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# NetWare 5: New and Improved Technologies

**Abstract:** Novell's next generation operating system, NetWare 5, is the culmination of company-wide efforts to further strengthen NetWare's traditional storage, printing and management functions while delivering pure IP environment and a Java development platform. A well-designed client/network platform, NetWare 5 enables network administrators to easily manage and control multiple operating systems, protocols, applications, and desktops.

Compaq has worked closely with Novell on the development of NetWare 5. In fact, NetWare 5 was developed on Compaq servers and storage.

This Integration Note details the configuration options and describes the new features and enhancements of NetWare 5, including

- Novell Upgrade Wizard
- PCI Hot Plug Technology
- NetWare Peripheral Architecture
- Novell Storage Services
- Pure Internet Protocol (IP)
- Multiprocessing Kernel (MPK)
- Java Server Framework
- Novell Directory Services
- Backup Utility
- Novell Distributed Print Services
- Z.E.N.works Desktop Management Tool Suite

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## New Hardware Requirements

Whether your intention is to upgrade an existing server or purchase a new Compaq server, the following minimum hardware requirements must be met for a NetWare 5 installation:

- A PC-compatible with a 90 MHz Pentium, or higher, processor
- VGA, or higher, resolution monitor
- 64 MB of RAM
- 550 MB of available disk space (500 MB for the NetWare partition and 50 MB for the DOS partition)
- A network controller

For a local installation, you will also need

- A CD-ROM drive that can read ISO 9660-formatted CD-ROM

The list above does not reflect the recommended standards, but the minimum. Consider adding more memory based on the support of NetWare Loadable Modules (NLMs), virtual memory, Java applications, ConsoleOne, and file caching. After the hardware requirements have been met, you are ready to configure your Compaq server for a NetWare 5 installation.

## Improved Installation and Configuration

### Compaq SmartStart

Compaq SmartStart is a set of server integration tools and utilities that rapidly configure Compaq server hardware. SmartStart ensures consistency, and maximizes reliability and system uptime by providing an intelligent configuration path. SmartStart 4.2 or later provides complete NetWare 5 support. SmartStart provides two paths for configuring your server: Manual and Assisted Integration. Both paths perform the following tasks:

1. System hardware and boards are detected.
2. The Compaq System Partition Installation Utility creates the System Partition, which is a special area of the fixed disk that contains Compaq configuration, diagnostic, and maintenance utilities.

The Manual path does not offer the full benefits of the Assisted Integration path. You must perform the following tasks manually before installing NetWare 5:

1. Create and format the DOS partition on the server.
2. Install CD-ROM drivers.
3. Update the AUTOEXEC.BAT and CONFIG.SYS files to include the necessary commands to access the CD-ROM drive and adjust the FILES and BUFFERS settings.
4. Identify the server's network board and storage device properties, such as the interrupt and port address.

Compaq even provides a utility to facilitate the Manual installation path as well. CPQBOOT.EXE, which resides in the \INSTALL directory on the NetWare CD, creates a bootable diskette. This diskette boots the server, creates a boot partition, starts the NetWare 5 OS installation.

The Assisted Integration path, however, guides you through the entire process of configuring your hardware and installing NetWare. SmartStart automatically installs the optimized drivers and utilities that support Compaq hardware running NetWare 5. However, with an existing NetWare 5 server, you can install Compaq Support Software for Novell Products (NSSD) via the Compaq Support Software Utility. This utility, which facilitates installation of Compaq drivers and utilities, can be loaded from the command prompt or via Product Options of NWCONFIG, the utility that replaces the INSTALL utility in NetWare 4.x.

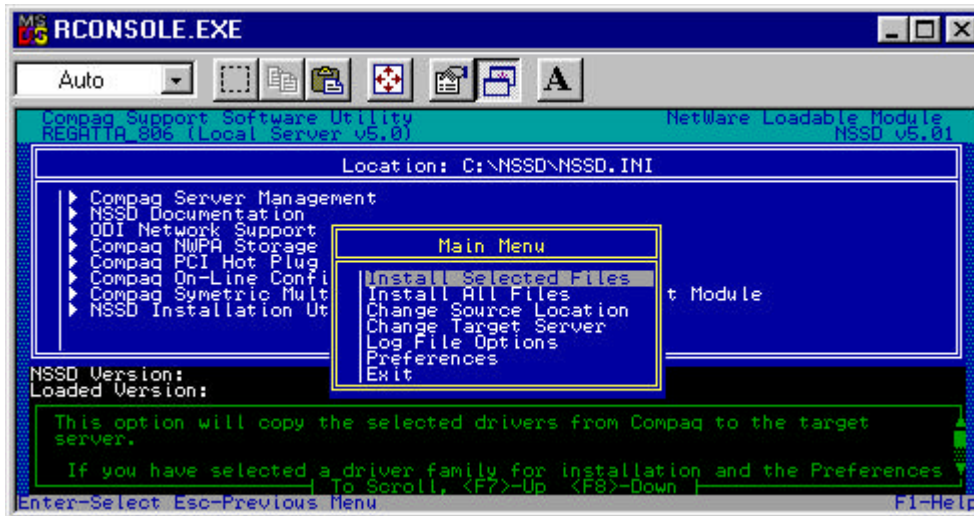


Figure 1 – Compaq Support Software Utility

The Compaq Support Software Utility is available from the [Compaq web site](#) via Compaq Softpaq. A SoftPaq is an executable file that extracts files to a directory on the hard drive. After the files have been expanded, the Compaq Support Software Utility is loaded from the server console with the command

Example: `LOAD E:\CPQSUPSW\NSSD\INSTALL\CPQNSSU`

You can install either all of the NSSD drivers, individually selected drivers, or a family of drivers such as the Compaq NWPA Storage Support option. The Compaq Support Software Utility includes a Preferences option (not shown) in the Main Menu that allows you to indicate whether server configuration files (STARTUP.NCF and AUTOEXEC.NCF) are to be updated automatically as well as whether or not a log file should be created. The log file summarizes the drivers that were successfully installed.

## NetWare 5 Install

During the Compaq SmartStart Assisted Integration path you can choose a Typical or Custom installation of NetWare. A Typical installation performs all of these tasks for you.

- Creates a 75MB DOS partition
- Copies updated Compaq devices drivers to the C:\NWUPDATE directory
- Provides information to the NetWare 5 installation process
- Automatically launches the NetWare 5 installation process

<sup>1</sup> For this example, E:\NSSD is the location where the NSSD files were extracted.

A Custom installation allows you to manually configure all of these options.

## Graphical User Interface

After the NetWare system files are copied to the SYS volume, the NetWare 5 installation continues in graphical display mode. Although a mouse is recommended, you can use the keyboard to navigate through the installation program.

The graphical user interface (GUI) is also launched at server startup. You can exit the NetWare 5 GUI at any time by choosing Exit GUI from the Novell menu. ConsoleOne and other Java applications can be launched from the NetWare 5 GUI. ConsoleOne is used to manage and administer network resources.

## Novell Upgrade Wizard

In the past, the tools for upgrading a NetWare 3.1x bindery and file system to an NDS tree were either limited or simply not available. This limitation made the NetWare 3.1x server bindery migration a challenging, time-consuming process. The tasks of migrating data, bindery, and print environments are now integrated into one utility, the Novell Upgrade Wizard.

The upgrade process involves three major steps that makes migrating resources more manageable than the existing toolkits.

1. **Upgrade Project** – Create a model that represents the NetWare 3.1x objects in the NDS tree. This allows you to carefully design your NDS tree to permit users to transparently access the network resources they need. You can create new NDS containers and objects in which to place the NetWare 3.1x bindery objects and file contents, or move the bindery and data to existing locations in the NDS tree.
2. **Verification** – Check for object conflicts, sufficient NDS and file system rights, disk space limitations, and other factors that could hinder the migration. If potential conflicts or errors are discovered, the Upgrade Wizard provides options for resolving those problems before the upgrade begins.
3. **Migration** – Begin the across-the-wire migration. The bindery and file system are copied to the previously defined locations.

The Novell Upgrade Wizard is available for free download from Novell's Web site on the [Novell Software Downloads](#) page.

## New Technology

The new features of NetWare 5 offers new features that enhance network management, facilitate uninterrupted service and access, and aid in managing multi-protocol environments.

### PCI Hot Plug

As a result of the inordinate costs associated with downtime, the vast majority of companies today require non-stop access to their critical systems. While advancements have been made to increase server uptime (redundant and hot-pluggable components), one area of availability that has not been adequately addressed is the replacement of pre-failed or failed Input/Output (I/O) adapter boards in a running system.

System administrators wishing to replace failed or suspect I/O boards must power down their servers. In enterprise environments, this results in additional costs and lost productivity. PCI Hot Plug technology is designed to address this customer concern. This breakthrough technology

pioneered by Compaq, offers unprecedented server availability by allowing users to replace, upgrade, and add PCI adapter boards to the PCI local bus while the system is running.

PCI Hot Plug technology features and benefits:

- **High availability** – PCI Hot Plug aids in identifying a failed component with the indicator lights. Particularly for enterprise environments, the ability to replace or upgrade a network or other I/O controller board while a system is operating is a substantial benefit. For instance, this allows replacement of a failed network controller board while the remaining network boards provide uninterrupted service.
- **Hot Add** – The ability to add new network or I/O controller boards while a system is operating ensures server availability. For example, adding an array controller attached to an external storage chassis results in increased storage capacity without any downtime.
- **Industry standardization** – Industry-standard PCI Hot Plug has multiple benefits. Specifically, multiple system providers, operating system suppliers, and adapter board vendors can all implement hot plug. Standardization gives investment protection if the proposed implementation is compatible with existing PCI standards. Any changes made to system hardware, operating systems, or adapter drivers should not affect functionality in an existing system.
- **Backward compatibility** – There is no need to overhaul entire systems just because certain components are hot-plug capable. PCI Hot Plug Technology is fully backward compatible.

The NetWare Peripheral Architecture was designed to support PCI Hot Plug technology.

## NetWare Peripheral Architecture (NWP)

NetWare Peripheral Architecture (NWP) is an extension of the NetWare Media Manager and the designated replacement for the legacy Device Driver Functional Specification (DDFS). The NWP modular design separates NetWare driver support into two components: a Host Adapter Module (HAM) and a Custom Device Module (CDM). The HAM is the driver for the controller while the CDM provides support for the device. Since the drivers for the controller and devices are separate, support for a new device may be added without affecting the HAM. An exception is custom HAMs, such as the Compaq Array Controller HAM, CPQARRAY.HAM, which incorporates aspects of both a HAM and a CDM. In this case, no CDM is required to manage the devices.

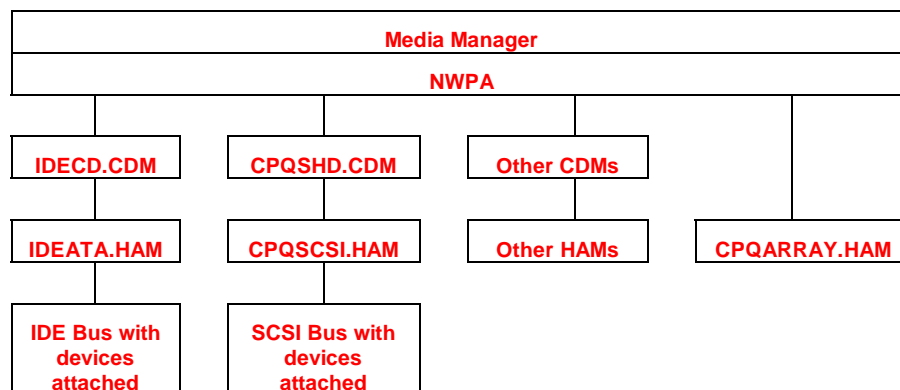


Figure 2. NWP Architecture

The legacy DDFS is the original design specification for storage device drivers developed by Novell. DDFS-based storage device drivers can be recognized by the .DSK filename extension. A

layered and more flexible architecture, NWPA surpasses the DDFS limitations without sacrificing performance. New features and hardware will be supported only with the NWPA drivers; DDFS will not be able to support the more sophisticated and demanding hardware/software features being developed.

Furthermore, Novell is phasing out support for the DDFS drivers and only supports NWPA in NetWare 5; Compaq has followed this trend in our driver development.

New features and technologies available with NWPA drivers:

- **Instance Unloading of Drivers** – This feature allows a device driver associated with a single slot to be unloaded. Under DDFS, as well as Novell's ODI Specification v3.3 for 32-Bit Assembly Hardware Specific Modules (HSMs), when a change to a running server environment is desired, you must

1. Unload the device driver (this means unloading ALL instances of the device driver).
2. Re-load the driver with the unchanged instances in their original state.
3. Modify the single changed instance of the driver under maintenance.

This process results in a wide service outage to all controllers controlled by the driver. With the new NWPA selective instance unloading, a single instance of a device controller is unloaded, and then reloaded with the changes. This is done without disruption of service to other controllers.

- **PCI Hot Plug Support** – When a disk controller or disk drive<sup>2</sup> becomes inoperable, it can be removed and replaced while the system is still running. There is no need to power down the server to perform the replacement. The layering of the NWPA design enables the many needed services to cleanly implement this functionally.
- **Modularity of Design** – With the layered design of NWPA, when a new device that works on an existing controller is added to a system, only the new device driver needs to be added. None of the other device drivers that use the same adapter need to be changed. This allows for the addition of new hardware without the disruption of existing matched hardware-software pairings. Fewer changes mean greater stability with less likelihood of unforeseen or unwanted side-effects.
- **Fibre Channel (FC) Storage** – This new technology is only supported with the new NWPA drivers. Fibre Channel Storage has a much larger capacity and more robust disk data storage technology. Fibre refers to the optical fiber that connects the server's controller card to the hub/disk array. The disks are not located in the server box, but in a separate box with its own power and cooling. The advantages of this technology are the ability of the disks to be located both locally and remotely (up to 500m from the server) and the support of 48 disks drives in a fully populated FC. For additional information, please see the Compaq Technology Brief, "Strategic Direction for Compaq Fibre Channel-Attached Storage," available on the Compaq website (<http://www.compaq.com>). Novell's new clustering technology fully supports fibre channel storage.
- **IDE Devices** – Support of IDE hard disks and CD-ROM drives is now available with NWPA. The layered design of NWPA allows the IDE device drivers to share common code in the adapter module and yet provide different functionality to the connected devices. Under the

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<sup>2</sup> Compaq Network Interface Controllers (NIC) are not NWPA devices. However, Compaq does offer NICs that support PCI Hot Plug as well as failover protection. Furthermore, fans are not PCI devices, but the ProLiant 6000, 6500, and 7000 Servers support hot-plug, redundant fans.

DDFS, two IDE devices can share the IDE port, but there is contention and both of the drivers must contain code to insure the contention is properly resolved.

- **Independent Development** – Each component in the NWPA architecture can be developed independently because of clearly defined interfaces. This allows developers to concentrate their efforts on their respective component. The IDE hard disk drive developer, for example, does not need to learn anything about the IDE CD driver, nor the CD device itself. This modular, less complex environment will result in cleaner, more reliable drivers.
- **Simpler Interface** – While the modularity within the NWPA design specification mainly effects software designers and developers, there are real benefits visible to users. The modularity introduced by NWPA has moved some of the complexity of writing DDFS drivers into NWPA itself, thereby simplifying NWPA device drivers. A simpler Application Program Interface (API) to NWPA makes driver development easier. This will speed driver development, testing, and deployment cycles; the net result being more reliable and easily maintained drivers, with fewer logical connections to other software to create side effects.

## Novell Storage Services (NSS)

Novell Storage Services is the next-generation storage/access system that surpasses file system limitations of previous NetWare versions. The NetWare 4.11 design uses File Allocation Table file system organization. With this implementation the amount of memory required for a server is based on the number/size of files. However, with NSS you can mount any size volume with as little as 1 MB of memory.

NSS is a 64-bit file system that allows you to store a single file as large as 8 Terabytes. There is no limit to the number of segments per volume, and up to 255 volumes may be mounted simultaneously.

NSS results in faster access to data by reducing the time required to mount a volume. Without NSS, the time required to mount a volume is linear to the volume size and the number of files.

Furthermore, when NetWare 4.x volume problems occur, volumes must be scanned and repaired with the Novell VREPAIR utility. This process can take hours to complete, during which users are unable to access data. NSS permits rapid repair times, and volumes are mounted in seconds regardless of their size.

## Pure Internet Protocol (IP) Environment

Today's enterprises comprise heterogeneous multi-protocol environments that require accessing network resources from geographically dispersed LANs. Besides being the industry-standard, routing protocol of the Internet, IP allows your network to share data with other IP networks without extra overhead.

Combining the maturity and reliability of the business network with the global reach and open standards of the Internet, NetWare 5 now supports "pure" IP—pure in the sense that it doesn't retain an IPX-based encapsulation.

Several advantages of migrating to an IP environment:

- Support costs decrease when you only have to manage one client protocol.
- Performance improves and costs decrease with more efficient use of bandwidth.



- Access to NetWare 5 servers increases, using either a Serial Line Internet Protocol (SLIP) or Point-to-Point Protocol (PPP) connection from anywhere in the world.
- Network administrators can manage remote LANs with less hardware and software costs.
- Interoperability improves with today's Internet/intranets.

NetWare 4.11 and earlier versions use only the Novell Internetwork Packet Exchange (IPX) protocol. With NetWare 5, choosing which protocol to use, is entirely up to the user. Businesses with large investments in the IPX transport protocol may not immediately choose to run in a pure IP environment. In fact, NetWare 5 allows you to assign both the IPX and the IP protocols to a single board or use IP as the native protocol. Using both the IP and IPX protocols on the same network allows NetWare 5 to run existing IPX-based applications with a seamless compatibility with IP. It also aids in the process of gradually migrating to a pure IP environment.

For those companies who want to move up to an IP-only environment, NetWare 5's Compatibility Mode facilitates the migration and ensures that IPX applications will continue to operate—without any disruption—in the IP world. Through its easy migration path, Compatibility Mode allows companies to control both the degree and the rate of change in their networks.

Compatibility Mode provides three primary functions:

- **Client and server drivers, for application compatibility** — enable IPX applications to run in a NetWare 5 environment. You can enable the server drivers when you install NetWare 5 on a server; then enable client drivers when you install Novell's client software on each workstation.
- **Migration agent, for connectivity compatibility** — enables the linking of IPX segments to IP segments without installing any additional hardware or software. You can enable the migration agent when you install NetWare 5, however, the necessity for the migration agent only arises if you have both IPX and IP segments that must communicate with one another.
- **Bindery agent, for bindery compatibility** — provides full backward compatibility to the NetWare 3 bindery and enables IP clients to access bindery information. If your IPX applications are dependent on the NetWare 3 bindery, enable the bindery agent when you install NetWare 5.

## Multiprocessing Kernel

On a multiprocessor server, each processor executes a separate stream of instructions for a specific stream of data. However, on a single processor server, a stream of instructions that are executed for a stream of data may be used by different applications, but the processor executes only one task at a time. NetWare 4.11 requires two kernels, one for systems with multiple processors and the other for single-processor platforms. The multiprocessing kernel (MPK) in NetWare 5 can run on a single processor and on multiprocessor systems.

NetWare 5 can detect up to 32 processors and will attempt to load the appropriate Platform Support Module (PSM). The PSM is provided by the hardware vendor in order for the symmetric multiprocessing (SMP) kernel to communicate with the processors. The NetWare 5 PSM for Compaq servers is CPQMPPK.PSM. This hardware support provides the same functionality as any device driver. For example, a network interface card requires a device driver to communicate between the network card and the operating system. The PSM is the same type of essential communication layer between the OS and the symmetric multiprocessing hardware.

The NetWare 5 MPK provides support for preemptible and nonpreemptible (legacy) applications. This allows the operating system to take control of the processor at any instant, regardless of the state of the currently running application. Preemption guarantees better response to the user and higher data throughput. MPK takes full advantage of multiple processors by allowing parallel execution on different processors.

Protected mode memory offered in NetWare 5 allows NLMs to be loaded and isolated from the server code and other NLMs. If a fault occurs with a protected module, the server will continue operating, and only the isolated address space fails. The failed address space can be reloaded without downing the server.

## Java Server Framework

Java is a programming paradigm that is platform and processor independent. Software developers can use Java to build programs that can operate anywhere. NetWare 5 includes an application-level development environment that enables programmers to develop network-centric solutions in Java to take advantage of platform independence, open standards, ease of use, and present and/or future functionality.

The Java Virtual Machine (JVM) must be loaded before running Java-based applications and applets on a NetWare 5 server. The JVM is an interpreter that converts Java byte code into machine language one line at a time before it executes.

The Novell JVM for NetWare is automatically installed when you install NetWare 5. The installation process sets default values for key environment variables. Starting the NetWare 5 GUI automatically loads the JVM.

Java-based applications are stored locally on the server and executed from the server console prompt. Applets are stored locally on the server and must run in a browser or a Java-based GUI environment. ConsoleOne, Console Manager, RconsoleJ, and JEditor are tools you can run as standalone Java applications on either a NetWare server or client.

## Improved Technology

NetWare 5 delivers improved functionality for Novell Directory Services. NDS for NT allows you to manage NT Domains as objects within NDS. DNS and DHCP are also integrated into NDS to facilitate automated management of enterprise-wide IP addresses, host names, and configuration information.

## Novell Directory Services (NDS)

Novell Directory Services is a flexible, multi-platform, distributed network directory that allows you to build and more easily manage your NetWare 5 network using an object-based implementation. Every resource on the network—servers, volumes (data), applications, printers, and with NetWare 5, workstations—is represented by an object in a directory tree. NDS offers network users, developers, and administrators the benefit of access to all available objects, or resources, by offering these design features:

- Single point of network administration
- Flexible and scalable directory database schema
- Consistent cross-development environment
- Unequaled network security

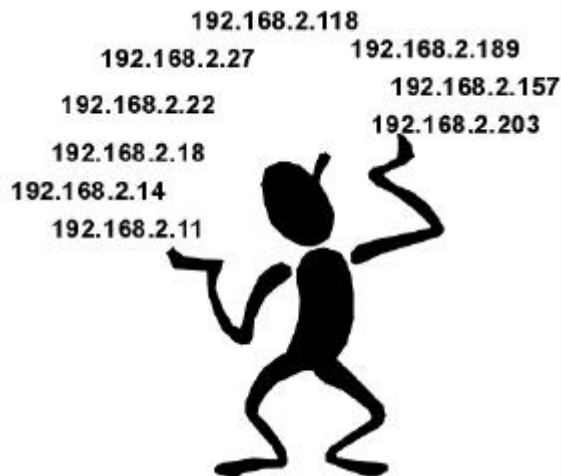
NDS security is based on a top-down, hierarchical architecture in which rights to resources are assigned and/or inherited. Authentication controls access to NDS objects and provides security for NDS by verifying that the object (user or application) has rights to access the resource. The Access Control List stores this information. So with a single login you can access multiple servers, applications or printers depending on your user rights.

### ***NDS for NT***

In heterogeneous network environments, the work of the network administrator increases with the necessity to manage user accounts. A user account must be created and maintained for each platform. In enterprises with hundreds of users, the task of account management alone could be quite cumbersome.

NDS for NT solves the account management problem with a single point of administration. User accounts can be created and managed using either NetWare Administrator (NWAdmin) or Microsoft User Manager<sup>3</sup>. Regardless of the administration utility used, user accounts information is updated in the NDS database as well as the Windows NT domain. Since only one user account is required for both environments, users can also take advantage of a single login to access both NetWare and NT resources.

### ***DNS/DHCP Services***



Traditionally, host configuration necessitates manually assigning a static Internet Protocol (IP) address to every network client. These IP addresses must be carefully managed to avoid duplicate address assignments, which could cause network problems. Dynamic Host Configuration Protocol (DHCP) automates the process by managing a pool of IP addresses and automatically leasing an address at each client's request. However, some devices such as servers or routers, require static IP addresses. Assigning permanent addresses along with DHCP could pose problems since Domain Name System (DNS) and DHCP do not share information. Problems with duplicate

addresses could still arise.

NetWare 5 DNS/DHCP Services simplifies management of IP addresses by integrating DNS and DHCP. With Novell DNS/DHCP Services, IP addresses are managed through NDS, which provides fault tolerance and improves manageability.

DNS/DHCP Services extends the NDS schema with two global NDS objects as well as new objects for DNS and DHCP. Table 1 describes the objects created by DNS/DHCP Services.

<sup>3</sup> Microsoft User Manager can be used to create and modify users in NDS. However, it does not offer all the administration features nor the configuration options available in NWAdmin.

Table 1. NDS Objects Created by DNS/DHCP Services

Object	Description
DNS/DHCP Group	A standard NDS group object that is used to grant DNS and DHCP servers the necessary rights to other data within the NDS tree.
DNS/DHCP Locator	An object that contains global defaults, DHCP options, and lists of all DHCP and DNS servers, subnets, and zones in the NDS tree.
<b>DNS Objects</b>	
DNS Zone	An NDS container object that holds all the data for a single DNS zone. It is the first level of the DNS zone description.
DNS Resource	An NDS leaf object located with a DNS Zone object. It represents an individual domain name within the zone.
DNS Server	A leaf object that stores DNS server configuration parameters.
<b>DHCP Objects</b>	
Subnet	A container object that represents the most fundamental division within DHCP: a subnet. It acts as a container object for the IP Address and Address Range objects. It also stores specific DHCP options and configuration parameters that apply to the entire subnet and override global options.
Address Range	An object primarily used to denote a range of addresses. It could represent a pool of addresses for dynamic assignment, or a range of addresses to be excluded from address assignment. There can be multiple Address Range objects under a Subnet object.
IP Address	A leaf object that represents a single IP address. The object is created by the administrator for static address assignment or by the DHCP server to represent a dynamic address assignment.
Subnet Pool	An object that provides a support for multiple subnets through a DHCP or BOOTP forwarder by identifying a pool of subnets for assigning addresses across a WAN or remote LAN connection.
DHCP Server	A leaf object that represents the DHCP server and contains a listing of the subnet ranges this DHCP server is servicing. It also contains all server-specific configuration and policy information.

## Improved Administration

Other major aspects of server administration—backup, network printing, and workstation management—have been enhanced with NetWare 5. These new features aid in centralizing administrative tasks.

### Backup Utility

To protect the data on your NetWare 5 server, you need both a preventative and maintenance strategy. A preventative strategy involves identifying the potential threats to enterprise operations and deciding what measures to take to protect data and applications. Backup is an option that is the least expensive of the possible protective measures<sup>4</sup>, yet does not compromise reliability. Establishing a backup plan can protect information in the event of loss or corruption. Backups should occur on a regular basis using hardware and software that can restore data efficiently in the event of a disaster. The Compaq TechNote, *Enterprise-Wide Contingency Planning* (document number ECG047/1097), provides tips to aid in developing a backup strategy.

The NetWare 5 Enhanced SBACKUP utility allows you to manage backups from the server or a workstation. Enhanced SBACKUP has a Windows-95 graphical user interface at the workstation and eliminates the need to access the server console to perform backups.

<sup>4</sup> Server fault tolerance, RAID technology, Compaq Recovery Server Option, Compaq Automatic Server Recovery, Compaq Insight Manager, and PCI Hot Plug are among the options that can help to ensure data and application availability on a network.

NetWare 4.x SBACKUP does include scheduling options to allow you to specify a date and time for backups to begin. However, the NetWare 5 Enhanced SBACKUP utility permits multiple and repetitive scheduling, which allows you to

- Specify the number of times to rerun a job after the current operation
- Specify the frequency of the backup job
- Require the backup job to stay in the queue after execution so that it can be rescheduled as needed. This feature is similar to saving a job script, which retains the details of the job such as the backup targets and filters.

The NetWare 5 Enhanced SBACKUP utility supports the following Compaq tape drives:

320-/525-Megabyte Tape Drive	1.2-Gigabyte ACA Tape Drive
1.3-/2.0-Gigabyte DAT Tape Drive	2/4-Gigabyte DAT Drive
2/8-Gigabyte DAT Drive	4/8-Gigabyte DAT Drive
525-Megabyte ACA Tape Drive	10/20-Gigabyte DLT Drive
5.0-Gigabyte DAT Drive	15/30-Gigabyte DLT Drive
4/16-Gigabyte TurboDAT Drive	

These secondary storage solutions can meet the needs of any backup strategy. All of the server tape solutions provide high reliability and fast data transfer rates in their respective class. Visit the [Server Storage & Options pages](#) of the Compaq web site.

## Novell Distributed Print Services (NDPS)

Novell has improved the printing setup process with NetWare 5. With NetWare 4.x, the print queue, printer, and print server must be created in NDS before activating the printing system.

Novell Distributed Print Services requires one printer object to represent each printer on the network. NDPS Printer Agent software, which is either loaded on the NetWare 5 server or embedded in the printer, serves the tasks previously performed by a printer, print queue, print server, and spooler. In this capacity, the Printer Agent serves as a liaison between the client and the printer. NDPS printer configurations are either controlled access or public access. A controlled-access printer is configured as an NDS object and provides the security offered by NDS. Public access printers, on the other hand, allow users access with NDS authentication. Both printer types are managed through NetWare Administrator, but the latter is not represented as an NDS object and cannot utilize all of the NDPS features.

Other NDPS features:

- **Backward compatibility** – Printers configured with NPRINTER or queue-based technology will continue to be accessible.
- **Bi-directional communication** – Users and administrators can receive real-time information on printers and print jobs, such as availability, status, configuration properties, and features.
- **Customizable event notification** – Administrators can specify individual users to be notified of an event or problem. NDPS event notification can be via email, popup windows, log files, or even programs developed by third parties.
- **Automatic printer driver download** – NDPS will access its printer driver database, which includes drivers for most commonly used printers, and automatically download the appropriate driver for the printer selected by the user.

Additional printer drivers can be easily installed using either the Novell Print Manager utility on a client or during client software installation when default drivers are selected.

## Zero Effort Networks (Z.E.N.works) Desktop Management Tool Suite

Network administrators spend a tremendous amount of time managing workstations. Diverse hardware configurations, operating systems, and user needs reflect some of the major challenges of installing, optimizing, and updating network clients.

Z.E.N.works is the Novell solution aimed at reducing the costs and challenges of managing network clients. Z.E.N.works leverages NDS by extending the NDS schema using NetWare Administrator 3.2, the NetWare 5 version of the NetWare Administrator utility.

The dynamic inheritance of NDS that gives, as well as restricts, access to resources on a network is further enhanced via Z.E.N.works User and Workstation Policy Packages. These Policy Packages facilitate performing the following tasks through NDS:

- registering workstations that are used to log into the network
- querying NDS for information on workstation hardware and configuration
- restricting end-user access to specific Windows 95/98 and NT utilities such as the Control Panel
- configuring end-users' printing environment
- configuring the Novell Client
- dynamically creating user accounts to allow access on NT workstations
- configuring user-defined preferences, such as keyboard settings, wallpaper, screen saver
- scheduling software updates on workstations
- pre-configuring applications for deployment based on workstation configuration and user needs
- delivering applications from the closest server
- generating more complete information from user help desk problems
- securing remote control access to workstations to troubleshoot software problems

Z.E.N.works requires an additional 32 MB of available memory and 125 MB of disk space on the NetWare server. Installation requires Supervisor rights to the server and NDS container. The system requirements for workstations:

- Windows 3.1, 95, or NT
- 486/33, or higher, processor

- 16 MB RAM for Windows 95/98 and 24 MB RAM for NT
- 4 MB of free disk space
- Novell Client that ships with Z.E.N.works

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