COMPAQ
White Paper

July 2001
159T-0701A-WWEN

Prepared by OS Integration Engineering

Compaq Computer Corporation

Contents

The Compaq Infrastructure Consolidation to Microsoft Windows 2000 and Microsoft Exchange 2000

Abstract: This white paper discusses key aspects of the massive migration and infrastructure consolidation effort Compaq undertook to move from Microsoft® Windows® NT 4.0 to Microsoft® Windows® 2000 and Microsoft® Exchange 2000.

Compaq is using this migration effort as a vehicle to:

- Consolidate formidable resources onto fewer servers
- Reduce the overall Total Cost of Ownership (TCO)
- Centralize IT resources and maximize system efficiencies
- Standardize operating systems with Windows 2000
- Create a single global infrastructure
- Save money by using Remote Support
- Improve security by using a stronger authentication model

The task of migrating and consolidating these resources is enormous. Because of our experience, Compaq is ready to assist other business enterprises with their migration and consolidation to Windows 2000 and Exchange 2000.

For additional information, visit the Compaq Server Consolidation Solutions website: http://www.compaq.com/solutions/serverconsolidation/index.html or the Compaq Microsoft Frontline Partnership's Windows 2000 website: http://www.compaq.com/partners/Microsoft/Windows2000/index.html

Help us improve our technical communication. Let us know what you think about the technical information in this document. Your feedback is valuable and will help us structure future communications. Please send your comments to: OSEngineeringfeedback@compaq.com

Notice

The Compaq Infrastructure Consolidation to Microsoft Windows 2000 and Microsoft Exchange 2000 White Paper prepared by OS Integration Engineering

First Edition (July 2001)

Document Number 159T-0701A-WWEN

Introduction

Compaq is already beginning to reap the benefits of our migration and consolidation effort. By migrating to Microsoft® Windows® 2000 and Microsoft® Exchange 2000, Compaq was able to solve several business and enterprise issues.

For example, the scalability available in Active Directory results in the need for fewer domains, leading to server consolidation, one of the key Windows 2000 benefits. Server consolidation allows enterprises to combine many of their smaller servers into larger clusters, which in turn saves money on software license fees and the IT personnel to manage them.

Specifically, internally Compaq is already experiencing the following benefits:

- Consolidation and standardization of Windows 2000 operating systems means fewer domains to manage and fewer servers to maintain
- Reduction in management overhead
- Reduction in the number of servers by 2,000
- Reduction in the number of technicians dispatched around the world
- Improvements in overall security

Businesses of all types can benefit from our global practice dedicated to Windows 2000 implementation and supported by certified Microsoft professionals. Compaq has a force of 26,000 services professionals, 3,000 of which are Microsoft Certified Systems Engineers (MCSE) as well as solution developers who have been involved in very large Windows NT and Exchange rollouts.

Compaq Direction and Purpose

As a long-time and close partner of Microsoft, Compaq was one of the first five companies to join the Windows 2000 Joint Development Partnership (JDP) program. In fact, Microsoft used Compaq ProLiant servers exclusively to develop and optimize their revolutionary new operating system, Windows 2000. Underscoring this strong, strategic alliance with Microsoft, Compaq began the initial planning for its own migration during the summer of 1998, deploying the first server in the new Windows 2000 domain infrastructure in July of 1999.

The Global Information Services team is now involved in replacing all Microsoft Windows NT 4.0 servers with Microsoft Windows 2000 servers throughout the Enterprise, as well as replacing all Microsoft® Windows® 95, Microsoft® Windows® 98, and Microsoft® Windows® NT on the desktop with Windows 2000 Professional edition. The impetus for this effort is multi-faceted; Compaq needed to consolidate all its formidable resources (network and domains) based on the merger of four legacy companies. Compaq chose the migration route to eliminate the complicated legacy network infrastructure from previous mergers and implement the new 21st century "Globalnet".

Following two years of planning, Compaq decided to move the company onto the next generation operating system at both the desktop and server levels. The Global Information Services Windows 2000 team split the migration and consolidation effort into six manageable areas or "threads".

Note: The "treads" below indicate resources before migrating and consolidating to Windows 2000 and Exchange 2000.

- **Domain Infrastructure Build Out**

  Compaq maintained over 10,000 Windows NT 4.0 servers including 13 Master User Domains. The new Windows 2000 infrastructure will consist of only four domains.

- **Workstation Operating System (OS) Consolidation and Remote Users**

  Compaq started with over 95,000 clients requiring migration to Windows 2000 Professional. Additionally, the Group Policy and the Help Desk are also to be integrated into the new network structure.

- **User Account Migration**

  Compaq administered over 107,000 NT4 user accounts that must be migrated seamlessly from Windows NT 4.0 to native Windows 2000 domains.

- **Exchange 2000 Mailbox Migration**

  Compaq commenced its mailbox migration with over 112,000 Exchange 5.5 mailboxes. The task of migrating and merging Microsoft® Exchange 5.5 directory entries into Active Directory must be well planned and executed.

- **Application Migration**

  All software applications must be migrated, validated, and certified on the back and front ends of the Windows 2000 operating system. Compaq had over 2,500 Windows-based applications to migrate.

- **Resource Domain Migration**

  Compaq started its efforts with 1,700 NT4 resource domains. It plans call for retiring all of them by moving all resources into Windows 2000 Organization Units. This is to be accomplished after all user accounts have been migrated.

Note: The individual threads listed above are addressed in more detail under the heading titled "*Migration and Consolidation Challenges*" located in this document.

Increasing ROI with Remote Support

Compaq developed Compaq Insight Manager XE and Compaq Remote Insight Lights-Out Edition as aid for remote support of enterprise wide systems. Compaq Insight Manager XE monitors and manages groups of servers, clients, clusters, and networking products anywhere, anytime from a standard web browser. It can manage an unlimited number of servers from a single console and provides device management capabilities that consolidate and integrate management data from Compaq and third-party tools, such as BMC Patrol, using SNMP, DMI, and HTTP.

Compaq Remote Insight Lights-Out Edition provides a seamless, hardware-based, operating system independent graphical remote access to Compaq ProLiant servers using a standard browser. It requires no additional software on either the server or browser. Compaq expects to reverse the current percentage of dispatches by remotely handling as much administration and support as possible. See Table 3 titled" *Server Deployment Methods*" for information on the various deployment methods used by Compaq.

Strategy from a Business Point of View

From a business point of view, Compaq is using the migration as a vehicle for a long-planned consolidation of its legacy server and network infrastructures. From a technical point of view, Windows 2000 will provide a much more robust and supportable environment than Windows NT Server 4.0 in the areas of scalability, availability, and server management.

Migrating to Windows 2000 and Exchange 2000 provides the capability to more centrally locate the respective server farms and by replacing multiple smaller Windows NT Server 4.0 systems with larger servers, management becomes easier, and support costs drop. Doing this eliminates and consolidates redundant server and network infrastructures reducing the Total Cost of Ownership (TCO). Windows 2000 lowers the overall TCO of our computing environment due to the reduction in the number of required infrastructure servers.

In the area of flexibility, Windows 2000 Advanced Server offers superior clustering and processor support capabilities for future growth of the enterprise business. Advanced Server adds support for more RAM and multiple processors, two-node clustering and network load balancing.

Windows 2000 also enhances the manageability aspect of our infrastructure because of the reduced number of domains and elimination of resource domains and associated trusts. For example, by using Windows 2000 Terminal Services, most processing can be remotely performed on the server. Terminal Services can be used in two different modes: remote administration or as an application server. Included in Windows 2000 is Microsoft Management Console (MMC). MMC is a common management framework enabling developers to build their own snap-ins (mini-applications) for managing specific applications. Snap-ins can be combined to build customized consoles to meet the needs of different types of administrators. For example, it is possible to have one console for help-desk staff, another for network administrators and yet a third for someone with responsibility for the entire enterprise, he explains.

Windows 2000 Server is enabling Compaq to shrink its domain infrastructure to one root and three child domains, pare its infrastructure server count down considerably and, with the Windows 2000 Active Directory™ service, consolidate the administration into a few manageable elements.

Strategy from a Technical Point of View

Technically speaking, Windows 2000 provides a much more robust and supportable environment than Windows NT Server 4.0 in the areas of scalability, availability, and server management. Windows 2000 allows Compaq to consolidate accounts, services, and systems into a more manageable environment that actively promotes corporate strategies and alliances. Windows 2000 permits single login with enterprise wide access while addressing management issues of local control and security.

In the scalability arena**,** Windows 2000 scales much better than Windows NT 4.0. Limited to roughly 30,000 users per domain, Windows NT 4.0 has no inherent tools to delegate administrative privileges other than creating additional domains. With Active Directory (a true directory service), Windows 2000 can scale to millions of objects per domain supporting increased memory, processors, and clustering options and has the ability to carve administrative boundaries around resources using objects called Organizational Units.

Windows 2000 offers improved availability; instabilities in previous versions of Windows as well as software conflicts caused frequent system crashes. For example, Windows 2000 Professional has already proven to be in the neighborhood of 30% more stable, and if errors do occur, they are frequently limited to the offending application only. Similar improvements are also seen in the server software environment.

A single Windows 2000 configuration provides a standard based operating environment. Standardizing policies and procedures across the company's entire IT infrastructure is one of the main objectives behind this migration effort. Standards refer to everything from how users and computers are named to management and configuration of Active Directory. Standardization of desktop and server configurations also paves the way for more centralized and automated systems management. Compaq is already moving in this direction via Windows 2000 features such as built-in remote server management.

Exchange 2000 represents a vast improvement over Exchange 5.5 in many respects. The most obvious improvements are that Exchange 2000:

- Now allows up to 4 storage groups with each supporting up to 8 databases
- Now utilizes the single Active Directory for all mail synchronization, lookup, and routing

Additional Benefits

Migrating to a single Windows 2000 configuration provides a standards based operating environment. Standards include everything from how users and computers are named to the management and configuration of Active Directory. Installations meeting most of these standards are easier to support. Standardization of desktop and server configurations paves the way for more centralized and automated systems management.

Migrating to Windows 2000 also improves security by using a stronger authentication model reducing vulnerability and allowing easier enforcement policies at both the desktop and server levels. Better security means fewer network administrators.Microsoft® Windows® Services for UNIX facilitates interoperability between Windows-based and legacy UNIX-based operating systems. The core of Windows 2000 interoperability is its support for a number common communications and security protocols, including Transmission Control Protocol/Internet Protocol (TCP/IP), Lightweight Directory Access Protocol (LDAP), Dynamic Host Configuration Protocol (DHCP), the Domain Name Service (DNS) protocol, and the Kerberos version 5-authentication protocol. To learn more about interoperability between these operating systems visit: http://www.microsoft.com/windows2000/sfu/ and http://www.microsoft.com/windows2000/server/evaluation/features/interop.asp.

Migration and Consolidation Roadmap

During the planning stage, Compaq understood that the migration consolidation effort required many hard choices. One of those was regarding how to migrate the user workstations – Compaq chose to employ a "wipe and load" approach. All user workstations are reloaded from scratch with Windows 2000; the data is saved to a migration server and then restored once the migration is complete. Additionally, Migrations rather then upgrades are necessary if the Windows 2000 domain architecture requires a re-design. Migrations are much more complicated because accounts must be moved from a Windows NT 4.0 domain into a different native Windows 2000 domain. Compaq decided to migrate and consolidate all of its resources in an effort to lower TCO by consolidating its domain and support infrastructure.

Months of planning are imperative to ensure the success of such a large migration and consolidation effort. Compaq studied its options for nearly an entire year before beginning to implement their Windows 2000 migration plan. The Windows 2000 Program team broke this process down and in the end; the basic roadmap for this effort consists of these four basic points.

- Setting up the entire Windows 2000 infrastructure for all groups
- Populating the new domains with network objects
- Moving all user accounts to the new domain infrastructure
- Collapsing and cleaning up of the old Windows NT domains

The overall goals of an enterprise wide Windows 2000 migration project were to complete the process on time, within budget, and with minimum risks and errors. Understanding the existing environment and creating a blueprint for the new infrastructure are critical steps of the overall migration process, making it possible to complete the migration on time and within budget.

Migration and Consolidation Challenges

"It is critical to understand Active Directory, its dependencies on DDNS, and its replication implications. We call it the lifeblood of Windows 2000. If AD is designed incorrectly, your whole network will suffer." Tim Benson, Worldwide Program Manager for Windows 2000

Compaq knew that before plunging headlong into such a massive undertaking, detailed plans and roadmaps were necessary for the overall success of the program. Particular attention was paid to the layout of the Active Directory structure.

Because Active Directory is a true directory service, Windows 2000 can scale to millions of objects per domain and has the ability to carve administrative boundaries around resources using objects called Organizational Units. This scalability was not available in Windows NT 4.0.

IMPORTANT: Active Directory must be made available when migrating to Exchange 2000.

Each of the Compaq program threads are designed to be semi-independent of the others, minimizing the possibility that a hold-up in one area will create a domino effect across the whole project. For example, Compaq started with its client migration first, since users of Windows 2000 Professional clients could still authenticate into the legacy Windows NT4 domains until the Windows 2000 infrastructure was ready. All other threads, however, have some dependence to the Windows 2000 infrastructure and Active Directory.

Domain Infrastructure Build-out

One of the more challenging aspects of the migration is moving four separate domain and network infrastructures into a single, non-redundant infrastructure. The Domain Infrastructure build-out establishes the basic structure all other threads depend upon.

During the preliminary planning stage, the Compaq Windows 2000 program team considered the following points:

- Creation of the system topology and deployment design
- Installation of the various components
- Training of and transitioning of support to the normal operations staff

The new Windows 2000 infrastructure is made up of domain controller servers to support Active Directory and Dynamic DNS, servers to support the myriad of other services required to manage the new environment, such as WINS, DHCP, File and Print, Remote Access and Tunnel Services. The hardware is all new servers from the Compaq ProLiant family and 1000 plus servers supporting the old Windows NT 4.0 infrastructure will be reused if possible (most likely as file servers) or retired if incapable of running Windows 2000.

To date, Compaq has completed 95% of their Windows 2000 infrastructure build-out.

Workstation Operating System (OS) Consolidation

At program initiation, Compaq had in excess of some 95,000 desktops using a mix of Windows 95, Windows 98, Windows NT 4.0, and Windows 2000 and badly needing standardization into a single, Window 2000 based configuration. The Compaq Windows 2000 program team began the task of creating strategies for the installation of Windows 2000 Professional on clients and providing support for Windows 9x along with establishing Windows 2000 Group Policies relating to the desktop. Consideration was given to the training and transitioning of the normal support staff, including the Help Desk. Users participating in an automated migration to Windows 2000 were required to register at a special web site before the process began and were provide with instructions on how to handle the changes.

To facilitate this effort the Compaq IT group wrote an “umbrella script” called “GLUE”. GLUE was written to help manage the entire process for each desktop, automatically kicking off a series of utilities to get the job done.

- First, GLUE determines whether a desktop meets a Compaq pre-determined minimum Windows 2000 hardware configuration standard of 300 MHz and 128M bytes of RAM. If the desktop does not meet the required criteria, GLUE will stop the migration process at that point.
- Another GLUE utility checks all the applications on a desktop’s hard drive. If an application is not part of the standard corporate “build,” the utility flags those non-standard applications and notifies the user to ensure they have the media available for post-migration reloading.
- GLUE also kicks off PC Transplant, a software product that Compaq markets externally as part of its Intelligent Manageability product line. PC Transplant takes a snapshot of user-specific desktop configurations, including where the network printer path is, and how the desktop is organized. It also includes Microsoft® Word, Microsoft® Excel, and Microsoft® Outlook® preferences, Internet Microsoft® Internet Explorer bookmarks, and all the user data. The snapshot is stored on a designated drive or server.
- Next, GLUE initiates Automated Software Installer, another application that Compaq uses internally and markets externally. Automated Software Installer wipes the old operating system and files, and builds the new desktop according to a standard configuration, registry settings, and security policy.
- Lastly, GLUE calls PC Transplant so that all files and user preferences are re-installed.

Figure 1 illustrates the method used for desktop migration.

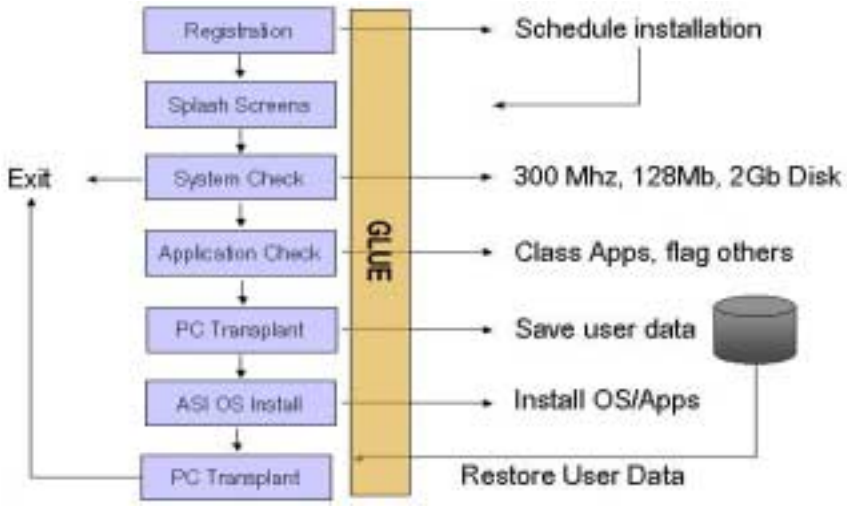

Figure 1. Graphic representation of the desktop migration process

A Note about Remote Users

Due to a lack of available bandwidth, remote users did not have the luxury of being able to perform the OS migration over the LAN. A special Windows 2000 CD was created allowing remote users to perform the workstation migration on their own. The only difference between the LAN and CD migration procedures is that remote users are responsible for backing up their user data themselves.

As of this writing, Compaq has migrated over 70% of its installed client base.

User Account Migration

This "thread" is the nexus for much of the activity making up the Windows 2000 program and includes:

- Implementation of Windows 2000 account management and migration tools
- Actual migration of accounts and security groups.

This involves moving user accounts (and their associated groups) to Windows 2000 and Active Directory domains while preserving their access to resources in the legacy Windows NT 4.0 Domains. To provide seamless migration of access from a Windows NT 4.0 account to a Windows 2000 account, the Compaq Windows 2000 program team had to either move resources accessed by the account into the Windows 2000 domain or create a trust relationship to the resource domain that currently owns the resources.

Compaq chose to push the actual resource migration thread after completion of the user account migration. For this reason, trust relationships were created from every Windows NT 4.0 domain to the Windows 2000 forest domains. A special Windows 2000 Active Directory attribute called SID History allows the newly migrated accounts to access all legacy resources across the trusts connecting the two domain architectures.

At the time of this writing, Compaq has over 10% of its users residing in the Windows 2000 domains and is currently fast-tracking the remaining user population.

Exchange 2000 Mailbox Migration

Compaq started with over 112,000 Exchange 5.5 mailboxes. Plans called for migrating all these mailboxes from their respective Exchange 5.5 servers to new Exchange 2000 mailbox servers, while reducing 367 Exchange servers down to a mere 175, a reduction of approximately 50 percent.

See the section titled "*Microsoft Exchange 5.5 to Exchange 2000 Migration Effort*" for details regarding this effort.

Application Migration

All Windows-based applications will be migrated to run on Windows 2000 Server. This thread involves migration, validation, and certification on Windows 2000 back and front ends. Critical tasks for this effort included:

- Identifying each application and its owner
- Informing owners that they should notify their third-party application vendors to get Windows 2000 certification as soon as possible
- Setting up a group of servers as a test bed for certifying applications that do not have their own development environments.
- Establishing policies and procedures for tracking an applications progress through certification, and ensuring applications do not go into production on the new Windows 2000 installation until they've been tested and validated.

Resource Domain Migration

Collapsing and retiring legacy Windows NT4 resource domains cannot be accomplished until after all applications have been certified, tested, and migrated to Windows 2000 servers AND those servers and all other resources are migrated to the native Windows 2000 domains. Migrating all resources is not trivial because of the need to apply new security access rights from the newly migrated user accounts and groups. Manually applying those security privileges was daunting, so Compaq chose to wait until the migration software tools provided an automated means for accomplishing this task.

By keeping the existing Windows NT 4.0 infrastructure intact until the migration is complete allows the process to be done in steps. By doing this, productivity was not harmed and if problems arose in business critical areas, the entire process did not collapse.

Compaq ProLiant Servers and Microsoft Windows 2000

Industry standard Compaq ProLiant server platforms were the hardware of choice for the Windows 2000 migration. ProLiant servers offer optimum availability, scalability, performance, cost benefits, and comprehensive enterprise-level solutions.

The Compaq Windows Program team chose the ProLiant DL380, ProLiant DL580, ProLiant CL380R (Two ProLiant DL380Rs), ProLiant ML530, and the ProLiant 8500 to serve as the workhorse platforms for running their Windows 2000 infrastructure.

The following tables illustrate the ProLiant server hardware configurations, type and function, environment and other relevant details regarding the servers used for this effort.

Table 1 shows the minimum hardware recommendations for servers and clients.

Table 1. Minimum recommended hardware requirements for Microsoft Windows 2000

Servers	Clients (Workstations)
700 MHz processor	300 MHz processor
256MB of memory	128 MB of memory
18.2GB hard drive	2GB free of hard disk space

Table 2 contains information on server platforms, type, and version of Windows 2000.

Table 2. Server platform, type and version of Windows 2000

Platform	Server	Version
Domain Controller	ProLiant DL380	Microsoft Windows 2000 Server
Global Catalog Server (Large)	ProLiant DL580	Microsoft Windows 2000 Server
Global Catalog Server (Small)	ProLiant DL380	Microsoft Windows 2000 Server
Operations Masters	ProLiant DL380	Microsoft Windows 2000 Server
WINS/DHCP Cluster	ProLiant CL380R (Two DL380Rs)	Microsoft Windows 2000 Advanced Server
Dedicated WINS	ProLiant DL380	Microsoft Windows 2000 Server
Bindview Migration Server	ProLiant ML530	Microsoft Windows 2000 Server
Desktop Migration File Server (small)	ProLiant DL380	Microsoft Windows 2000 Server
Desktop Migration File Server (large)	ProLiant DL580	Microsoft Windows 2000 Server
Exchange 2000 Server (Tiny – 250 users)	ProLiant DL380	Microsoft Windows 2000 Server
Exchange 2000 Server (Small – 500 users)	ProLiant DL580	Microsoft Windows 2000 Server
Exchange 2000 Server (Medium – 1,500 users)	ProLiant 8500	Microsoft Windows 2000 Server
Exchange 2000 Server (Large – 5,000 users)	ProLiant 8500	Microsoft Windows 2000 Advanced Server

Table 3 lists servers by type and function.

Table 3. Servers by type and function

Server	Function
Domain Controller	Domain root and Geo-specific domain controller
Global Catalog Server (Large)	Domain root and Geo-specific Global Catalog Server
Global Catalog Server (Small)	Global Catalog server for smaller or remote sites.
Operations Masters	Dedicated Forest or Domain Operations Master (PDC, Schema, Infrastructure, Domain)
WINS/DHCP Cluster	Active-Active cluster providing centralized WINS and DHCP services to Core
Dedicated WINS Server	Dedicated server for Tier2, Tier3, or Tier4 WINS services.

continued

Table 3. Servers by type and function *(continued)*

Server	Function
Domain Migration Server	Dedicated server for BindView Domain/Account Migration software.
Desktop Migration File Server (Small)	Repository for client desktop data during migration to Windows 2000.
Desktop Migration File Server (Large)	Repository for client desktop data during migration to Window 2000.
Exchange 2000 Server	Repository for user mailboxes

Software Environment

For the Windows 2000 migration effort, all new ProLiant servers were built with the latest build kit, Automated Software Installation for Windows 2000 (formerly know as “SEPS”). Automated Software Installation (ASI) is Compaq designed software to aid in the unattended installation of operating systems and software products on servers and desktop systems. ASI allows customers to automate the installation, upgrade, and standardize the software configuration on their systems.

ASI for Windows 2000 "Distribution kits" can also be used to update registry settings, apply security standards, and modify the desktop. ASI is used extensively within Compaq Corporation worldwide to manage software change on a large number of production systems.

Visit our web site at, http://www.compaq.com/emea/asi/ for more information on Automated Software Installation (ASI).

Server Reduction Statistics

One of the major reasons to migrate to Windows 2000 and Exchange 2000 was to reduce and consolidate resources. Prior to the migration, approximately 10,000 Compaq ProLiant servers ran Windows NT 4.0, inclusive of application servers. In implementing Windows 2000, Compaq expects the servers required to support the infrastructure will be drastically reduced (See Table 5 below).

Additionally, Compaq expects to achieve similar reductions of file and print servers as well as application servers (as a result of retiring legacy applications) when they complete the planning and execution of their resource migrations

Table 5 is a summary of the overall reduction in infrastructure server resources.

Table 5. Server reduction statistics

Server function	From	To
Dynamic Host Control Protocol (DHCP) servers	Replace some 280 Windows NT 4.0 DHCP servers worldwide	Less then 20 Windows 2000 servers clustered in a few large data center environments and running Advanced Server.
Master User Domains	13 Windows NT 4.0	3 Windows 2000 user domains + a root domain.
Domain controllers	5,000+	Reduced by about 1,500
Exchange servers	376	175

Migration Management Tools

Compaq employed the use of several third party software tools and other resources readily available and designed specifically as an aid to managing such a massive migration effort.

Table 6 contains the primary software tools employed by Compaq to migrate and manage their Windows 2000 environment. Compaq chose these tools based on a number of factors that included availability, functionality, and incentives.

Note: Compaq does not endorse any of these tools over some of their competitors.

Table 6. Software tools to manage the Microsoft Windows 2000 environment

Function	Tool	Action	Vendor
Account Administration	Directory Resource Admin. (DRA) 6.02	Provides Directory Management based on rules and policies on Active Directory objects. Directory "Active Views" provide cross OU/Domain/Version administration in one simple view. Provides provisioning functionality, linking with other directories.	NetIQ
Monitoring	Patrol 3.4	Standard monitoring agent for Windows	BMC
Account Migration	Direct Migrate 3.5	Allowed IT to take a group of users and reconcile names and resources on Active Directory, identifying any duplicates before committing the user accounts to the new infrastructure.	Bindview
Active Directory Health Monitoring	Directory Analyzer	Monitors the health of Active Directory	NetPro
Backup	Legato 5.7	Backup solutions	Legato
Group Policy	FAZAM 2000	Group Policy administration	Full Armor
Exchange 2000 Anti-virus	Antigen	Anti-virus protection on mailbox servers	Sybari
Desktop Migration	PC Transplant	Used to copy contents of one PC onto a new PC	Altirus
Software Installation	Automated S/W Installer (ASI)	Compaq designed software to aid in the unattended installation of operating systems and software products on servers and desktop systems. ASI allows customers to automate the installation, upgrade, and configure software on their systems.	Professional Services

Role of Compaq Intelligent Manageability Software

Compaq Intelligent Manageability software tools are an invaluable aid when deploying new ProLiant servers and installing application management tools.

- **Compaq SmartStart** decreases the time required installing and upgrading servers. This automated tool surveys systems and configurations, enabling easy manageability of upgrades.
- **Compaq Insight Manager XE** manages an unlimited number of servers from a single console. It provides device management capabilities that consolidate and integrate management data from Compaq and third-party devices using SNMP, DMI, and HTTP. With Compaq Insight Manager XE, you can monitor and manage groups of servers, clients, clusters, and networking products anywhere, anytime from a standard web browser.
- **Compaq SmartStart Scripting Toolkit** delivers an unattended automated installation for high volume server deployments. The SmartStart Scripting Toolkit is designed to support the Compaq ProLiant DL and ML series servers. The toolkit includes a modular set of utilities and important documentation that describes how to apply these new tools to build an automated server deployment process.
- **Compaq Remote Insight Lights-Out Edition** provides seamless, hardware-based, OS-independent graphical remote access to Compaq ProLiant servers using a standard browser. It requires no additional software on server or client browse.

Table 7 illustrates server deployment methods using Compaq Intelligent Manageability Solutions.

Table 7. Server deployment methods

Deployment Method	Type of Installation	Benefits
SmartStart for Servers	Single server installation	Assistance during server configuration and software installation
SmartStart using Replicated Installation	Replicated multiple server installations	Replicate a saved SmartStart configuration across multiple servers
SmartStart Scripting Toolkit	High Volume Server Deployment using the CD as OS Source	Automated, unattended server deployment
SmartStart Scripting Toolkit	High Volume Server Deployment using the Network as OS Source	Automated, unattended server deployment using a file server hosting your OS and Compaq software
SmartStart Scripting Toolkit	High Volume Server Deployment using Remote Insight Lights-Out Edition Board	Automated, unattended server deployment using remote installation over the network
SmartStart Scripting Toolkit with 3rd Party Imaging Applications	High Volume Server Deployment using Imaging Applications	Automated, unattended server deployment with the benefits of popular imaging applications

To find out more about the Intelligent Manageability software solutions, visit the Compaq Intelligent Manageability website: http://www.compaq.com/manage/.

Exchange 5.5 to Exchange 2000 Migration Effort

Compaq is a member of the Exchange 2000 Joint Development Partnership and is the prime integrator worldwide for Exchange 2000. With more than 8 million Microsoft Exchange seats directly deployed by Compaq at over 550 Global Enterprise customers, Compaq has more experience in deploying Microsoft Exchange than any other hardware vendor.

Key activities for the implementation of Exchange 2000 within the Compaq infrastructure include:

- Designing and establishing the Exchange 2000 topology
- Migrating data from the Exchange 5.5 Global Address List to Active Directory

Planning for the migration of Exchange 5.5 mailboxes to Exchange 2000, priority was given to the training and transitioning of support activities to the normal Operations staff, the Help Desk and Account Administration.

IMPORTANT: Exchange 2000 is dependent on the infrastructure thread for the establishment and operation of the Windows 2000 Active Directory. Careful planning is necessary because Exchange 2000 uses the Windows 2000 Active Directory for storing the mail database.

Exchange 5.5 possessed many inherent architectural limitations that increased support requirements, such as; a single information store, a separate directory database (Global Address List) and separate replication infrastructure. Exchange 2000 Active Directory Connectors (ADC's) and their corresponding Connection Agreements (CA's) are the means responsible for synchronizing Windows 2000 Active Directory with the existing Exchange 5.5 Server infrastructure.

ADC's synchronize two types of directory objects present in the Exchange 5.5 directory:

- Recipients (mailboxes, distribution lists, and custom recipients)
- Configuration information (connectors, monitors, and protocols)

ADC's synchronize contents of the Global Address List onto the Active Directory, resulting in the creation of disabled user accounts for all mailboxes and distribution groups for all distribution lists. While there is no actual dependency here, there is an interaction between this activity and the account migration, as most migrated Windows NT 4.0 accounts will "connect" with disabled user accounts that represent personal mailboxes, resulting in a single directory object to represent both the email directory entry and the authentication principal.

Many Windows NT security groups will "collide" with the ADC created distribution groups, resulting in mail-enabled security groups. Exchange 2000 offers many enhancements that overcome these limitations.

The information store can now be broken up into multiple storage groups allowing maintenance on a single storage group without taking down the entire mailbox server allowing larger servers to be built and centralized to improve support. This regrouping results in an overall reduction of supported mailbox servers to less than half of those Exchange 5.5 servers.

Additionally, the Exchange 5.5 Global Address List (GAL) has been absorbed into Active Directory in Windows 2000 forming a central repository of directory data. One directory database is easier to maintain and manage than two and the replication of the Active Directory database.

The Exchange 2000 ADC creates and maintains this bond between an Exchange 5.5 mailbox and a Windows user until the last Exchange 5.5 server in the organization has been migrated or upgraded.

Table 8 shows recommended hardware requirements for Exchange 2000 as stated by Microsoft.

Table 8 Exchange 2000 server recommended hardware requirements

Exchange 2000 server minimum hardware requirements
Intel Pentium 300-megahertz (MHz) or faster processor
128 megabytes (MB) of RAM (256 MB recommended)
4 gigabytes (GB) of available hard-disk space

Summary

The benefits of the migration to Windows 2000 and Exchange 2000 resulted in cost reductions in all areas including infrastructure, management, and maintenance by reducing the number of desktop operating systems supported to a single Windows 2000 operating system. Major TCO benefits also accrue because of the move from the Windows NT 4.0 domain to the Active Directory single global infrastructure.

"At the beginning of the migration in January 2000, Compaq had over 1,700 resource domains, each of which required a primary and at least one backup domain controller. Moving to Windows 2000 and Active Directory will enable our IT organization to retire at least 1,500 servers."

Compaq has experienced some serious trimming of both network and server costs by eliminating legacy infrastructure redundancies from its mergers with Digital Equipment, Tandem, and Microcom. By moving to Windows 2000, the reduction in domains (1,700 resource domains, each required primary and backup domain controller servers) enables our IT organization to retire approximately 1,500 servers. Windows 2000 also enables the company to consolidate its Dynamic Host Control Protocol (DHCP) servers, which administer IP addresses to clients.

Compaq has replaced some 280 Windows NT 4.0 DHCP servers worldwide with fewer than 20 Windows 2000 servers clustered in a few large data center environments running Windows 2000 Advanced Server.Microsoft Windows 2000 uses powerful load balancing and fail-over capabilities, this coupled with the high-end Compaq ProLiant server hardware ensures optimal reliability. The server consolidations described throughout this paper translates into a big reduction in management and support costs, as well as hardware and software savings.

Compaq has streamlined its support services by implementing the remote administration features built into Windows 2000. Microsoft Windows 2000 built-in Terminal Service for remote administration and the ability to update the operating system across the Internet, Compaq can concentrate its high-level technical resources at the seven central support centers, where they will be able to accomplish the most, rather than diffuse those resources throughout the corporation. The company expects to free the already understaffed local IT staffs from infrastructure related problems and allow them to concentrate on their local user issues.

Appendix A - Consolidation Types and Benefits

Server consolidation is an industry trend that optimizes physical resources, consolidating applications onto fewer, more powerful servers and centralizing the management of many business critical applications.

Server consolidation involves optimizing hardware resources to increase staff productivity and reduce labor requirements, reducing total costs. Placing systems at core locations enables IT organizations to effectively respond to emerging business challenges, simplifies data management, reduces space requirements, and helps control the overall cost of ownership.

Table 1 describes consolidation types, definitions, and benefits.

Table 1. Server consolidation types and benefits

Consolidation Type	Definition	Benefits
Location centralization	Move distributed computing environments into a single, centralized location.	Reduction in skilled administrators Increased reliability and availability Reduced facilities costs Lower operations costs Improved security and management
Physical consolidation	Replace small servers with large servers	Reduced hardware and software costs Improved processor utilization Reduced facilities costs Lower operations costs Improved manageability
Data consolidation	Combine data from multiple sources onto a single repository	Reduced storage management costs Improved resource utilization Lower administrative costs Improved backup/recovery capabilities Enhanced data access and integrity
Application consolidation	Move distributed computing environments into a single, centralized location.	Reduction in skilled administrators Increased reliability and availability Reduced facilities costs Lower operations costs Scalability

For additional information about server consolidation solutions, see the white paper “Server Consolidation with Compaq ProLiant Servers” located at http://www.compaq.com/support/techpubs/whitepapers/145v-0101a-wwen.html.

Appendix B – Compaq and Microsoft Web Resources

Table 1 provides Internet links that you might find helpful when investigating Compaq solutions for Microsoft products.

Table 1. Compaq web resources

Web Link Name	Web Location	Description
Compaq and Microsoft Frontline Partnership	http://www.compaq.com/partners/Microsoft	Provides a comprehensive listing of Compaq solutions for Microsoft products based on the Compaq and Microsoft Frontline Partnership, an industry benchmark for collaboration in developing leading information technologies and delivering customer-focused integrated solutions through highly qualified service professionals.
Compaq Resource Paq for Microsoft	http://www.compaq.com/partners/microsoft/resourcepaq/index.html	Includes a wide range of information products and tools supporting Windows NT 4.0, Windows 2000, Windows 2000 Datacenter, and Whistler emphasizing the Compaq and Microsoft Frontline Partnership.
Windows 2000	http://www.compaq.com/partners/Microsoft/Windows2000/index.html	Provides a collection of news articles, success stories, support information, and technical documents developed by Compaq to support Compaq products running Windows 2000.
Windows 2000 White Papers	http://www.compaq.com/partners/microsoft/windows2000/whitepapers.html	Includes a collection of white papers optimizing the Windows 2000 planning, migrating, and deploying experience with Compaq products.
Windows 2000 Support	http://www.compaq.com/partners/microsoft/windows2000/support/index.html	Includes a collection of downloads and technical documents developed by Compaq to support Compaq products running Windows 2000.
Whistler Support	http://www.compaq.com/partners/microsoft/whistler/index.html	Consists of a collection of downloads and technical documents developed by Compaq to support Compaq servers running beta versions of Whistler.
Data Center Solutions Program	http://www.compaq.com/datacenter	Includes a collection of information resources and downloads for Compaq Data Center Solutions for Windows 2000 Datacenter Server.
Microsoft Solutions on ActiveAnswers	http://vcmproapp02.compaq.com/ActiveAnswers/Global/en/partner.8620/default.asp	Contains sizers and technical information developed by Compaq to support Compaq products running Microsoft solutions such as Microsoft SQL Server, Microsoft Exchange Server, Microsoft Application Server, etc.
Windows 2000 Clustering	http://www.compaq.com/solutions/enterprise/highavailability-win2k.html	Includes a collection of product descriptions, FAQs, and technical documentation developed by Compaq to support Compaq clusters running Windows 2000.

continued

Table 1. Compaq web resources

Web Link Name	Web Location	Description
Intelligent Manageability Products	http://www.compaq.com/products/servers/management/index.html	Includes product information, technical documentation, and downloads for management products included in the Intelligent Manageability suite.
ProLiant Servers	http://www.compaq.com/products/servers/platforms/	Provides product, support, and purchasing information for ProLiant servers, featuring Intel-based processors that support Windows NT and Windows 2000. Choose from the density-optimized ultra-thin server for ISPs up to breakthrough scalable performance with 8-Way clustering.
Deskpro & iPAQ Desktops	http://www.compaq.com/products/desktops/index.shtml	Provides product, support, and purchasing information for Deskpro and iPAQ desktops for the business environment.
Armada Notebooks	http://www.compaq.com/products/notebooks/index.html	Provides product, support, and purchasing information for Armada notebooks for the business environment.

After you visit the Compaq Web resources listed above take a look at the Microsoft Windows 2000 Server website for additional tools and information critical to your upgrade process.

Table 2 lists Microsoft resources on the Web.

Table 2. Microsoft web resources

Item	Web Location
Overview information on Windows 2000 for Servers	http://www.microsoft.com/windows2000/guide/server/overview/default.asp
Windows 2000 Server Help documentation	http://windows.microsoft.com/windows2000/en/server/help/
Windows 2000 Hardware and Software Compatibility testing	http://www.microsoft.com/windows2000/upgrade/compat/default.asp
Microsoft Hardware Compatibility List (HCL)	http://www.microsoft.com/hcl/default.asp
Upgrading from Previous Versions of Windows	http://www.microsoft.com/windows2000/upgrade/path/default.asp
Windows 2000 Resource Kits	http://www.microsoft.com/windows2000/library/resources/reskit/default.asp

Throughout this paper, we have discussed many issues and the steps necessary to plan for a successful upgrade to Microsoft Windows 2000 Server. Windows 2000 Server proves to be a sophisticated new OS requiring concrete planning efforts.