

Understanding NDS

Networking is moving towards a sophisticated structure that connects the Internet, workgroups and enterprise networks into an information system for businesses and consumers. In order to efficiently manage and use this complex infrastructure, Novell has designed NDS to provide a single, global, logical view of all network services and resources.

By PCNA Staff

Businesses have discovered over the past few years that networking is essential to making them more productive. Novell's Directory Services (NDS) introduces the next level of productivity and efficiency. NDS helps users and administrators become more efficient, by making the network easier to access and manage. This ease of use and administration also significantly lowers the cost of owning a network.

NDS and NetWare are also the foundation for the Smart Global Network, Novell's vision for the future of running a business. It is a worldwide network that connects the Internet, workgroups and enterprise networks into a single information system for businesses and consumers. The Smart Global Network has many advantages. For example, it will enable companies to work directly with their vendors as if they were in the same office, employees to access resources around the world as if they were next door, and enterprises to work together as a single unit.

NDS provides the foundation for the following three elements that will make the Smart Global Network a reality:

Smart Network Services

Smart network services work intelligently for the user. These services identify users when they connect, determine where they are, what they need and how to work best for them.

Universal Access

Universal access allows people to access the network anytime, from any place.

Integration

Heterogeneous integration consoli-

dates products and devices from a variety of vendors into a single, cohesive network.

NetWare Directory Services

NDS is the technology that provides a single, global, logical view of all network services and resources. This allows users to access network services and resources with a single login, regardless of the user's location or the location of the resources. NDS provides a platform on which to implement the strongest network security available today. It also offers a single point of control for administrators through easy-to-use graphical administration utilities.

Global Access

NDS is a global, distributed information database included with NetWare 4 that provides access to all network resources – regardless of where they are physically located. NDS maintains information about every resource on the network – users, groups, printers, volumes and other devices – in a single, logical database.

NDS presents a simple view of a complex physical infrastructure, providing seamless, global access to all company resources. Users log into a multi-server network and view it as a single information system instead of a collection of individual servers. This single information system increases productivity and reduces administrative costs.

Hierarchical Directory

Like a telephone book or an address book, NDS helps network users locate

information quickly and efficiently. NDS, however, does more than just catalogue resources on the network. It organises resources – referred to as objects – in a hierarchical tree structure. This tree structure is known as the directory tree.

An organisation can arrange objects in the directory tree according to the way people access and use company resources. This not only makes accessing resources easy, it allows NDS to be used to establish rules-based administration. Rules-based administration allows administrators to grant access to an entire branch of the directory tree at once. This makes granting security access for a whole company fast and easy, minimising the need to administer multiple groups. NDS acts as a repository of information based on the specific needs of the organisation.

This hierarchical directory tree is the key differentiator between NetWare 4 and its competitors. While others claim to have a directory service – such as Microsoft does with Windows NT Server – their services are simply a flat file name service. Flat file name services have no hierarchy, so they can be difficult to search and manage. Name services also tend to be limited in use, primarily restricted to email systems and user authentication, and they are server-specific. NDS, on the other hand, was designed to provide a complete networking infrastructure, linking users to network services, applications and data.

One Login

NDS provides a central point of access for the entire network. Instead of logging into many individual file servers, users and administrators log into

the network once, using one password. They are then given seamless access to all the network resources they are authorised to use. Access to resources after initial login is handled automatically through background authentication – users are never asked for another password and are unaware that authentication is taking place.

With NDS, user login is the same no matter where an individual is physically located on the network. NDS allows users to access the network from any geographic location and have a consistent view of the network regardless of which workstation they use to log in from.

The hierarchical database structure of the NDS design reduces network traffic and makes user searches and operations fast and efficient. Users can find a required network resource by searching or browsing the tree with Novell or third-party utilities.

Powerful Administration

A recent Gartner Group study found that 73% of the total cost of owning a network is incurred in administration costs. NDS provides sophisticated but easily managed administration that helps reduce the cost of managing a network. NDS allows administrators to manage the entire network from a single location, with a single graphical user interface (GUI) administration utility.

Without a directory service, administrators are often required to perform the same operations multiple times, either for each user or for each server. NDS eliminates the need for redundant

administration by providing a single point of administration for an entire enterprise. Each network resource has an exclusive global identity, requiring resources to be created only once for the entire network. For example, although a user may need access to multiple servers, only one user ID is required for the entire network. The result is lower network administration costs.

NDS also allows for freedom of management. In many organisations, it is desirable to centralise management and administration services that reach across departmental boundaries. In other cases, administration may be delegated to the department or workgroup level. NDS supports both centralised and distributed administration operations, giving organisations the power to determine which method of administration works best for them.

Distribution

NDS is a distributed database that is fully replicated to provide fault-tolerant login and administration from anywhere on the network. By breaking the NDS database into manageable pieces (partitioning) and distributing it across the network, fault tolerance is provided. In addition, NDS data can be placed close to the users who need it, thereby ensuring optimal performance when accessing the network.

NDS partitions are copied or replicated across the entire network as many times as necessary. If a primary partition is lost, the network reconfigures itself to use a backup copy. This further increases reliability of the net-

work and allows for construction of a system where failure, maintenance of a file server, or temporary loss of a communications link need not affect operations.

Extensibility

The directory schema regulates the structure of an NDS directory tree. The schema is a rules system that defines how the NDS directory tree is structured. The schema determines what objects are defined, what attributes can be associated with objects, what properties objects inherit, and what positions objects occupy in the directory tree.

The NDS schema is extensible, which allows administrators to modify the base schema supplied with NetWare and customise NDS to fit their needs. For example, a user object can be extended to include a social security number or an emergency contact name and telephone number.

Independent software vendors (ISVs) and administrators can integrate new services into the network by extending the NDS schema and adding new objects. For example, an ISV can add fax server functionality to the network by adding a fax server object to the NDS tree.

Flexibility

Because organisations are always in a constant state of change, NDS was designed to be very flexible, allowing a company's directory tree to change as the organisation changes. Individual objects, groups of objects, or entire branches of the directory tree can be moved to different locations in the tree with a simple drag and drop. Moving objects with name services such as the NetWare 3 bindery or NT Server's Domain Name Service requires administrators to completely delete and recreate the object in the new location.

NDS also allows the merging of two separate directory trees into one. This allows separate NetWare 4 networks to be easily combined into one enterprise-wide network. In addition, merging trees gives organisations the ability to implement separate NDS trees by de-

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partmental or geographical locations. The trees can then be combined later.

Scalability

NDS can be customised for any size and type of network. Even when organisations merge with other companies and continue to grow in the future, the NDS design easily accommodates this growth. New resources can be added to the network with a simple point and click of the mouse.

Security

NDS creates a platform on which a full range of security and access control can be built. NDS allows administrators to quickly and reliably define the security associated with a particular branch of the NDS tree, and all objects within or below that branch inherit those rights. This rules-based administration simplifies security administration so only the exceptions to the rules require special attention. This process not only enhances security, but also greatly reduces administrative costs.

To give users access to network services, NDS uses an authentication service based on the RSA public-key/private-key encryption technology. This authentication mechanism – a critical part of login security – uses a private key attribute and a digital signature to verify a user's identity. Authentication is session-oriented and the client's signature is only valid for the duration of the current session. Ongoing (background) authentication is transparent to network users and takes place as required when users access other services. Only during login (user ID and password exchange) is the user aware of authentication.

Administration

The NetWare Application Manager works together with NDS to simplify management of network applications by allowing administrators to centrally control users' Windows desktops. Without leaving their administration console, administrators can install new network applications or upgrade existing applications and have the application icons dynamically appear on

users' Windows desktops. Network administrators no longer have to visit each user's workstation to install applications or create a Windows icon for each application.

The NetWare Application Manager uses the NDS-based NetWare Administrator utility to give administrators the ability to create NDS objects that represent network-based applications. These objects contain information about the physical location of network-based applications and about which users are authorised to use those applications.

Integration

NDS integrates a variety of network devices, presenting a simple view of a complex physical infrastructure. Through Novell Embedded Systems Technology (NEST), this integration extends to virtually any device with a microprocessor. This includes, but is not limited to, copiers, fax machines, air conditioning units, building security systems and home appliances.

NDS also provides a foundation to integrate all network services and applications regardless of platform.

Novell Applications

NDS provides the foundation that enables the integration of all distributed services and applications into a unified, cohesive information system. Novell is providing a variety of distributed NetWare services operating through NDS, including file services, print services, security services and many others.

Third-Party Applications

NDS currently offers a set of APIs that give software developers the ability to integrate their applications and services with NDS. Applications and services can use the information stored in the NDS database to connect users to network services and resources.

For example, an email server or a fax server can use the NDS database, instead of maintaining a separate database of users. Administrators then have a single, central database to ad-

minister instead of multiple databases. This reduces the time and cost of administering company databases. Users simply log into NDS once and are transparently authenticated for any application or service that uses the NDS database.

In addition to using the information already stored in NDS, applications or services can store customised information in the database. For example, a database server, third-party print server or other service provider can create an object in NDS to represent that particular service. By registering with NDS, applications and services are no longer required to advertise their services using the Service Advertising Protocol (SAP). This reduces network traffic.

Application Servers

NetWare database services, working together with NDS administration utilities such as NWAdmin, provide easy administration and management of third-party network databases running on the NetWare platform. The availability of symmetrical multiprocessing (SMP) for NetWare 4.1 has added parallel querying capabilities for database servers running on NetWare 4.1, providing optimal performance as the number of users grows.

Many organisations have line-of-business applications running on a variety of platforms other than NetWare. These platforms include Unix, Windows NT Server and OS/2. Novell plans to make all application servers manageable through NDS. Application servers integrated with NDS will allow publication of their resources through the NDS directory. Users will then be able to identify and access applications on application servers in the same way they access other resources on the NetWare network. Administrators will be able to use NWAdmin, the NetWare global administration tool, to manage these application servers.

Name Services

A major limitation of name services is that they are server specific. That is, they require the creation and maintenance of a different name database on

each server. This increases administration costs by requiring redundant administration. Directory services, on the other hand, provide a single point of administration for the entire network.

Like name services, directory services also map network names to network addresses. Unlike name services, however, directory services provide an advanced naming method that gives all network resources a clear and unique identity across the entire network. Consequently, directory services provide global access to all network resources, regardless of their location. This provides users and administrators with transparent, location-independent access to printers, servers and other resources, as well as to other users. In addition, it simplifies network use and management by making network resources readily available to users regardless of their location or the location of the resource.

Name services such as the NetWare 3 bindery and Microsoft Windows NT Server's Domain Name Services hold only the minimum information about networking, including basic objects such as users, groups, printers and file servers. These objects contain a limited number of attributes that provide very general information; however, NDS supports many different types of objects with extensive attribute information. The NDS database is also extensible, allowing the creation of custom objects and properties. This extensibility provides attachment and access to any intelligent device on the network.

NDS also provides extensive query and search capabilities into the directory database, allowing users to search for network resources using attributes as search criteria. For example, a user can search for all colour PostScript printers. This makes accessing and managing network resources much easier than with name services.

Another major difference between directory and name services is that directory services are based on a hierarchical structure, whereas name services are typically based on a flat structure. A hierarchical structure makes networks easier to use and manage. For example, a network may be structured hierarchically along organi-

sational lines with each department having its own administrator. With a hierarchical structure, each department administrator need only work with a particular branch of the hierarchical directory tree, easily identifying the network resources for which he or she is responsible. In a flat domain environment, there is no method of decentralising administration aside from maintaining a separate domain database for each administrative workgroup. Although this is a possible solution, providing cross-domain user access is difficult to manage.

NDS And X.500

NDS is a full-function directory service that is based on the X.500 international standard. The International Standards Organisation (ISO) and International Telecoms Union (ITU) created X.500 to provide standards to enable the creation of a truly interoperable, distributed, worldwide directory service.

All of the features and functions described in the X.500 standard are implemented in NDS. In addition, all of the NDS operations and protocols are modelled directly on the X.500 specification. NDS, however, provides significant functionality beyond the X.500 specification, offering a complete networking infrastructure that links users to network services, applications and data.

However, although NDS is very closely aligned with X.500, there are some differences between the two. These differences are in the protocols used in NDS, not in the architecture. Novell chose to implement lightweight NetWare protocols over the heavyweight Open System Interconnection (OSI) defined by X.500. Because the differences are in the protocols only, it is easy to provide solutions to enable NDS and X.500 to operate together fully. Novell understands that this interoperability is important to customers and is fully committed to providing these solutions.

Conclusion

Novell's vision for running a business in the future is a Smart Global

Network that connects the Internet, workgroups and enterprise networks into a single information system for businesses and consumers. NDS is a key component of this vision. It is the technology that provides a single, global view of all network services and resources in the enterprise networks of today and the Smart Global Network of tomorrow.

For today, NDS allows NetWare users to access network services and resources with a single login, regardless of the user's location or the location of the resources. NDS also provides easily-managed administration that permits the entire network to be managed from a single location, reducing administration time and costs.



Acknowledgement

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