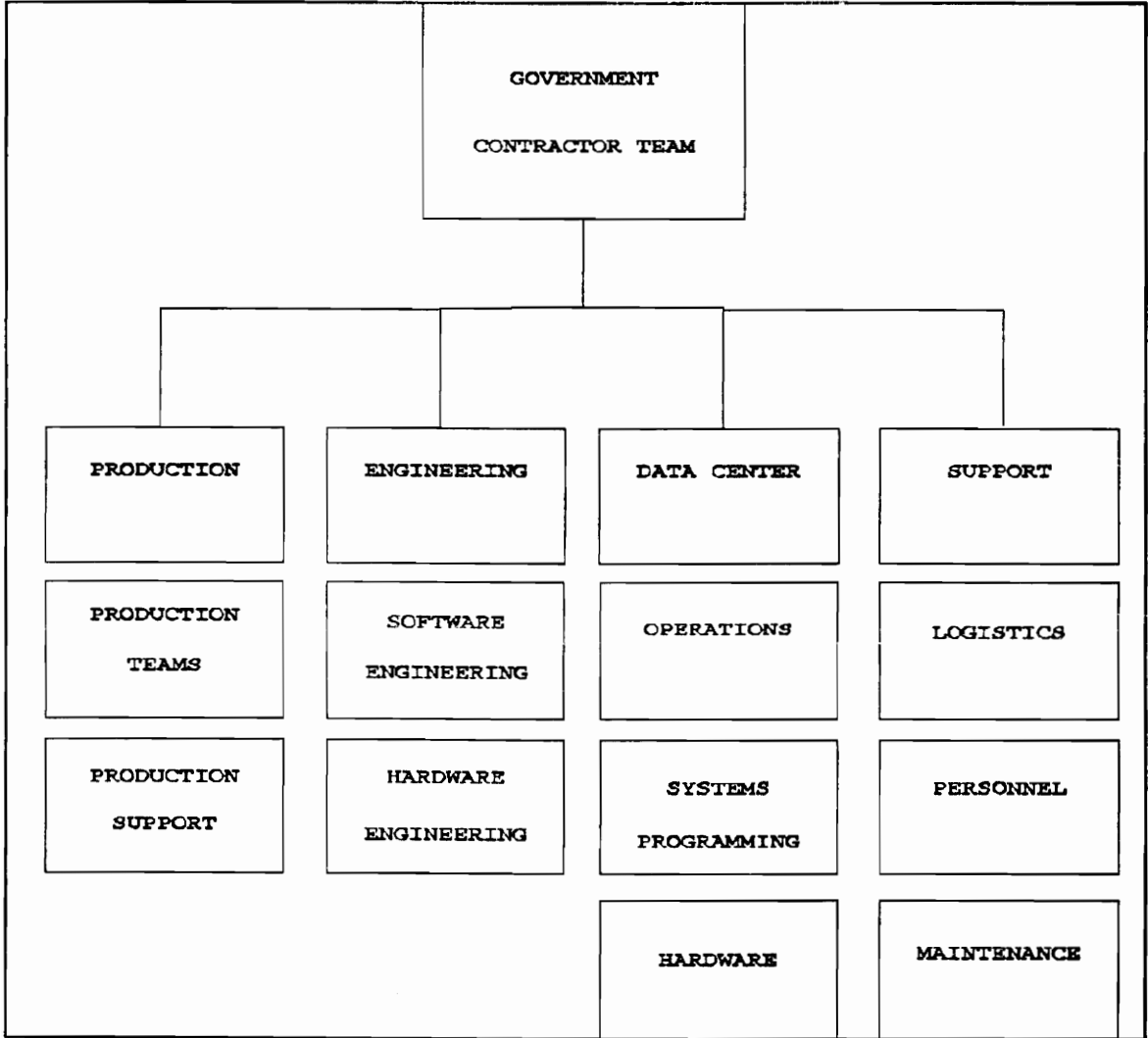
Figure 1.1 Organizational Structure.

center for office automation support. The management hierarchy has more

than the average number of senior managers for the size of the organization.

This is true for both the government and contractor staffs. As a result, the

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administrative support has many executive secretaries. These secretaries have direct access to senior management personnel when problems arise in the office automation environment.

The entire organization is dedicated to providing support to the production section. The engineering and support sections, however, view their roles as more important to the organization than the other sections. Consequently, the senior personnel in these sections do not want any changes to be introduced which will decrease their ability to support both production and their own projects.

The office automation environment is further complicated by the different problem solving methodologies used in production and office automation. In the production environment, when a problem is discovered, it is documented in a report and given a priority from A through D. These priorities address the varying degrees of impact problems create within the production environment. 'A' is the highest priority. The problem is then assigned to one of the non-production sections for investigation in priority and numerical sequence. In the office automation environment, when a problem is discovered, the person with the problem calls the manager in his/her section. The next call is to the data center management. The newest problem is given a priority based upon the position of the caller within the organization. Therefore, no proper prioritization of any office automation problems is ever done.

1.3 Management Constraints

Management has made several decisions that impact the office automation migration strategy planning. These decisions translate into a set of constraints that limit the available options for the office automation environment. These constraints are described in the following paragraphs.

1.3.1 Mainframe Resources

The IBM mainframe resources are dedicated to production, production support, and engineering. The mainframe processor sizing is driven by external requirements. The processor is sized to accommodate a well defined application and does not have enough margin to add on office automation applications.

1.3.2 Distributed Processing

Maximize the use of distributed processing for office automation. Network based applications and increased file sharing will help to reduce licensing, software, and hardware costs. Additionally, the automated date processing resources can be used more efficiently.

1.3.3 Proprietary Vendors

The new office automation system must reduce the organization's dependence on proprietary vendors. The use of commercial-off-the-shelf (COTS) products and an open systems based operating system will provide an office automation thai more robust, expandable, and enhance software portability.

1.4 Summary

The government/contractor management team has directed the organization to move the office automation complex towards a more open and distributed environment. The migration strategy must comply with the management constraints, and system requirements while minimizing the impacts to the organization. The uniqueness of the organization's structure complicates the impacts of the technological changes upon the organization. The planners will require top level management support to ensure that the option selected is the best option for the organization and not just two or three sections within the organization.

Section Two: Future Directions for Information Systems (IS)

2.1 Overview

Many companies have large investments in their computing complexes and are investigating the possibilities of OSI. A major reason for their interest is that OSI provides the company with alternative hardware and software vendors should the current provider of services fail to meet the company's requirements. When a company's computing complex is based on proprietary software and hardware, the cost to go to another vendor is prohibitive. The company must live with limitations of the current system or rebuild the computing complex. The latter is not a viable solution for firms with large capital investments in both hardware and software.

2.2 Open Systems Interconnection (OSI)

OSI presents users with an architectural vision based on a seven layer standard. The computing environment gains potential due to the increased availability of applications that can operate on any hardware platform. However, Stallings states that OSI "is based on the concept of cooperating distributed applications... OSI is concerned with the exchange of information between open systems and not with the internal functioning of each individual system. Specifically, it [OSI] is concerned with the capability of systems to cooperate in the exchange of information and in the accomplishments of tasks. The objective of the OSI effort is to define a set of standards that will enable open systems located anywhere in the world to

cooperate by being interconnected through some standardized communications facility and by executing standardized OSI protocols."[3]

OSI standards have the goal of making the specific details of the computing complex transparent to the user. When the underlying structure of the information system is transparent, the focus can be on the use of information rather than the technology required to transfer the information from point to point.[4] OSI based systems must provide a user friendly application layer interface to achieve the desired transparency of the computing environment. The application layer services provided by the OSI model are:

1. Message Handling Services (MHS or X.400) for electronic mail

2. File Transfer, Access and Management (FTAM) for file transfer services

3. Virtual Terminal (VT) for terminal emulation and

4. Directory Services (DS or X.500) for a single directory supporting multiple systems within the network.[5]

Therefore, companies currently using proprietary computing complexes must begin to develop a long term direction for migration towards an OSI compliant environment. The direction must have top management approval and support.

2.3 Impact of OSI on the IS Organization

A company moving toward an open systems environment must assess the appropriateness of the new OSI compliant products to their organization. Hodges says that "Open systems...will effect much change in the IS

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community... Two forces are driving the push towards open systems. First, the never-ending quest for independence from vendors and, second, the need to connect and interoperate the islands of automation that exist throughout the corporate universe."[6] However, a full product suite to run OSI compliant applications does not exist. Companies need to evaluate the degree to which UNIX based systems are required for their computing requirements as the open systems applications become readily available in the commercial environment. Jeff Moad reports that "top IS managers are saying that UNIX itself, while a good start, is not nearly enough. Open systems... should not just mean a non-proprietary operating environment in which applications can be easily moved among a number of hardware architectures. If open systems are to help users become more competitive,... they must operate with the billions of dollars worth of hardware and software already in place."[7] Moad continues to say that "To get there [a more open environment], many [IS organizations have] chosen to focus on interoperability - which can be defined as the ability to use standard interfaces to allow communications and data sharing between applications running on different types of systems - rather than buying into UNIX to achieve application portability."[8] Further complicating the computing environment are increasing user demands for increased standardization. "[Users] want industry wide database interface definitions so they can mix and match relational databases and development tools such

as fourth generation languages(4GLs) as easily as they can combine UNIX hardware platforms today. They want a single, standard graphical user interface. They want standard object management across heterogeneous environments. And they want standard network management protocols that can be used to run complex networks of hundreds and thousands of different types of devices... Users need standard interfaces at every link in the applications architecture chain. And most large users - especially those needing to link non-proprietary systems with existing proprietary systems are finding those interfaces just aren't there yet."[9]

Information Systems professionals who must continue to connect the entire organization are left with the problem of defining the interim solution until the OSI product suite is more robust. As plans are developed to move to the next level of technology, IS managers must be cognizant of the new applications and hardware being developed. New offerings could make their well developed plan obsolete before the first year of operation is complete.

2.4 Upcoming Developments in Information Systems

DATAMATION magazine, in its 15 August 1991 edition, published an article titled 'Connecting the Enterprise'. The article addressed topics related to connecting the computing assets of a company to allow access to all of the information system resources. Electronic mail, distributed network servers and local area networks (LANs) are discussed in the following paragraphs.

2.4.1 Electronic Mail (e-mail)

"As companies integrate and extend e-mail, they face the task of knitting together multiple internal host-based systems... with LAN based systems... [Companies] are trying to cope [with e-mail interconnectivity] by reducing the number of e-mail systems to two or three... The ultimate is one system because you'd then have interoperability,"[10] reports McCusker. Additionally,"...many IS groups are engaged in meshing unlike e-mail systems within organizations to work as one. A major factor enabling that process has been the proliferation of gateways using X.400 - the Consultative Committee on International Telephony and Telegraphy(CCITT) standard for e-mail interchange. And users are looking forward to... the X.500 standard for directory services, which will eliminate the need for multiple user names across multiple e-mail systems,"[11] continues McCusker. Evidently, much work is in progress and much remains to be done before even e-mail is fully OSI compliant. Additionally, every company must plan how e-mail can be used effectively so that the maximum benefit to the organization will be achieved by introducing the new technology. There is optimism that the X.400 and X.500 compliant processes will allow companies to integrate diverse e-mail products across multiple platforms. If this happens, companies will not be forced to buy one e-mail product to achieve interoperability.

2.4.2 Network Servers

Distributed systems have caught many large system IS managers with a skill base that supports neither the smaller systems nor the network that unites them. Many consider them a fad and still do not take them seriously. Also, "the rapid spread of personal computers and workstation networks is provoking a split among IS managers about how far to take the micro based technology.

"On the one side are those who say that, although PCs are gaining more power, critical corporate applications will continue to be run on minicomputers and mainframes, which can offer better security, administration and reliability. PC-based local area network (LAN) servers are suitable mainly for basic file serving and device sharing, say these traditionalists.

"On the other side are those who say that running client/server applications on minicomputers and mainframes is a waste of time and money. They point out that network servers are becoming more powerful and are acquiring sophisticated networking and administration software. And they say the time has come to move beyond basic services and run business-critical, transaction-oriented applications on PC servers."[12] However, companies should ensure that the system and network management tools are in place before moving any business critical applications to the new superservers.[13]

The issues of reliability, security and administration of the network based systems have IS managers fully evaluating the distributed processing systems before recommending any distributed solutions to upper level management. Migration to the distributed environment must be phased. The requisite skill base for systems and network management must be part of the IS section of the company. Also, the management team must decide which critical business applications can be migrated to the distributed systems.

2.4.3 Local Area Networks (LANs)

"Information Systems managers mulling over their future connectivity schemes should not restrict their thinking to the problems of typical data transfers."[14] The capability to integrate voice, image, video, and data at the desk top is a realizable goal. Full integration is a laudable goal, but it will take years to [achieve]... Most experts agree that today's LANs can handle still image and audio applications without [resulting in unacceptable network performances levels]. The real challenge begins when full motion video is brought into the picture...Some companies may choose to wait however, until they can put in higher bandwidth data nets and bring any kind of data to the desktop. That will be most probably a combination of ISDN [Integrated Services Digital Network] for wide area networks and FDDI [Fiber Distributed Data Interface]."[15]

Companies must evaluate the technology needs of their specific organizations prior to procuring equipment to support issues like those

presented in the above paragraph. Planning should be underway to address the integration of multiple types of media to the desktop level when such advances in technology will be beneficial to a company's market position.

2.4.4 Open Systems Migration Examples

How to maintain the corporate market position is not clearly defined. "Planning...[for changes in information technology] is harder than ever today... Two forces are complicating things for IS planners. One is the accelerating pace of product development from leading technology suppliers. The other complicating factor is the widening proliferation of technology into the enterprise... Clearly, many enterprises aren't prepared to deal with significant and fundamental changes in technology."[16] However, there are example of companies that have made major changes with the introduction of new technologies. Three examples are presented in the succeeding paragraphs:

2.4.4.1 Shearson Lehman Hutton Inc.

Reason for Changing - Shearson wanted to expand its over-the-counter (OTC) equities business. Their proprietary PC-based Program It system proved unsuitable due to limited expandability.[17] Shearson has an application that is well suited for the distributed environment. OTC trading is a world-wide, transaction based enterprise. The inability of their IBM mainframe and PC system to meet their requirements forced Shearson to look at another product to reach their goal of an increased open systems computing complex as shown in Table 2.1. Without any open systems standards, Shearson would

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merely have been moving from one proprietary system to another. There would

be no assurance that the current situation would not be repeated in the future.

Table 2.1 Shearson Lehman Hutton, Inc. Systems Overview.

OLD SYSTEM	NEW SYSTEM	GOAL
IBM Mainframes IBM PCs	SUN SPARC IBM RS/6000 (under evaluation)	Increase open systems computing complex

2.4.4.2 MetLife

Reason for Changing - MetLife adopted a corporate strategy to achieve

an open systems environment centered around IBM's Systems Application

Architecture(SAA). MetLife's major objective was to maximize the resource

utilization of the desktop computers and its mainframes simultaneously.

Networking the large PC base within the company will minimize the

technological and organizational impacts while SAA compliant products are

developed.[18]

MetLife has evaluated its computing complex requirements and decided

that the firm can wait for the development of open system software products

to execute on IBM's distributed systems as shown in Table 2.2. The decision

is for the long term. Met Life needs both the distributed and mainframe

resources. The company is willing to wait for SAA compliant hardware and

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software to become more readily available.

Table 2.2 MetLife Systems Overview.

OLD SYSTEM	NEW SYSTEM	GOAL
IBM Mainframes, IBM PCs (not networked)	IBM Mainframes, IBM PCs (networked)	Open Systems via IBM's SAA Plan

2.4.4.3 Products Research and Chemical Corporation

Reason for Changing - The computing requirements within the chemical industry must comply with strict regulatory requirements. Products Research sought improvements over its present mainframe system to provide more flexibility in meeting the changing regulatory requirements.[19] Additionally, the firm needed a system which would allow data to flow to and from all five of its divisions. The current UNISYS system, while having met its original requirements, could not handle the additional requirement for the distributed nature of today's Products Research environment. Table 2.3 provides the overview of the Products Research systems.

Table 2.3 Products Research Systems Overview.

OLD SYSTEM	NEW SYSTEM	GOAL
UNISYS (SPERRY) 1100	HP 9000-855S, HP 9000-825S	Single system to access all five divisions.

2.5 Summary

The need for standards within the computer industry continues to be a major topic for vendors and users. In fact, the user community is beginning to drive the manufacturing vendors to meet their requirements or lose business. Each day more companies are deciding that distributed processing is the answer to some or all of their computational needs. Others companies are still investigating the possibilities of distributed processing. Every company will be confronted with a major strategic decision concerning to what degree, if any, distributed processing is necessary to ensure the company's success in an increasingly competitive market place. OSI-based systems and products will provide needed standards to allow more portability of information within a company or between multiple companies.

Section Three: Office Automation Environment

3.1 Overview

Before a strategic plan can be developed, the current environment must be defined. The organization's current office automation platform is a mix of multiple proprietary and non-proprietary systems. These systems evolved over a period of years to support distinct and separate user communities. There was no overall plan to provide connectivity because there was no one single organization responsible for the systems. Each system became an 'Island of Automation'. The result is a very cumbersome and labor intensive environment when implementing even the simplest form of data transfer. Therefore, the user is limited by the architecture in place to meet his or her minimal requirements for office automation.

The overall goal is to provide the user community with a single workstation desk top environment that has default access to multiple applications residing on different platforms. The management team desires to install and operate an open systems architecture without replacing all the hardware and software currently in use. Thus, the new systems must be capable of being integrated with the current systems. The result will be a fully interconnected system which brings the organization closer to the OSI environment.

3.2 Statement of the Problem

The lack of connectivity provided by the current office automation systems makes it necessary to store duplicate data on multiple systems. Each user stores the data needed to accomplish the job on the system to which he/she has access. To maximize the connectivity and interoperability of the office automation environment, the organization must develop a long term Office Automation Migration Strategy to replace today's office automation tools while minimizing the impacts to current operations.

3.3 Office Automation Environment

3.3.1 Evolution of the Office Automation Environment

The current systems, while they met the specific user requirements, did not address the overall connectivity of the entire organization. Initially, there were only two types of data processing systems, WANG and IBM. The former was dedicated to office automation and the latter to critical business applications. This arrangement allowed for a convenient separation of operation and administration of the two systems between two organizations. Therefore, planning, budgeting and upgrades were viewed in separate spheres of influence, as well as, different approval chains for the procurement of hardware and software.

Since the IBM was used for critical applications, the user base was highly technical with little need for office automation tools at the inception of the organization. A line oriented text editor was sufficient for word

processing and the only graphics available required programming skills. Also, the organization did not allow the resources of the mainframe systems to be used for office automation purposes. The organization dedicated the IBM resources to production, production support and engineering.

The WANG was the logical choice for office automation when it was selected. Its products supported the following:

1. Electronic mail via WANG Office

2. Scheduling via WANG Office and

3. Word Processing via WP+.

There was no spreadsheet, database or graphics support. However, as automated applications were conceived for databases, the WANG programmers would meet the user requirements with COBOL programs which executed on the WANG. There are now multiple non-DBMS database applications on the WANG which must be converted to DBMS applications in the new office automation environment.

The emergence of the stand-alone PC in the work place increased the complexity of the office automation environment. The end user decided just what hardware and software would be required on his or her desk. From the end user standpoint, there were the advantages of independence from the central system, the ability to tailor applications, the absence of lengthy approval cycles for application development, and the availability of commercial-off-the-shelf software products to provide the software to meet

the day-to-day office automation needs.[20] The PC made it easier for the end

user to do the job. However, there were drawbacks to this dramatic

increase in end user computing power. For the IS organization tasked with

licensing these products, there was more application software and more

hardware to support and track. Additionally, a more broad skill base was

needed to support the new products. Furthermore, each user wanted to get

support for the newest hardware or software product. In short, the

proliferation of both hardware and software in the work place became a

maintenance concern.

A UNIX based system was the next platform to be installed. The SUN

was the choice of the engineering world as the organization began to operate

non-proprietary systems. These systems were largely used for engineering

development. A major change in the IS environment was the introduction

of the network. The software products for office automation on the SUN

are Island Write or Word Perfect for word processing, Island Paint/Draw for

graphics, LOTUS 1-2-3 for spreadsheet applications and a relational DBMS,

dBase IV, for database applications.

Finally, the growing PC community made it necessary to create a

local area network to provide better service for them. Management realized

that the IS organization could not support all the software products favored

by each section within the organization. Therefore, a decision was made

to support the following software products on the PC LAN: Word Perfect for

word processing, LOTUS 1-2-3 for spreadsheet applications, Harvard Graphics for graphics support, and dBase IV for database applications. The decision to provide one product per office automation function has helped reduce software licensing costs and staffing levels.

3.3.2 Today's Office Automation Environment

Today the data center is responsible for supporting IBM, WANG, PCs and SUNs. All user support for these systems is under the administration of the data center from the procurement of hardware and software to the removal of obsolete equipment. One section within the organization plans for the future of office automation within the organization. Table 3.1 summarizes the capabilities of today's office automation systems.

<u>Table 3.1. Current Systems Capabilities.</u>

	E-Mail	Data-base	Word Processor	Graphics	Sche-duler	Spread-sheet
IBM	No	No	Line Editor	Limited	No	No
WANG	Yes	Yes	Yes	No	Yes	No
PC	No	Yes	Yes	Yes	No	Yes
SUN	Yes	Yes	Yes	Yes	No	Yes

3.4 System Requirements

The overall requirement is for a data processing system which meets the office automation needs of a highly diverse user community. Definition of the minimum requirements for the new office automation permits an objective evaluation of whether or not each possible platform meets the stated requirements. Additionally, the system must comply with the management constraints presented in paragraph 1.3. The succeeding paragraphs define the specific requirements for security, budget, system capabilities, application migration, data translation service, and the user interface.

3.4.1 Security

3.4.1.1. Physical separation of different levels of classification on non-certified operating systems.

3.4.1.2. Workstations must be diskless.

3.4.1.3. An audit trail must be provided to trace activities.

3.4.1.4. Password authentication is required.

3.4.2 Budget

3.4.2.1. The solution must be cost effective and expandable.

3.4.2.2. The plan must be a phased, multi-year process due to limited funding.

3.4.2.3. Operations and maintenance costs must be minimized by using the following objectives:

a. Work towards single O/S on network.

b. Support standard software packages.

c. Support standard hardware configurations.

3.4.3 System Capabilities

3.4.3.1. The new system must be brought on line with minimal impact to current operations.

3.4.3.2. The new system must not deplenish any capability currently in use without providing an acceptable substitute to the user.

3.4.3.3. The system must provide default connectivity to all systems

3.4.4. Application Migration

3.4.4.1. Recode the COBOL based database applications on the WANG to a network supported relational DBMS.

3.4.4.2. The schedule of new DBMS activations must be fully coordinated with the impacted user community.

3.4.5 Data Translation Service

3.4.5.1. Provide standard forms on new system.

3.4.5.2. Provide interface with internal and external users.

3.4.5.3. Provide access to older technology for two months after transition.

3.4.5.4. Translate all files to the new system format.

3.4.6 User Interface

3.4.6.1. Provide a graphical user interface with a default environment for all users.

3.4.6.2. The system must be easy to use with on-line documentation.

3.4.6.3. Provide a single logon form for all systems.

3.5 Summary

Today's computing environment for office automation is limited. The development of separate systems to meet specific user requirements did not account for the possibilities of multiple distinct hardware platforms being interconnected. Therefore, the ability of the new system to provide access to multiple platforms is essential. The new system must be capable of meeting the stated requirements in the order presented. Security is an overriding concern in the organization due to the classified nature of the work. The ability of the computing system to meet each requirement must be evaluated on a case-by-case basis for cost/benefit purposes. The shrinking federal budget highlights the increasing demand for cost effectiveness. The impact to current operations must be minimized at all times. The remaining requirements provide for a more user friendly office automation environment.

Section Four: Platform Options

4.1 Overview

Recognizing the iimitations of today's systems will assist planners of the next generation of office automation to design a fully interoperable computing environment. There are several office automation platforms which need evaluation. The final selection should be made based upon the capability of the new platform to satisfy the office automation system requirements, provide connectivity to all existing systems, meet management constraints, and be cost effective. However, the requirement for continued support of the current platforms, combined with the decreased funding available, will restrict the number of platform selection options.

In the following paragraphs, three types of evaluations for each platform are shown in tabular format. These evaluations are explained below:

1. Yes - The option meets constraints and system requirements.

2. Can be - Advances in hardware or software will allow the option to meet the constraints and system requirements.

3. No - The option cannot meet constraints and system requirements.

4.2 Platform Options vs. Management Constraints

The management constraints presented in paragraph 1.3 are considered before any technical requirements. The migration strategy must provide a solution that can comply with all of the constraints during the execution phases of the plan. Table 4.1 shows that both the IBM and WANG systems fail to

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meet one or more of the management constraints. Therefore, neither the IBM
nor the WANG are considered as viable options for the office automation
platform.

Table 4.1   Platform Options vs. Management Constraints.

Para	Description	IBM	WANG	SUN	PC/SUN
1.3.1	Mainframes Dedicated for Production/ Engineering	No	Yes	Yes	Yes
1.3.2	Maximize Distributed Processing for OA	No	No	Yes	Yes
1.3.3	Fewer Proprietary Vendors	No	No	Yes	Can Be

The only office automation application which deserves investigation for
mainframe use is electronic mail. The mainframe can be used as the e-mail
'switch' to provide additional security verification not currently available on the
other platform options. Additionally, the e-mail service can be extended to the
production, production support, and engineering groups.

The SUN and PC/SUN options can meet the management constraints.
SUN's announcement of the Solaris 2.0 operating system (O/S) extends the
UNIX O/S to any intel 386 based personal computer. The use of Solaris 2.0 in
the LAN environment will provide a single O/S for the networked systems. This
change reduces the dependence on a proprietary vendor, Novell, for the PC

based systems.

4.3 Platform Options vs. System Requirements

Each of the two remaining platform options must meet the system requirements stated in paragraph 3.4. The following paragraphs discuss the ability of each option to meet all of the system requirements.

4.3.1 Security

Table 4.2 illustrates that both the SUN and PC/SUN solution meet all of the current security requirements. Additionally, each option postures the organization for a UNIX-based operating environment that could provide a multi-level secure operating environment. The requirement for physical separation of different classification levels could then be dropped.

Table 4.2 Platform Options vs. Security Requirements.

Para	Description	SUN	PC/SUN
3.4.1.1	Physical Separation of Classification Levels	Yes	Yes
3.4.1.2	Diskless Workstations	Yes	Yes
3.4.1.3	Audit Trail	Yes	Yes
3.4.1.4	Password Authentication	Yes	Yes

4.3.2 Budget

The PC/SUN option is more cost effective as shown in Table 4.3. The workstation cost for a PC is 5K versus 10K for a SUN workstation. Since the

Table 4.3 Platform Options vs. Budget Requirements.

Para	Description	SUN	PC/SUN
3.4.2.1	Cost Effective	No	Yes
3.4.2.2	Phased Process	Yes	Yes
3.4.2.3.a	Single Operating System	Yes	Can Be
3.4.2.3.b	Standard Software Packages	Can Be	Yes
3.4.2.3.c	Standard Hardware Configuration	Yes	Yes

SUN workstations required under the mixed PC and SUN option would be for technical users, the initial dollar expenditure would be less for the mixed option. Also, the server cost for PC based systems are only 25% of the SUN server cost. The SUN does not currently support all of the standard software packages in use on the PC LAN. Additional product evaluations are necessary to provide standard software application support on a SUN only platform.

As previously stated, the SUN announcement of Solaris 2.0 provides the capability of using one O/S in the LAN environment. Subsequent upgrades of PC's would need a minimum of 16MB of memory to handle the O/S overhead.

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4.3.3 System Capabilities

The PC/SUN solution meets all of the system capability requirements. Table 4.4 points out that the SUN option requires more product evaluation to ensure that the deplenishment of the office automation functions currently in use can be minimized. Additionally, only the PC/SUN option provides connectivity to all systems.

Table 4.4 Platform Options vs. System Capability Requirements.

Para	Description	SUN	PC/SUN
3.4.3.1	Minimize Impact to Operations	Yes	Yes
3.4.3.2	Minimize Functional Deplenishment	Can Be	Yes
3.4.3.3	Default Connectivity to Systems	Can Be	Yes

4.3.4 Application Migration

The WANG-based COBOL database applications form a major project in the later stages of the office automation migration strategy. Tables 4.5 illustrates that either solution can meet the requirements for the conversion of these 'home grown' databases into a suitable relational DBMS. Close coordination with each user group is necessary to define the database requirements, select the DBMS to be used, develop a design that meets the requirements of the user group involved and the overall organizational goals, and implementation of the database design.

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Table 4.5 Platform Options vs. Application Migration Requirements.

Para	Description	SUN	PC/SUN
3.4.4.1	Convert COBOL databases to Relational DBMS	Yes	Yes
3.4.4.2	Fully Coordinated with User	Yes	Yes

4.3.5 Data Translation Service

Additional product evaluations will assist in determining if either or both platforms can meet all of the requirements shown in Table 4.6. Currently, a

Table 4.6 Platform Options vs. Data Translation Service Requirements.

Para	Description	SUN	PC/SUN
3.4.5.1	Standard Forms	Yes	Yes
3.4.5.2	Interface with All Systems	Can Be	Yes
3.4.5.3	Access to Old System	Can Be	Yes
3.4.5.4	File Translation	Can Be	Can Be

WANG to PC/LAN integration effort is underway to verify that all WANG word processing files can be accessed from the WANG system and converted into Word Perfect format for use on the PC/LAN system. This can be done without requiring the user to logon to the WANG. This reduces the conversion time by

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eliminating the need for data center personnel to execute the file conversion.

4.3.6 User Interface

Ease of use of the office automation platform, or 'User Friendliness', is a major requirement. Table 4.7 shows this to be a shortcoming of the SUN only option. The UNIX environment is not easy to use if the windowing application is not functioning properly. The office automation user community

Table 4.7 Platform Options vs. User Interface Requirements.

Para	Description	SUN	PC/SUN
3.4.6.1	GUI with Default Environment	Yes	Yes
3.4.6.2	Easy to Use System	No	Yes
3.4.6.3	Single Logon Form	Yes	Yes

is comprised of a majority of non-technical users. The learning curve for the UNIX environment is more pronounced than the PC environment. User training is needed for either technology change. However, the impact of the PC/SUN option will be less severe since many users are already familiar with the DOS-based personal computers used in the organization today.

4.4 Platform Selection

The major differences between the SUN and the PC/SUN platform options are budget, system capabilities and the user interface. The mixed PC/SUN solution is selected for the following reasons:

1. Management constraints can be satisfied.

2. Least costly option to implement over a multi-year period.

3. Allows for single operating system support with the conversion to SUN's Solaris v2.0.

4. Provides all the office automation tools across two platforms without requiring data conversions on the user's part.

5. Least technological change for the user community.

4.5 Summary

The management constraints placed upon the office automation environment eliminate the IBM and WANG options from consideration as viable alternatives in the office automation platform evaluation. The SUN and PC/LAN options are different with respect to budget, system capabilities, and the user interface. The mixed PC/SUN solution allows for the maximum flexibility in the short term. It meets more of the system requirements than the SUN only solution. Also, the PC/SUN solution represents a lower level of technological change for the non-technical user community. With continuing evaluation of the of new hardware and software, the potential impacts due to technological or organizational changes can be accommodated.

Section Five: Organizational Impacts[1]

5.1 Overview

The need to evaluate the organizational changes, which will be driven by the technological advances, is a key element in determining whether the introduction of the new technology will succeed or fail. For, as Flores stated, "... technology is not the design of physical things. It is the design of practices and possibilities to be realized through artifacts. Computer technology... encompasses the design of new practices... and beyond that it opens the possibility for new realms of practice... When we accept the fact that computer technology will radically change management and the nature of office work, we can move toward designing that change as an improvement in organizational life."[21] The organization contemplating a major change that will result in some type of structural change must be aware of the various factors involved. The government/contractor management team must begin to assess who will be impacted by changes in organizational relationships. Additionally, the identification of those who will resist the change, and therefore, threaten the success of the introduction of the new office automation environment, is critical. Once the candidate list of those most likely to resist has been developed, the management team must

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[1]Portions of the Organizational Impacts section of this report were derived from "Introduction of Structural Changes in Organizations", by John R. Ruppert, for MGT 5314, Organizational Behavior, Fall 1990 at the Northern Virginia Graduate Center of Virginia Tech.

analyze the reasons for resistance. Next, the manager can develop a plan to eliminate or reduce the impact of the resistance.

5.2 Process of Planned Change

Once the management team has recognized the external forces dictating the need for an organizational change, a process to implement the planned change must be chosen. Kurt Lewin proposed that planned change is a multistage process involving three steps: 1) unfreezing, 2) moving to the new level, and 3) refreezing at the new level.[22] Moorehead and Griffin present an expanded process model, shown in Figure 5.1, which is more complex and addresses planned change from the view of top management.[23] The five steps of the model encompass the life cycle of organizational change. Step 1 is the presence of the necessary factors for change. Steps 2 through 5 involve problem identification and solving processes, change implementation and evaluation. All during the change process, a change agent, one who monitors the progress of required changes, is needed.[24] Top management must work closely with the change agent to ensure a successful transition to the desired future state. Furthermore, if the future state is not clearly defined, Nadler asserts that "transition management in an uncertain context must be refined into a series of shorter, smaller transitions on the way to the hypothesized future state or toward a set of alternate scenarios of the future."[25] The technique of dissecting a large project into smaller ones will

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┌─────────────┐        ┌─────────────┐          ┌─────────────┐
│ 1· Forces   │───────▶│2.Recognize  │─────────▶│ 3.Problem   │
│    for      │        │ and Define  │          │  Solving    │
│   Change    │        │  Problem    │          │  Process    │
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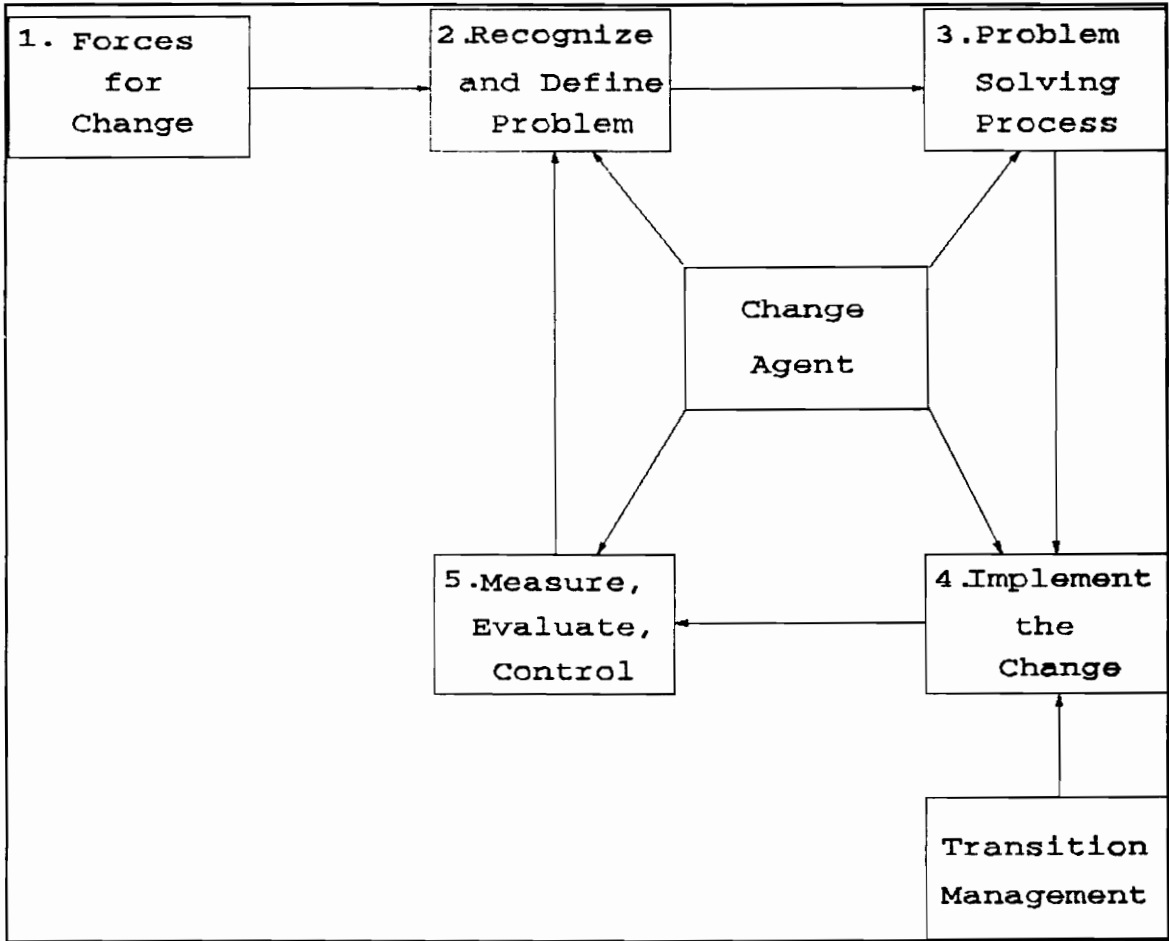
Figure 5.1. Expanded Process Model for Organizational Change.[26]

be applied to the office automation changes envisioned.

The overall planning and approval process for the office automation migration strategy will be communicated to all impacted personnel and organizations. This will help to achieve three major objectives. First, the management team will decide on the strategic direction for the future of Information Systems within the organization. Next, the rumors of an impending change will be quieted with clear and accurate information on the status of the

planned office automation migration strategy. Lastly, the employees will be able to express their views on the soundness of the plan.

5.3 Resistance to Change

A key ingredient to a successful structural change in an organization is the recognition of resistance to change. The resistance can be organizational or individual. Organizational resistance to change is composed of six factors: 1) structural inertia, 2) narrow focus of change, 3) group inertia, 4) threatened expertise, 5) threatened power, and 6) resource allocation.[27]

Individual resistance processes are presented by Zaltman and Duncan(and refined by Moorehead and Griffin) as the following: 1) habit, 2) security, 3) economic factors, 4) fear of the unknown, 5) lack of awareness, and 6) social factors.[28] [29]

There are different ways to approach the management of resistance to change. The type and complexity of the change, coupled with the time available to implement the change, will dictate the type of resistance management strategy chosen. Management must select a path that is beneficial to the organization.

Kotter and Schlesinger maintain that the choice of which strategy is appropriate for the change to be implemented depends on the following factors: 1) amount and type of resistance, 2) position of the initiator with respect to the resistor(especially as relates to power), 3) person who has the relevant data for accomplishing the change, and 4) stakes involved.

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Also, the time allotted for conversion to the desired state will dictate which strategy or combination of strategies is chosen.[30]

As seen in Figure 5.2, "the strategic options available to managers can be thought of as existing on a continuum. At one end of the continuum, the change strategy requires a rapid implementation, a clear plan of action and little involvement of others. At the other end of the continuum, the strategy

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< -------------------------------------------------------- >
FAST                                    SLOW
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Clearly Planned   Not Clearly Planned to Start
Little Involvement   Plenty of Involvement
Attempt to Overcome   Attempt to Minimize
Resistance   Resistance
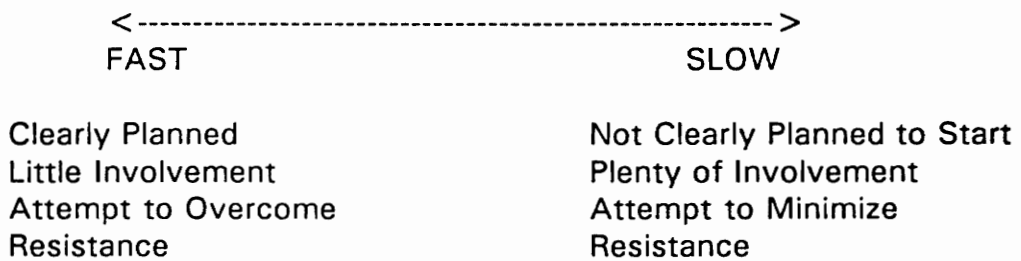
Figure 5.2. Strategic Continuum.[31]

would call for a much slower change process, a less clear plan and involvement of many people other than the change initiator."[32]

Since the scheduled completion for the migration strategy covers multiple years, this projects falls into the slow category along the continuum. The plan can be fully developed, properly communicated and executed to benefit the organization. Periodic assessments will be needed to ensure that the desired future state remains achievable and within the organization's strategic plans.

5.4 Minimizing the Resistance to Change

The major sections within the organization are production, engineering, data processing, and support(administration, logistics, personnel, and maintenance). Due to the large amount of computing resources needed to

conduct daily operations, the data center has direct, and often, daily interaction with users from every level of technical expertise. There is a wide range of technical and non-technical personnel who have office automation requirements. Therefore, the organizational impacts must be addressed from the vantage point of each major group or type of individual.

The success of the organization dictates that all sections work together to ensure that production is accomplished successfully. Therefore, on a daily basis, there is a large amount of interaction between the major sections at both the group and individual levels. These interactions range from the simple issues of memoranda processing within the organization to the complexities of integrating future hardware and software deliveries into the daily operations of the organization.

Table 5.1 shows group resistance by type. This table illustrates that the data center operators, software and hardware engineers, production personnel and administrative support personnel(i.e., executive secretaries), by their resistance, are potential threats to the successful transition to the new office automation environment. These groups need to be shown how the completed system will impact them and informed of what plans are being made to minimize any impact. For example, the computer operators only see additional responsibilities for new platforms being required of them without their being trained in UNIX or network operations. Most people would resist such a change.

Table 5.1. Group Resistance by Type.

	Comp Oper	Engr	Logs	Prod	Admin	Pers	Maint
Structural Inertia	X	X			X		
Narrow Focus of Change	X	X	X	X	X	X	X
Group Inertia	X						
Threatened Power	X						
Threatened Expertise	X	X			X		
Resource Allocation	X	X	X	X	X	X	X

A narrow focus of change is present in the entire organization. Management must establish a team of key individuals from each section. The team can evaluate the current interorganizational interdependencies and assess the impact that the office automation changes will have upon the

interdependencies. Once the evaluation is complete, the team can present their recommendations to management concerning whether the current interorganizational interdependencies should be retained, modified or discarded. For example, does the introduction of e-mail negate the need for original signatures on any documentation? Also, what is the legal requirement for original signatures? Additionally, does the organization need to establish formalized chains for information flow or does the ability to reach any user on e-mail help the information flow within the organization?

Resource allocation impacts all groups when discussing office automation. Each section will seek agreements with the data center to ensure that the current level of service provided and the methodology for allocation of automated data processing resources is not degraded by the movement to another platform. For example, the logistics database which supports every facet of daily operations will require extensive testing before the logistics manager will agree to transition to the new system.

Table 5.2 depicts the types of group resistance to the products selected for the office automation migration. Engineering, Logistics and the administrative personnel (i.e. executive secretaries) are major users of the current office automation systems. Therefore, these groups will resist any solution that does not meet their requirements. Defining their requirements and informing them of the new system's capabilities will lower the resistance level.

Table 5.2. Anticipated Areas of Resistance - Group.

	Comp Oper	Engr	Logs	Prod	Admin	PPers	Maint
Word Proc					X		
Spreadsheet		X	X				
Graphics	X	X	X	X	X	X	X
E-mail	X	X			X		
Scheduling		X			X		
Database		X	X				
Unique Appl			X	X		X	X

These groups can be influenced to support the plan by conducting an informational briefings on the status of the migration. Also, a demonstration of the new system's capabilities validates the availability of functions. Table 5.2 also illustrates that additional work is required in the areas of the standard graphics package, electronic mail and the migration of the "home grown" databases to a network supported relational database.

Table 5.3 illustrates the individual resistance by type. Understanding the types of resistance by individuals to the planned changes in the office automation environment will help to ensure a successful transition to the new

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system. Internal to the data center, the WANG programmers are directly

Table 5.3. Individual Resistance by Type.

	WANG Prog	Comp Oper	Exec Staff	PC Spec	Senr Engr	Admin
Habit			X	X	X	
Security	X	X				
Economics	X	X				
Fear of the Unknown		X				X
Lack of Awareness		X				X
Social Factors			X	X	X	

impacted because their jobs are at risk with the current plan. Additionally, the computer operators are confronted with an inconsistent working environment due to the status of the migration plan, economic security and the new skills required of them. An approach that requires an operator to be skilled in UNIX, mainframe operating systems, networks and any other small systems does not appeal to any of the current operators. Neither is this single operator for all

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systems approach supportable from the staffing viewpoint. Hiring and retaining personnel with the multiple levels of knowledge required would not be possible on the pay scale for a computer operator.

The executive staff, PC/UNIX software specialists and senior engineers will provide resistance to the plan due to items of habit and image within the organization. Involvement of these particular individuals in the planning process will ease the resistance. The formation of a LAN users group is in the planning stages. Many of the PC users have developed utilities that will be useful to all office automation users. Transfer of this knowledge can help ensure the success of the upcoming changes. Additionally, those involved in the LAN users group will begin to take ownership in the transition to the new office automation environment.

Secretaries are impacted by fear of the unknown. Each executive secretary has direct access to senior government or contractor management. This access translates into power within the office automation environment. The secretaries understand this power and use it to ensure that their problems are solved in a timely manner. Identification of the direct impacts will minimize the resistance.

The anticipated areas of individual resistance to the changes in the office automation products is shown Table 5.4. The WANG programmers and senior engineers from the sections with unique applications (logistics, personnel,

Table 5.4. Individual Areas of Resistance.

	Wang Prog	Exec Staff	Senr Engr	PC Spec
Word Proc		X	X	X
Spreadsheet				X
Graphics		X	X	X
E-mail		X	X	X
Scheduling		X	X	X
Database		X	X	X
Unique Appl	X		X	

maintenance and production) will resist the changes until the data center demonstrates that all current requirements are met by the new system. The executive staff members, senior engineers and PC/UNIX software specialists will advocate their favorite software products. Their resistance is a direct result of these users operating with PC's in a non-networked mode. These personnel currently do their own product evaluations for office automation applications. Resistance can be minimized by making these individuals part of the team to select the next level of products to be supported throughout the organization.

5.5 Summary

Minimizing the organizational and individual resistance to change is necessary to ensure that the plans for the new office automation environment are successful. The IS community considers the new office automation environment to be a major step forward in computing power and availability. However, the user community may perceive it as a major impact to their daily operations. By addressing the reasons for the user community concerns, individually and as groups, the plan can better service the user community needs and raise the chances of success for the migration strategy. Early in the planning process for the office automation migration strategy, the user community will be given a briefing to ensure that the users recognize the need for the projected changes. Also, the briefing will help to reduce resistance to the planned changes due to lack of accurate information on the scope of the plan. For individuals and groups with an emotional involvement in the changes, there will be an invitation to join the team tasked with planning and implementing the changes. The involvement of these users will give them ownership in the migration strategy. This acceptance of the plan is critical when the individuals involved have a large amount of power within the organization. Examples of these individuals are the executive staff, senior engineers, and the PC specialists.

Section Six: Migration Plan

6.1 Overview

Now that management is aware of the types of impacts that can be expected with the introduction of technological change, the migration plan must address the production, engineering, personnel and organizational impacts to ensure its success.

Each platform is in one of two categories: 1) the platform is part of the long term solution for office automation or 2) the users are operating on a non-supported platform and must be migrated to an alternate platform. Networking and interoperability are key ingredients to the new office automation environment. These components will allow more direct user to user electronic information flow. Due to budgetary constraints, the plan must be phased over a multi-year period. The impact to current operations must be kept to a minimum during all phases of the transition from the current environment to the new environment. The impact to daily operations can be minimized by actively managing the transition from the old to the new environment. This will require anticipating any pockets of resistance to the proposed change and the reduction of the impact via an appropriate method from the management plan for the evolution of the change. The succeeding paragraphs discuss the various phases of the Migration Plan.

6.2 Phase I - Concept Development

The organization has chosen to implement the Open Systems Interconnection (OSI) model as its strategic direction in the Information Systems field. Consistent with that choice, the Office Automation Migration Strategy must begin to move from the current environment of multiple proprietary and non-proprietary systems with minimal connectivity to a complex of multiple fully connected systems which offer the user community full interoperability. The migration strategy presented in this paper works toward that goal. The major parts of the migration strategy are as follows:

1. Communication of the strategy to both management and users

2. Platform integration

3. Migration of word processing from the WANG to the LAN

4. Integration of e-mail across all platforms

5. Selection of a scheduling package

6. Conversion of all users to the standard office automation products

7. Migration of unique applications form the WANG to relational DBMS supported products

8. User requirements

9. User training

10. Transition criteria and

11. Equipment removal.

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6.2.1 Communication of the Migration Plan

Critical to the success of the entire project is the support of top level management and the end user community. Separate briefings will be scheduled so the concerns of each group can be addressed in an appropriate forum. Common to both levels of briefings will be the following items:

1. The forces driving the changes.

2. The capabilities of the new system.

3. Scheduling of the transition by organization.

4. Training to be provided during each phase of the transition.

Communication of the migration plan to the user community provides the users with an understanding of the new office automation environment. As such, the briefing will help reduce group resistance by demonstrating to the users that their office automation requirements are being considered in the planning for the next generation of office automation technology. The briefing relates directly to the system requirement to minimize the impact to current operations and minimize the deplenishment of office automation functionality. Information flow will raise user concerns regarding how the new system will support their daily automation requirements.

6.2.2 Platform Integration

The ultimate office automation environment is envisioned to be an OSI compliant, UNIX platform interconnecting both proprietary and non-proprietary systems. This goal environment cannot be realized in fewer

than five to seven years. The integration efforts must begin to migrate IBM and WANG terminal users off of their respective platforms onto the SUN or PC LAN platforms. Also, users will require access to the WANG database applications from the SUN or PC LAN until the applications can be migrated off the WANG.

Platform integration meets the budgetary requirement for a phased process over a multi-year period. The migration to the mixed PC/SUN environment will require at least two years. During the hardware integration period, user resistance will be lowered by convening monthly LAN users group meetings to discuss the progress of the migration and software products available on the new system. Additional functionality will be addressed to determine whether or not the system can provide the requested support.

6.2.2.1 WANG Migration - WANG terminals will be replaced with PCs for all upgrades. These users will retain their WANG connectivity and gain access to the standard software products available on the local area network. Reliance on the WANG will decrease as users are trained on the LAN packages and the unique applications have been transitioned to the new office automation platform.

The retraining of the WANG operators is necessary when there is no longer a need for a dedicated WANG operator. The data center must develop a new skill base to provide support for the newer applications being used by the office automation community. The WANG operators can be retrained to

provide this necessary service.

6.2.2.2 IBM Migration - IBM terminal users who have office automation requirements will be moved to the PC or SUN LAN with subsequent upgrades. The users can access the IBM via terminal emulation and also get the standard software packages available on the LAN.

6.2.2.3 PC Integration - Integration of the PCs into the SUN environment is needed. This can be accomplished by using a network file system (NFS) on the Novell file servers and the Internet protocol suite on the PCs. Future upgrades of PCs will include a minimum of 16 MB of RAM on an Intel 386 processor. This will posture the PC systems for the conversion to SUN's Solaris v2.0. The operating system upgrade will provide a single UNIX operating system in the office automation environment.

6.2.2.4 SUN Development - The administrative support for SUNs in the office automation environment currently will not handle a large quantity of non-technical users. Unfortunately, the bulk of the office automation users are non-technical. A default, menu driven user environment must be developed. This will provide all users with an easy to use system on their desk. Additionally, an evaluation of products that will provide SUN to WANG and SUN to PC integration must be accomplished.

6.2.3 Word Processing Migration

The word processing system is the most highly used office automation function. As such, it will prove the most difficult to migrate.

This migration will impact all users of the WANG. WP+ is the word processing system on the WANG. However, WP+ is not supported on networked platforms and the SUN and PCs cannot directly access any WP+ documents. Migration of word processing from the WANG to the SUN/PC environment will require the retraining of all WP+ users.

Word Perfect is the standard word processor on the SUN/PC networked systems. This provides a good word processing product across the two major office automation platforms. To migrate all WP+ users to Word Perfect, the following must be accomplished:

1. Platform base must be all PCs or SUNs.

2. A conversion of all standard forms and user files to Word Perfect must be completed.

3. All word processing users in each section must be trained on the use of Word Perfect.

4. Access to WP+ must be removed.

Particular emphasis will be given to the non-technical user community's training needs in the word processing functional area.

The word processing migration is related to both group and individual resistance elements. The LAN users group will be the forum to discuss topics such as the LAN word processing package, training on the package, schedule for transition of each section within the organization and user requirements. Additionally, the details for implementing the system requirement for a data

translation service will be fully developed in the LAN users group. The word processing migration also meets the management constraints of maximizing the use of distributed processing and the reduction of dependence on proprietary vendors.

6.2.4 Electronic Mail

Currently, this function is performed on the WANG using WANG Office. Integration efforts are underway to allow PC users to access WANG Office without the need to logon to the WANG. Sun users have access to UNIX mail, but no access to the other platforms. The incorporation of all users into a unified e-mail system is the desired state. The most promising solution is the use of X.400 and X.500 compliant products. These will negate the need for a single electronic mail system, as well as, simplify the administration of the e-mail systems across multiple platforms. The user community groups most impacted by this change are the management team, senior engineers, executive staff members and status analysts. Retention of the current e-mail systems and integration via gateways will minimize the impact of the new changes envisioned.

6.2.5 Scheduling Function

Scheduling software is used to support both personal calendar systems and the scheduling of conference rooms at each organization location. WANG Office currently provides the scheduling function. Product selection on the PC/SUN platform needs a technical investigation into the available

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products. The entire user community makes use of the scheduling function. Products are being researched to provide a system which can be accessed from any desk to allow confirmation of the scheduling of a meeting room time and date. Additionally, the ability to browse multiple calendars from any desk is desired.

6.2.6 Applications

There are two categories of applications with respect to office automation. First, there are standard applications for database, spreadsheet and graphics work. Then, there are unique or "home grown" WANG database applications which are too large for database products such as dBase IV. The transition of users to the new environment requires the definition of user requirements, close coordination with the impacted user group and the demonstration of the new product.

The LAN users group will investigate the future directions for office automation application needed by the user community and make recommendations to management. The users group will work within the management constraints and system requirements to provide a technically feasible, cost effective solution. New requirements which have not been addressed by the current requirements will be forwarded to management with a recommendation that the capability be incorporated as a new requirement. The users group has ownership in the migration strategy solutions. This reduces the resistance at the group and individual levels provided that the new

solutions are communicated to all impacted personnel.

6.2.6.1 Standard Applications

These are the automation tools of day-to-day operations. Spreadsheets, databases, and presentation graphics applications are run on the PC and SUN platforms. Currently Lotus 1-2-3 and dBase IV are available on both platforms. Harvard Graphics is available on the PC LAN. Investigation of a single graphics package for the PCs and SUNs is underway. At a minimum, there must be a package on each system which will support similar formats. The package must import and export files with relative ease.

User involvement in the selection of new products to be supported by the organization is being planned. This will help to increase the productivity of each section in the organization.

6.2.6.2 Unique Applications

These applications execute on the WANG and can be accessed from the non-WANG systems via gateways. Each application supports the work of a specific section, e.g., logistics or personnel. Each section with a unique WANG based application coded in COBOL will be briefed on the direction of the Office Automation Strategy. A plan can then be developed for each application for migration to a relational DBMS to fit the needs of the section. Direct involvement of each section's requirements personnel is necessary to ensure that the new database supports all the functionality of the old system.

6.2.7 Migration Schedule

Plans call for the mechanical replacement of all WANG and IBM terminals used for Office Automation over the next two years. Parallel plans for the migration of word processing, integration of e-mail and scheduling, migration to the standard applications supported, and the conversion of unique WANG based applications can be developed. Current estimates place the completion of full implementation of the plan within five to seven years.

Communication of the migration plan schedule will reduce speculation on the migration strategy, reduce fear and anxiety in those employees who fear the unfamiliar, and raise the interest level of the impacted sections concerning how the plan will be executed. Each section can then send a representative to the LAN users group to voice concerns, document requirements, or participate as an active member of the office automation planning committee.

6.3 Phase II - User Requirements

A survey of the user community needs to be undertaken to ascertain what products should be considered for incorporation into the standard product list. Additionally, any unique, yet critical, applications requirements need to be identified. For example, document publishing is instrumental in maintaining the organization's productivity. However, the normal user of word processing functions does not require the additional functionality of a document publishing system for normal daily operations.

The user survey is an important part of the migration strategy. This is because the user community can begin to help with the planning of what new products should be selected to meet their daily needs. The LAN users group will become the focal group for the future of the office automation environment. This group can address the interorganizational interdependencies and help reduce the group resistance caused by a narrow focus of change. Additionally, the system requirement to minimize the impact to current operations will be met by scheduling changes via the LAN users group and informing the impacted sections of the changes.

6.4 Phase III - User Training (Application/UNIX)

As each level of integration and migration is completed, the training of the user community is required. Most applications support computer based training and this can be integrated into the transition schedule. Additionally, basic UNIX training will become important once the integrated PC/SUN environment is an all UNIX platform.

Training users will meet the system requirement to ensure that the system is easy to use. Training provides knowledge regarding how to use the system and the on-line documentation. Additionally, information on how and where to get help is provided in each training session. Also, training will help reduce individual resistance stemming from the factors of habit, fear of the unknown, lack of awareness, and image within the organization.

6.4.1 Standard Training

Training will be provided for beginner and refresher levels on all supported programs. Additionally, the reference documents for each program will be on-line for easy access by anyone within the organization.

The minimum training to be provided will include the following:

      a. UNIX operating system course.

      b. 'C' language shell script development course.

      c. Word Perfect course.

      d. Lotus 1-2-3 course.

      e. dBase IV course.

      f. Electronic mail course.

      g. Scheduling package course.

6.4.2 Data Ownership

Part of the training must emphasize that the movement to the networked environment will not mean that their data is no longer their property. Data belongs to the users and only those designated by the user to have read or write capabilities to the user's data will receive such authorization.

6.5 Phase IV - Installation/Demonstration/Parallel OPS

The Office Automation Migration Strategy must be a matter of public record. All impacted sections must be aware of when they can expect to be entering the new environment. Prior to any changes, each section will be

given a demonstration of the new system's capabilities.

Phase IV provides the user with a full understanding of the future direction of the office automation environment within the organization. The result will be a reduction in group resistance due to structural and group inertia, threatened expertise and power. The demonstration of the system capabilities to each section will help reduce individual resistance due to factors of security, fear of the unknown, and lack of awareness. The management constraints and system requirements fulfilled by phase IV are maximizing the distributed processing for office automation, reducing dependence on proprietary vendors, reduced operations and maintenance costs via standard software packages and hardware configurations, minimizing impacts to current operations, and providing the user a graphical user interface with a standard user environment.

6.5.1 Installation schedule - The installation schedule will be coordinated with the impacted section. All areas of concern will be addressed before actual installation. All concerns will be resolved prior to transitioning to the new system.

6.5.2 Demonstration of the New Platform - A standard demonstration of the PC/SUN platform will be setup in the data center for user question and answer sessions.

6.5.3 Parallel Operations - Each transition will be preceded by a period of parallel operations. No old system will be removed without first verifying that the new system is functioning to the requirements level specified by the

gaining section.

6.5.4 Transition Criteria - The criteria which determine a successful transition to the new system must be agreed upon by the section managers in advance of the scheduled transition. A 'GO' for transition decision will make the new system operational. A failure of the new system will be able to reverse the 'GO' decision. Any impact to the production environment will cause a 'NO GO' decision.

6.6 Phase V - Equipment Removal

The removal of the equipment supporting the old systems will be done after each transition. A detailed equipment removal plan will be developed and briefed to senior government and contractor management for approval. All sections will be briefed on the removal plan.

6.7 New System Vision

The New Office Automation environment will be a more highly distributed system with business critical applications executing on both the mainframes and the distributed systems. The capabilities of the office automation systems of the future are summarized in Table 6.1. The WANG and IBM will provide connectivity to both internal and external interfaces

Table 6.1 New Systems Capabilities.

	E-Mail	Data-base	Word Processor	Graphics	Sche-duler	Spread-sheet
IBM	Yes	No	Line Editor	Limited	No	No
WANG	Yes	No	No	No	No	No
PC	Yes	Yes	Yes	Yes	Yes	Yes
SUN	Yes	Yes	Yes	Yes	Yes	Yes

for e-mail and computer to computer communications services. A well developed Office Automation Migration Strategy will keep the organization productive in an era of reduced funding the defense industry.

Section Seven: Conclusion

Impact of Analysis

The analysis presented in this paper will enable the government/contractor management team to adequately address the Office Automation Migration Strategy impacts on the organization from both the technological and organizational perspectives. Each section, production, engineering, support, and data processing will be tasked to provide a representative to the LAN users group. An integrated team can then be formed to address the system requirements and management constraints to assess whether or not the plan can be implemented. This paper acts as a starting point in a multi-year effort to move the organization towards a more open office automation environment which maximizes distributed processing in a cost effective manner.

Lesson Learned

The research conducted for this paper highlighted some valuable lessons for other planners who must address the future of the office automation environment within their organizations. Presented below are the lessons learned:

1. Understand the functions required for office automation within the organization.

2. Specify the constraints and requirements prior to any planning.

3. Separate standard and unique automation requirements. Treat unique requirements outside of the office automation migration strategy.

4. Get the impacted user community involved during the early stages of the planning process.

5. Gain management support for the plan.

6. Assess the status of the plan at each major transition point.

7. Continually adjust the plan when technological or organizational changes dictate the need for adjustment.

8. Keep an open mind - Always be willing to change the plan if someone has a smarter or more cost effective approach.

9. Minimize the impacts to current operations, even if scheduled transitions must slip.

10. Coordinate, demonstrate and execute the plan.

11. The topics of organizational and technological change are well documented in management and computer industry journals and publications.

12. Actively manage the organizational changes as well as the technological changes. Be ready to investigate why transitions went very smoothly or not so smoothly.

Strategy Implementation

The office automation strategy eliminates the IBM and WANG systems as viable options due to their failure to meet the management constraints. The

platform chosen addresses all management constraints. The system requirements of cost effectiveness, default connectivity to all systems, and ease of use for the end user make the mixed PC/SUN option the choice over the SUN only option.

The formation of a LAN users group is critical for requirement verification and communication of the plan to the impacted user community. Additionally, the LAN users group can help to reduce resistance to the plan at both the group and individual levels.

The government/contractor management team has made a commitment to embrace an OSI environment as its strategic direction for Office Automation. There are many challenges ahead prior to achieving a fully integrated, OSI compliant environment. Additionally, the data center manager of today must continue to evaluate the current environment in light of the newest technological advances. These advances will challenge the LAN users group to continually reassess the ability of its current office automation information technology resources to enable the organization to improve its productivity. In addition to the technical issues, the managers must continually look for the organizational fallout of the technological advancements. People must be kept informed about the upcoming changes and the anticipated impacts to their office environment.

The Office Automation Migration Strategy presented in this paper addressed the complex issues cited in this section. The management team

has chosen to embark on a migration path that will allow the office automation environment to move towards a more highly distributed and interconnected open systems environment with the emphasis on maximizing interoperability across a mixture of proprietary and non-proprietary systems. The stated direction of the next generation of office automation will position the organization to move forward rapidly into a fully OSI compliant environment as products become available on the different hardware platforms supported by the data center. The path to the future is complex and the decisions concerning when to make the necessary changes to increase productivity will always be difficult ones. However, diligent planning that accounts for both the technological advances and the resulting organizational impacts will better position the organization to continue to maximize productivity.

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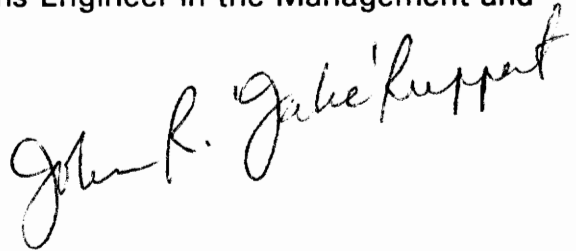   Information Systems</u>, 5, No. 4, October 1987, 393-427.

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