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Compaq Tips and Tricks for Novell Directory Services (NDS) eDirectory

Abstract: This integration note provides useful tips and tricks to help network administrators, developers, and users plan, design, manage, and optimize Novell Directory Services (NDS) eDirectory.

We offer tips in the following areas:

- Migrating from NetWare 4.1x to NetWare 5.1 and NDS eDirectory
- Planning and designing your NDS
- Replicating your NDS Directory
- Extending your NDS schema
- Managing your NDS
- Improving your NDS operations

Finally, we provide a table with websites where you can find more Novell Directory Services information.

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: Novell.feedback@Compaq.com

Notice

Compaq Tips and Tricks for Novell Directory Services (NDS) eDirectory
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Overview of Novell Directory Services

A well-integrated family of distributed directory-based services, Novell Directory Services (NDS) organizes, categorizes, and names all resources within a network—servers, volumes (data), applications, printers, and beginning with NetWare 5, workstations. Since NDS also works well with Linux, Solaris, and Microsoft operating systems, it can be installed in these heterogeneous and multi-platform networks.

NDS Version 8 and NDS eDirectory

NDS Version 8 allowed any LDAP-enabled web browser or application to access information stored in the NDS database. In addition to performance enhancements, NDS Version 8 included an additional container object, called domain, and allowed complete auxiliary class support. Previously, NetWare 5 NDS supported three auxiliary classes and extended NDS into the Internet and enterprise directory niches with no loss of functionality. NDS Version 8 was available only for NetWare 5.x servers with Support Pack 1 already installed.

NDS eDirectory, the new name for Novell Directory Services, is simply NDS Version 8 on Solaris, Windows NT, Windows 2000, Novell NetWare, and Linux. For the first time, NDS is not only cross-platform, but OS independent, meaning there is no NetWare dependency in the code. For example, you can run a complete Solaris or a complete Windows NT shop on NDS eDirectory.

TIP: The NDS eDirectory™ database sometimes is referred to as a DIB Set. DIB is an acronym for Directory Information Base. To determine the size of your DIB Set do the following: On NetWare download TOOLBOX.NLM from Novell's website. This will allow you to see the SYS:_NETWARE directory on your server. On Windows NT you can find the DIB Set at \NOVELL\NDS\DIBFiles. On Sun Solaris, the DIB Set location may vary depending on the path you specified during the installation.

NDS eDirectory focuses on companies that want to face their information and services toward customers.

In fact, you can also think of NDS eDirectory as a backbone directory. Other directories, such as the Microsoft Active Directory just plug into the bigger picture.

The bottom line: NDS eDirectory is a full-service directory that simplifies, automates, and protects information while taking full advantage of emerging information and Internet technologies.

NDS Corporate Edition

NDS Corporate Edition replaces NDS for NT, NDS for Solaris, and so on. When you buy NDS Corporate Edition, you get all of the platforms Novell supports in one package.

NDS Corporate Edition focuses on the typical network operating system management market. For example, if you want to integrate NetWare and Windows NT user account information, you should purchase NDS Corporate Edition.

NDS for Windows NT and Solaris

The network administrator's work increases with each user account to be managed. A user account is created and maintained for each platform. In enterprises with hundreds of users, the task of account management alone could be quite cumbersome.

NDS is not just for NetWare anymore.

NDS for Windows NT solved the account management problem with a single point of administration. User accounts could be created and managed using either NetWare Administrator (NWAdmin) or Windows User Manager (although it does not offer all the administration features or the configuration options available in NWAdmin). Regardless of the utility used, user account information was updated in the NDS database, as well as the Windows NT domain. Since only one user account is required for both environments, users could take advantage of a single login to access both NetWare and Microsoft Windows NT resources.

NDS for Windows NT Version 2.0 was the second major release of NDS for Microsoft Windows NT products. Significant enhancements included the following:

- Ability to store an NDS replica on an Windows NT server
- Ability to manage Windows NT files shared through NDS
- Single sign-on for users accessing NetWare and Windows NT servers
- Enhanced scalability

Novell also offered NDS for Solaris 2.0. Primary tasks included the following:

- Migrate Solaris user and group accounts to NDS
- Revert migrated accounts from NDS back to Solaris
- Manage migrated Solaris accounts with NWAdmin
- Manage UNIX related groups
- Manage UNIX user objects

NDS eDirectory for Linux

Novell has announced the availability of NDS eDirectory and Corporate Edition for Linux expanding its leading portfolio of Net services software products across all types of networks and all leading operating systems. Integrated access to NDS eDirectory and Corporate Edition offers organizations significant new advantages, including the ability to simplify and secure management of Linux users and groups across the internet, strengthening Linux as a platform for e-business. Additionally, eDirectory for Linux enables customers to seamlessly integrate and manage their cross-platform networks.

Understanding LDAP

Lightweight Directory Access Protocol (LDAP) is rapidly becoming a standard, and anyone who is serious about developing a directory or directory-based application will have to provide support for LDAP. To centralize the information of an enterprise, the directory must span the multiple network environments that make up the enterprise including NetWare, Tru64UNIX, Windows NT, Windows 2000, Linux, and UNIX.

LDAP, controlled by the Internet Engineering Task Force (IETF), actually started out as a means to simplify access to X.500 compliant directories. Some analysts speculate LDAP client software will soon become a standard feature of Internet browsers and the standard protocol for accessing directory information over the Internet.

The network hardware for this environment must be able to support the directory itself and multiple operating systems throughout the enterprise. In addition, the hardware products must be tested with the software being supported. It should also provide the following functions:

- Manageability both locally and remotely throughout the enterprise
- Reliability to operate 24x7
- Convenience of online maintenance
- Ability to remotely administer servers
- Security to maintain the integrity of the network environment
- Capacity to maintain the vast amount of data generated

Other features include rapid recovery, fault prevention, performance monitoring, and investment protection. Compaq hardware and intelligent manageability features contain all of the necessary requirements for the directory-enabled enterprise.

LDAP Services for NDS allows you to easily publish your organization's information to your intranet and to the internet, while still maintaining control of who can access your information.

The NDS search application is built to use LDAP allowing NDS to search all user objects in all directories to find the required information. This means you do not need a separate directory-specific search application for each of the directories on your network. LDAP not only saves you time, but saves you money as well.

The directory schema is a list of object types or classes permitted in the directory. Adding to the list of object types permitted in the directory is called extending the schema. Pre-NDS Version 8 permitted LDAP-enabled applications to look at (read) the schema, but not to write (extend) to it. NDS Version 8 allowed the NDS schema to be extended through LDAP.

Beginning with NDS Version 8, LDAP support automatically installed when you installed the directory services. You will not see any LDAP-related screens, once the NDS eDirectory Install is finished, you can browse your tree and find the new LDAP Server and Group objects created by the install. The LDAP Install also creates a SAS Server object and a Security container object. If you want secure connections through LDAP clients, you must configure Novell Security Services. You can find detailed information on Novell Security Services at http://www.novell.com/corp/security.

Here are a few more tips:

TIP: If you installed LDAP Services for NDS as part of the NetWare 5.x Install, an LDAP Catalog object was automatically created. The purpose of the catalog object was to speed up object searches on large NDS directory trees. NDS eDirectory is now so much faster than the NDS that shipped with NetWare 5, the engineers at Novell no longer deemed the catalog object necessary. If you already have catalog objects in your tree created when you installed NetWare 5, do not worry. Those catalog objects will not be removed from your directory tree.

TIP: LDAP support can be disabled and restarted on any server by unloading and reloading *NLDAP.NLM* on that server.

TIP: If, after installing NDS eDirectory, you have problems performing common LDAP tasks—like class and attribute mappings— it may be because you do not have the LDAP snap-in for ConsoleOne installed. You can install a version of ConsoleOne that already has the LDAP snap-in by running the *SETUP.EXE* that is located in the S*YS:PUBLIC\MGMT\CONSOLEONE\1.2\INSTALL* directory on your NetWare server.

TIP: You might also want to enable clear text passwords. Clear text passwords are disabled by default, but you can enable them from the General Property page of the LDAP Group object. If you do not allow clear text passwords, LDAP functionality will be equivalent to an anonymous user. For more information of clear text passwords, go to http://developer.novell.com/research/appnotes/1998/december/02/index.htm.

TIP: NDS has a list of names for each NDS object class (type) and attribute it recognizes. Likewise, LDAP has a list of names for the object classes and attributes it recognizes. In most cases, the names are either identical or so similar that you would have no trouble knowing which names go together. However, NDS and LDAP need the names to be exact in order to communicate, or you have to convert or translate LDAP names to NDS names. This conversion process is known as mapping.

TIP: NDS eDirectory already has default Class and Attribute Mapping list that converts most of the LDAP class and attribute names to NDS class and attribute names. But, occasionally, you might find an LDAP attribute or class name that is not mapped or is mapped to the wrong NDS attribute or class name. This will cause you some problems. In this situation, you first have to figure out which NDS class or attribute name corresponds with the LDAP class or attribute name and manually reconfigure the mapping for each class or attribute.

Throughout this integration note we have gathered several tips from Compaq engineers, Novell engineers, *Novell AppNotes* and *Novell Developer Notes.* If you need additional information on NDS or configuring the LDAP Server and Group objects go to the Novell web site at http://www.novell.com/products/nds/ldap.html.

Migrating from NetWare 4.1x to NetWare 5.1 and NDS eDirectory

Before you jump into NetWare 5.1 migration and an updated NDS, be sure to plan. You might also want to evaluate a server upgrade. With NDS eDirectory, you can now manage a billion objects within one tree. See the Novell white papers and integration notes on our website: http://www.compaq.com/support/techpubs/whitepapers/index.html.

To optimize NetWare 5.1 and NDS eDirectory, evaluate the Compaq ProLiant 8000, ProLiant 8500, or the newly released DL, CL and ML series servers. All offer a tremendous increase in processor speed, RAM, and storage capacity, starting with the ProLiant 8000 offering 32.5 TB of storage. See the website: http://www.compaq.com/support/servers/index.html.

Here are additional migration tips:

TIP: Verify the requirements of your applications. If you still use some NetWare 3 applications, they may not be compatible with NDS and, therefore, still require bindery emulation.

TIP: Bindery services are automatically enabled when you install NetWare 5.1, however, if the network includes Macintosh network nodes, you must either leave bindery services enabled or install the MAC OS Client, which is NDS-aware.

TIP: Verify the ability of your backup software to backup and restore NDS eDirectory, then verify your bandwidth, increased bandwidth may be necessary for NetWare 5.1 and verify your memory, NDS and time synchronization may create overhead.

Next, you must update the NDS on all NetWare 4.1x and NetWare 5.0 servers in the tree to ensure reliability of the NDS tree and compatibility between servers. Download the following Support Packs from the website: http://support.novell.com (also check the latest Novell Support Connection Minimum Patch List at the website: http://support.novell.com/misc/patlst.htm.

Proper, prior planning prevents poor performance.

TIP: Upgrading from NetWare 4.10? You must load these files: *410PT8B.EXE, DS410N.EXE, LIBUPI.EXE,* and *SMSUPG.EXE* or later. Copy these files to the SYS:SYSTEM directory.

TIP: Upgrading from NetWare 4.11? You must load these files: *DS411N.EXE, LIBUPI.EXE,* and *TSA410.NLM* or later. Copy these files to the SYS:SYSTEM directory.

TIP: Upgrading from a NetWare 4.2 or 4.11? You must install Novell Support Pack 6 (*IWSP6.EXE)* or later.

TIP: Upgrading from NetWare 5.0? You must install Support Pack 2 (*NW5SP2.EXE*)

One last tip in this area: To start NetWare 5.1 without running NDS, type SERVER –ND. This allows you to easily debug an NDS issue.

For more information on migrating from NetWare 4.x or NetWare 5 to NetWare 5.1 and NDS eDirectory, read the white papers from our website, http://www.compaq.com/support/techpubs/whitepapers/WhitePapers_Operating_Systems.html .

You can also find some great information on the Compaq Resource Paq for Novell. See the partnership website: www.compaq.com/partners/novell for ordering details. To learn more about the Novell Upgrade Wizard go to http://www.novell.com/products/upgradewizard/quicklook.html or to browse the Novell documents proceed to http://www.novell.com/documentation/.

Planning and Designing Your NDS

All networks need solid NDS tree design to ensure easy access to the services and applications relying on the directory. The NDS tree structure also affects network security and ease of management. So, keep a few things in mind:

Keep the design as simple as possible. Novell recommends that you use no more than five levels because flat trees are stable and easier to troubleshoot.

A good design provides NDS fault tolerance while reducing synchronization traffic, especially across a WAN. (If this traffic crosses WAN links unmanaged, it needlessly increases costs and overloads slow WAN links during high-usage periods.

TIP: To minimize traffic between remote sites, keep network services; such as NDS, login, authentication, time, file, and print services, local to the remote user.

TIP: In general, do not include dial-up sites in a corporate tree. Create a separate tree for each site.

TIP: Standardize naming conventions for all objects and enforce the conventions.

TIP: Naming conventions for other operating environments, such as ActiveX, are different.

TIP: Avoid duplicate Server Names, Internal IPX Numbers, or Tree Names.

TIP: Remember that the first NDS server installed on the network holds the master replica by default.

TIP: Do not install the same server in more than one NDS tree.

TIP: In order to communicate properly within a mixed-protocol environment running the Migration Agent, the agent must be loaded on the server with the NDS master replica. Otherwise, an IPX server will not be able to connect.

Do you think you will ever move your servers to another floor or another building? With reorganizations a common occurrence in enterprise operations, steer away from tying server names to a specific department. You will eliminate the need to continually rename servers.

Generally, periods in NDS names separate objects, similar to a slash in a file directory name. However, in NDS, we have two periods: leading and trailing. Here are two tips about when and where to place those dots.

TIP: Distinguished (or Complete Names) and Relative Names do not use a leading period; Fully Distinguished Names do. A leading period means NDS will resolve the name from [Root], regardless of the current context of the object.

TIP: Only use trailing periods in relative naming. For each trailing period in a Relative Name, NDS resolves the name from one container closer to [Root]. Each trailing dot removes one naming component from the default context. That means two trailing periods remove two name components from the default content.

Table 1 summarizes additional NDS design guidelines for partitions and replicas

Table 1. NDS design rules

NDS Design Rules		
	For NetWare 5.x and NDS eDirectory	**For NetWare 4.x**
Tree size	Unlimited (tested to 1 billion objects)	Unlimited number of objects
Partition size	Unlimited (tested to 100 million objects)	10,000 + objects
Subordinate partitions	Unlimited (tested to 75 partitions)	30-40 partitions
Replicas per partition	Unlimited (always have 2 or 3)	10 replicas
Non-dedicated replica server	50 replicas	20 replicas
Dedicated replica server	150-200 replicas	

Here are four tips from a Compaq engineer.

TIP: Create a group for anything that two or more persons share in common. Assign the Group the rights that it needs and assign users to those rights.

TIP: Create another emergency Admin account just in case the Admin account is corrupted. Protect the password and audit the account for usage.

TIP: Backup your NDS by using *NWCONFIG.NLM*, particularly after doing any large NDS changes.

TIP: If you have a medium-to-large network and you want to be sure that your master replica is protected, you may want to establish a dedicated NDS server. It's sole purpose? Be a dedicated master replica. The probability of the server crashing is minimal. Think about it! Since the master replica is not busy with file serving processes, running databases, or performing web functions, your NDS activities will run faster.

A good server example: a Compaq 933MHz Proliant DL380, SYS: volume protection (RAID 1 or 5), and Compaq Intelligent Manageability tools. Of course, you will only reap the benefits if you stand firm and allow no one to store data on this server. In addition, remember this server must have an NDS Tree Name and be the first server installed on the network.

Tuning NDS eDirectory™

Tuning NDS is extremely important. Even with the best hardware, unless it is properly tuned, it will not perform to its full potential.

The following is a list of settings that will optimize NDS eDirectory™ for a variety of uses.

Maximum Pending TCP Connection Requests 4096	Maximum Number of Internal Directory handles 1000
Maximum Packet Receive Buffers 10000	Maximum Number of Directory Handles 100
Minimum Packet Receive Buffers 3000	Maximum Record Locks Per Connection 10000
Maximum Physical Receive Packet Size 2048	Maximum Record Locks 100000
Maximum Concurrent Disk Cache Writes 2000	Maximum Outstanding NCP Searches 500
Dirty Directory Cache Delay Time 0	Enable file compression Off
Maximum Concurrent Directory Cache Writes 500	Immediate purge of deleted files On
Maximum Directory Cache Buffers 200000	Maximum Number of Directory Handles 100
Maximum Number of Internal Directory handles 1000	Maximum Record Locks Per Connection 10000

These parameters are for NetWare implementations.

TIP: The biggest setting to affect NDS eDirectory™ performance is the cache. With NDS, administrators can configure the amount of RAM used as cache. Try to get as close to a 1:1 ratio of cache to DIB set as possible. For best performance, exceed this ratio.

Replicating Your NDS

Do not copy individual NDS files from one server to another. If your network has more than one NDS server, replicate the NDS Directory. Replication simply means that your network has more than one copy of the Directory, and NDS automatically keeps all the copies up-to-date, or synchronized. Keeping multiple copies of the directory lets users continue to log into the network and use the remaining resources if servers or network links fail.

Important: NDS replication is not a back-up solution. The replication and synchronization process only replicates information about NDS objects, not files and documents.

Extending Your NDS Schema

Use Schema Manager—if you have Supervisor rights to the [Root] of the tree—to view and customize all aspects of the schema. You can find Schema Manager on the Object menu in NDS Manager (*NDSMGR32.EXE*). Once you are in Schema Manager, a handy wizard will take you through the process step-by-step. The wizard even includes a Help function to answer any questions you have during the process.

You can also find a discussion of the process in the NetWare 5 documentation. If you are not using NetWare 5.0 yet, there is a DOS utility called *NDSSCH.EXE* that will read a file in the .SCH format (like you'll find in SYS:SYSTEM\SCHEMA today) and can extend the schema. Another and perhaps more common option to extend the schema is to write to the NDS API set directly from your application.

Managing Your NDS

Understanding the practical aspects of your NDS tree is vital to successful and proactive directory management. You probably know in order to reduce unnecessary traffic overhead, enhance NDS performance, and reduce costs, you need network traffic baseline documentation that will help you understand what objects and processes are generating the traffic. This is where NetPro Computing DS Analyzer and DS Expert can help you manage your network. Novell NetWare utilities, DSREPAIR and DSTRACE are always useful in repairing and monitoring NDS.

Compaq and NetPro Computing® NDS Solutions

NetPro Computing®, Inc., the leading provider of software for managing critical eBusiness and enterprise directories, signed a worldwide software distribution agreement with Compaq designating NetPro as a Compaq Solution Provider. Under the terms of this agreement, Compaq resells the NetPro directory infrastructure management solution to the customers of its consulting organization. NetPro offerings include DS Analyzer™, and DS Expert™.

DS Analyzer

DS Analyzer collects and displays data all the way down to the object level, making it possible for you to establish baselines for network traffic with a few simple steps. You can view such potential NDS issues as excessive tree walking, backlinking, replication storms, and extreme hop counts. Moreover, armed with this data, you can make decisions that reduce unnecessary traffic overhead and reduce costs.

You could baseline the performance of your network without DS Analyzer by taking the following measures.

You *RCONSOLE* into each server that you want to monitor and write down specific measurements for each respective server on your tree. This task might take one hour to several hours, depending on the number of servers you want to monitor and the time required gathering the required statistics using existing Novell tools. (These tools might include *MONITOR.NLM*, *DSTRACE.NLM*, NDS Manager and *DSREPAIR.NLM*.)

Next, you take measurements and manually enter them into a spreadsheet (Excel, Lotus, and so forth). Again, this task may require several hours of time. Finally, you use the statistics in the spreadsheet to create a graph to represent the health of the network.

To establish baseline performance with DS Analyzer.

- Load DS Analyzer on your server.
- Plan for an optimal baseline by evaluating the start and end points for existing data (representing optimal state) to be used for comparison. Then schedule the interval of time when you would like to take your measurements. (When a graph reflects a healthy NDS tree, it is an excellent time to establish a baseline to measure the effects of growth and changes on your network. In the future, when you suspect a problem, you can use the baseline to measure progress against optimization or problem resolution.)
- Select DS Analyzer's Tools >Baseline Information > Establish Baseline. Simply enter the start and end points that will serve as the baseline.

DS Analyzer instantly creates an easy-to-read graph or pie chart from the traffic information it gathers. The data can be exported to a log file to save a record of the information. This process takes minutes rather than hours.

DS Expert 3.0

Directory problems like stuck obituaries, invalid backlinks, and DS locked can downgrade overall server performance hindering you from performing your daily tasks. DS Expert 3.0 puts the health of your directory on autopilot by monitoring 24x7 and alerting on more than 25 critical conditions. DS Expert eliminates the need to manually check the state of the directory before adding users or performing configuration changes

DS Expert monitors everything from invalid external references to schema sync errors that can affect the integrity of the directory and eventually prevent user access to vital network services.

Some of DS Expert 3.0 features include:

- Displays real-time view of your entire NDS eDirectory tree – even across WAN links
- Pinpoints the location and type of NDS eDirectory error
- Provides full or sub-tree viewing – including servers, replicas and partitions
- Uses an extremely efficient event-driven architecture to send alerts without SAPs
- Ensures round-the-clock monitoring and alerting
- Captures and displays DSTRACE messages from multiple servers
- Scales to networks of all sizes
- Compatible with NDS eDirectory Version 8
- Enables administrators to set customized alert thresholds, such as:
  Old obituary
  Slow sync
  DS locked
  Invalid backlink
  Replica synchronization
  Time synchronization
  Master replica status
  Schema synchronization

For more information on these NDS solution products visit NetPro Computing web site at http://www.netpro.com/dsexpert/default.asp.

Novell NetWare Utilities

DSREPAIR.NLM

The *DSREPAIR* utility (*DSREPAIR.NLM*), run from the server console or via RCONSOLE**,** is another important management tool that performs three basic functions:

- Corrects or repairs inconsistencies in the NDS database
- Checks NDS partition and replica information and makes changes where necessary
- Initiates replica synchronization

In fact, the Unattended Full Repair Option automatically performs all possible repair operations that do not require operator assistance.

DSTRACE.NLM

In previous versions of NetWare 4.x, *DSTRACE* referred to a group of **SET** commands available at the server console.

DSTRACE commands do the following:

- Monitor the status of NDS synchronization process
- View errors that occur during NDS synchronization

Weekly Health Checklist

Experience has shown if the status of NDS is verified before and after operations are initiated, NDS management can be virtually error free. One of the most popular NDS tips comes from the Novell Support Knowledgebase (TID 2913292): complete a weekly NDS health check.

We have included the following tips outlining basic NDS maintenance and prevention checks to do each week for every NetWare 4.1x and NetWare 5.x file server.

Tip: The *DS.NLM* should be the same version on each NetWare file server in the tree. That is, all 4.10 servers should be the same version; all 4.11 servers should be the same version, and all NetWare 5 servers should be the same version. Performing a time synchronization check within *DSREPAIR* will report the *DS.NLM* version for each NetWare file server in the tree.

Tip: Time synchronization is critical for directory services functions. This operation can be performed from the Available Options menu of *DSREPAIR*.

Tip: A server must have a replica to display any directory services trace information. From the file server console, perform the following routine:

Type [SET DSTRACE=ON] (this activates the *DSTRACE* screen for directory services transactions).

Type [SET DSTRACE=*H] (this initiates synchronization between file servers).

Press **Ctrl** + **Esc.**

Select Directory Services Trace screen.

If there are no errors, you will see the message: "All processed = YES." This message will be displayed for each partition contained on this server.

If the information is more than can fit on a single screen, use these commands:

[SET TTF=ON] (sends *DSTRACE* screen to *SYS:SYSTEM\DSTRACE.DBG)*.

[SET DSTRACE=*R] (resets the file to 0 bytes).

[SET TTF=OFF](once NDS has completed synchronizing all partitions).

Then, map a drive to your server's *SYS:SYSTEM* directory. Run a text editor and open the *DSTRACE.DBG* file and search for "-6" (this will show any NDS errors during synchronization, such as -625). Finally, search for "YES" (this will show successful synchronization for a partition).

Tip: A server must have a replica for this operation to display replica synchronization status. In *DSREPAIR* from the Available Options menu, select Report Synchronization Status.

Tip: In *DSREPAIR* from the Available Options menu, select Advanced Options. Select Check External References. This option will display external references and obituaries and will show you the states of all servers in the back link list for the obits.

Tip: In *DSREPAIR* from the Available Options menu, select Advanced Options; then select View Remote Server ID list. Press **Enter** and this should bring up the Remote Server ID Options menu; select Verify All Remote Server IDs. This option executes authentication from server to server using the remote server's ID. This option verifies this server's ID on the other servers.

Note: NetWare 5 servers do not use Remote ID to synchronize, so this is not applicable to them.

Tip: Run *DSREPAIR* from the Available Options menu, select Advanced Options, then select Replica and Partition Operations and verify that the replica state is ON.

In some cases, if left operating, *DSTRACE* will increase utilization. After completion of all checks, type the following *DSTRACE* commands:

[SET DSTRACE=NODEBUG]

[SET DSTRACE=+MIN]

[SET DSTRACE=OFF]

This will minimize filters and turn *DSTRACE* off.

Tip: Run *DSREPAIR* on the server holding the master replica of each partition and on one of the servers holding a read/write replica to check for replica ring mismatches. From the Available Options menu, select Advanced Options then Replica and Partition Operations and View Replica Ring. Verify that the servers holding replicas of that partition are correct.

Tip: A server must have a replica to display any directory services trace information. From the file server console, perform the following:

Type [SET DSTRACE=ON] (this activates the trace screen for directory services transactions).

Type [SET DSTRACE=+SCHEMA] (this will display schema information).

Type [SET DSTRACE=*SS] (this initiates schema synchronization).

Press **Ctrl** + **ESC**.

Select Directory Services.

Check for the message "SCHEMA: All Processed = YES."

This should be performed after business hours and only when errors occur during checks. This option will lock the directory services database. Authentication cannot occur on this server with directory services locked. That is, users will not be able to login to this server during this operation. In some cases, if left operating, DSTRACE will increase utilization.

Improving Your NDS Operations

Six areas often causing headaches if not handled properly:

- Performing Partition Operations
- Changing Server Names
- Backing Up and Restoring NDS for Planned Hardware Upgrades
- Removing an NDS Tree
- Removing a Server
- Recovering From a System Crash

Performing Partition Operations

When performing partition operations, remember to:

Tip: Centralize the partition operation administration**.**

Tip: Consider how a partition operation will affect the NDS tree.

Tip: Check replica ring synchronization before performing a partition operation.

Tip: Verify the partition operation on the back end from the master replica.

Tip: Do not change read/write to master under partition error conditions.
For more details on partitioning, see the *"Novell AppNotes"*
http://developer.novell.com/research/.

Changing Server Names

NDS contains information about server objects, based upon the server name and object ID. Other servers in the NDS tree use the server internal IPX address as an external reference. If you change the server name, object ID, or internal address, you can create problems in the NDS environment. You could also lose user rights. So, avoid changing the internal IPX or File Server Name.

TIP: If you must change a server name, delete the first server name. NDS will take care of the details for you and replicate this information to all the other replicas in the ring. Of course, the larger your tree and the more partitions you have, the longer you will need to wait after deleting the old server name.

TIP: Do a [SET DSTRACE=*L] to start the limber process, which verifies the IPX addresses and server names. If you get an "All Processed = Yes" response, you can (with confidence) rename the server in your *AUTOEXEC.NCF* file. Do not forget to rename the volumes using NWAdmin. Lastly, down the server and bring it back up.

Backing Up and Restoring NDS for Planned Hardware Upgrades

Before you begin the backup and restore process, be aware of the dependencies other servers currently have on the server you are upgrading. Take into consideration processes such as NDS time synchronization.

If the server plays a crucial part in the time synchronization of the NDS tree you may need to reassign the time server functions and responsibilities to another server before you run *INSTALL.NLM*. Also, see the Novell Technical Information Document (TID) 2908156 *"Time Synchronization Issues and Definitions"* and TID 2911661 *"Changing Time Source Type"* for additional information. Both documents are available at http://support.novell.com.

TIP: Use NDS Manager to verify the integrity of the tree and the synchronization status of the partitions/replicas that the candidate server contains. Resolve any errors before continuing.

IMPORTANT: Do not add or remove any replica/partition types during this time; do not uninstall or reinstall any existing servers; and do not install any new servers until the Save and Restore procedure completes.

It is important that NDS partition and replica information remain consistent during the entire upgrade process. If you do not maintain consistency of the tree including; partitions, replicas, placement of replicas, and servers, the INSTALL verification process will return a 601 error (*Directory field data not found)* during the Restore phase, and the process will not complete.

Make sure you also have a current tape backup of the entire server. If the server to be upgraded contains the master replica of your NDS tree, you need to move the master replica to another server using *DSREPAIR.NLM*.

Use *INSTALL.NLM* to (1) save NDS information a hardware upgrade and (2) restore NDS information after an upgrade.

Because other servers in the tree are expecting the server to come back online quickly, you should not plan to take several days to upgrade the server. Complete the upgrade promptly and restore NDS information on the server as soon as possible.

The "Save Local DS Information before Hardware Upgrade "option prepares the NDS information on the server before the upgrade and creates a *BACKUP.NDS* file in the SYS:SYSTEM directory. *BACKUP.NDS* stores all the NDS information for this server, including replica information. This option also locks and disables the NDS database on this server, preventing certain NDS operations on this server from taking place. To other servers that normally communicate with this server, the server appears to be down. NDS information normally sent to the locked server is held by other servers in the tree; when the server comes back online, this stored information is used to synchronize the NDS database to the other servers in the tree.

Tip: When backing up your NDS database, the default is A: for copying to a diskette. However, in most cases, the NDS database will not fit on a floppy. So, press **F3** to specify a different path. You might want to specify a temporary directory on the local hard drive of your workstation. If you are copying the file to another server, type the second server name and path, and authenticate to the remote server as prompted.

Tip: The "Restore Local DS Information" after Hardware Upgrade option uses *BACKUP.NDS* to restore NDS information on the server. Before the NDS information is restored, INSTALL verifies that the server is in the same relative state as before the upgrade. INSTALL verifies that the server object and authentication keys still exist and that the server still exists in all the replica

rings for replicas that were on this server before the upgrade. If you copied *BACKUP.NDS* to a second server, you might need to re-authenticate as prompted.

IMPORTANT: Remember that these backup and restore tips do not consider the PCI Hot Plug feature on Compaq ProLiant Servers. With this feature, drives and other hardware can be added, removed, or replaced while the server remains up and running.

Removing an NDS Tree

TIP: To remove a corrupted NDS tree from a server, type the command **LOAD INSTALL /DSREMOVE** to avoid authenticating to NDS. Then you can remove the tree, without the password (it may prompt you, but it will not verify for password).

Removing a Server

Never just pull out the power plug. A server abruptly removed from the NDS tree can generate NDS and time synchronization problems.

Tip: If the server has a replica of distributed partitions and participates in time synchronization activities; you must remove the replicas and remove the server from a replica list before you down the server.

Tip: If the server that you are removing has the master replica, you must change the replica type and assign a new master replica. If the server is a single-reference-time server, designate one of the secondary-time servers as a temporary single-reference-time server until it is connected.

Recovering From a System Crash

When a server crashes, fails, or is taken out of an NDS tree without properly removing NDS from that server, you need to take several steps to ensure that the remaining network servers can synchronize correctly.

WARNING: Deleting a server object for a failed server will cause loss of server references unless proper steps have been taken.

If a server fails and needs to be replaced, follow TID # 2920601.The DSMAINT -PSE procedure will retain links to home directories, directory map objects, and NDS-aware printing that will be otherwise lost if the server object is just deleted.

Tip: If time is not synchronized, changes cannot properly be made to the directory services tree. See TID 2908867 for time synchronization help.

Tip: If a server goes down permanently or is replaced without removing NDS, the replicas it contained will have incorrect replica ring information.

You must clean the replica rings, otherwise each server in each of the replica rings will still think the downed server should be contacted with updates whenever they occur.

Tip: Verify that a master replica exists for each partition. Run *DSPEPAIR*.

Note: You might need to bring the server DOWN before you can delete the server object.

Tip: Clean up the NDS Tree (server objects). Run PARTMGR or NDS Manager in Windows.

Tip: An undocumented utility that can be useful in managing NDS for Windows NT is the NDSConsole (*NDSCONS.EXE*) copied into the directory that you specified to store NDS information. This utility shuts down NDS or load additional modules.

Tip: NetWare stores NDS database files on Volume SYS: However, in a Windows NT environment, the server stores the NDS database files in an NDS installation directory (which can be replicated on multiple servers).

Late-Breaking News

PROVO, Utah -- Aug. 22, 2000 -- Novell, Inc., the leading provider of Net services software, today announced the next generation of the NetWare® Net services platform to manage the exploding need for ever-larger amounts of network-based information storage. Novell's next generation NetWare will integrate heterogeneous corporate networks into the emerging one Net economy as companies make the jump to eBusiness. Built on proven, market-leading reliability and security, the next version of NetWare gains important new network storage management capabilities that integrate file, messaging, database and directory storage for Web-based one Net solutions. In addition, it supports fail-safe clustered arrays of up to 32 servers to make it the optimal platform for deploying Net services software.

"The future, and value, of NetWare in one Net solutions is certain," said Eric Schmidt, chairman and CEO of Novell. "We've made it a key enabler as a hosting platform for Net services that secure and simplify networks and accelerate the move to eBusiness solutions. Significantly, next-generation NetWare moves network storage management to an Internet model that simultaneously simplifies file and resource access control for Windows*, UNIX*, Linux* and other desktops across one Net solutions. No one else can readily provide the level of multiplatform integration that we will deliver with this product."

Novell will offer three configurations of NetWare to make it easy to deploy Net services software as required by large data centers, midsize companies or smaller organizations. All will ship with NDS® eDirectory™, the industry-leading directory providing identity and resource management for one Net solutions.

NetWare 6 will host Net services as deployed in data centers and add new capabilities that make the product more powerful and usable in multisystem environments across all sizes of organizations. In addition, NetWare 5.1 and Novell® Small Business Suite 5.1 will continue to serve the market.

NetWare 6 to Host Net Services Software Deployed in Large Data Centers to Small Firms

Targeted at mission-critical installations that support the business needs of large data centers to small firms, NetWare 6 focuses on a core customer requirement in eBusiness: integrating the massive and disparate types of storage (files, messaging, databases and directories) that eBusiness is generating. Other key features of NetWare 6 include:

Ability to cluster up to 32 systems to provide the round-the-clock access required for today's Net economy.

Symmetrical multiprocessing (SMP) that lets users harness the power of up to 32 processors, adding even more power to enable companies to effectively handle the exponential growth eBusiness brings.

Full-featured Novell Storage Services (NSS) to handle any storage requirements by supporting billions of volumes and directories, with each volume capable of holding billions of files, each one up to eight terabytes in size. It also takes advantage of all the processors available in the server.

According to Gary Light, CTO for Capital Region HealthCare, NetWare is a key component of CRHC's infrastructure and will continue to be as their needs evolve and grow. "NetWare's storage, print, directory and management superiority is complemented by the solution's extreme reliability," Light said. "Reliability and security are expected in a NOS at all levels. Novell's cross-platform strategy provides this by allowing us to choose best-of-breed products which meet our current needs and our future needs as we grow and change."

Novell business objectives for NetWare 6 include continuing to increase site-license deployments of NetWare. NetWare site-license sales by channel partners and Novell were up 5 percent in the first nine months of fiscal 2000. For 2000, the NetWare site-license run rate represents $362 million in annualized revenue for the company.

Pricing, Availability and eLearning Support

NetWare 6 is currently in a controlled beta release and will be available in the first half of 2001. Pricing will be announced later. For pricing and purchase information for the currently available NetWare 5.1 and Novell Small Business Suite 5.1, see http://www.novell.com/products/netware and http://www.novell.com/products/smallbiz.

To support next-generation NetWare customers, Novell Education offers a suite of always-available Web-based learning services, including online forums, mentoring and labs. For more information, see http://education.novell.com.

Web Resources

Table 3 contains some websites to grab more information on NDS and other third-party support products.

Table 3. Web sites for NDS information

Websites with NDS Information	
URL	**Contents**
http://www.novell.com/products/nds/	NDS® eDirectory™ is a stand-alone, cross-platform LDAP directory service that powers e-businesses. eDirectory provides the foundation to grow your business by building and maintaining secure and highly customized e-business relationships while leveraging your existing technology investments.
http://www.dreamlan.com/	This is Peter Kuo's stomping ground, and it is the home of the famous NDS Toolkit. You will find a lot of cool information and resources on this site. Be sure to check the NDS Notes and Tips page for lots of NDS tidbits.
http://www.grouplink-tm.com/products/ntndsi/	If you are looking for an NDS-based workflow solution, check out GroupLink's product. They have a solution that automates the preparation, routing, and approval of business process workflow.
http://www.novell.com/products/schemax/	Netoria, acquired by Novell, Inc., creates ScheMax, a product that provides some slick NDS solutions. Using Schemax, you can quickly view the structure of your schema, and if you know how to drag and drop, you can create your own NWAdmin snapins.
http://www.netpro.com/	NetPro provides solutions that monitor and analyze directory services. They presented at BrainShare 99 and submitted some handy tips and tricks for our “From the Trenches” area.
http://www.netvision.com/	NetVision Synchronicity products make it easy for you to sync your NetWare 3.x, Notes, and NT databases with NDS.
http://www.future-gate.com	Future Gate Software has put together a backup program for backing up and restoring directories.

Compaq Web Resources

Table 4 contains Compaq websites to find more information on Compaq and Novell solutions.

Table 4. Compaq Web sites

Compaq ActiveAnswers (NetWare)	http://vcmproapp02.compaq.com/ActiveAnswers/Global/en/solutions.1144/default.asp
Compaq and Novell Partnership	http://www.compaq.com/products/servers/novell/
Compaq Intelligent Manageability	http://www.compaq.com/manage/deployment.html
Compaq ActiveAnswers Resource Paq for Novell CD-ROM	http://www.compaq.com/partners/novell/resourcepaq-order.html
Compaq Info Messenger	http://www.compaq.com/infomessenger
Compaq Insight Manager XE	http://www.compaq.com/support/files/server/us/index.html
Compaq Management CD-ROM	http://www.compaq.com/support/files/server/us/index.html
Compaq Option ROMPaq	http://www.compaq.com/support/files/server/us/index.html
Compaq Remote ROM Flash Utility	http://www.compaq.com/support/files/server/us/index.html
Compaq SmartStart Subscription Service	http://www.compaq.com/support/paqfax/1233.html
Compaq Remote Insight Lights-Out Edition	http://www.compaq.com/manage/remote-lightsout.html
Compaq SSD for Novell Products	http://www.compaq.com/support/files/server/us/index.html
Compaq Survey Utility for NetWare	http://www.compaq.com/support/files/server/us/index.html
Compaq System ROMPaq	http://www.compaq.com/support/files/server/us/index.html
Current Novell Patchlist	http://support.novell.com/misc/patlst.htm
Customer Advisories	http://www.compaq.com/support/techpubs/customer_advisories/Customer_Advisories_Novell.html
Press releases	http://www.compaq.com/newsroom/pr
SoftPaqs (complete listing)	http://www.compaq.com/support/files/server/us/index.html
White Papers and other technical document (complete listing)	http://www.compaq.com/support/techpubs/whitepapers/index.html