

Adopting A Sensible Windows NT Strategy

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Microsoft® Windows NT has rapidly evolved to become a robust and stable business computing solution. From a shaky start, just a few years ago, NT has overcome major performance and reliability problems to evolve into a viable choice for a growing range of computer applications. This, coupled with increasingly powerful computing power of today's Intel and Alpha processors, as well as improved symmetrical multiprocessing implementations by a number of vendors including Hewlett-Packard, has resulted in a new computing paradigm. It is now perceived as a low-cost desktop and server operating system alternative, which contributes to Windows NT being well on the way to becoming the enterprise solution of the future for high-end personal computing, as well as an important workgroup network print/file and applications server platform. Moreover, NT is increasingly being thought of as an alternative to current UNIX and MPE/iX server platforms for many application and database server roles.

What Is NT, An Overview?

There are really two different Microsoft Windows NT products: NT Server and NT Workstation. Microsoft recommends *Windows NT Workstation* as a desktop operating system (like Win 95) and *Windows NT Server* as both a server operating system and a network operating system (NOS). This provides users with an environment that is architecturally very clean, since both the desktop and the server are running the same operating system and have the same APIs, etc. Windows NT Workstation is a great corporate client for users who need the power, scalability, fault tolerance, or security it offers. Windows NT Server is a powerful server environment for customers who want to leverage its applications server (like MPE or UNIX), file and print services (like NetWare), or remote access capabilities. To put it more directly, Windows NT Server combines the file and print sharing capabilities of Novell NetWare and the application support of UNIX or MPE into one, easy-to-use networking package. Windows NT Server is a scalable, robust, secure, and easily administered networking system, which provides cutting-edge technology for all of your networking needs. Windows NT Server also comes with many built-in features that would be expensive add-ons for other networking systems such as Novell NetWare.

Why Windows NT?

The adoption of Windows NT is moving like a tidal wave. Never before has the computer industry witnessed such rapid adoption of new operating system technology. There is every reason to believe that this rapid growth will continue. The question is why?

Same Operating System for Both the Client and the Server!	Windows 4.0 provides an excellent platform for both servers and workstations.
Windows NT Server Provides a Powerful Application Server	Windows NT can be used as application server hosts.
Windows NT Server Is Scalable	NT Server accommodates single processor servers, as well as multiprocessor servers, which may contain up to 32 symmetric processors and from 1-32 disk drives.
Windows NT Server Is Reliable	Fault tolerant features are included as standard NT features.
Windows NT Workstation Is Also Nearly Crash Proof	DOS and Windows 3.1x are not reliable, Win 95 is better, NT Workstation is rock solid.
Windows NT Server Is Secure	Complies with U.S. Department of Defense's National Computer Security Center requirements for a C2 secure system.
Client/Server Usage of Windows NT Server	Windows NT Server can actually act as both a server and a client to other systems.
Windows NT Remote Access	RAS allows users to dial into the server using any PC equipped with a modem and an ordinary phone line..
Windows NT Server Is Internet/Intranet Ready	NT Server includes MS Internet Information Server (IIS) and Internet Explorer
Windows NT Server Is Easy to Use	Contains the widely used Windows graphical interface.
Multitasking	It provides support for multiple tasks from the same client system.
Applications Availability	Runs existing MS-DOS_ and Windows 16-bit applications. Supports applications written to the Win32 application programming interface (API).
Effective, Inexpensive Management	Single login for network services, remote access services, centralized system management, and built-in tape backup.
Scalability	Windows NT can access up to 20 GB of memory and 18 TB of data.
Open Networking	Windows NT provides interoperability with X Window System(TM) applications, NetWare_, LAN Manager, DECnet, PATHWORKS, LAN Server, and Vines_. It also provides connectivity to TCP/IP, IBM_SNA, NETBEUI, X.25, AppleTalk_ and other wide area networks through Windows NT and other third-party software.

NT Promises Value

By providing all of the above functionality, NT provides an excellent value to computer users. It is a product that costs approximately one-third less than Novell NetWare. Value comes in several forms. This includes features such as built-in utilities, including the Internet Information Server, Remote Access Server, Macintosh support, client software, protocols, dial-in support, and management utilities. Another valuable aspect of NT is that it has scalability and therefore it can grow with business needs. Moreover, since it is a multipurpose server operating system, designed to meet all of customer needs, users are not bound to a product that can only do one thing, such as file and printer sharing. Further, the NT Server value proposition is extended even more with Microsoft BackOffice. This integrated

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suite of products that Microsoft makes available with NT at extra cost includes most of the products that today's computer needs in order to implement Full Service Intranets and Networks. BackOffice includes SQL/Server RDBMS, Microsoft Exchange, Internet Information Server and System Management Server.

In today's chaotic world of heterogeneous networks, NT has the appeal of helping reduce complexity. Figure 5 illustrates this point. It shows some typical server and client applications that are operational at a hypothetical company. The current client and server host computers are a mixture of hardware and operating systems. This is shown in the column marked Current Hosts. The difficulty and expense of owning and operating such a complex environment are not appealing. What NT promises to do is shown in the next column, Future Hosts. Theoretically, NT is capable of ultimately replacing all host operating systems at this fictitious company.

NT Adoption and the I.S. Mission

The first and foremost objective of an I.S. organization is to accomplish its mission, and that is to put it succinctly; to provide needed services at an acceptable service level in the most cost-effective manner. A sensible strategy for NT usage takes into account the target organization's operating system needs and the capabilities and limitations of NT. Because NT is so versatile it has the potential to become the single operating system solution in many organizations. In fact, for many companies, particularly small companies, departments of larger organizations and some specialized firms, as well as companies with no legacy applications, NT may meet all of their needs now. However, just like any other operating system, NT does have limitations. It is far better to recognize those limitations before embarking on a "replace all other operating systems" project. This paper is an attempt to provide a framework for an analysis of whether or not NT can be used to provide operating system services at your company. Since each company is different and therefore operating system needs vary, there is no one conclusion that fits all. Determining the suitability of NT is a process with a changing landscape. The needs of organizations change every day and so do NT's capabilities and limitations.

Developing a sensible NT strategy involves:

1. Assessing the organization's needs.
2. Becoming familiar with NT's capabilities and limitations.
3. Understanding the tools and techniques for NT and other operating systems' coexistence.
4. Careful planning to assure that adopting NT for any usage in the organization does not interfere with the organization's ability to accomplish its mission.

This paper is organized in accordance with the above list. Part I, "Assessing Needs" describes a method of listing the various roles and functions performed by workstations and servers within an organization and documenting such factors as required service level, security requirements, the various processing modes required (i.e. batch processing), etc. Part II, "Understanding NT's Capabilities and Limitations and Understanding NT Coexistence" addresses the factors that can best be used to determine how well and to what extent NT can be used to replace or coexist with existing computer systems. Finally, Part III, "Developing A Sensible Strategy" suggests alternative ways to bring NT into an organization based on the needs of the organization, NT's limitations and capabilities and the tools available for integration and coexistence.

The paper was written for the Information Systems (I.S.) professional. It is intended to serve as a tool to help them understand the key issues that will lead to an effective NT adoption strategy. It helps define the terrain. It is not a comprehensive or a definitive step-by-step guide, it is more of a guideline. What it says in short is:

- NT is good.
- NT is being widely adopted.
- NT has certain limitations, particularly when it comes to porting (rehosting) existing applications to run in the NT environment.
- Before you make any kind of commitment to use, it is best to learn what those limitations are and find a work-around if there is one, you will be happier and more successful if you do.
- Don't try to replace all of your server operating systems at once because it could get you in trouble.
- Most users will probably want NT to coexist within their existing environment, at least for a while.

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This paper will probably be of most use to a user that:

1. Has existing non-NT operating systems such as MPE/iX, HP-UX, Windows 95 and Novell NetWare.
2. Has an Enterprise Network (client/server) strategy that includes a number of desktop computers and server connected via local and wide-area networks, and NT will be used to enhance that strategy.
3. Wants to make use of NT only when and where it makes sense, that is, where the use of NT is an intelligent choice.

Part I: Assessing Needs

Before we can determine NT's suitability to replace other operating systems, it is important to understand what functions operating systems perform in organizations. It is useful to view this from several different perspectives. One perspective is with regard to the operating systems' role in contributing to the accomplishment of the I.S. Mission. Another perspective is to understand the types of software applications that must run on today's operating systems. Still another perspective is to understand that many installations still run a combination of application generations including batch, distributed terminal-based, client/server, etc. Part I of this paper discusses these issues in order to help identify the needs of organizations as they relate to operating systems.

What Everyone Wants - The I.S. Mission

One universal theme these days is the list of needs for information systems. These reasons are consistent with the expectations that most people have for developing enterprise networks or so-called client/server environments. They are exactly the same thing that Spewak calls "success factors".

1. Access to data in a useful format when and where needed
2. Ability to adapt to changing business needs
3. Accurate and consistent data
4. Share data across the organization
5. Contain costs

The five success factors determine the mission of the I.S. organization.

*The Evolution from Client/Server Computing
to Pervasive Computing*

How Computing Has Changed

The business of computing is constantly changing. The evolution is shown in an illustration titled "The Evolution from Client/Server Computing to Pervasive Computing" and is illustrated in Figure 2. Hewlett-Packard describes a concept of pervasive computing which will create a world where:

- Users can access, share, and collaborate across the Extended Enterprise.
- Users can rapidly develop and deploy new solutions, technologies and applications.
- It is easy to manage mixed environments effectively from a central point: Web, UNIX, NT, NetWare and legacy systems.
- Your Intranet is secure, reliable, available and high performance.

Pervasive computing is further illustrated in Figure 3. This assumes that not only will your computers be networked within your company, but with your customers and your suppliers.

The realization of pervasive computing is inevitable because it makes sense; such interaction between companies can save both time and money and those ideas usually prevail. There are several issues that make progress difficult in the use of computing. The most important of which are legacies, these include computer system applications and trained users, among other things. The ideal would suggest that it is possible to abandon what we now have and adopt newer approaches that make sense. In reality what usually happens is some form of coexistence between what we had before and the new systems. Even if an existing system is to be totally replaced, usually some form of coexistence is required during a transition or migration period.

The most likely scenario, that most IT professionals will face, will be an environment in which all stages of the computer evolution coexist. Today's computing environment must be able to support what we have today, as well as what we will use tomorrow. This may include an environment which features batch processing, terminal-based distributed computing, PC LANs, Client/Server applications, and Web-based applications, all on the same pervasive computing network.

Today's Required Infrastructure

The keyword is networked. A prerequisite to maintaining competitiveness in the future will rest on your ability to network computers together to perform the various functions required by users, customers and suppliers. Interestingly enough, networking and interoperability are what are also needed to allow the coexistence required for other reasons previously identified.

Nowadays, the number and type of products needed to implement what may seem to an end-user like a simple application, can be quite large. Whenever more than one product is necessary to perform a single function, like LAN-based host access, product interactions should be a concern for the implementer.

One of the more bewildering aspects of the new computing environment is the increasing number of application types that client and server host environments are required to satisfy. Figure 5 indicates the number of different applications today's users are requiring from server and client hosts. If the number of different operating systems is large, so is the expense of maintaining them.

Software Applications Performed on Computers Today

One of the reasons NT is appealing is that it is able to serve as the host operating system for most of the application needs of today's computing environment. Figure 5 shows many of the applications that are performed in today's computing environment. It is not unusual for an I.S. department to be responsible for the variety of host computers shown in the Current Hosts column. The costs to own and operate a given computing environment can be in direct proportion to the variety of hardware and software products that they must be responsible for. The hope is that NT will provide for a lower-cost environment, such as that shown in the Future Hosts column. However, in order for this to happen, NT must be able to accomplish these functions with the same functionality and reliability as the current solution.

Summary

NT's various strengths, including its processing power, application support and numerous value-added features, make it appealing to different users for different reasons. It can be used as both a desktop operating system in place of Windows 95, as a Network Operating System (NOS) like Novell NetWare or it can be used as an applications' server. When one looks at the variety of uses for operating systems in today's organization and the complexity of today's enterprise network, it is easy to see that an operating system, which promises to simplify that environment, would be appealing. Because NT is so versatile, it has the potential to become the single operating system's solution in many organizations.

The first and foremost objective of an I.S. organization is to accomplish its mission, which is to provide needed services at an acceptable service level in the most cost-effective manner. In light of the advantages that use of NT might offer, one has to minimize any potential destabilization which the introduction of NT might cause to an organization, particularly an organization which has existing systems in use.

The Many Uses of NT		
Software Applications	Current Hosts	Future Hosts
<i>Server Software</i>		
Commercial Applications		
Multiuser	UNIX,MPE,MVS	NT Server
Client/Server	UNIX,MPE	NT Server
Technical Applications		
Multiuser	Solaris,HP-UX	NT Server
Client/Server	None	NT Server
Document Imaging	Novell NetWare	NT Server
Database Management System	UNIX,MPE,MVS	NT Server
FAX	DOS	NT Server
Network Services		
(NOS) Print/File Services	Novell NetWare	NT Server
FTP	All	NT Server
Telnet	All	NT Server
Web	NT Server	NT Server
Firewall	LINUX	NT Server
Mail	UNIX	NT Server
News	UNIX	NT Server
Catalog	UNIX	NT Server
Proxy	NT Server	NT Server
Directory	Novell NetWare	NT Server
Data Warehousing	UNIX	NT Server
Systems Management		
OpenView	UNIX	NT Server
Tivoli	UNIX	NT Server
Unicenter	UNIX	NT Server
Security	All	NT Server
Replication	UNIX	NT Server
<i>Client Software</i>		
Desktop Applications	Win 3.1,MAC, Win 95	NT Workstation
Multiuser	None	NT Workstation
Client/Server	Win 95	NT Workstation

Figure 1

Part II: Understanding NT's Capabilities and Limitations and Understanding NT Coexistence

As was mentioned previously, there are really two different Microsoft Windows NT products; NT Server and NT Workstation. Microsoft recommends Windows NT Workstation as a desktop operating system (like Win 95) and Windows NT Server as a server operating system and network operating system. This provides you with an environment that is architecturally very clean, since both the desktop and the server are running the same operating system and have the same APIs, etc. Windows NT Workstation is a great corporate client for users who need the power, scalability, fault tolerance, or security it offers. Windows NT Server is a powerful server environment for customers who want to leverage its applications server (like MPE or UNIX), file and print services (like NetWare), or remote access capabilities. To put it more directly, Windows NT Server combines the file and print sharing capabilities of Novell NetWare and the application support of UNIX or MPE into one, easy to use networking package. Windows NT Server is a scaleable, robust, secure, and easily administered networking system which provides cutting edge technology for all of your networking needs. Windows NT Server also comes with many built-in features that would be expensive add-ons for other networking systems such as Novell NetWare.

Regardless of whether NT be used as either a workstation or a server operating system within an organization, the two approaches to consider are to completely replace all client and server hosts with computers that run NT, or the develop methods of coexistence. These choices, however, are usually not mutually exclusive. The tools used for coexistence will probably be employed during migration in the event of complete replacement. However, before either approach is adopted, one must understand the capabilities and limitations of NT in order to asses how will NT can be used to satisfy the computer processing needs of the organization.

Use of NT as either a workstation and/or a server is expected to continue to increase at a rapid rate. However, we feel that the majority of users will want to choose a strategy in which, at least initially, NT will coexist with their existing environments. This includes MPE, UNIX and Novell NetWare among others. Keeping the goals of coexistence and/or graceful migration in mind, the most important prerequisites to either goal are interoperability and internetworking.

The balance of this section of the paper describes issues involved in a coexistence strategy for NT implementation. Therefore, our emphasis will be on those products and features required to facilitate internetworking and interoperability between NT and either UNIX, MPE and NetWare. This is done to provide a general overview of the internetworking technologies available for integrating Windows NT and enterprise computer systems. Our focus is not to compare and contrast the UNIX, MPE or Novell and Windows NT platforms. The discussion focuses primarily on solving Windows NT and multi-vendor enterprise integration issues from a workstation and server perspective. And it presents a brief overview of the Windows NT server, which includes a discussion of the UNIX-NT application porting process.

Windows NT Server and NT Workstation offer many advantages, but as with anything else, there are some limitations. Moreover, other factors can influence decisions to change operating systems.

Some Sobering Realities

Until Windows NT achieves the robustness, scalability, clustering, 64-bit processing, and multiuser capabilities of UNIX and MPE/iX (except for the 64-bit part), it will have limited impact on enterprise servers that currently deliver mission critical information and applications to enterprise desktops. Organizations have invested millions of dollars over the past ten years in developing mission-critical applications on the UNIX and MPE-based enterprise servers that now run their businesses. According to International Data Corporation (IDC), currently 80% of all enterprise servers are UNIX based, and the implementation of UNIX-based enterprise servers is expected to grow at a compound annual growth rate of 20% over the next several years.

The immediate impact of Windows NT has been primarily on UNIX desktops; Novell-based workgroup server's file, print, and application servers; but, not on UNIX enterprise servers. Widespread deployment of Windows NT servers, primarily as workgroup servers, is underway and many organizations are implementing Windows 95 desktops and controlling application access through NT servers.

Another reality is that many of current UNIX or MPE/iX applications, that are in place today at customer sites, may not need to be replaced today, usually because they do the job. However, even at these sites, many users are considering NT as a platform on which to run additional new applications such as e-mail, document imaging and intranets.

Issues Involved in Integrating NT Into Existing Environments

Fortunately, a rich array of third party technology based on open industry standards is currently available. Successful coexistence of Windows NT systems in the enterprise network is dependent on the implementation of this rich suite of enabling technologies. (Unfortunately, the products available for NT interoperability change on a daily basis. Therefore, it is impossible to keep a section such as this up-to-date. Therefore, this section is not meant to present a comprehensive list, but rather, it is intended to serve as a guideline for research.)

Because today's enterprise network is usually a heterogeneous mix of hardware and software products from multiple vendors and they involve interoperability—the ability to share information between different computer systems—has become a critical requirement for internetworking software. A special problem presented by NT integration with non-NT environments is caused by the fact that when an NT node is added to the network it only sees other Microsoft nodes, i.e. NetBEUI. Compounding this issue is NT's limited support for DNS, and the overall lack of TCP/IP utilities and applications. For example there is no support for one of the world's most powerful and successful multi-vendor network connectivity technologies, the X Window System.

Windows NT to Enterprise Enabling Technologies

One of the primary strengths of the UNIX operating system are the powerful set of open standards that enable interoperability. Third party software vendors are rapidly developing a rich array of integration technologies based on these open industry internetworking standards. There are products available today that provide Windows NT with full POSIX compliance, UNIX shells, UNIX to NT application porting and development tools, TCP/IP application suites, DNS for the Windows NT workstation and server, and even 3-D capable PC X servers. Interestingly, these third party enabling technologies are in reality leveraging the best of UNIX, its interoperability, to support the Windows NT environment and address the following areas.

Windows NT and Enterprise Integration Coexistence Areas

- Foundation Communication & Integration Technologies
- Legacy Application and Data Base Access With Emulation Technologies
- Migration of MPE and UNIX Applications to Window NT
- File System Integration
- System Management
-

Windows NT can present some significant issues for organizations integrating Windows NT servers and workstations, especially regarding the assignment of IP addresses, control of networked peripherals, support for NIS and DNS and others. For example the Windows Internet Naming Service (WINS) doesn't recognize UNIX workstations and servers and doesn't interoperate well with the Domain Name Service (DNS). If you are integrating Windows NT workstations and servers with UNIX platforms you may need to implement WINS/DNS gateway support, and/or coordinate both DHCP/WINS and some other solution such as DNS or DHCP/DDNS (Dynamic Domain Naming Service). There are several third-party DNS solutions that are easily implemented and reportedly address most of these issues. However, Microsoft recently added Windows NT Internet Information Server version 4.0, which includes a DNS name server, that can be installed, but not configured, through the Network Control Panel.

The Windows NT Workstation

The following table details some of the most common issues encountered by enterprise customers. Third party software developers have addressed many of NT's enterprise integration issues and the table below identifies some common integration issues and their solutions.

Windows NT Workstation Integration Issues and Solutions

Integration Issue	
Solution	
Implement third-party terminal emulation from the NT desktop. Software	
Implement third-party PC X server software the Windows NT desktop.	
Implement third-party HP terminal emulation software on the NT desktop	
Implement third party NFS client software on the Windows NT desktop.	
Implement NFS server software on Windows NT servers.	
Port UNIX application to Windows NT with X Window System development tools.	
Implement third-party software that allows terminal based applications	
Implement third-party encapsulation and server distribution technologies on Windows NT servers.	
Implement GLX X Windows extension on the NT workstation along with X server software.	
Implement third party serial X solution for high performance access.	
Turn off Microsoft networking and utilize only TCP/IP based file and print services.	
Implement TCP/IP and WINS/DNS gateway on the Windows NT workstation and server.	

Windows NT Server

Although Windows NT supports multi-tasking, it is not a multi-user operating system. Adding this multi-user capability makes it possible to use NT as an enterprise server. This multi-user capability requires the use of third-party products. The two products usually used are adding Citrix's WinFrame (ICA protocol) and/or Insignia (X Windows protocol) technology to Windows NT servers. Although this approach provides an excellent means of delivering Windows applications to non-Windows desktops, a multi-user Windows NT implementation requires a significant hardware investment, and a dedicated server with a minimum of 128 MB of RAM per ten users. Presently, the majority of enterprise desktops accessing Windows applications via this approach appear to be primarily UNIX workstation, Macintosh and X terminal users.

The Windows NT server's scalability has also been reported to be limited, and the limited support for symmetrical multiprocessing significantly impacts its success as an alternative to UNIX database servers. Windows NT 5.0, a 64-bit, object-oriented Windows NT Server version will feature global naming services, server clustering and 64-bit application support. A wide spectrum of third party software products significantly enhance the Windows NT Server's functionality and include capabilities such as:

- Provide Windows NT servers with a multiuser capability.
- Enable distribution of Windows NT applications over a network.
- Development of 3-D X Window applications with GLX and Xlib.
- Distribute 3-D applications over the network.
- Add NFS server software for enterprise-wide file system sharing.
- Add UNIX style INET daemon functionality.
- Add UNIX system commands.
- Add UNIX shell capability and full POSIX compliance.

- Third party software developers have addressed many of the NT server enterprise integration issues; the following table identifies some common integration issues and their solutions.

Windows NT Server Integration Issues and Solutions

Integration Issue	Solution
Integrate NT servers with the enterprise network.	Implement WINS/DNS gateway or third-party DNS and NT 4.0 IIS
Enable NT servers to share files with multi vendor workstations and servers. -	Implement third-party NFS server software or SMB server freeware.
Provide NT servers with a multi-user capability.	Implement third-party Citrix based WinFrame and/or Insignia-Tektronix technology.
Distribute NT and Windows applications to other Windows desktops.	Implement third-party Citrix based WinFrame and other multi-user technologies.
Distribute NT and Windows applications to non-Windows desktops: UNIX, Macintosh and X terminals.	Implement third-party X Windows encapsulation technology (Tektronix WINDD) on Windows NT servers.
Run UNIX applications on Windows NT servers.	Port UNIX applications to NT servers with X Window System development tools.
Enhance Windows NT administration and network functionality.	Implement third-party Inet daemon and NFS server on Windows NT server.
Control access to network-based peripherals such as high end printers and plotters	Turn off Microsoft networking and utilize only TCP/IP based file and print services.
Add UNIX system commands.	Implement third-party system commands.
Add UNIX Shell and POSIX compliance to Windows NT server.	Implement third-party UNIX shell and POSIX functionality.

Summary

There are several reasons that most companies cannot suddenly replace all of their desktop and server computers with NT-based computers. These reasons include but are not limited to the need to preserve existing investments in hardware and software, the difficulty of porting the applications, capacity limitations on NT-based computers (scalability), etc. Therefore, if NT is to be adopted, it will in all likelihood, have to coexist with other non-NT existing clients and servers. Moreover, other software will have to be purchased, installed, configured and maintained to allow for NT's proper integration into the current environment.

Fortunately, an increasing number of products are becoming available to meet these needs. It is important for anyone anticipating either re-hosting an existing application to an NT server or accessing existing applications with NT clients, to carefully research the products that will be needed to allow for the projects success *before* proceeding with a full implementation. We have presented a limited analysis that can serve as a starting point for such a study.

Part III: Developing A Sensible Strategy

As was mentioned in the introduction of this paper, developing a sensible NT strategy involves, assessing the organization's needs, becoming familiar with NT's capabilities and limitations, understanding the tools and techniques for NT and other operating systems coexistence, and careful planning to assure that adopting NT for any usage in the organization does not interfere with the organization's ability to accomplish its mission.

Part I discussed needs assessment, and Part II discussed the capabilities and limitations of NT and coexistence requirements. This section will discuss the implications of the issues identified in Parts I and II as they relate to the creation of a strategy for adopting NT. The goal of such a strategy would be to obtain the desired benefits from NT usage in the organization while at the same time ensuring that NT's use does not interfere with the I.S. organization's ability to accomplish its mission.

What then is the best approach to use in adopting NT Server? Should a company replace all of their NetWare and MPE or HP-UX applications with NT or should NT Servers be added instead of these servers? How does a data center manager make NT as resilient as their MPE and/or UNIX environment?

NT Roles and Possible Adoption Approaches

NT's ability to fulfill a variety of roles in the enterprise network offers many ways to get started. Here are some possibilities; Desktop Operating System, Network Operating System, Business Applications server, Technical Applications server, Specialized server, and Standardize on NT for all new implementations.

Migration from UNIX/MPE/Novell/DOS/Windows 3.1x to Windows NT Server and Workstation can be appealing, however, it may be quite some time before NT can replace all servers in all organizations, particularly in mission critical applications. In some cases it may not be worth it to make the change any time soon. In other cases a coexistence strategy or in migration is felt to be inevitable, a gradual migration might make more sense. In a few cases a wholesale, rapid migration may be in order. The following are some approaches to consider:

1. Add an NT server to your existing NetWare server-based PC LAN

Suppose you want to add a server based application to your Novell based LAN, for example, Disk Extender from OTG for optical jukebox control. NT Server makes it relatively easy utilizing NWLink IPX/SPX compatible protocol so that NetWare clients can access NT server applications while retaining the capability to access the existing NetWare servers.

2. Add an NT server to your existing HP-UX or MPE/iX server based LAN

Start with a specific vertical market application such as sales force automation or document imaging.

3. Give Windows NT Clients the ability to utilize what they have now and NT

You are adding new workstations and you wish to take advantage of Windows NT 4.0 workstation. If you have one NT server on your network, you can utilize "Gateway Services for NetWare" which is included with NetWare to allow NT clients to access NetWare Servers and Printers. In addition these new workstations will be able to support other protocols such as TCP/IP for Internet or Intranet access.

4. Give your MPE/UNIX or NetWare clients completely transparent access to NT Server file and print services

For an small additional cost you can install File and Print Services for NetWare, a Microsoft product for Windows NT. This makes your NT server "look like" a Novell server to your Novell clients. The result is that these NetWare clients can access the services on the NT server as if it were a Novell server.

5. Migrate NetWare users to NT Server

Microsoft provides a "Migration Tool for NetWare 1.1 that allows you to migrate NetWare login scripts, files, directories and permissions to NT Server.

6. Migrate MPE or HP-UX users to NT Server

Re-host an existing application that needs to be rewritten to NT Server and use tools such as ODBC and/or LeeTech CSF to provide for interoperability between the new application and other existing applications.

7. Use NT for Internet access

Use NT Server and the Microsoft NT Backoffice to provide Internet based access to existing databases and applications.

Summary and Conclusion

Webster's dictionary defines a strategy as "a plan of action encompassing the methods to be adopted from beginning to end of a task or endeavor, focussing on the general methods". This part of the paper has presented a starter list of the roles and adoption approaches one might consider in developing a strategy for NT adoption.

A sensible strategy for NT usage takes into account the operating systems needs of the target organization and the capabilities and limitations of NT. Because NT is so versatile it has the potential to become the single operating systems solution in many organizations.

However, just like any other operating system, NT does have limitations. It is far better to recognize those limitations before embarking on a replace all other operating system project. This paper has attempted to provide a framework for an analysis of whether or not NT can be used to provide operating systems services at your company and if it can be used, to what extent. Since each company is different and therefor operating systems needs vary, there is no one conclusion that fits all. Determining the suitability of NT is a process with an ever changing landscape. Organizations needs change every day and so do NT's capabilities and limitations.

Only companies with no existing applications running on computers do not need to concern themselves with coexistence. If your company wants to adopt NT, the most likely situation will be one of coexistence with existing operating systems. However, even if you want to replace your existing server hosts with all NT, in most cases coexistence at least for a time will be in order (during migration at least). How NT can coexist with other operating systems then becomes a very important topic and it is probably the key issue in any NT strategy.