Understanding
Nterprise Linux Services

For Linux
Professionals

N

Novell®

Proprietary Statement

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1: Introduction

Novell embraces the emergence of Linux and open source software as key enabling technologies for enterprise solutions. Novell Nterprise Linux Services is a crucial component of the Novell promise to deliver one Net - a world without information boundaries. It lets you take advantage of the open-source benefits of Linux combined with the powerful set of enterprise services previously only available on Net-Ware, including:

- Personal File Management

- Directory Services

- Print Services

- Internet Messaging and Calendaring

- System Management

- Web Experience

In response to business customers' wants and needs, Novell becomes the first major software vendor to deliver a comprehensive set of network enterprise services that run on all of the top Linux platforms, including RedHat Enterprise Linux and SuSE Enterprise Linux.

Backed by the entire Novell ecosystem including full customer support, training, developer support, certification and more, Novell Nterprise Linux Services gives customers a compelling new data center offering that has the same level of security, sophistication and reliability provided by the NetWare platform. With this move, Novell provides services on both NetWare and the fastest growing platform in the market today offering customers choice and flexibility in how they deploy these critical services.

1.1: Have you ever heard about Novell?

Many people from the Linux community do not know much about Novell.

If at all, people remember Novells premium operating system, NetWare versions 3.x or 4.x, providing only file and print services using IPX as standard communication protocol.

However, Novell has changed considerably over the past 5 years with NetWare version 5.x, 6.x and the recently released 6.5 embracing Linux and open source communities.

Back in 1998, at the time when Linux with version 2 of the kernel went mainstream, Novell released version 5 of the NetWare server operating system running purely on IP. Today, Linux is well known for it's scalability, reliability, and robustness. The Linux and Open Source communities build an amazing number of products. Novell ported many products to the Linux platform starting with the first version of eDirectory, Novell's Directory Service, developed to run cross-platform. This was back in 1999.

Today, in 2003, one only has to look at Open Source Software and Internet Standards. This listing is far from complete but highlights Novell's involvement and vision.

- Novell give the OSS:
  - UDDI Server & service test environment
  - DSML v2 server through OpenLDAP
  - NDK APIs and sample code

- Novell participates in:
  - Apache Web Server
  - Tomcat
  - Ethereal - OS sniffer decodes
  - Forge
  - NCPs
  - OpenLDAP
- Novell's current server, NetWare 6.5 is heavily influenced by OSS:
  - Apache 2 Web Server
  - PERL & PHP
  - Tomcat
  - MySQL
  - OpenSSH
  - OpenLDAP (Novell contributed JLDAP and DSML)
  - UDDI

For more detailed information, visit Novell's OSS portal at http://forge.novell.com or search for Novell in the RFCs. Just visit the Web and make up your mind in terms of Linux contributors. Look out for the major software vendors and their commitment to the OSS community.

One of the key strategies for all Novell solutions, and therefore products, is to deliver for integration rather than replacement.

Enjoy this study kit and have a closer look at current Novell technologies and how they are used in networks of any scale independent of the server operating system, client operating systems or devices.

1.2: Product aim

To make a clear point, the Nterprise Linux Services are aimed to introduce a fully supported set of enterprise proven services on Linux servers.

Although you are welcome to test Nterprise Linux Services on a Linux distribution developed for multiple purpose or just as a workstation, in a production environment you will use the right scaled and supported server distribution.

Novell Nterprise Linux Services are a contribution to the Linux community, but the product is licensed software like many of the other commercial products ported to Linux.

This study kit is aimed to give you a better understanding of the services offered with Nterprise Linux Services and how they differ from Open Source alternatives if applicable.

2: Using Novell Solutions

Novell has been a Linux contributor for a while now and Novell solutions on the Linux OS are not new.

Nterprise Linux Services has many of the Novell contributions packaged together with a common installation and management toolbox

The single products covered include:

- eDirectory
- DirXML
- eGuide
- iFolder
- iPrint
- Parts from ZEN for Servers (Application and Content distribution via RPM)
- NetMail
- exteNd Director

Detailed information on each of these products can be obtained from www.novell.com

Version 2 of Nterprise Linux Services will in addition include:

- Enterprise File Services
- End User Services such as JSR 168 Portlets
- Almost all NetWare 6.5 functionallity

2.1: Enterprise proven

Novell solutions establish information solutions for corporate networks and because of the heterogeneous nature of these networks, most of Novell's products run with the same functionality on various OS platforms including Linux, SUN Solaris, Microsoft Windows Servers and of course Novell NetWare.

As an example, Novell's Directory Service, eDirectory, can be partitioned and the data from each partition can be replicated to other servers. All these servers running a piece of the enterprise wide Directory Service can have a different server operating system. The administrative tools to work with this Directory Service are Web based and can be launched from any supported browser running on any device.

Note: *You will get more detailed information about all products provided with Nterprise Linux Services in this training kit.*

Different customers have chosen Novell services for several reasons. Novell's Web site www.novell.com offers many links where you can find information about how Novell solutions have been implemented at customer sites and what the results are. Just for starters you can discover the 'solutions' area.

2.2: Cross Platform for corporate use

The ability to run services across multiple server operating systems has many advantages.

Firsty, you can choose the right services for your enterprise before deciding what server operating system and OS related services will fit the needs best.

Furthermore, you can migrate your server platforms from one operating system to another without interrupting the installed services.

The decision for the operating system can be based on hardware, reliability, needed OS services such as File Systems, Application needs, etc.

Linux operating system provides the reliablity of OS services on many hardware platforms from Intel based PCs up to Supercomputers. Thus, you can scale your needs down to the hardware level without having to worry about your services such as Directory, Mail, File access, Print, and so on.

2.3: What is in Nterprise Linux Services?

Novell Nterprise Linux Services provides you with a full set of enterprise proven services with very simple installation and configuration mechanisms for Linux servers.

The first version will be fully supported by Novell's Service departments - Consulting Services, Technical Support, Training Services - on the following two Linux Enterprise Server distributions:

• RedHat Enterprise Server 2.1

• SuSE Enterprise Server 8

This chapter lists the prerequisites for installing the Novell services on the above platforms.

You will then receive the information on how to build a simple test system, as used in this kit, and then be guided through the full installation of Nterprise Linux Services. This first step will make you comfortable in starting to test Nterprise Linux Services in your own environment. In case you do not have a spare Linux Enterprise server, you will be provided with information how to setup an inexpensive Linux version.

The remaining chapters will guide you in more detail on other products.

2.4: Prerequisites

These few prerequisites will in almost all cases be already fulfilled in your Linux based environment. However, you should ensure that all prerequisites are fully met before running Nterprise Linux Services in production environment.

2.4.1: Linux Versions

This training kit is based on the supported Linux distributions of Nterprise Linux Services.

Version 1 of Nterprise Linux Services supports two Linux Distributions:

• RedHat Enterprise Server 2.1

    For this training kit we used the AS version

• SuSE Enterprise Server 8

    This distribution is powered by United Linux 1.0

The advantage of using supported versions for your production environment is to ensure that you receive right support from both the Linux Distributor and Novell.

Note: *Your production environment should always be built on supported versions. This will ensure that you get the right support levels for the Linux distribution and the Nterprise Linux Services products.*

Planned versions of Nterprise Linux Services will be supported on additional market leading Linux distributions. Likely candidates include:

• Conectiva

• Turbolinux

• Debian

• MandrakeSoft

For testing purposes, you can run Nterprise Linux Services on the not supported, inexpensive Linux versions from RedHat and SuSE. Later in this chapter we provide an overview about the main differences and how to set up an inexpensive test system.

Novell Training Services will build the Courseware for it's Certified Linux Engineer (CLE) certification on the inexpensive Linux versions from RedHat and SuSE. In doing so, attendees of the course can take away all needed software to build their own test environments and continue to build on the knowledge received from the course. This is especially important for those choosing to purchase the course as Self-Study Kit as well as for those customers not yet running Linux Enterprise versions.

Note: *The Novell Training Services Courseware for the CLE certification is course 3015 - Novell Nterprise Linux Services. To register for a CLE training locate a Novell Training Provider near you using the URL http://developer.novell.com/partnerlocator*

This training kit will list the differences between implementations on RedHat and SuSE Enterprise distributions. The following is an example of how the differenced will be documented.

RedHat: *This is an example for specific notes on the RedHat Enterprise Server version 2.1 AS*

SuSE: *This is an example for specific notes on the SuSE Enterprise Server 8 version*

Installation Report

For your reference, provided here is a detailed report on the installation and configuration of the RedHat and SuSE Enterprise server versions.

This will ensure that you can easily build a test environment equal to the environment used throughout this training kit.

RedHat Enterprise Server 2.1 AS

The RedHat distribution installs the following versions:

- Kernel 2.4.9-e.3
- GCC version 2.96
- GLIB version 1.2.10-5
- GLIBC version 2.2.4-26

For this kit, the RedHat Server AS has been installed on Dell Latitude 610 laptops as follows:

- Language English
- Keyboard US
- 2 Button Mouse (PS/2)
- Installation Type: Advanced Server
- Manual Partitioning:

  10 GB root partition (ext2)

  1 GB Swap Partition
- Boot Loader default (GRUB on MBR, no password)
- Assign fixed IP address 192.168.200.200 / 24
- Assign RedHat as hostname
- No Firewall
- Language Support English (USA)
- Time Zone: Europe/Berlin
- Root Password = novell
- Package Group Selection (all):

  GNOME

  KDE

  Software Development
- Use detected Graphical Interface

  Dell 1024X Laptop Display Panel

  Resolution 1024 x 768 / 24bit

  KDE as default desktop environment (KDE 2.2.2-2)

  Login type graphical (initdefault 5)

Configured for 8 screens, Small Panel, Focus follows mouse.

Additional setup / configuration steps

- **Nterprise Linux Services** Beta product copied to / novell-sources

- Added package kdegraphics to have **ksnapshot** handy to produce screenshots for this kit

SuSE Enterprise Server 8 (United Linux 1.0)

The SuSE distribution installs the following versions:

- Kernel 2.4.19-4GB

- GCC version 3.2

- GLIB version 1.2.10

- GLIBC version 2.2.5-163

For this kit, the SuSE Enterprise Server has been installed on Dell Latitude 610 laptops as follows:

Standard Installation

- Keyboard US

- Mouse Aux port

- Partitions

  10 GB root partition mounted at /

  1 GB Swap partition

- Software default selection

  Default System

  Yast2

  Analyzing Tools

  Authentication Sources (NIS, LDAP, Kerberos)

  DHCP, DNS

  File and Print Services

  Mail and News Services

SLES Administration Tools

GNOME

KDE

Simple Webbrowser

Help and Support Documentation

Graphical Base System

LSB Runtime Environment

- Booting setup from /dev/hda
- Time Zone Setting for Europe/Germany
- Language US English
- Graphic capabilities

  Graphic card 3D abilities disabled

  GUI standard setup 1024x768 24 bit

- Auto detect a printer at LPT1
- Network Interface

  Fixed IP address at 192.168.200.201 / 24

- KDE as default desktop environment (KDE 3.0.3)
- Authentication via KDE (initdefault 5)

  Configured for 8 screens, Small Panel, Focus follows mouse.

  Panel and desktop have been cleaned up for this kit

Additional setup / configuration steps

- Install **gettext** from Yast Installer (needed by Nterprise Linux Services installation script)
- Install **locate** for easy file location
- **Nterprise Linux Services** Beta product copied to / novell-sources

Note: *Please bear in mind that this kit is written based on the Nterprise Linux Services Beta product. Eventually you will see a difference between the final product behavior and the Beta*

version described here. However, we wanted to have this kit out as soon as possible to give you a quick start for hands-on experience with the Nterprise Linux Services product.

2.4.2: IP network

Your production environment will, of course, have a clearlly documented and healthy IP network setup.

To successfully introduce the Nterprise Linux Services product, you will additionally need to consider the following:

- The IP network must be known to the servers you install Nterprise Linux Services on. You can refer to your inter-network documentation and perform the tests necessary to ensure this.

- Your firewalls need to allow communication through ports opened by Nterprise Linux Services. Some of these ports might already be in use in your network. Check for potential port conflicts before you install Nterprise Linux Services. By default these ports are:

    80 for HTTP

    443 for HTTPS (SSL)

    8008 for eDirectory iMonitor

    8010 for eDirectory iMonitor over SSL

    8018 for NetMail WebAdmin

    8020 for NetMail WebAdmin over SSL

    52389 for the NetMail LDAP server

    52080 for NetMail ModWeb

    52443 for NetMail ModWeb over SSL

    25 for the NetMail SMTP Agent

    110 for the NetMail POP Agent

    143 for the NetMail IMAP Agent

    389 for the eDirectory LDAP server

636 for the eDirectory LDAP server over SSL

631 for the iPrint IPP server

443 for the iPrint IPP server over SSL

137 for SAMBA

138 for SAMBA

139 for SAMBA

8080 for Tomcat HTTP

8009 for the MOD_JK

524 for NCP (NDAP access to eDirectory)

1229 for ZEN for Servers

123 for the NTP protocol

427 for the SLP protocol

All these services and tools using open ports are be explained in greater detail in the appropriate chapters.

- Servers acting as eDirectory servers must communicate with each other to keep the distributed, partitioned database of Directory Services in sync.

Note: *Novell's Directory Service eDirectory is the foundation for all Novell services.*

For more information, refer to the eDirectory chapter in this training kit.

2.4.3: Service Location

In 1998, when Novell moved from the IPX protocol to TCP/IP as the core protocol, it had to decide on how to detect and advertise services on the network.

Of course solutions like DNS / DDNS have been around, but based on the very good experience with dynamic and automated service advertising in the IPX world, the Internet

standard Service Location Protocol (SLP) has been chosen as main service resolution protocol for all Novell services.

Note: *Refer to RFC 2165 for SLP version 1 and RFC 2608 for SLP version 2. Also check the OpenSLP homepage at www.openslp.org for detailed information.*

If you do not want to introduce a new service resolution protocol, you can use the facilities you have up and running such as DDNS.

However, it is important to understand that Nterprise Linux Services as defined and supported rely on SLP to be available. This may mean that to receive full support for your implementation you either introduce SLP in your network or work with Novell Consulting and Novell Technical Services to help you with the workaround.

2.4.4: Time Synchronization

In almost all cases you will already have time synchronization established in your production environment. One example could be that Kerberos based authentication is being used.

Logically, you will have configured the Network Time Protocol (NTP) for that purpose.

Note: *Please ensure time synchronization for your test environment as well. If you like a reference for the NTP protocol, please refer to RFC 1305 and RFC 2030, depending on what version of NTP you are using. Both of the supported Linux Enterprise versions come with NTP version 4. You can also refer to the NTP documentation that comes with your Linux distribution. Both supported Linux versions have extensive information on configuring NTP.*

All Novell Services are based on eDirectory, Novell's Directory service. Like any distributed and partitioned database, there is a clear dependency on the synchronization mechanism.

Novell uses Timestamps with 32 bit for the UTC second, 16 bit for a replica counter, and 16 bit for an event counter to stamp every event in eDirectory. This raises the need that all servers, regardless of the operating system, running Novell Services (they all are based on eDirectory) must be synchronized to the same time source.

To setup an easy time synchronization in your test network based on NTP do the following:

- Choose one of your servers as the time source.

- This server must have a way to connect to the Internet to synchronize its own time to NTP time sources on the Internet.
  For test environments you can also simplify this further and let this machine use its own BIOS time as NTP time source.
  To do so, modify your /etc/ntp.conf file to read only the following lines, and then start the NTP daemon:

     server 127.127.1.0

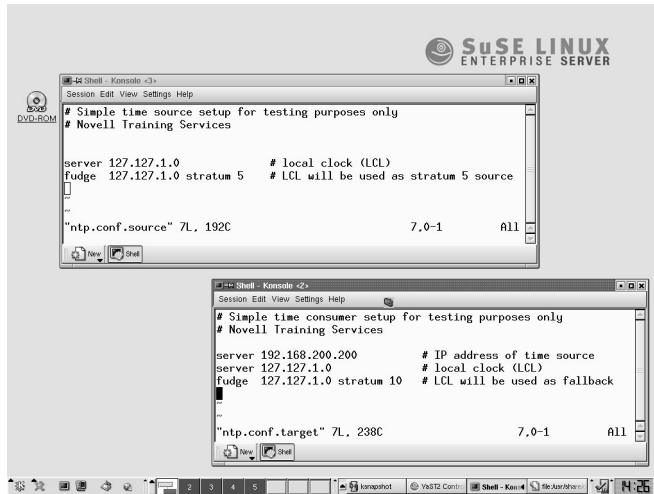   fudge 127.127.1.0 stratum 5

     Add the NTP daemon to appropriate runlevels.

- This server then need to be referred to from all other servers in the network to synchronize time.

  Again, for testing purposes you can ease the process and just modify the /etc/ntp.conf file to read only the following lines, and then start the NTP daemon:

     server <IP address of your corporate time server>

     server 127.127.1.0

     fudge 127.127.1.0 stratum 10

     Add the NTP daemon to appropriate runlevels.

This will ensure, that the software time of the time source server uses its BIOS time as stratum 5 timesource. The other servers will connect to that time source server and establish synchronization at stratum 7. They also have their own BIOS time configured as a fallback source if the communication to the time source server fails.

Furthermore, the software time of all servers sharing time need to be written back to the BIOS time on a scheduled basic. This can be accomplished by atd or crond and avoids issues during unwanted reboots (which might happen during abnormal situations but cannot be avoided totally).

Note: *Note that NTP takes up to 5 minutes after a reboot to establish NTP software time on a Linux server. If a big time difference between BIOS time and NTP provided time is detected, the NTP daemon simply terminates without further notice. This behavior can cause serious issues within an eDirectory server communication.*

You should, in any case, verify your time synchronization is healthy before you introduce Nterprise Linux Services, albeit in a test environment.

The easiest way to accomplish this is by ensuring that the NTP daemon runs and that time synchronization is established. You can check the current status with ntptrace.
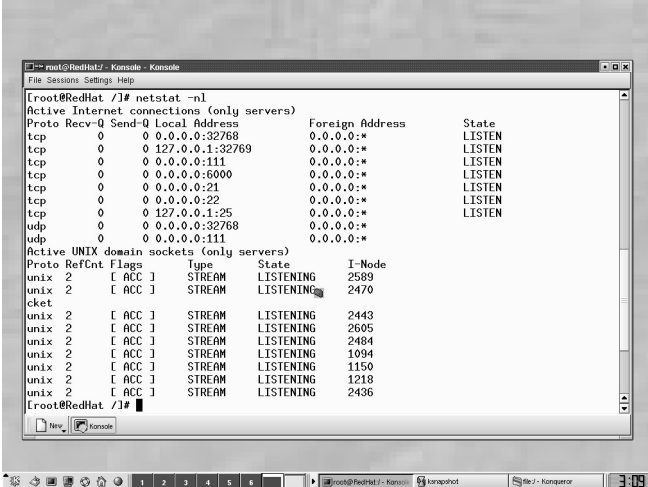
2.5: Install Nterprise Linux Ser-vices

At this point, having met all prerequisites, your are ready to install Nterprise Linux Services on a Linux Enterprise server.

Here we show how to install the whole Nterprise Linux Services product in one single run using the express install function.

Later chapters will then provide detailed information about the main products and show how they can be installed, including a closer look at the specific pre requirements.

Just as a check, we do a netstat -nl to compare the ports in use after the Nterprise Linux Services are installed.
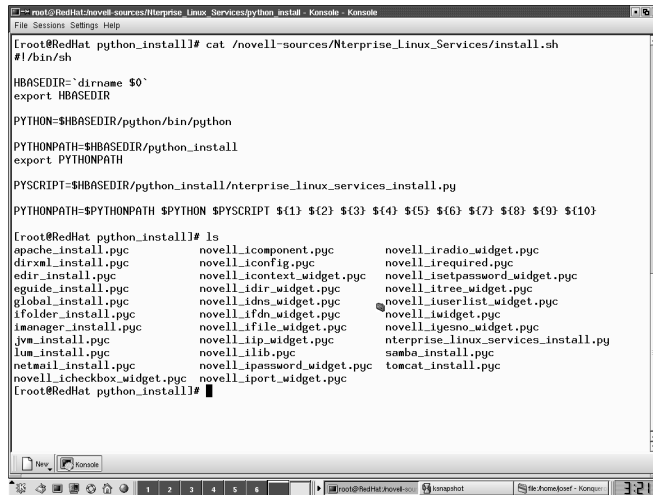
2.5.1: Install all services in one step

The Nterprise Linux Services product comes with a single install script which calls the various Python based installation routines.

Once you call the install script, the installation starts. For the purpose of this chapter, we perform an express installation.

You need to read and accept the License agreement as the Nterprise Linux Services are a licensed product.

Next you need to provide the path and filename for the license key. In Beta state you will get a license key for evaluation with the Beta product. Once you purchase the product, you will get your company license.

In the next few steps, you need to provide some information on how you wish to configure:

• The name for your new eDirectory tree

• The name for your eDirectory Administrator and the context it should be created in

• The Administrator password

• The DNS server address holding the records for your NetMail service

Once you have provided the necessary information, you can review a configuration summary or make changes.

```
┌─ root@RedHat:/novell-sources/Nterprise_Linux_Services - Konsole - Konsole ───────────┐
│ File  Sessions  Settings  Help                                                       │
│    Admin name with context      : cn=admin.o=novell                                  │
│    Admin password               : ******                                             │
│    LDAP port                    : 389                                                │
│    Secure LDAP port             : 636                                                │
│                                                                                      │
│  iFolder Summary Information                                                          │
│    LDAP server IP Address       : 192.168.200.200                                    │
│    LDAP port                    : 389                                                │
│    Admin name with context      : cn=admin.o=novell                                  │
│    Admin password               : ******                                             │
│    iFolder server IP address    : 192.168.200.200                                    │
│    iFolder admin users          : admin                                              │
│                                                                                      │
│  NetMail Summary Information                                                          │
│    Admin name with context      : cn=admin.o=novell                                  │
│    Admin password               : ******                                             │
│    Primary DNS server address   : 192.168.200.200                                    │
│    Secondary DNS server address :                                                    │
│    NetMail server domain name   : RedHat                                             │
│    NetMail WebAcess HTTP port   : 52080                                              │
│    NetMail WebAccess HTTPS port : 52443                                              │
│    NetMail LDAP port            : 52389                                              │
│                                                                                      │
│  iManager Summary Information                                                         │
│    iManager server address      : 192.168.200.200                                    │
│    Admin name with context      : cn=admin.o=novell                                  │
│    Admin password               : ******                                             │
│    LDAP server IP address       : 192.168.200.200                                    │
│    LDAP port                    : 389                                                │
│    Secure LDAP port             : 636                                                │
│                                                                                      │
│ Do you want to make any changes? (no): ▉                                             │
│ [ New ] [ Konsole ]                                                                  │
└──────────────────────────────────────────────────────────────────────────────────┘
```

Upon accepting these settings, the installation process starts. After a few minutes Nterprise Linux Services are installed and configured on your Linux Enterprise server platform.

The installation log file is copied to /var/log and can be used as reference. For instance, the running sendmail service has been detected, terminated, pulled out of the runlevels, and then NetMail has been installed.

As mentioned at the beginning of this installation, below is a screenshot with the results of netstat -nl after the installtion of Nterprise Linux Services.

Install Nterprise Linux Services

2.6: Building an inexpensive test environment

The Nterprise Linux Services installation script is build to avoid most of the issue from the past.

As already mentioned with the NetMail example, it checks on already occupied ports or existing versions. It then de-activates those potential conflicts and installs the Nterprise Linux Services component.

With this in mind, you can use virtually every current Linux distribution and install Nterprise Linux Services.

The following few suggestions will help to succeed:

- Make a very basic install of your Linux Distribution. Nterprise Linux Services are services aimed to run on dedicated server platforms.

- Have the Nterprise Linux Services media and a valid license key available.

- Make sure you met the pre requirements listed earlier in this chapter.

- Run the installation script and look for error messages during installation.

- Once the installation is done, have a close look at the installation log file in /var/log. This file contains detailed information how the product has been installed. Use tools like grep to search for specific pat-terns.

- If you run into unresolved dependencies, you can use the standard RPM tools to fix these issues. The RPM packages are in sub-directories on the Nterprise Linux Services media under Lynx-Bins.

- Ensure that you use a supported Web browser such as Netscape 6 or higher.

3: Directory Services

Directory Services plays a significant role especially in all enterprise scale networks because of they handle information about resources in the enterprise.

The main components of Directory Services as first defined in the X.500 recommendation are:

- Discovery

- Storage

- Relationship

- Security

With the Lightweight Directory Access Protocol (LDAP) a common standard has been established to access the data stored in a given Directory Service. The current version is LDAP v3 still without encryption facilities.

Note: *For more information about LDAP, visit Novell's developer Web site at http://developer.novell.com, visit www.openldap.org, or just type ldap in the search field of any Internet search engine.*

In the past a Directory Service was implemented for various different reasons because different vendors had different sets of functionality. For example, if a Directory Service was only implemented to store the company white pages, only a limited set of functionality retrieved from the X.500 recommendations is needed. There was simply no need to implement more functions into that Directory Service. And, keeping the code size small in general creates a fast program.

Note: *Use a search engine on the Internet for the pattern 'Directory Services' with additional information on the X.500 recommendation.*

The most logical Directory Service implementation on Linux is OpenLDAP, an Open Source Software. Just have a look at the Linux Enterprise Solution Web sites; whenever a specific application benefits from an existing Directory Service,

OpenLDAP is the first chose. As mentioned earlier, Novell contributes to OpenLDAP.

The primary reson for the introduction of Novell's own proprietary Directory Service more than 10 years ago along with NetWare 4 was very simple. Prior to that all NetWare servers had a server based user and group management much like the Linux world. With the customers' needs for larger scaleable networks having many servers where specific people need access to, the server based user and group management became a nightmare to administer. Other server operating system vendors faced the same challenges and found ways to overcome them.

UNIX / Linux systems for instance used their Network Information Service NIS or NIS+ systems to administer users and groups in only one location. Don't forget that Linux was just born being a little but very promising child.

Novell introduced Novell Directory Services (NDS). This Directory Service was only developed to store resources for NetWare users based on the X.500 recommendations. Later specific versions of NDS were developed for the SUN Solaris and Microsoft Windows server platforms. From the beginning every single object has its own Access Control List (ACL) where specific rights for other Directory objects can be assigned for the whole object as well as for any single attribute of the given object.

3.1: OpenLDAP

Let's have a brief look at OpenLDAP. A full discussion about OpenLDAP is outside the scope of this study kit.

As OpenLDAP is an Open Source project and widely used for special purposes with Linux based solutions, it is assumed that you know where to get from and how it is installed:

- Get the most current build from the OpenLDAP Web site and make yourself familiar with the release notes and documentation

- Unpack the tar-ball and configure the package

- Adjust the make file if appropriate

- Make the dependencies, then the product itself

- Install the product

- Configure the product

- Use the product in all aspects it provides

You might also be able to use a pre-configured RPM package form your Linux Distributor.

OpenLDAP is a Directory Services following the X.500 recommendation for Directory Services.

We will not discuss certain limitations in this chapter but instead talk about the features and benefits of eDirectory. We are confident that you will be able to make your own judgement, especially as we provide links to publicly available Web sites throughout the study kit for finding all relevant information.

Understand clearly that OpenLDAP is very valuable and an excellent example for the quality of Open Source Software. However, Novell created a so called 'full service directory' supporting much more needs out of the same, enterprise wide implementation where eDirectory servers can exist on disparate operating systems.

3.2: Novell eDirectory

With NDS version 8, on the market since 1999, the product was renamed to eDirectory to make the main new features visible:

- eDirectory is a product independent from NetWare

- eDirectory works cross platform with the same code base for many server operating systems including Linux, NetWare, Windows, Solaris, AIX, ...

- Because of a change in the underlying database engine, eDirectory is able to scale almost without limits. In 1999 a single eDirectory tree was presented with 1 Billion objects which by the way is NOT the upper limit. One single server instance of eDirectory can handle up to 1 TB of eDirectory data. That equals to apporximately 1 Billion objects without indexing. On platforms like Linux you can easily scale the hardware even above that and run multiple instances of eDirectory to overcome this 'limitation'.

- eDirectory is a global Directory to store information about all network resources such as users, groups, NetWare Volumes, workstation configuration, user profiles, applications, DNS entries, DHCP entries, Novell Cluster Resources running on Netware based Cluster Services with up to 32 nodes, and many more. Furthermore the eDirectory schema can be exended for any special purpose object or just company specific extensions to already existing objects.

For detailed information about eDirectory, visit Novell's Web site or simply use an Internet search engine.

3.2.1: Main Features

Novell eDirectory is a full service Directory which can be extended in almost all aspects. Full service Directory means

that it can be used for multiple purposes. Traditionally, it serves very well for all authentication and authorization processes in Novell based networks. Whatever the size might be, a single employee has one single user object which has relations to all resources being represented as eDirectory objects as well. With that concept, the employee can log in to the network from any place inside or outside the firewall using any device while eDirectory guarantees that all corporate polices are enforced and the user has authorized access to all assigned resources.

Within the last couple of years, eDirectory has also been chosen for many other purposes:

- Ease the management of Windows domain based networks

- Act as very fast LDAP server for authentication needs of devices or applications

- Handle content management and authentication for dynamic Web sites

Note: *Of course, this list is far from complete and acts only as example. Visit Novell's Web site or an Internet search engine for more detailed information*

The main benefits include:

- It scales to billions of objects

- It runs cross platform with a common management and administration toolset

- It can be accessed via LDAP

- It can be partitioned

- The data from any partition can be replicated to various servers independent of the OS for fast access and fault tolerance

- The synchronization process is highly optimized and works transitive meaning that not all servers holding a replica of the same partition need to be able to communicate with each other

- Only delta changes on an attribute level are synchronized - If the telephone number of a user object is changed, only that single value is synchronized to the servers holding replicas of that piece of Directory data (Partition).

- In partitioned and replicated implementations, queries are automatically resolved between servers in the background (tree walking or chaining) if the information is not stored locally.

- LDAP requests by default get a referral back if the request cannot be answered from the local Directory data but eDirectory can be configured to chain these requests as well.

- Every object has a Access Control List (ACL) to define the rights other objects have to this object on both, the object level and every single attribute of this object. This allows for very flexible rights assignment and easy administration.

- Decentralized administration is easily to be established by just assigning the proper right at certain parts of the Directory tree.

Note: *Novell's full product documentation including the eDirectory documentation is available through the Web at www.novell.com/documentation - Application and Developer notes as well as all developer information can be accessed at http:// developer.novell.com*

3.2.2: Review the prerequisites

What you need to ensure is:

- Have time synchronized with other servers in the network

- Have a clearly structured IP configuration

- Check on possible port conflicts

- Check your firewall configuration for possible issues with the ports which will be opened for eDirectory to function (of course this is not required for a single server environment)

- The eDirectory monitoring and maintenance tool, iMonitor, will be established on its own Mini Web server. By default it occupies ports 8008 and 8010 (SSL).

- Ensure the running of SLP if this is the first server (that's taken care of by the install script). Remaining servers will need access to the SLP traffic (multicast) prior to the installation of eDirectory.

- Have a supported Web browser installed i.e. Netscape 6 or greater.

- Have a plan of your overall implementation before you press any key.

3.2.3: Installation and Configuration

If you already have a running NDS or eDirectory tree in your enterprise, you will most logically add your Linux servers to that existing tree. In this case you need to check the pre-installation tasks for the eDirectory version that ships with Nterprise Linux Services. In the Beta state used for this kit it is version 8.7.1

For testing and before rolling out to a production environment, you create your eDirectory tree on the first server. All other servers are then added to the existing tree.

The installation guide can be found on the Nterprise Linux Services product media and on the Web at www.novell.com/documentation/lg/nnls/02install/data/front.html

The single server test environment

This is the most logical step to get hands on with the Novell technology.

In the previous chapter, we presented information about the express installation of Nterprise Linux Services.

Here you receive information on how to install only the eDirectory component from the Nterprise Linux Services product.

First, we check the routing table and the active connections of the Linux server before the eDirectory installation.

Because this is the first server, to create a new tree in a test environment, there is no need to add a multicast route for SLP or to check for time synchronization.

The default ports eDirectory and its management tools occupy will not be in use.

By not selecting the express installation of Nterprise Linux Services the install script offers a list of products allowing for customized selections.

In this chapter, only eDirectory is chosen.

Note: *If you need help with any of the terms used in this chapter,*
              please visit the online documentation at www.novell.com/docu-
              mentation

```
┌─────────────────────────────────────────────────────────────────────────┐
│ root@RedHat:/novell-sources/Nterprise_Linux_Services - Konsole - Konsole  │
│ File  Sessions  Settings  Help                                            │
│                                                                           │
│                                                                           │
│                                                                           │
│ Select products to install                                                │
│                                                                           │
│ #    selected   Item                                                      │
│ 1)     no       Apache                                                     │
│ 2)     no       JVM                                                        │
│ 3)     no       Tomcat                                                     │
│ 4)     yes      eDirectory                                                 │
│ 5)     no       Linux User Management                                     │
│ 6)     no       DirXML                                                     │
│ 7)     no       eGuide                                                     │
│ 8)     no       Samba                                                      │
│ 9)     no       iFolder                                                    │
│ 10)    no       NetMail                                                    │
│ 11)    no       iManager                                                   │
│ 12)    no       iPrint                                                     │
│ 13)    no       Virtual Office                                             │
│ 14)    no       ZENworks Package Delivery                                  │
│                                                                           │
│ Select from the following:                                                │
│   1 - 14)  toggle selection status                                        │
│       a)   all                                                            │
│       n)   none                                                           │
│       f)   finished making selections                                     │
│       q)   quit -- exit the program                                       │
│ Selection [4]: █                                                          │
│                                                                           │
│                                                                           │
│  New   Konsole                                                            │
└─────────────────────────────────────────────────────────────────────────┘
```
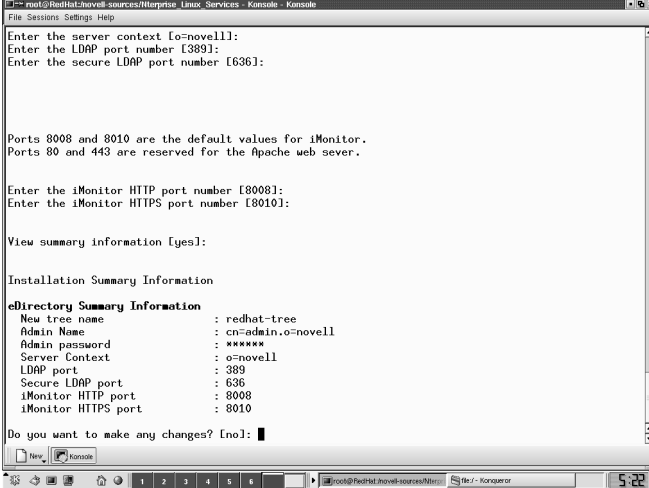
After accepting the license agreement a valid license key
needs to be provided. For testing purposes, a license can be
downloaded from www.novell.com/products/edirectory/
licenses/eval_87.html

For this study kit, the following selections are made for the
installation of a new tree:

•   Create new tree

•   Tree name: RedHat-Tree

•   Administrator name and context: cn=admin.o=novell

•   Password: novell

•   Server object context: o=novell

•   LDAP port: 389

•   LDAP over SSL port: 636

•   iMonitor HTTP port: 8008

•   iMonitor over SSL port: 8010

Once the presented installation summary is accepted, the installation actually takes place.

The installation settings can be saved to a file.

As an alternative or to get more detailed information about the single packages making up the eDirectory installation, you can also use a standard RPM manager. The RPMs are in subdirectories on the Nterprise Linux Services product media.

The installation log file can be found in /var/log for a detailed report of the installation.

The routing table has been updated with a multicast route for SLP and the eDirectory services run on the expected / configured ports.

```
[root@RedHat /]# netstat -nr
Kernel IP routing table
Destination     Gateway         Genmask         Flags  MSS Window  irtt Iface
192.168.200.0   0.0.0.0         255.255.255.0   U       40 0          0 eth0
127.0.0.0       0.0.0.0         255.0.0.0       U       40 0          0 lo
224.0.0.0       0.0.0.0         240.0.0.0       U       40 0          0 eth0
[root@RedHat /]# netstat -nl
Active Internet connections (only servers)
Proto Recv-Q Send-Q Local Address          Foreign Address       State
tcp        0      0 0.0.0.0:32768          0.0.0.0:*             LISTEN
tcp        0      0 127.0.0.1:32769        0.0.0.0:*             LISTEN
tcp        0      0 0.0.0.0:389            0.0.0.0:*             LISTEN
tcp        0      0 127.0.0.1:8008         0.0.0.0:*             LISTEN
tcp        0      0 192.168.200.200:8008   0.0.0.0:*             LISTEN
tcp        0      0 127.0.0.1:8010         0.0.0.0:*             LISTEN
tcp        0      0 192.168.200.200:8010   0.0.0.0:*             LISTEN
tcp        0      0 192.168.200.200:524    0.0.0.0:*             LISTEN
tcp        0      0 127.0.0.1:524          0.0.0.0:*             LISTEN
tcp        0      0 0.0.0.0:111            0.0.0.0:*             LISTEN
tcp        0      0 0.0.0.0:6000           0.0.0.0:*             LISTEN
tcp        0      0 0.0.0.0:21             0.0.0.0:*             LISTEN
tcp        0      0 0.0.0.0:22             0.0.0.0:*             LISTEN
tcp        0      0 127.0.0.1:25           0.0.0.0:*             LISTEN
tcp        0      0 0.0.0.0:636            0.0.0.0:*             LISTEN
udp        0      0 0.0.0.0:32768          0.0.0.0:*
udp        0      0 127.0.0.1:32770        0.0.0.0:*
udp        0      0 192.168.200.200:524    0.0.0.0:*
udp        0      0 0.0.0.0:427            0.0.0.0:*
udp        0      0 0.0.0.0:111            0.0.0.0:*
Active UNIX domain sockets (only servers)
Proto RefCnt Flags       Type       State         I-Node Path
unix  2      [ ACC ]     STREAM     LISTENING     1149   /tmp/.font-unix/fs7100
```

The data files for eDirectory can be found at /var/nds/dib by default. Make sure /var is on a partition with enough space for your planned eDirectory content and is configured for a high performance file system.

The main settings for eDirectory can be found in the /etc/nds.conf file. For more information, see man nds.conf.

In the process table you will find the ndsd processes and the slpuasa (SLP User Agent and SLP Service Agent).

As usual, you can start, stop, or restart the ndsd daemon using the script in /etc/init.d

The /etc directory also now has the configuration files for iMonitor, the eDirectory monitoring and maintenance tool, and the SNMP MIB and configuration samples. If you have a running network management system, you should include the eDirectory traps.

3.2.4: Administrative tools

You now have a running Directory Service, but the main tool to administer and manage this Service, iManager, has not yet been installed.

The only tool that is installed by default is iMonitor. iMonitor allows you to monitor and maintain eDirectory.
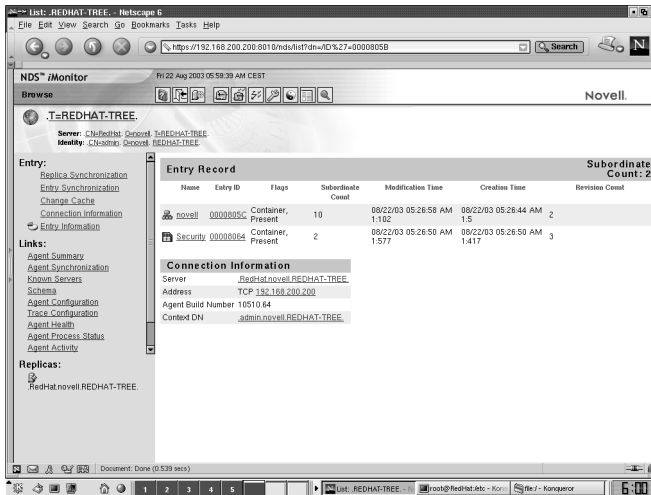
Note: *For more information on iMonitor and its functionality, visit the online documentation or consider attending attending course 3015 for Nterprise Linux Services from Novell Training Services.*
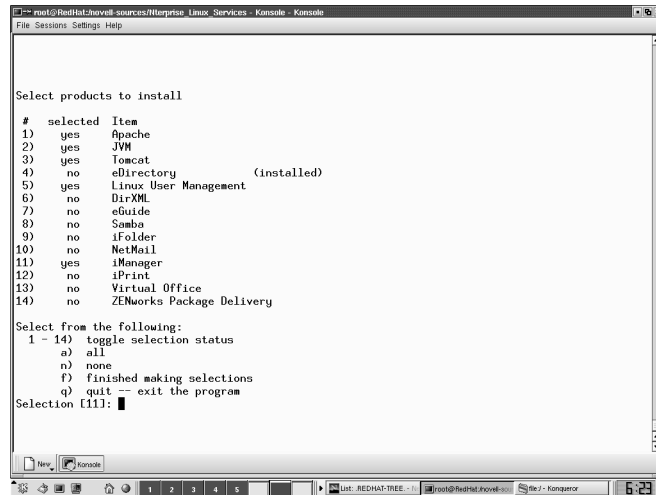
With this configuration you can use LDAP tools to add, modify, or delete object. However, in the next step we will install and show the management tools.

Again, the installation script is launched for a single packet install.

The main tool to administer all Novell services including eDirectory, iManager, depends on Apache 2 and Tomcat 4 as well as an appropriate JVM. As a result, all these packages must be installed.

Additionally we also install the Linux User Management in this step. This package adds the functionality to migrate Linux users and groups from server based files or NIS / NIS+ systems into eDirectory allowing for one single Directory to manage all identities in your enterprise.

Authentication for Linux users is then provided via PAM modules calling eDirectory.

Upon the completion of the installation, view detailed information found at the same locations as mentioned before.

As already mentioned in chapter 2, the installation process tested for existing versions of Apache, Tomcat, etc. to avoid conflicts. If a potential conflict was detected, the running service is terminated, pulled out of the runlevels, and then the new service is established. Detailed information about these steps can be found in the installation log file stored in the /var/log directory.

At this point, the main administration tool for all Novell Services, iManager, can be installed and accessed from any supported Web browser.

In the following chapters you will see a couple of screen shots showing the various tasks possible from within this single, Web based tool.

3.3: Conclusion

At this point, the foundation for all Novell Services, eDirectory, has been successfully installed and configured.

You have also seen how to install the main tools to manage, administer, monitor, maintain, and troubleshoot this Directory service.

Because you have seen the installation process with an express install already in chapter 2 and with detailed single package install twice in this chapter, the installation steps will be ommitted from the rest of the study kit.

4: Meta Directories

Meta Directories are used to provide flexibility in synchronization between disparate systems so that all common data can be kept up-to-date with minimal maintenance costs

DirXML is the Novell Meta Directory product based on eDirectory. In existing eDirectory implementations, the DirXML product is just an extension to the existing infrastructure.

The overall architecture of DirXML is shown in the graphic below.
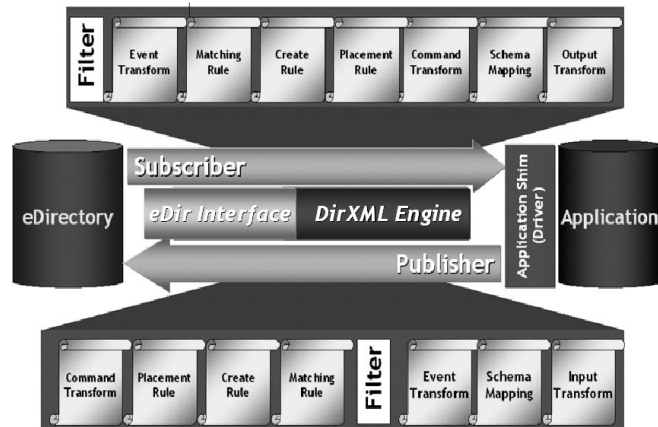
DirXML provides a general method for directory-enabling applications.

- The applications do not require changing

It is to share data through the directory

- Transform data to/from the application's native format
- Common data is stored in the directory

4.1: The business need for Meta Directories

The business justification to implement a Meta Directory solution can be prepared with a few simple questions.

- How many applications does your organizationmaintain with separate identity management?

    A survey in the US resulted in an average of 80!

- How often are users forced to login to a system with just another set of username and password?

- How long does it take until a new employee is entered into all these systems - just to enable her/him to start working and be productive?

- What happens if an employee leaves the company or the contrac is terminated?

- Is the data you stored in the disparate systems consistent?

- What happens data on one system changes? Have you ever moved houses?

- Have you ever heard about typos?

- Does it really make sense that your valuable administrators enter new user information?

- Have you ever had or plan a merger?

4.2: Connecting to any data source

In general, the DirXML system is flexible enough to connect eDirectory to any data source regardless of a Directory Service, database, application, mail system, HR system, or just something simple like a text file with user information.

In the DirXML documentation all these data sources are called application. We follow with this terminology in this study kit.

The fact that application need not be touched when implementing DirXML, has got to be good news. So let's explain what happens to the data on the way from the application into eDirectory and back.

- The Application

  There is no need to do anything with the application other than understand how you want to use the data from the application in the Meta Directory or in other systems connected to the Meta Directory as well.

- The Application driver

  This is the key component as it needs to understand what the application output is and how to create a valid and well formed XML document out of it. However, the Document Type Definition (DTD) this driver is using can be totally different than the DirXML driver's DTD.

  If you like to write your own driver, you can find skeleton driver in Java and C++ as well as instructions and learning materials on http://developer.novell.com

  In most cases a pre-configured driver are used.

- The Join engine on the publisher channel

  As the XML data travels the publisher channel it can be modified in any aspect. The filter, XML rules, and XSLT

style sheets applied here modify the data itself or the XML flavour to fit the business need of this synchronization and make the XML valid against the DirXML DTD.

- The DirXML Driver

  This entity works much like the application driver, but the application for this driver is eDirectory. Thus, it receives valid and well formed XML from the join engine and generates events for eDirectory.

- eDirectory

  In eDirectory the events coming in from the DirXML driver are accepted like any other event for instance from an ldapadd or from an administration tool like iManager.

- And the other way - being on the subscriber channel

  On the other way it goes all the way down, but in reverse order. When you have a look at the graphic on the first page of this chapter, you will notice, that the order of the rules, style sheets, and the filter are different, but that's it.

Having these two separated channels with different filter settings, allows you to easily define what kind of data flows in what direction.

The complete list of pre-configured drivers shipping with the Nterprise Services for Linux product is not defined at this moment in time. Novell developed pre-configured drivers for many systems. A complete list can be taken from Novell's Web site.

The pre-configured drivers include:

- Active Directory
- Exchange
- GroupWise
- JDBC for DB2
- JDBC for Informix
- JDBC for MS SQL

- JDBC for MySQL
- JDBC for Oracle
- JDBC for Sybase
- LDAP
- NT
- PeopleSoft
- SAP
- SIF
- Workflow
- eDirectory
- Notes

4.2.1: Applications running on the same host as eDirectory

This was the only possible way to implement DirXML in the first version. Because eDirectory can run cross-platform this was not a big issue. Remember, with appropriate partitioning and a well designed replication plan, the actual datasize of eDirectory and therefore the impact of running eDirectory as additional service can be minimized.

With this concept, the physical server hosting the application you would like connected to DirXML you just get an additional task: Synchronize defined data with eDirectory.

Applications running on a different host

The current version of DirXML can be implemented with a remote driver setup. That means, the application can run on one machine and communicate with the DirXML / eDirectory system on another physical machine using an SSL encrypted connection.
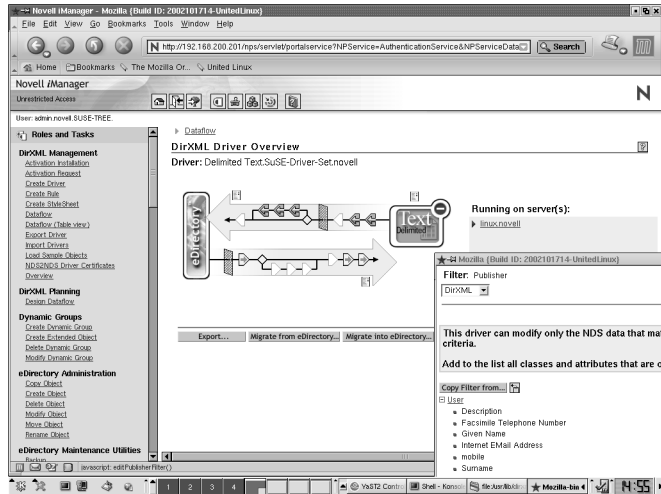
4.3: How to administer DirXML

DirXML is installed on a Linux host like any other product from Nterprise Services for Linux.

The whole administration to setup and configure a DirXML system is done from within iManager.
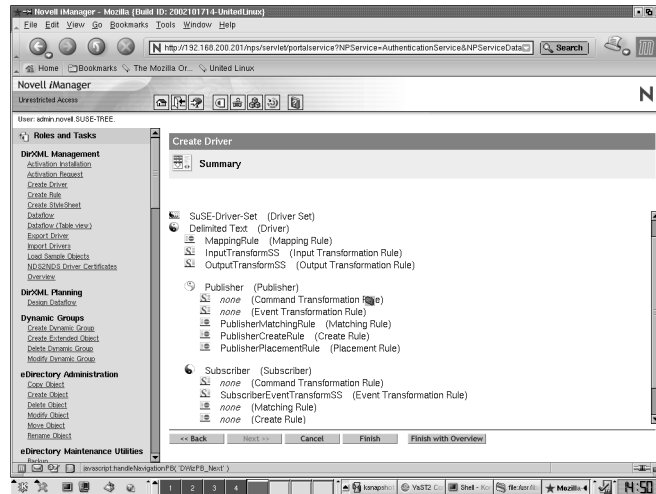
In this sample, a pre-configured driver has just been created.

This graphic shows the overview of the just installed driver and the filter definition in the publisher channel as detail.

5: eGuide

Novell eGuide, delivered as part of the Nterprise Services for Linux is a platform-independent, web-based Net service that helps you quickly find and make one-click connections to people, places and things.

It allows you to search for information from a number of LDAP-enabled sources, including Novell eDirectory.

The Web interface lets you quickly launch any web-based application such as e-mail, instant messaging, and video conferencing.

The main features of eGuide are:

- Directory lookup engine

    100% LDAP-compatible

    Multiple directory support and load balancing

    Schema detection

- White pages/search

    Address book functionality

    Multiple search contexts

    Wildcard support

- Collaboration tool

    Launch collaboration applications from address book

    Admin-configurable

- Self-provisioning

    End-user modification of user information

    Admin configuration of "setable" attributes and classes

- Organizational view

    Display and print org charts based on reporting hierarchy and structure

Dynamically generated in real-time

- Platform support

Servlet-based

Pure HTML on client side

- Security

Secure through HTTPS

Admin-configurable filter of attributes and classes

SSL LDAP directory authentication

5.1: Using data from eDirectory

To access one or more LDAP Directories to retrieve data from, the administrator need to configure them in the eGuide configuration tool.

In the sample shown below, two different LDAP Directories are used. With this setting, employees from Novell and Cambridge were immediately all visible for the eGuide clients. This was especially helpful at the time the two companies merged.

For each Directory the administrator can map and enable the attributes visible from the eGuide clients.

Using a DirXML Meta Directory as source for eGuide, you can access data from various systems connected via DirXML.
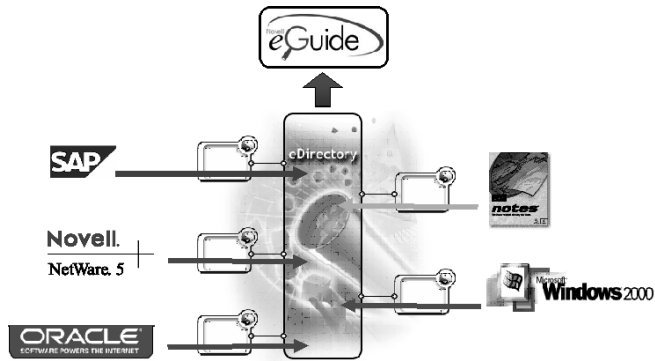
5.2: User Experience

From the Client side, users can simply search for people in various configured categories such as Employees and Customers. The results can be retrieved from different LDAP Directories or LDAP enabled applications.

Depending on the administrative configuration, users will see more or less attributes for each search result. They can not only view attributes but also, by clicking on those attributes, link to messaging services such as e-mail, instant messaging, etc. what launches the appropriate application on the client workstation.
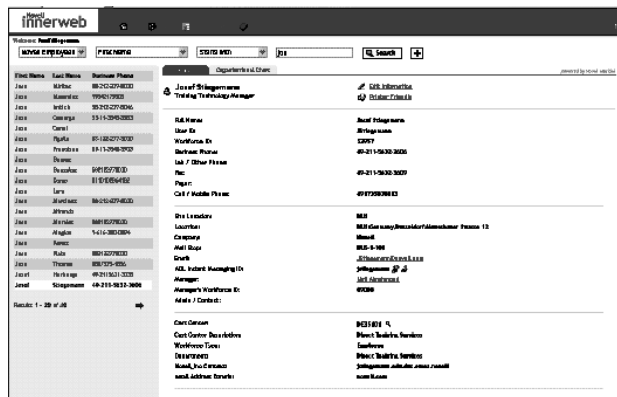
Every user can make modifications to her/his own entries directly via the eGuide interface. With this, users have a very easy tool to keep some of their records current thus relieving the administrators.

5.3: Organizational Charts

Based on eDirectory attributes, eGuide automatically generates Organizational Charts. To make use of this feature, you need to decide, how these eDirectory attributes for user objects will be modified with the current value. You can grant the appropriate rights via the eDirectory ACLs to a team of administrators, to those employees acting as people manager only, or you have a DirXML connection to your HR system to fill the values from that source.

The result is an Organizational Chart which users can view for every object in the search result. Furthermore, every user can walk the whole reporting structure of the enterprise.
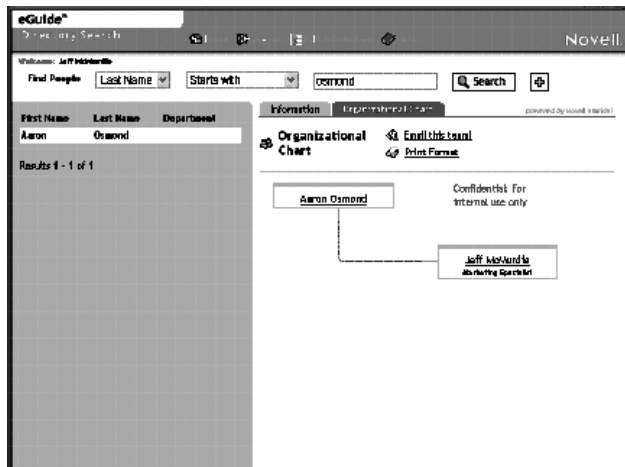
5.4: Customize the Interface

You have seen already a few screenshots from the user interface of eGuide with a different look and feel.

The interface can be modified to have for instance your corporate identity. You can also very easily change many of the fields from a choice of pre-defined options.

The same is true for the skin, the overall look and feel. If the pre-defined skins are not appropriate, you can modify the XML file to apply your corporate identity.

6: File Access

In terms of providing the server based file systems to client workstations with various operating systems, Linux has almost the same level of experience than Novell has.

Nterprise Services for Linux comes with its own Samba package you might want to have a closer look at before you install it rather than risk loosing your current Samba configuration for Windows users.

In terms of server based file systems and security you should already in place a clear strategy.

In this context we cannot stress the importance of the fact on placing the storage areas for Nterprise Services for Linux related files.

Most important is the directory where you store the eDirectory DIB sets. By default they are stored in /var/nds/dib but this can be changed during the installation or later by editing the /etc/nds.conf file. You need to plan enough free disk space, as a rule of thumb you can calculate 75 MB disk space for every 50.000 average user objects. The file system you created for the partition holding /var should be a as high performance file system as you would choose it for any database storage. You should also setup security restrictions for that directory structure to avoid problems caused by unauthorized access.

The next thing you need to consider in terms of disk space for Nterprise Services for Linux is the space you want to provide your users with via iFolder. This component of the Nterprise Services for Linux product is described in this chapter. In terms of disk space, you need to calculate the disk space you want to assign to your users and multiply that with the number of your users. This can be quite a significant amount of space.

6.1: iFolder

iFolder is provided as a component of the Nterprise Services for Linux product and allows users easy access to their files from anywhere using any device.

It comprises of two main components, the iFolder Server and the iFolder client components.

The user authentication is accomplished via LDAP against eDirectory.

6.1.1: Server components

The server component provides disk space (by default on /var/opt/novell/ifolder) for all users allowed to use the system. It stores all files encrypted which the user puts into his iFolder account in that storage area. It also controls the authentication via LDAP for users accessing iFolder and the synchronization with iFolder clients.

6.1.2: Client components

A real iFolder Client component is currently only available for MS Windows users. This client creates a local disk space area on the Windows machine which is then synchronized with the iFolder server as long as a connection can be established. The synchronization is a delta sync and the interval can be customized by the administrator and the user.

Because the same user can establish many iFolder clients which all synchronize to the iFolder server, employees can have the same data content on their workstation in the office, their laptop computer when travelling, and their home office computer. As soon as the machines are connected to the Internet, they will connect to the iFolder

server and synchronize the data. And because the iFolder server data is stored on corporate file servers, a regular backup is ensured by standard security policies every company has in place.

All non MS Windows clients need to use a browser based interface to access the data stored on the iFolder server directly. This can be done from anywhere, as long the computer has a browser installed. The current development on iFolder adds more devices, recently a PDA access has been added.

The browser based access has some more advantages. If you are one the road it is no longer a disaster if you loose your presentation - just ask for an Internet connection and grep it from your iFolder.

To authenticate, you have three pieces:

• Your login name to iFolder which needs to be setup in eDirectory (your employees will be already be configured in eDirectory. This includes the Linux users if you configured for Linux Account Management)

• A password for your iFolder client

• A pass phrase which is used to encrypt your data and which is needed to access your data via a browser.

6.1.3: Administrative Tools

All administration tools for administrators can be found in iManager.

The administration tool for iFolder client users is installed with the client on MS Windows machines and has an icon in the Windows system tray.

Here we present a couple of screenshots showing how the iFolder client administration and monitoring looks on the MS Windows workstation in your enterprise you serve from your Linux based iFolder server.
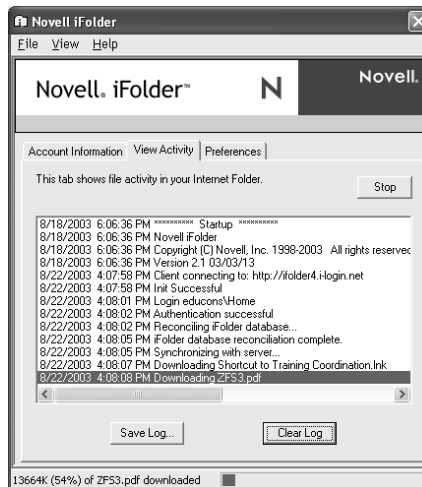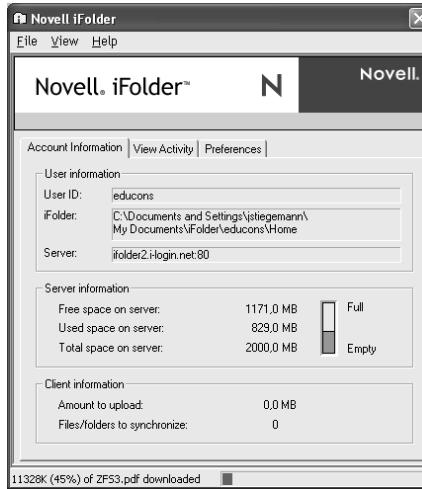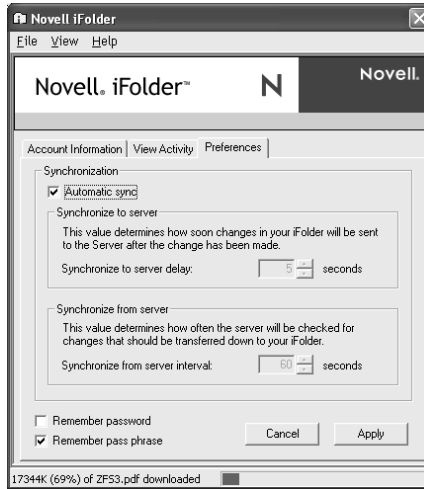
7: Other Solutions

In this chapter we will briefly describe the solutions provided with Nterprise Services for Linux not covered so far.

These are:

- Printing

- RPM Distribution

- Messaging

- Web experience

Note: *As mentioned earlier in the study kit, please bear in mind, that this kit has been written in an early Beta state where not all components are in a shape to be covered in great detail.*

7.1: Print Services

Novell's solution for enterprise wide printing is based on the Internet Printing Protocol (IPP).

Note: *You might want to refer to RFC 2911 for more information about IPP*

With Nterprise Services for Linux, Novell introduces iPrint on Linux servers as well as, for some time now, on NetWare.

iPrint supports standard IPP enabled printers. The package comes with a map generator allowing the creation of office floor plans and adding symbol for your IPP printers to it. Users can then click the symbol to install the appropriate printer driver and print to that printer.

This is very handy for enterprise scale networks with employees travelling between different offices. They do not need to care anymore where they are and where to find the appropriate printer driver. They just bring up the correct floor plan in a browser and click on a printer near to them.

Provo H 2nd Floor
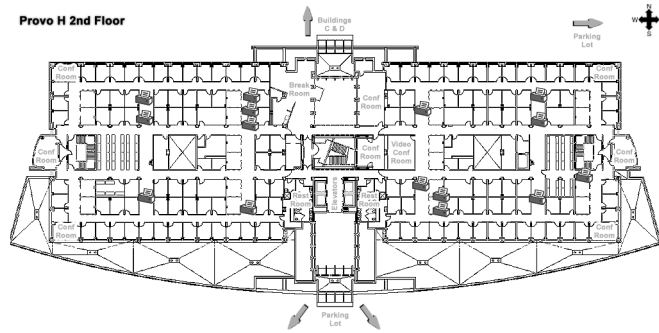
7.2: RPM Distribution

Novell developed a solution to ensure the distribution of software packages automatically between servers. On NetWare servers, this solution is part of the ZEN for Servers product.

Based on the physical network a given company uses, such software packages are distributed in a so called Tiered electronic distribution (TED).

TED allows a software package to be customized and created on a single server. Policies can then be used to distribute the package to other defined servers. The server the original package resides on will send it in a compressed format to a set of servers defined to subscribe from it. These 2nd tier servers will not only unpack and apply the package but continue to send them on schedule to servers subscribing from them.

With a well designed system for this tiered electronic distribution you automatically distribute and apply software packages optimizing your physical network resources. Just think about your different line speeds and network loads.

For Linux, Nterprise Services for Linux in version 1 will just introduce the tiered electronic distribution for RPM packages following the same concept used on NetWare servers.

Future versions of Nterprise Services for Linux will introduce even more ZEN for Servers functionality.

Note: *Don't forget to visit Novell's Web site and look out for ZEN for Servers. The cool solution area give you a pretty good understanding what Novell's customers have already in use and what the effect is.*

7.3: Messaging Solution

Novell has two products handling mail:

- GroupWise
- NetMail

While GroupWise is a complete collaboration tool including mail, calendaring, scheduling, document management, and more working with proprietary clients, NetMail is just mail and calendaring but build entirely to support Internet Standards.

NetMail is part of the Nterprise Services for Linux product and can be installed to introduce a simple, highly scalable e-mail and calendaring system supporting Internet standards such as POP/IMAP, iCAL, and CAP. In this first version of Nterprise Services for Linux two client are provided:

- A Web based mail client
- The full GroupWise client for the MS Windows users you support.

However, due to the supported standard, every standard mail client can be used with the NetMail system.

Note: *For more information on NetMail, just visit the Novell Web site.*

Just to give you an idea what we are talking about high scalability, a single NetMail server can server 50.000 users.

7.4: Web Experience

Novell Nterprise Services for Linux ships with Novell exteNd Director, Novell's portal solution.

This package supports tools we already talked about in this kit such as iManager.

Having a portal solution installed makes it easy to customize your own dynamic Web sites with content based on the identity of the user. This is easily accomplished because the exteNd Director is linked into eDirectory. This makes it easy to customize the content accessible based on eDirectory objects such as containers, groups, and users.

Also included is an implementation of Novell's virtual office, an already pre-defined portal for a unified user experience via the Web. Virtual office includes:

- eGuide
- NetMail
- Bookmarks
- Virtual teams can be setup to collaborate with team members
- iFolder
- iPrint
- Self Management - change password

Here is a view of the main Virtual Office page.

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